NATIONAL WETLANDS INDABA 2023

HANDBOOK and ABSTRACTS

Monday 23 to Thursday 26 October 2023

ATKV Buffelspoort, North West Province, South Africa

INDEX

2023 NATIONAL WETLAND INDABA ORGANISING COMMITTEE

Chairperson	Eric Munzhedzi
Local Organising Committee	Kate Snaddon, Lulu van Rooyen, Shaddai Daniel, Steven Ellery, Wynand Malherbe, Marc de Fontaine, Althea Grundling, Piet-Louis Grundling, Renée Grundling, Simone Koert, Roderick Juba, Vusi Lubisi, Kelebogile Rapoo, Martha Tepo
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ACKNOWLEDGEMENT

The organisers of the **2023 INDABA** would like to express their sincere thanks to the authors who have written and will present their oral presentations, or posters, or facilitate their workshops and panel discussions, and to the organisations which have supported or funded their attendance at the conference.

A very special word of thanks to all our sponsors for their generous support of the conference.

SOCIAL FUNCTIONS AT THE INDABA

Monday 23 October 2023

Meet & Greet at the Dahlia Room, sponsored by SANBI ***19:30***
Wine will be served; delegates can purchase additional drinks from the cash bar.

Tuesday 24 October 2023

Braai at Kgaswane Mountain Reserve, sponsored by Impala Platinum ***17:00***
Soft drinks and water will be served, no alcohol to be consumed on the premises.

Wednesday 25 October 2023

Gala Dinner in the Dahlia Room, sponsored by MONDI ***19:00 – 24:00***
Wine will be served at the table; delegates can purchase additional drinks from the cash bar.

WELCOME FROM THE SOUTH AFRICAN WETLAND SOCIETY

Welcome to the 26th National Wetlands Indaba!

The South African Wetland Society (SAWS) together with the North West Wetlands Forum (NWWF) are excited to welcome you all to this compelling calendar event, hosted within the beautiful landscapes of Buffelspoort and the North West Province.

This year's Indaba is set to be thought-provoking, innovative and aimed at ensuring that the best knowledge and practice, in the fields of wetland management, research and restoration are made available to you.

The theme for this year will focus on Wetland Restoration! Whether we choose to believe it or not, South Africa is moving towards a new normal in all facets. Therefore, it is important to know and understand the importance of water resources as a whole and the ecosystem services they provide, not only to the surrounding environments but for people and their daily lives, and also how restoration and rehabilitation can benefit everyone. As the country moves towards establishing economic benefits for people to earn a living, we must remember that the natural resources within this country define us, and enhance South Africa's natural heritage, which people around the world enjoy and in which they find solace.

As a Society, we're excited to share and engage with you all. Yet again, as we stand on the shoulders of giants, let us create an environment of learning and support, and ensure that wetland management and restoration are done in a way that benefits all, for many generations to come.

A big thank you to all our sponsors, organising committee members and various stakeholders in making sure that this Indaba is successful, and one that ensures that knowledge is made available to all.

BE A CANDLE AND SHARE YOUR LIGHT!
Shaddai Daniel-Harris
SAWS Chair

WELCOME FROM THE NORTHERN PROVINCE WETLAND FORUM

Welcome to the 26th National Wetlands Indaba!

It has been exactly 20 years since the North West Wetland Forum (NWWF) last hosted the National Wetland Indaba (NWI). We are fortunate to be remembered and given the opportunity to host NWI again this year. We are very pleased to welcome you all to the NWI 2023, only the second in-person NWI since COVID.

The theme for NWI this year is in accordance with that of Ramsar, namely "It's Time for Wetland Restoration". The conservation of wetlands is fundamental to the sustainable management of water quality and quantity, and wetland rehabilitation is therefore essential to conserving water resources in South Africa. South Africa is a dry country, but it is endowed with exceptionally rich biodiversity and as a nation we therefore have a reason to value the water-related services that wetlands provide. So, you are welcome to celebrate this theme and enjoy listening to invited keynote speakers, plenary sessions, presentations, workshops, discussions, and training events.

We are also celebrating the 11th year of the South African Wetland Society. We are grateful for their dedication and hard work and wish them the best for the years ahead.

The NWWF would like to thank all those who will be partaking and contributing towards the success of this event, our presenters, students and all key role players. To the LOC and the Conference organisers, thank you for your dedication and commitment and to SAWS for their undying support. Once more, enjoy your stay at our beautiful venue in the beautiful Magaliesberg Mountain Range, and remember we all deserve an outing.

Eric Munzhedzi
Chair: North West Wetland Forum

Keynote speakers

After **Japie Buckle** completed his studies at Stellenbosch and Pretoria Universities **(**BSc Forestry, and BSc Hons. Wildlife Management), he worked as a professional catchment management planning officer for the Department of Environmental Affairs and Forestry, Tsitsikamma Region, and as district manager for Cape Nature Conservation: Western Region. From 1994 to 1998 he was employed as regional ecologist for Western Region and simultaneously the regional manager Eastern Cape for the Working for Water Programme. Japie was the provincial coordinator for the Working for Wetlands Programme under the auspices of the South African National Biodiversity Institute for eleven years. In 2016 Japie was appointed Assistant Director - Operational Support and Planning for the Department of Environmental Affairs: Chief Directorate Natural Resources Management, national technical advisor on all restoration projects. In 2020 he was appointed Director/General Manager: Operations for the Value Added Industries under the Working on Fire Programme.

Japie is currently the managing director for a British company, Hive Ecosystems, doing thicket restoration of an 8309ha farm in the Somerset East district.

Dr Vere Ross-Gillespie is an aquatic ecologist and entomologist with a PhD from the University of Cape Town. He has extensive experience in the consulting and applied research realm having worked on aquatic and terrestrial ecosystems across southern and eastern Africa, the sub-tropics and the Indian Ocean Islands. He has over a decade combined applied research and consulting experience in the water sector within Southern Africa and SADC member states. Having previously managed a team of ecologists in an environmental consulting firm based in South Africa, he joined the NatureMetrics team in February 2020 and is currently responsible for managing strategic accounts across the extractives and onshore industrials sector. Since joining NatureMetrics he has designed surveys and managed over 150 eDNA projects globally for international funding grants, NGOs, consultancies and large multinational corporations. He is interested in DNA-based applications for aquatic, riparian and terrestrial biodiversity management and monitoring, conservation and restoration projects, capacity development and citizen science, in the SADC region and globally.

Mr Anton Linström is a highly experienced Wetland Ecologist who has dedicated many years to conservation and his passion for wetlands. With a background in both conservation and consultancy, he possesses extensive knowledge of wetlands in general. He also serves as a wetland ecologist for the Working for Wetland Rehabilitation Programme in the Mpumalanga and Limpopo Provinces. In addition, Anton actively participates in biomonitoring projects for Sasol in the mining sector, overseeing operations at eight different mining sites. He is also involved in the annual State of Biodiversity project for the Sasol Secunda Industrial site. Anton's expertise extends to education, as he lectures at the Wetland Rehabilitation Course through WETREST. He is a registered Professional Natural Scientist with the South African Council for Natural Scientific Professions and proudly holds membership in the South African Wetland Society.

SPONSORS

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The Agricultural Research Act (Act No 86 of 1990) mandates the ARC to carry out research, development and technology transfer aimed at promoting agriculture, industry and ultimately to improving the quality of life of the South African population, whilst protecting the environment.

ARC VISION
Excellence in research and innovation for sustainable agricultural systems and economic development.

ARC MISSION
The Agricultural Research Council is a premier science institution that conducts research, develop partnerships and human capital, to foster innovation for a sustainable agriculture sector.

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I**mplats** has a diversified global mining footprint with world-class assets in key platinum group metals (PGM) bearing jurisdictions. We mine, process, refine and market high-quality metal products safely, efficiently and responsibly from a competitive asset portfolio. We deliver metals that enable a cleaner and healthier world, in a way that generates sustainable returns for our shareholders and strives to make a meaningful and lasting positive contribution to society.

Our vision is to be the most valued, sustainable and responsible metals producer, creating a better future for our stakeholders. Underpinning our purpose is our commitment to create economic opportunity for our communities and protect our natural environment.

Our environmental strategy aligns with our purpose and core values. It ensures we mitigate environmental impacts at our operations and across our value chain. We are committed to the protection of the environment, including biodiversity, land management and responsible post-closure management.

Mr Brent Corcoran
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Mondi is a leader in packaging and paper, employing around 26,000 people across more than 30 countries. We delight our customers with innovative and sustainable packaging and paper solutions.

We are fully integrated across the packaging and paper value chain - from managing forests and producing pulp, paper and plastic films, to developing and manufacturing effective industrial and consumer packaging solutions. Sustainability is embedded in everything we do, with clearly defined commitments across ten action areas.

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The North West Parks and Tourism Board (**NWP&TB**) was established by the NWPTB Act 2 of 2022, and registered as a Section 3C state-owned entity.

The vision of the North West Parks and Tourism Board is to create a sustainable biodiversity and tourism economy that creates jobs and protects the environment.

NWP&TB ensures conservation and sustainable use of biodiversity through the establishment, development and management of a network of formally proclaimed Protected Areas. To this end, part of **NWP&TB**'s mandate gravitates around tourism planning, destination marketing, hospitality training and conservation.

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The Unit for Environmental Sciences and Management (**UESM)** is a highly dynamic research institution with a strong commitment to inter-, multi-, and trans-disciplinary research programs. Our research programs are designed with the overarching goal of fostering expertise to provide a comprehensive understanding of our intricate environment. The mission of the UESM is to lead cutting-edge research efforts in Africa by offering science-based knowledge to address global environmental challenges. This mission is accomplished through a combination of outstanding research, high-quality postgraduate education, and specialized services. The **UESM** is dedicated to promoting the responsible and sustainable utilization of natural resources, always mindful of the resilience of ecosystems. We aspire to gain international recognition while actively contributing to local and regional efforts to understand our environment better and implement best practices in environmental management. The UESM is committed to striking a balance between fundamental academic research and practical, market-oriented research, including contract work.

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The Western Cape Wetlands Forum is a Non-Governmental Organisation, which is a vehicle for sharing information and expertise regarding the protection, management and restoration of wetlands in the Western Cape Province.

The Forum sees a future of environmental responsibility in which the Wetlands of the Western Cape are:

- Protected in terms of their biodiversity, hydrological function, and value to human communities,
- Benefit from effective management of human activities regarding currently accepted best sustainable practice, and
- Optimally restored and rehabilitated where degraded.

The Forum meets quarterly, to discuss and share information on the wetlands of the Western Cape and the Nation. We are governed by a voluntary Steering Committee made up of representatives of a number of stakeholder organisations across the Province.

Ms Lientjie Mogano, Project Leader
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The South African Council for Natural Scientific Professions (**SACNASP)** is a registration and regulatory authority for the natural science profession in South Africa. **SACNASP** was established in terms of the Natural Scientific Professions Act (Act No. 27 of 2003) (the NSP Act), as amended by the Science and Technology Laws Amendment Act (Act No. 7 of 2014). The Council is mandated as the Accounting Authority to implement the provisions of the Act, under the oversight of the Minister of Higher Education, Science and Innovation.

Vision
Leading the development and advancement of the Natural Science Professions in South Africa.

Mission
To provide an efficient statutory Council for the recruitment, registration, regulation, and advancement of Natural Scientific Professionals to ensure high-quality services for economic growth and societal benefit.

Values
SACNASP will be guided by the values of independence, non-discrimination, diversity, inclusiveness, honesty, integrity, respect, non-partisanship, innovation, diligence, responsiveness and collaboration.

SANBI
Biodiversity for Life
South African National Biodiversity Institute

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Vision
South Africa's biodiversity is conserved and enhanced to deliver sustainable benefits for all.

Mission
To provide leadership in biodiversity research, policy advice, conservation, and human capital development; and to promote the appreciation, sustainable use, and equitable sharing of the benefits of South Africa's biodiversity.

Values
USANBI UGREAT

- **U**buntu – Harnessing, caring, sharing and being in harmony with all of creation.
- **G**rowth – Nurturing and empowering teams and individuals to grow and reach their true potential.
- **R**espect and tolerance – Creating open, honest relationships built on trust, mutual respect, dignity and fairness AND valuing and accepting individuals and diversity.
- **E**xcellence – Providing service excellence through passion, professionalism, and commitment not just to our clients, but also to each other.
- **A**ccountability – Taking pride and responsibility in our work and caring for our environment and communities with honesty and integrity.
- **T**ransformation – We use equitable approaches to change the world, foster togetherness, and inclusivity within our organisation, the sector and our communities.

LOCAL ORGANISING COMMITTEE ORGANISATIONS – donations of time and passion!

NATIONAL WETLANDS INDABA 2023 - PROGRAMME

23 - 26 OCTOBER 2023 | Buffelspoort ATKV Resort, North West

DAY 1: Monday 23rd October 2023

10:00	Registration Opens | Venue: Outside Jones & Wagener Room	
Opening Session | Chair: Ms Shaddai Daniel | Venue: Jones & Wagener Room		
11:00	Shaddai Daniel	South African Wetland Society Opening Speech
11:10	Eric Munzhedzi	North West Wetlands Forum Opening Speech
11:20	Mr Umesh Bahadur, DFFE	Guest speaker
11:30	Mr Stanley Tshitwamulomoni, DFFE	Guest Speaker
SESSION 1: Plenary Session: Rehabilitation and restoration in a changing world | Chair: Mr Bonani Madikizela | Venue: Jones & Wagener Room		
11:40	Mr Japie Buckle	KEYNOTE: Upscaling dryland restoration projects in South Africa
12:20	Dr Florence Murungweni	Linking ecological restoration activities to vegetation development in a Ramsar wetland
12:35	Mr Ryan Edwards	Wetland rehabilitation planning in highly modified urban catchments in the eThekwini Municipality
12:50	Mr Brian Gardner	Urban wetland rehabilitation: Three case studies from conception to completion
13:05	Dr Donovan Kotze	Local stakeholders invest in ecological infrastructure: a pilot initiative from the Klein Swartberg Mountains, Ladismith
13:20	***Lunch - Restaurant***	

SESSION 2: Workshop Session					
14:00	Ms Nancy Job, Ms Adwoa Awuah, Mr Dean Ollis, Ms Kate Snaddon	Workshop 1: Freshwater Biodiversity Information System (FBIS) Workshop: An interactive walk through the wetland-related functionality	14:00	Dr Lulu van Rooyen, Mrs Ramugondo Pfarelo, Dr Damian Walters, Mr Mlu Ntuli	Workshop 2: Wetlands and land use: Community-based conservation management through NPOs
15:30	***Tea / Coffee Break***				
SESSION 3a: Parallel Session: Wetlands, people and community engagement | Chair: Ms Thandeka Ndlela | Venue: Jones & Wagener Room			SESSION 3b Parallel Session: Hydropedology | Chair: Prof Johan van Tol | Venue: Impala Room		
16:00	Mrs Sheraine van Wyk	From community engagement to active citizenship and participatory governance	16:00	Dr Johan van der Waals	Critical review of the soil wetness and soil form criteria for wetland delineation
16:15	Mr Relebohile Ramokoatsi	Successes and downfalls in the process of wetland resuscitation in the Southern part of Lesotho using Mohale's Hoek District as a case study	16:15	Mr Edward Smit	The impact of hydrological soil information on wetland water regimes in the Sabie catchment, South Africa
16:30	Ms Pfarelo Ramugondo	Community conservation initiatives for the wise use of wetlands.	16:30	Panel Discussion with Prof Johan van Tol	Introducing the hydropedological guidelines for wetland management and development authorization from site to catchment scale
16:45	Dr Ilse Aucamp	Perceptions of the value and changes in wetlands to traditional community members of the Maputoland Coastal Plain			
17:00	Dr Roderick Juba	Using social learning to improve sustainability aspects of our wetland management practices			
17:35	***Break***				

SESSION 4: Poster Session | Chair: Prof Wynand Malherbe | Venue: Jones & Wagener Room			
Session starts at 18:00 - Drinks will be served!			
Mr Nande Bija	Mapping the spatial distribution and fragmentation of vegetation in urban wetlands: A case study of the Khayelitsha wetlands in Cape Town, South Africa	Mr Hannes Marais	A vegetation classification and description of whitewinged flufftail (*Sarothrura ayresi*) habitat at selected high-altitude peatlands in South Africa
Mr Asive Bomvu / Ms Phumla Mayekiso	Building blocks to a great National Wetland Map	Mr Bongani Mkhize	Assessment of Wetland Characteristics and Stream Power Index using TauDEM in the Breede Catchment
Mr Corne Carinus	Assessing the effects of environmental stressors on fish growth using fish otoliths in two impoundments in the North West Province.	Ms Kagiso Moteke	Application of Remote Sensing and Geographic Information System Tools for assessing Land use and Land Cover Impacts in Duthuni Wetland, Thohoyandou
Dr Mandy Carolissen / Ms Nancy Job	Integrating remotely sensed and citizen science data to monitor suitable habitats for waterbirds	Ms Ntsemeni Mudzanani	Towards bridging the gap between policy makers and community member to restore wetlands: Assessing the understanding of wetlands importance in Vhembe District.
Miss Renée Grundling	Proposed Anthropogeomorphological Wetland Classification System	Ms Nokubonga Mzimela	Losing the jargon - communicating how wetlands work, how we impact them, and how they work for us, to local communities.
Ms Nancy Job	An invitation for input on a number of current national initiatives	Ms Lucy Ngubeni	Wetland species monitoring using iNaturalist in the Living Catchments Project (LCP)
Mr Arni le Roux	Classification and ecology of wetlands in a section of the southern Waterberg.	Mr Oscar Tshivhombela	Evaluating the impact of wetland utilisation, and socioeconomic characteristics on wetland condition
19:30	***Dinner: Meet & Greet | Venue: Dahlia Room | Sponsored by SANBI***		

DAY 2 – Tuesday 24th October 2023

08:00	Registration Opens | Venue: Outside Jones & Wagener Room	
SESSION 5: Plenary Session: Wetland monitoring | Chair: Dr Piet-Louis Grundling | Venue: Jones & Wagener Room		
08:30		Welcome & Housekeeping
08:35	Dr Vere Ross-Gillespie	KEYNOTE: Global applications of environmental DNA (eDNA) for ecosystem monitoring
09:15	Dr Pearl Gola	The potential of community-based citizen science monitoring for wetland ecosystem function
09:30	Miss Maleho Sadiki	Assessing gaps in the National Wetland Inventories of African countries for responding to the Global Biodiversity Framework Targets 1-3
09:45	Prof Wynand Malherbe	Application of environmental DNA as a biodiversity monitoring tool in African aquatic ecosystems: Challenges and opportunities
10:00	Ms Kate Snaddon	Dust off the datasets: repurposing wetland data on the Freshwater Biodiversity Information System
10:15	Ms Masego Montwedi	Effectiveness of peri-urban wetlands in providing ecosystem services: Mankweng, as a case study
10:30	***Tea/Coffee Break***	

SESSION 6a: Parallel Session: (1) Water quality and pollution (2) Special insert 30 by 30 | Chair: Mr Tsepo Sekaleli | Venue: Jones & Wagener Room			SESSION 6b Parallel Session: Wetland ecology and biodiversity | Chair: Miss Maleho Sadiki | Venue: Impala Room		
11:00	Ms Shaddai Daniel	Tracking biodiversity recovery, one spill at a time: Case of the uMhlanga Estuary, South Africa	11:00	Dr Chantelle Girgan	Nematode diversity in selected peatlands in the North West Province, South Africa
11:15	Dr Piet-Louis Grundling	In the face of a total sewage onslaught: is there still a role to play for natural wetlands in contaminated watercourses?	11:15	Dr Kyle Lloyd	How species conservation can safeguard our wetlands - the case of the White-winged Flufftail
11:30	Miss Joelene Govender	Towards characterising pollution in mangrove-dominated estuaries in the context of anthropogenic	11:30	Ms Refilwe Chilo	Water beetles as indicators of climate change vulnerability in South African freshwater ecosystems

		disturbance: A South African case study on microplastics			
11:45	Prof Chris Curtis	Baseline study for construction of an artificial wetland on the Bronkhorstspruit River: a comparison of water quality and biomonitoring data using a BACI design	11:45	Dr Matthew Bird	Water beetles (Coleoptera) associated with Afrotemperate Forest patches in the Garden Route National Park, South Africa
12:00	Dr Heidi van Deventer	Reporting the extent of wetland restoration interventions relative to pressures and impacts for Target 2 of the GBF, using the Maputaland Coastal Plain as an example	12:00	Miss Sone Janse van Rensburg	The distribution and taxonomy of Sphaeriidae bivalves in South African wetland systems
12:15			12:15	Miss Marlize Muller	From Bitterns to Widowbirds: A review of wetland birds to inform management guidelines
12:30	Collect packed lunches; organise transport				
12:45	Mid-Conference Field Trips to Kgaswane Mountain Reserve and Rietfontein				
17:00	***Braai at Kgaswane Mountain Reserve (return to venue by ±19:00) | Sponsored by Impala Platinum***				
19:30	Short movies shown in the Dahlia Room; Cash Bar				

DAY 3 – Wednesday 25th October 2023

08:00	Registration Opens | Venue: Outside Jones & Wagener Room				
SESSION 7: Plenary Session: Wetland ecosystem functioning | Chair: Prof Wynand Malherbe | Venue: Jones & Wagener Room					
08:30		Welcome & Housekeeping			
08:40	Mr Anton Linström	KEYNOTE: Bring your fire			
09:20	Prof Michael Grenfell	Reading between the mounds: the biogeomorphology / biogeochemistry interface of wetlands in drylands			
09:35	Mr Steven Khosa	The geomorphic characterisation of wetlands on various landscapes in Marakele National Park, Limpopo Province, South Africa.			
09:50	Mr Tlotlisang Nkhase	Seasonal variation of carbon dioxide net ecosystem exchange on Waterkloofspruit Peatland, Kgaswane Mountain Reserve			
10:05	Mr Ayabonga Gangathele	Effects of headcut and gully erosion on the hydraulic properties of peat on a high-altitude mire			
10:20	Mr Jason le Roux	A hydrological investigation into a historic peat fire on the Maputaland Coastal Plain			
10:35	***Tea/Coffee Break***				
SESSION 8a: Parallel Session: Mapping, monitoring and remote sensing | Chair: Mr Edward Smit | Venue: Jones & Wagener Room			SESSION 8b: Parallel Session: Water quality and pollution | Chair: Ms Refilwe Chilo | Venue: Impala Room		
11:10	Mr Ryan Kok	Updating of the North West Provincial Wetland Inventory using field data collection, desktop mapping and remote sensing techniques	11:10	Ms Thembela Bushula	An assessment of the Present Ecological State (PES) of the Kluitjieskraal Wetland, with emphasis on water quality impacts
11:25	Mr Jaco Kotzé	Extrapolation of digital soil mapping approaches for soil organic carbon stock predictions in the alpine wetlands of the Northern Maloti-Drakensberg: An Afromontane environment	11:25	Dr Donovan Kotze	Assessing the impacts of wastewater on wetland ecosystem services supply in South Africa to inform wetland management and restoration/rehabilitation decisions
11:40	Miss Nkosingizwile Ndlovu	Assessing changes in the hydrological regime of lacustrine wetlands on the Maputaland Coastal Plain, South Africa	11:40	Dr Munyaradzi Manjoro	Sediment and water quality investigation in the Kamfers Dam Kimberley, the only breeding site for Lesser Flamingo (*Phoeniconaias minor*) in South Africa
11:55	Miss Lukho Goso	Using Geographic Information Systems (GIS) to assess the biodiversity and protection levels of Africa's rivers	11:55	Miss Owami Mashaba	Water use efficiency of riparian plants and their influence on aquatic biota in the Riet and Lower Vaal River Systems

12:10	Miss Carli van Zyl	Historical hydrological trends in the Olifants River Catchment, Western Cape: implications for floodplains in a changing climate?	12:10	Miss Chelsea Withfield	The widespread freshwater clam Corbicula sp. as potential bioindicator species for mercury pollution in South Africa
12:25	Mr Philani Apleni	Quantifying changes in the extent of wetland types of the Maputaland Coastal Plain using remote sensing: Implications for Restoration and Conservation	12:25		
12:40	***Lunch - Restaurant***				
SESSION 9a: Parallel Session: (1) Rehabilitation and Restoration, (2) Wetlands people and community engagement | Chair: Mr Jason le Roux | Venue: Jones & Wagener Room			SESSION 9b: Parallel Session: Wetland ecology, conservation and management | Chair: Mr Jaco Kotze | Venue: Impala Room		
13:30	Mr Dieter Kassier and Ms Shavaughn Davis	Rehabilitation of high-altitude peatlands - Observations and insights from an ongoing rehabilitation planning study within the Lesotho Highlands.	13:30	Dr Peter Chatanga	Plant community composition of the high-altitude montane wetlands of Bokong Nature Reserve in Mats'eng Biosphere Reserve, Lesotho
13:45	Mr Tebogo Nkadimeng	Showcasing the impact of Gauteng Department of Agriculture, Rural Development and Environment (GDARDE) and Rand Water Foundation Developmental Investment: Restoration of the Blesbokspruit wetlands at Marievale Bird Sanctuary	13:45	Ms Tshifhiwa Malise	Vegetation classification of the hydrogeomorphic wetland types in the Kgaswane Mountain Reserve
14:00	Dr Catherine Dzerefos	Cultivating a community-based stewardship legacy in the headwaters of Majakaneng in the Magaliesberg Biosphere Reserve	14:00	Miss Thandeka Ndlela	Comparing differences in the ecohydrology, physical and chemical characteristics of two differently managed peatlands in Eswatini
14:15	Ms Anele Ngcobo	Community-based monitoring by Mpophomeni Enviro-Champs	14:15	Ms Damaris Kisha	Influence of wetland conversion on greenhouse gas emissions in valley-bottom wetlands in Taita Hills, Kenya
14:30	Mr Gilbert Tayebwa	Engaging communities in wetland conservation: The role of village-based Wetland Management Committees and Conservation Agreement Groups within Kiyanja-Kaku Wetland in Uganda	14:30	Mr Tsepo Sekaleli	A review of the mire types of Lesotho for current and future contribution to management
14:45	***Tea/Coffee Break***				
SESSION 10: Workshop Session					
15:15	Dr Heidi van Deventer and others	Workshop 3: Explore our inland water spatial data! Conversation cafe to allow interaction between stakeholders and people who have generated inland water maps and other products	15:15	Dr Alanna Rebelo, Dr Althea Grundling, Jason le Roux, Dr Piet-Louis Grundling	Workshop 4: Draft protocols ("decision trees") for peatland management and rehabilitation
16:45	***Break***				
17:00	SAWS AGM | Chair: Shaddai Daniel | Venue: Impala Room				
19:00	***Gala Dinner & Wetlands Awards Ceremony | MC: Shaddai Daniel | Venue: Dahlia Room | Sponsored by Mondi***				

DAY 4 – Thursday 26th October 2023

08:00	Registration Opens | Venue: Outside Jones & Wagener Room	
SESSION 11: Plenary Session: Wetland threats| Chair: Ms Kate Snaddon | Venue: Jones & Wagener Room		
08:30	Ms Kathy Taggart and Mr Dieter Kassier	A moving target: The protection and management of the estuarine / freshwater interface while mining in tropical Sierra Leone
08:45	Dr Hannes Erasmus	Then and now: comparing the mollusc diversity of the Mooi River over a period of 60 years
09:00	Miss Nqobile Sithole	Identifying Prosopis species invading the Molopo area (North West, South Africa).
09:15	Mr Teodor van Wyk	Dragonflies and damselflies as indicators of human impacts in Magaliesberg streams
09:30	Mr Sashin Pillay	Managing wetland ecosystems during the age of South Africa's renewable energy transition
09:45	Ms Mariette Jansen van Vuuren	Determining the source, pathways and receptors of metals and sulphate in the bottom sediment of an ecologically engineered wetland, that receives acid mine drainage.
10:00	***Tea/Coffee Break***	
SESSION 12: Plenary Session: Mapping, monitoring and remote sensing | Chair: Dr Althea Grundling | Venue: Jones & Wagener Room		
10:30	Ms Nancy Job	An integrated approach to the mapping, conservation and management of South Africa's freshwater ecosystems
10:45	Dr Nacelle Collins	WetMap: An ArcGIS toolbox for integrated wetland mapping
11:00	Dr Siyamthanda Gxokwe	An assessment of long-term and large-scale wetlands change dynamics in the Limpopo transboundary river basin using cloud based earth observation data
11:15	Ms Adwoa Awuah	Workflows: Building the recipe book for the National Wetland Map 6 and future versions
11:30	Dr Heidi van Deventer	Mapping changes in estuarine ecosystem functional types with Landsat and Sentinel-1 and -2 to align with South Africa's four national land covers of 1990, 2014, 2018 and 2020
11:45	Miss Hannah Chemaly	The spatial distribution of floodplain types across two river systems
SESSION 13: Closing Session | Chair: Mr Eric Munzhedzi, Ms Kate Snaddon | Venue: Jones & Wagener Room		
12:00		Wrap up and Prize Giving (best student and student runner-up for oral presentation and poster)
12:30		Conference closure

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ORAL PRESENTATION ABSTRACTS

QUANTIFYING CHANGES IN THE EXTENT OF WETLAND TYPES OF THE MAPUTALAND COASTAL PLAIN USING REMOTE SENSING: IMPLICATIONS FOR RESTORATION AND CONSERVATION

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ABSTRACT

Wetland ecosystems play a vital role in biodiversity conservation and the provision of ecosystem services. Understanding the rate and extent of changes in wetland types is crucial for effective restoration and conservation efforts. The aim of the project was to quantify changes in the extent of wetland ecosystem functional groups (EFGs) of the Maputaland Coastal Plain (MCP) between 1990 and 2020. The Google Earth Engine (GEE) cloud computing platform was utilised to map seven wetland EFGs for seven years between 1990 and 2022. Two estuarine EFGs (Coastal salt marshes and Intertidal forests and shrublands) and five freshwater EFGs (Lacustrine, Large macrophytes, Permanent marshes, Seasonal marshes, and Subtropical-temperate forested wetlands) were mapped for seven years in the 22-year period, using the random forest classification algorithm. Landsat images were employed for typing EFGs for 1990, 2000, 2006, and 2013, whereas Sentinel-1 and Sentinel-2 were used to create cloud-free median composites for 2018, 2020, and 2022. A digital elevation model was generated from 5-m interval contours and 1:10 000 spot heights and used in the classification of the EFGs. Changes in the extent of the wetland EFGs were then used to calculate the rate of change and estimated year of potential collapse.

The results showed that the average percentage extent of wetlands is 14.8% of the MCP, and the average rate of change was -0.5% between 1990 and 2013 and -2.92% between 2018 and 2022. This suggests a more rapid decline between 2018 and 2022 compared to earlier years (1990 to 2013). Over the years, wetlands have shown changes predominantly to two land cover categories, including Cultivated wetlands and Croplands. Cultivated wetlands occurred across the estuarine-freshwater ecotone, totalling approximately 8.2 km². In the iMfolozi/uMsunduzi Estuary, approximately 11.3 km² of subtropical-temperate forested wetlands underwent conversion to cropland, posing risks to wetland ecosystem functions and the provision of ecosystem services. These sites could be considered for restoration to meet the 30% extent of the GBF's target 2.

Keywords: Global Biodiversity Framework (GBF), Google Earth Engine (GEE), IUCN global ecosystem types, Landsat, Random Forest, Sentinel

Philani Apleni is a geoinformatics Masters student at the University of Pretoria, Apleni's work is focused on the mapping and monitoring of wetland types using remote sensing.

PERCEPTIONS OF THE VALUE OF AND CHANGES IN WETLANDS OF TRADITIONAL COMMUNITY MEMBERS ON THE MAPUTOLAND COASTAL PLAIN

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ABSTRACT

The Maputoland Coastal Plains (MCP) is under pressure for several reasons, including transformation of wetlands to croplands, water abstraction, alien invasive species, and climate change. Many community members in the area have relied on the wetlands to enhance their livelihoods for more than three generations. However, communities are not the only stakeholders to consider. People's perception of the value of wetlands, changes in the extent of different types of wetlands, and the need to conserve these different wetland types were examined in the study. Remote sensing maps were used as a tool to engage with community members from the Tembe and Mabasa Traditional Authorities.

The aim of the engagement was to enhance our current understanding of the area in terms of people and their relationships with the freshwater environment. Through the use of participatory methods, the research and learning gained from this project included the input from local stakeholders and attempted to ensure benefits to not only science, but also society – in particular local stakeholders living in the area. We will share the methodologies that were used, successes and challenges. It shows the importance of involving local communities in conservation efforts and highlights.

Keywords: communities, wetlands, Maputoland Coastal Plains, remote sensing, stakeholder engagement

Ilse Aucamp is a Director of Equispectives Research and Consulting Services in South Africa. She conducts social, gender and human rights assessments, due diligence studies, public consultation, stakeholder management processes and designs and implement social impact management strategies. She teaches Social Impact Assessment on a masters' degree level at several universities in South Africa. Her passion is working with grassroots communities. She holds a DPhil degree in Social Work from the University of Pretoria and a Masters' degree in Environmental Management from North West University.

WORKFLOWS: BUILDING THE RECIPE BOOK FOR THE NATIONAL WETLAND MAP 6 AND FUTURE VERSIONS

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ABSTRACT

More often than not, when it comes to large projects or developing national datasets, the methodology and workflows are kept quite close to the chest or are a “black box”. Over the years, with the development of versions of the National Wetland Map, lead investigators have increasingly shared their methods and processes through governance structures such as Technical Working Groups, and published reports. The National Wetland Map team, which consists of the SANBI Freshwater Biodiversity Programme and Dr Nacelle Collins (Free State Department of Small Business Development, Tourism and Environmental Affairs), have been working to continue this trend and take it a step further through developing robust, defensible, and repeatable workflows for the various components of work for the National Wetland Map.

To date, the team has advanced significantly in the development of data cleaning workflows and protocols, which can be seen during the poster session, and project setup. The workflows for engaging with each province are in development with the NWM Technical Working Group, which consists of the Provincial Conservation departments and SANParks, and which continues to meet monthly. This presentation provides a case study of how such a workflow can be developed with a province, and how various stakeholders can interact collaboratively with the National Wetland Map team to slowly, yet confidently, improve our wetland baseline information.

Keywords: Wetland mapping, workflows, National Wetland Map Technical Working Group

Adwoa Awuah is a freshwater scientist with the SANBI Freshwater Biodiversity Programme, which is based at Kirstenbosch, Cape Town . Her work at SANBI focuses on working with different stakeholders to update the National Wetland Map. Her work in the Western Cape and opportunities to travel around South Africa brought a shock to her warm blooded KZN system, but also challenged her understanding of how wetlands function in different parts of the country.

WATER BEETLES (COLEOPTERA) ASSOCIATED WITH AFROTEMPERATE FOREST PATCHES IN THE GARDEN ROUTE NATIONAL PARK, SOUTH AFRICA

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ABSTRACT

Southern Afrotemperate Forest is concentrated in the southern Cape region of South Africa and whilst it is relatively well known botanically, the fauna, specifically the aquatic invertebrate fauna, are poorly documented. The majority of remaining intact forest habitat is contained within the Garden Route National Park (GRNP), which straddles the provincial boundary between the Western and Eastern Cape. This study undertakes a survey of the water beetle fauna inhabiting the GRNP.

The aquatic ecosystems within temperate forests of the region are poorly researched from an ecological and biodiversity perspective, despite being known to harbour endemic invertebrate elements. We collected water beetles and *in situ* physico-chemical data from a total of 31 waterbodies across the park over two seasons (summer and late winter) in 2017. The waterbodies sampled were mostly small freshwater perennial streams and isolated forest ponds. A total of 61 beetle taxa was recorded (29 Adephaga, 32 Polyphaga) from these waterbodies. The water beetle fauna of these forests appear to be diverse and contain many species endemic to the fynbos-dominated Cape Floristic Region, but very few of the species appear to be forest specialists. This is in contrast to the fynbos heathland habitat of the region, which harbours a high number of water beetle species endemic to this habitat, often with Gondwanan affinity.

Our study is the first to document the water beetles of Afrotemperate Forests in the southern Cape region and provides an important baseline for future work on such habitats in the region and in other parts of southern Africa.

Keywords: aquatic Coleoptera, aquatic invertebrates, biodiversity census, forest conservation, freshwater biodiversity, southern Cape, temperate forests

Matthew Bird's main interests focus on the invertebrate community ecology of shallow aquatic environments, including wetlands, rivers and estuaries, predominantly using field investigations. The bulk of my work focusses on using aquatic macroinvertebrate .

UP-SCALING DRYLAND RESTORATION PROJECTS IN SOUTH AFRICA.

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ABSTRACT

Severe land degradation through dry-land erosion and bush encroachment occurs in many parts of South Africa. The presentation will define dry-land restoration and illustrate the massive degradation problems in SA. Restoration operations are expensive and possible ways of how to finance these projects (through involving the private sector) will be discussed. The importance of good restoration planning will be highlighted. The Department of Forestry, Fisheries and the Environment (through the Working on Ecosystem Services program) has been implementing many rehabilitation projects over the years in various biomes of the country. Visual examples of the methods which have been used to address degradation in the following projects will be illustrated:

- Special attention will be given to the restoration of the Thicket biome that can be financed through the Carbon sequestration / Carbon market model. Erosion control and replanting of thicket in the Baviaanskloof and Somerset East areas will be used as examples;
- Dry-land erosion work in the Tsitsa River and Mt Fletcher Catchments (Grassland biome)
- Erosion control mitigation and Invasive Alien Plant (IAP) control after the devastating 2017 Knysna fire (Fynbos biome)
- Bush encroachment control combined with erosion control methodologies in various parts of the Savannah biome in the Limpopo Province
- Erosion control methods in the Mountain Zebra National Park (Karoo biome)

Different methodologies have been used and some of the softer options like ponding, gully erosion re-sloping, soil blankets, installation of fibre filled rolls, brush packing and silt fences will be discussed and illustrated.

Keywords: Dry-land restoration, degradation, Carbon sequestration, Carbon market, restoration methodologies

As an ecologist, **Japie Buckle** has been involved with practical implementation of invasive alien plant eradication/rehabilitation and restoration of wetlands, dry-lands and bush encroachment projects for the past 37 years. He currently manages a thicket restoration project on a large farm in the Somerset East district on behalf of the British company, Hive Ecosystems.

AN ASSESSMENT OF THE PRESENT ECOLOGICAL STATE (PES) OF THE KLUITJIESKRAAL WETLAND, WITH EMPHASIS ON WATER QUALITY IMPACTS

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ABSTRACT

A study on the valuation of the Kluitjieskraal and Romansrivier Wetlands in the water landscape in the Breede River Catchment has been commissioned by Department of Environmental Affairs and Development Planning, Western Cape Government, and is being led by eScience. The study aims to determine the value of the services provided by these wetlands, including, amongst others, nutrient retention, flood control and water retention and release. A management plan, including recommendations for rehabilitation and monitoring and evaluation, for these wetlands will also be developed. The primary purpose of this presentation is to present some key findings of the field assessment relating to the Present Ecological State (PES) of Kluitjieskraal Wetland, the most severely impacted of the two wetlands, focussing especially on water quality impacts, as well as broadly outlining the economic value of the wetland in ameliorating the impact of reduced water quality effluent from the Wolseley Waste Water Treatment Works (WWTW). The presentation will also discuss some management implications of these findings.

Field assessment included auger samples at different points in both wetlands to determine soil morphology based on the Munsell soil colour chart, from which the hydroperiod was inferred. At each sample point the dominant, sub-dominant and additional plant species were identified, and vegetation condition was rated. Kluitjieskraal Wetland was dominated by *Typha capensis*, *Phragmites australis*, and *Juncus effusus* and these are indicative of disturbance within a wetland, such as water quality impacts from the WWTW, agricultural encroachment and cattle grazing. Alien vegetation infestation by *Eucalyptus* sp, *Acacia mearnsii*, and others was noted. Three key point sources of pollution entering the wetland were identified, one of which was a major leak in a sewage pipeline. This key surcharging point was the sewer line feeding the Wolseley WWTW. Positive support was provided by BOCMA, when this was reported by the service provider of the project and was fixed within days by the Witzenberg Municipality.

The presentation will report on long-term water quality data at one of the inflows to the Kluitjieskraal wetland and within the wetland near its outflow, which enables an understanding of the possible value and impact of a wetland in cleansing effluent from a WWTW. The PES categories will be presented separately for the four individual components, hydrology, geomorphology, water quality and vegetation. The PES for Kluitjieskraal Wetland was estimated at a D, as hydrology and water quality have been severely altered.

Keywords: Kluitjieskraal Wetlands, Wolseley WWTW, Management Plan, PES

Thembela Bushula is a freshwater ecologist with the Breede-Gouritz Catchment Management Agency (BOCMA) in the Western Cape. Thembela has a Bachelor of Science (Honours) degree in Zoology from Fort Hare University. She has acquired hands-on experience in the implementation of the National Water Act (Act 36 of 1998), as well as having knowledge of other related legislation, and is passionate about the protection and conservation of the water resources and environment at large, not forgetting the importance and requirement to strike a balance between their use and management. Her professional goal is to be a well-recognised and professional aquatic ecologist/scientist within the field of water resource management.

BOKONG NATURE RESERVE IN MATŠENG BIOSPHERE RESERVE, LESOTHO

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ABSTRACT

Bokong Nature Reserve (BNR) is one of the two protected areas forming the core of the recently declared and Lesotho's first Man and Biosphere Reserve – Matšeng Biosphere Reserve (MBR). Furthermore, the BNR falls within the main catchment of the Katse Dam, which is one of the Lesotho Highlands Water Project dams. Despite having been protected for more than three decades and being part of the core of the MBR, the wetland vegetation of BNR had not been documented in detail. Thus, this study characterised the vegetation of the high-altitude montane palustrine wetlands of BNR in MBR, Lesotho. Data were collected in March 2022 using a 3 × 3 m vegetation plot placed in each visually homogenous plant community in each wetland in BNR. Plant species composition was assessed using the Braun-Blanquet method. The height and cover of the vegetation were also measured and environmental data were collected using standard methods. The data were analysed mainly by determining species richness and calculating Shannon-Wiener diversity and evenness, as well as employing hierarchical cluster analysis, canonical correspondence analysis and redundancy analysis.

The results show that a total of 175 plant species from 102 genera and 40 families were encountered in the wetlands. The four most frequently occurring species in the wetlands, in decreasing order, were *Oxalis obliquifolia, Senecio macrocephalus, Athrixia fontana* and *Merxmuellera disticha*. The three most dominant plant families in terms of number of species encountered were Asteraceae (21.14%), Poaceae (16.0%) and Cyperaceae (11.43%). Hierarchical cluster analysis produced ten plant communities. Shannon-Wiener diversity was in the range of 0-2.21 per plot, while species evenness ranged from 0.34 to 0.86. The height of the vegetation was 2-70 cm, while its cover was 50-100%. Important environmental factors influencing the vegetation included longitude, altitude, latitude, soil sodium, inundation, soil texture and soil magnesium. The results suggest that the wetlands in BNR are in a relatively stable condition. Due to the fact that the vegetation in a wetland determines the functioning of the system, which in turn influences its capacity to supply ecosystem services, the information from this study forms the baseline for monitoring the BNR wetland vegetation and wetland condition. The BNR wetlands are also of international conservation value because they form part of the core of a UNESCO-declared Man and Biosphere Reserve and play a role in supporting biodiversity and in protecting water resources.

Keywords: Biodiversity conservation; Ecosystem service; high-altitude montane wetland plant community; Maloti-Drakensberg; Matšeng Biosphere Reserve; water resources

Peter Chatanga is a Senior Lecturer and Head of the Department of Biology at the National University of Lesotho where he teaches Ecology and Biodiversity courses, as well as supervising M.Sc. research projects. His academic background includes a B.Sc. Hons. (Biological Sciences), M.Sc. (Tropical Resource Ecology) and a PhD (Environmental Science – Ecology). He is also an Associate Editor of the Journal of Ecology and a reviewer of the British Ecological Society grant applications. Peter is a plant community ecologist with more than 15 years of experience in research and teaching in higher education.

THE SPATIAL DISTRIBUTION OF FLOODPLAIN TYPES ACROSS TWO RIVER SYSTEMS

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ABSTRACT

South Africa is geomorphologically diverse with a range of river and floodplain types. Floodplains are vital landscape features providing multiple ecosystem services while also serving as biodiversity hotspots, yet they are highly threatened by human activities. Floodplain wetlands may be classified based on processes related to stream power and sediment calibre, resulting in a range of systems varying from single-thread (straight, sinuous or meandering) to multiple-thread (anastomosing, mixed bedrock-alluvial anabranching or wandering). Variations in geomorphic process and form has implications for ecosystem service provision. There has been no large-scale study or attempt at mapping and describing floodplain types across the country.

This study aims to assess patterns and/or trends in the spatial distribution and characteristics of floodplain types. Data outputs from two river systems will be presented and contrasted. The two catchments include the Olifants River in the west of South Africa with a mean annual rainfall ranging between 48 and 1635 mm/a across the catchment, and the Tugela River, located within KwaZulu-Natal with a mean annual rainfall between 650 and 1500 mm/a. Floodplains will be delineated using HAND (height above nearest drainage) on a SRTM dataset and classified using the genetic geomorphic classification system of Grenfell et al. (2019). The characteristics of each floodplain (area, length, average width, longitudinal slope, geology, confinement, river sinuosity) and their respective catchment (mean catchment slope, maximum and minimum elevation, area, MAR, MAP, geology, Köppen Climate, Aridity Index, vegetation) will be derived and compared using a combination of ArcGIS Pro, XLSTAT and SPSS.

The data could assist in establishing whether there are any broad-scale continuums that may be used to describe the spatial occurrence of different floodplain types due to the macro-scale geomorphic context and/or the aridity gradient. This research will also contribute to the accurate mapping of floodplains and their catchments for these two river systems.

Keywords: Floodplains, Floodplain types, Floodplain wetlands, Mapping, Large-scale study, Hydroclimatic regions

Hannah Chemaly is a Geography and Environmental Studies master's student at Stellenbosch University, specialising in fluvial geomorphology. She discovered her interest in fluvial geomorphology during her honours year and aims to continue this pursuit. Her master's research is a GIS project focusing on the spatial distribution of floodplain types across South Africa's hydroclimatic regions. Her goal is to make a meaningful contribution towards the field of fluvial geomorphology through research. Hannah is passionate about nature.

WATER BEETLES AS INDICATORS OF CLIMATE CHANGE VULNERABILITY IN SOUTH AFRICAN FRESHWATER ECOSYSTEMS

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ABSTRACT

A rapidly changing climate is a global phenomenon which is expected to have severe impacts on our water resources in South Africa. However, specifics regarding the nature and extent of these effects on aquatic ecosystems have not been adequately investigated. This is mainly due to the lack of empirical studies testing biotic responses to the expected thermal changes resulting from climate change. Macroinvertebrates are one of the best-known indicators of environmental change in freshwater ecosystems, and within this group, water beetles show promise as indicators of thermal stress. Although there are a few studied in northern temperate regions, virtually no studies have investigated the thermal tolerance of water beetles in austral regions. One of the broader aims of this study is to investigate the thermal tolerance limits of water beetles from lotic (stream) and lentic (wetland) freshwater environments of two biogeographically distinct regions of South Africa. The study will compare the vulnerability of stream vs wetland fauna to climate change by assessing the relative thermal sensitivity of water beetle taxa inhabiting each habitat type. The water beetles collected will be exposed to both dynamic ('Critical Thermal Maximum/Minimum' – CTM) and static ('Incipient Lethal Temperature' – ILT) exposures to assess relative differences in thermal tolerance among the regions, habitats and taxa. It is broadly hypothesized that water beetles inhabiting streams will be more vulnerable to climate change than those inhabiting lentic wetlands, given the greater temporal fluctuation in temperatures in wetlands, thus leading to a more resilient fauna.

Keywords: Water beetles, climate change, thermal tolerance

Refilwe Chilo is a PhD student at the University of Johannesburg. She enjoys being outdoors and engaging with all things in nature, except snakes. She is passionate about conservation and sustainability.

WETMAP: AN ArcGIS TOOLBOX FOR INTEGRATED WETLAND MAPPING

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ABSTRACT

The first National Wetland Map of South Africa was published in 2006, and it has since then been updated many times. Recently such updates were made mostly as part of the National Biodiversity Assessments, including the latest National Wetland Map (NWM5). However, in spite of all the mapping efforts, NWM5 is still considered to be of insufficient accuracy to be used with confidence at a national level. For the NBA2025, SANBI will again be improving on the National Wetland Map. The focus will be to integrate existing data to create a single 'best' version thereof, and to supplement it with new data where existing data are insufficient. New data can be in the form of on-screen mapping, or by way of topographic mapping. To facilitate this process a suite of ArcGIS tools, known as WetMap, is being created. In addition to the tools for mapping and integrating existing data, WetMap also provides a framework for data warehousing. It also includes the tools for topographic mapping, which, unlike previously used mapping technologies that attempt to map the consequences of water accumulation, rather attempts to map the cause thereof. In addition to the tools for mapping, WetMap also includes tools for improved assessment of wetland attributes, e.g. their Present Ecological State.

Keywords: Mapping, ArcGIS

Nacelle Collins is employed by the Free State Department of Economics, Small Business Development, Tourism, and Environmental Affairs as a wetland ecologist.

BASELINE STUDY FOR CONSTRUCTION OF AN ARTIFICIAL WETLAND ON THE BRONKHORSTSPRUIT RIVER: A COMPARISON OF WATER QUALITY AND BIOMONITORING DATA USING A BACI DESIGN

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ABSTRACT

The Bronkhorstspruit Dam on the eastern edge of Gauteng is an important local and regional resource for both water supply and amenity value, with tourism, water sports, fishing and an adjacent municipal nature reserve. However, over the past few years there have been major issues with water quality as well as invasive species (e.g. water hyacinth) which have greatly impacted the services provided by the dam. Potential sources of pollution include farming and food processing industries, failing wastewater treatment plants, landfill sites and the growth.

of formal and informal settlements within the catchment of the main inflow, the Bronkhorstspruit River. Stakeholders within the Bronkhorstspruit Catchment Management Forum (BCMF) have proposed the construction of an artificial wetland on the river within the municipal nature reserve to both improve water quality and enhance biodiversity and provision of ecosystem services including ecotourism. As part of a GDARD funded research programme under the theme of the "Water, Energy and Food Nexus", a baseline study was recently completed to assess water quality at locations upstream, within and downstream of the footprint of the planned wetland. Monthly water quality sampling was carried out from June 2022 to May 2023 to provide baseline data within a Before-After-Control-Impact (BACI) study design.

The data show minor spatial differences in water quality across the three sample locations. At the upstream location, monthly biomonitoring of macroinvertebrates using the miniSASS tool was also established to determine the ecological state of the river entering the dam. Both the water quality and miniSASS data captured a major pollution incident during the spring of 2022 which resulted in a temporary decline from "largely modified" or "poor" condition to the worst category of "seriously/critically modified" or "very poor" condition. The intention would be to repeat sampling after construction of the wetland to determine whether there have been any water quality improvements at the downstream location that may be attributed to the wetland itself, rather than to changes in pollutant loads from the upstream catchment. The correlation between miniSASS scores and independent water quality assessments in an accredited laboratory demonstrate the value of citizen science approaches for community-based environmental monitoring.

Keywords: WEF Nexus, citizen science, miniSASS, constructed wetlands

Chris Curtis is a biogeochemist interested in environmental change in aquatic systems. His studies have focused primarily on the impacts of water pollution, air pollution and climate change on the ecosystems of wetlands, dams, remote lakes and streams in southern Africa, the Arctic, Canada and mountain regions of Europe. He is increasingly working in lowland and urban aquatic systems on human induced changes during the Anthropocene

TRACKING BIODIVERSITY RECOVERY, ONE SPILL AT A TIME: CASE OF THE UMHLANGA ESTUARY, SOUTH AFRICA

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ABSTRACT

Environmental monitoring is key for timely and prioritised decision-making around interventions such as habitat restoration, rehabilitation and remediation which draw on a suite of practices to help nature heal through inputs by qualified scientists, contractors and communities. While remediation controls the pollution, restoration efforts, like the construction of wetlands and the planting of trees and vegetation, complete the process of providing healthy habitat for fish and wildlife, and ensuring safe environments for people to live and work in. Habitat recovery and restoration are often essential in sensitive aquatic habitats such as estuaries and wetlands following extreme pollution events and is particularly important in the context of coastal habitats which are highly susceptible to various climate change scenarios and threatened by anthropogenic pressures linked to land use change in many parts of the world.

The current study, which forms part of a three-year Environmental Pollution Programme funded by the UK Department for Environment, Food and Rural Affairs and the Joint Nature Conservation Committee, investigates the utility of sensitive indicators for tracking ecosystem recovery in the chronically and episodically polluted Ohlanga River and uMhlanga Estuarine system. A situational analysis of the area severely impacted by a chemical spill, in July 2021, has indicated high levels of degradation to a number of biotic species and abiotic variables. These include the death and decline of a number of biota such as bivalves, fish, invertebrates, diatoms and birds. Furthermore, the introduction of toxic and persistent heavy metals and pesticides, such as arsenic, manganese and copper has seen a rapid deterioration in water quality having a knock-on effect within the system. This data, in conjunction with data from a control site, the iNonoti Estuary, will be used to benchmark and track the recovery of the system over a two-year period. Ecosystem recovery will be based on a number of suitably sensitive indicators particularly carbon stocks (sediment), fish, diatoms, macroinvertebrates, water quality and vegetation density, which will be monitored biannually to account for seasonal flow variations. The project aims to recommend a suite of suitable monitoring variables to fast-track environmental disaster management decision-making to improve and expedite rehabilitation and mitigation interventions, which could inform recovery of estuaries subject to extreme pollution events around the world.

Keywords: Environmental monitoring; Restoration; Ecosystem recovery; Pollution; Estuaries

Shaddai Daniel has been working at the National Department of Water & Sanitation (Western Cape Operational Office) for 14 years. She is the Departmental representative and scientist in the fields of wetland, river and estuarine management; Water Use Authorisation, Policy and legal development and review; as well as being specialist witness for Compliance and Enforcement issues for the Department. Shaddai is currently undertaking her MSc at the University of the Western Cape (UWC) under Professor Anusha Rajkaran, and will focus on research expertise in the fields of integrated catchment management, using biological monitoring indicators to track recovery of a system, and establishing carbon stock capacities associated with blue and teal carbon habitats.

CULTIVATING A COMMUNITY-BASED STEWARDSHIP LEGACY IN THE HEADWATERS OF MAJAKANENG IN THE MAGALIESBERG BIOSPHERE RESERVE

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ABSTRACT

The COVID-19 pandemic imposed unprecedented anthropogenic pressure on the Magaliesberg Biosphere Reserve (MBR) and its natural water systems but a transformative project, the Save Our Species Project and Eco-Rangers programme, also emerged. Conceived by the MBR NPC and backed by the German Federal Government and German Commission for UNESCO, this project had a profound mission: to combat poaching, illegal tree felling, and the spread of invasive alien plants (IAPs) within the MBR. Seven Eco-Rangers were selected in August 2020 and underwent three months of intensive training at various MBR locations with the help of committed partners from Kainav Conservation, the Mountain Club of South Africa (MCSA), Tshwane University of Technology (TUT) and the Wildlife and Environment Society of South Africa (WESSA). Mentorship and hands-on experience followed, with Eco-Rangers actively participating in IAP removal efforts and snare patrols, to safeguard the region's biodiversity and ecological integrity. During this time the Majakaneng Eco-Rangers expressed concern about escalating environmental degradation in the kloofs abutting their community from scramblers and 4x4 vehicles traversing critical biodiversity zones, tree and protea harvesting and pollution of mountain water from spiritual and cultural practices. Recognizing the untapped potential of the area for ecotourism, the MBR, with the Eco-Rangers' input, successfully submitted a #SOS African Heritage application in 2021. The application aimed to establish a 10 km guided Heritage Trail and a trail basecamp featuring educational signage on Majakaneng's cultural and natural heritage. Erosion control measures were imperative, particularly around sacred springs and river areas. Furthermore, a Participatory Action Research project was initiated in collaboration with TUT to involve sacred space users in preserving water quality. Under the title "Rangers in Mission (RIM)," the Majakaneng Eco-Rangers expanded to encompass the establishment of a recycling centre and a children's conservation club equipped with miniSASS water quality testing kits. The "Be the Change" programme was successfully piloted at a local school by RIM, and outreach to children was extended in collaboration with the NPO, Summits with a Purpose. After nearly two years, there is compelling evidence of RIM's effective conservation work and advocacy within the MBR. Not only is there a substantial reduction in IAPs, erosion control and preservation of natural water but environmental stewardship has been conveyed to local children, the community and students from three universities. This project highlights the potential of community-led conservation initiatives and partnerships with NPOs to safeguard water resources.

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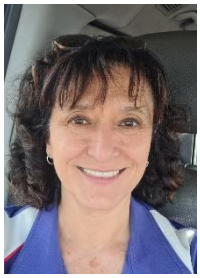
Keywords: Community-based conservation; biosphere reserve; eco-trail; heritage trail; Magaliesberg; headwaters; water quality



Cathy Dzerefos' transdisciplinary research has centred on the sustainable utilisation of natural resources to support viable livelihoods. She has investigated edible insects and beneficial plants in the northern provinces of South Africa. During a post-doctoral fellowship at the North-West University, she was involved in an international study to build community resilience in schools against climate change on the western platinum belt. She was a lead investigator on a collaborative research study comparing the use and promotion of edible insects in Japan and South Africa. She currently lectures at the Tshwane University of Technology and serves as a director on the Magaliesberg Biosphere Reserve board.

WETLAND REHABILITATION PLANNING IN HIGHLY MODIFIED URBAN CATCHMENTS IN THE ETHEKWINI MUNICIPALITY

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ABSTRACT

The Maputoland Coastal Plains (MCP) is under pressure for several reasons, including transformation of wetlands to croplands, water abstraction, alien invasive species, and climate change. Many community members in the area have relied on the wetlands to enhance their livelihoods for more than three generations. However, communities are not the only stakeholders to consider.

People's perception of the value of wetlands, changes in the extent of different types of wetlands, and the need to conserve these different wetland types were examined in the study. Remote sensing maps were used as a tool to engage with community members from the Tembe and Mabasa Traditional Authorities. The aim of the engagement was to enhance our current understanding of the area in terms of people and their relationship with the freshwater environment. Through the use of participatory methods, the research and learning gained from this project included the input from local stakeholders and attempted to ensure benefits to not only science, but also society – in particular local stakeholders living in the area. We will share the methodologies that were used, successes and challenges. The project shows the importance of involving local communities in conservation efforts.

Keywords: Rehabilitation, offsets, floods.

Ryan Edwards is the director and principal environmental scientist and wetland ecologist at Verdant Environmental with more than fifteen years experience in the natural scientific and environmental management consulting sector. His core field of focus, specialisation and passion is wetland ecosystem ecology, conservation, management and restoration. He holds a Master of Science (MSc) in Environmental Science (Research Masters) that focused on wetland origin and evolution (geomorphology) in South Africa. He has extensive experience in wetland rehabilitation / restoration planning and wetland and biodiversity offset planning. Other areas of expertise include specialist wetland and river (aquatic and riparian) assessments and ecological monitoring.

THEN AND NOW: COMPARING THE MOLLUSC DIVERSITY OF THE MOOI RIVER OVER A PERIOD OF SIXTY YEARS

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ASTRACT

The highest number of documented extinctions of any major taxonomic group is ascribed to the Mollusca. Factors mainly responsible for this include environmental changes and anthropogenic impacts that result in habitat destruction. Furthermore, the conservation status of less than 2% of the more or less 7000 mollusc species known worldwide, is still not properly assessed.

The aim of the present study was to assess the current status of the mollusc diversity in two aquifer springs located in the Mooi River, North West Province. Sampling took place in 1963, 2014 and 2023 to assess the mollusc diversity over 60 years. The pH, electrical conductivity (EC) and temperature were also measured at each locality. A total of 11 mollusc species were collected from the two sites, where seven of the species overlapped between the two sites. At Bovenste Oog the most dominant species were *Radix natalensis* and *Gyraulus costulatus*, while an invasive species *Physella acuta* was additionally collected at this site. At Gerhardminnebron the most dominant species were *Radix natalensis* and *Gyraulus connollyi*. A steady decline in species could be observed over time where at Bovenste Oog the species diversity decreased from seven to three species, while at Gerhardminnebron the species declined from six to two species. With regard to the abiotic factors, the pH values recorded in 2014 showed a moderate to large decrease as compared to the 1963 survey, but an increase in the 2023 survey. This acidification can be ascribed to the development of gold mines in the adjacent area. A steady increase in EC was recorded at both sites over time, however, there was a sudden decrease in 2023 at Gerhardminnebron. From the results it is clear that with an increase in anthropogenic impacts, the mollusc diversity decreased over a 60-year period.

Keywords: gastropods; aquifer springs; ecosystem health; *Radix natalensis*

Hannes Erasmus is a Post Doctoral Research fellow at the Water Research Group within the Unit for Environmental Sciences and Management at the North-West University. His passion is freshwater macroinvertebrates and to teach people about the amazing critters in our aquatic systems and the adaptations they have to live in different environments. His research focus is on anthropogenic threats to these ecosystems, and how we can work improve environmental conditions.

EFFECTS OF HEADCUT AND GULLY EROSION ON THE HYDRAULIC PROPERTIES OF PEAT ON A HIGH-ALTITUDE MIRE

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ABSTRACT

Peatlands are a type of wetland ecosystem where the sedentary accumulation of partially decomposed plant material under waterlogged conditions occurs. These systems are widely spread across the world, although they only cover 3% of the global land surface. This value is even smaller in South Africa where, due to the negative water balance caused by high evapotranspiration and low annual precipitation, peatlands occupy only 1% of the land area.

More than half (60%) of peatlands are found on the Natal Coastal Plain with 10% in the highveld. These ecosystems are highly valuable in the highveld as they provide various ecosystem services in these areas. One such system is the Waterkloofspruit peatland in the headwaters of the Waterkloofspruit River, which originates in Kgaswane Mountain Reserve, Rustenburg. The Waterkloofspruit catchment provides the city of Rustenburg and surrounding communities with potable water, which makes this wetland a highly valuable ecosystem in terms of ecosystem services. This ecosystem service provision is threatened by headcut and gully erosion which causes drainage of the system and subsequent peat desiccation. An investigation into the impact of gully erosion on the peat has shown that the erosion has increased the bulk density of the peat and changed the hydrological properties of the peat in the wetland; which essentially changes the functioning of the system. It is recommended that non-invasive erosion control measures be implemented in the wetland to curb the impacts of gully erosion not only on the peat, but the whole system.

Keywords: Headcut and gully erosion, humification, bulk density, organic matter, peat desiccation

Ayabonga Gangathele is a SANBI Groen Sebenza intern stationed at the Stellenbosch University. He grew up in a rural town called Mqanduli in the Eastern Cape. He completed his undergraduate studies in Geography and Statistics at the University of the Free State, where he also did his Honors and Masters degrees in Geography. He has worked at the Agricultural Research Council - Natural Resources and Engineering as a Professional Development Progamme student from 2020 until March 2023, prior to joining the South African National Biodiversity Institute.

URBAN WETLAND REHABILITATION: 3 CASE STUDIES FROM CONCEPTION TO COMPLETION

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ABSTRACT

Urban rivers and wetland systems are becoming increasingly degraded, disturbed and altered. This is largely due to the expansion of and increase in impermeable surfaces associated with urban development, the dumping of waste and litter, and from increased storm water runoff within catchment areas. Climate change is bringing more intense and more regular Highveld storms, which further exacerbates the problems of the condition of freshwater resources. The wetland case studies to be presented follow similar histories, where increased stormwater inputs into the systems have resulted in severely incised and eroded watercourse channels, mostly invaded with alien and invasive vegetation. A critical need was identified in all cases to curb the degradation of the watercourses, remove various alien and invasive species, and most importantly, control and manage flood waters on the sites, and further downstream.

Urban wetland and watercourse rehabilitation, management and maintenance have become essential in an environment where runoff from urban areas is persistently causing erosion and damage to wetlands and watercourse systems, radically impacting on natural hydrological functioning and the wider biodiversity of riparian areas. The danger to human life and expensive infrastructure is also of significance. Successful rehabilitation projects have been completed in Johannesburg in recent years, and all of these have greatly improved the functioning of the wetland systems and hydrological characteristics of the watercourses.

The three case studies that will be presented are:
1. Witkoppen (Cedar Lofts development) wetland rehabilitation;
2. American International School Johannesburg wetland rehabilitation, and
3. Bryanston Krom Park Wetland Rehabilitation

This presentation will focus on these three successful wetland rehabilitation case studies, and will touch on the legal and regulatory framework that each site/ project was subjected to in order to obtain approval. The presentation will also focus on before, during and after photos and elaborate on the key rehabilitation concepts used in each project and the envisaged outcomes of each project. The outcomes include: Improved stormwater management, wetland educational aspects, curbing head-cut erosion and stabilising the overall watercourse system, and improved riparian biodiversity.

Keywords: Stormwater management, climate change, hydrological characteristics, legal process, wetland education, improve biodiversity, erosion, stabilization

Brian Gardner has thirteen years of environmental management and impact assessment experience in South Africa. Brian qualified with an N.Dip and B.Tech Environmental Science at Tshwane University of Technology in 2008. Primary responsibilities at Seaton Environmental include the preparation of (including field surveys) and final submission of Basic Assessment Reports and Environmental Impact Assessment reports to the various Provincial Department's and the National Department of Environmental Affairs (DEA), as well as preparation and submission of Water Use Authorization to Dept. of Water and Sanitation. Brian has a passion for water and catchment management and rehabilitation projects.

NEMATODE DIVERSITY IN SELECTED PEATLANDS IN THE NORTH WEST PROVINCE, SOUTH AFRICA

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ABSTRACT

Nematodes are the most abundant and diverse Metazoa occurring in various habitats. It has been estimated that between 80 and 90% of all multicellular organisms on earth are nematodes. Only approximately 7% (about 1 808) of nematodes species known to science have been reported from freshwater globally, with 351 species residing in the Afrotropical region. However, very little work has been done on wetlands and virtually no nematode biodiversity information is available for peatlands in South Africa. Three peatlands in North West Province were selected for this study based on their degradation status namely: Watervalspruit Peatland (Kgaswane Mountain Reserve) and Molemane Peatland (Molemane Eye Nature Reserve) are pristine peatlands, and the third, Molopo Peatland (near the Molopo Private Park), is highly threatened and degraded.

Peat and grass (as reference) samples were collected from several sites within each peatland. Nematodes were extracted from the peat samples to determine diversity and abundance. DNA will be extracted from selected nematodes in order to generate barcodes. This survey is the first of its kind in South Africa and will generate extensive data on the nematode diversity of peatlands in South Africa. Preliminary results indicate between 23 and 27 nematode genera are present in the three peatlands. This study anticipates detecting potential new species as well as expanding the geographical range of several nematode species. The potential to use nematodes as biological indicators of ecosystem health in peatlands is also being investigated using a pristine peatland as reference in comparison to degraded peatlands. Nematodes are divided into feeding groups based on their food source: herbivores (plant-parasitic nematodes), bacterivores, fungivores, predators and omnivores. Representatives of each of these feeding groups were identified in all three peatlands. Preliminary results indicate all three peatlands were dominated by bacterivores (bacterial feeding nematodes) followed by herbivores.

Keywords: Nematodes; Peat; Ecosystem; Degradation; Management.

Chantelle Girgan holds a Ph.D. in Environmental Sciences and Management, specializing in nematode taxonomy. Chantelle is a researcher at ARC-PHP in the Nematology unit and a nematode taxonomist who specializes in free-living nematodes, soil health and plant-parasitic nematode families *Pratylenchidae, Criconematidae* and some *Hoplolaimidae*. Her research includes nematode diversity in natural ecosystems, including grasslands and peatlands.
Chantelle is the curator of the National Collection of Nematodes. In her career Dr Girgan has described various new nematode species and has been a part of various nematode projects specifically in agricultural soils and grasslands.

THE POTENTIAL OF COMMUNITY-BASED CITIZEN SCIENCE MONITORING OF WETLAND ECOSYSTEM FUNCTIONING

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ABSTRACT

Wetland ecosystems are important ecological infrastructure for the delivery of ecosystem services such as flood attenuation, assimilation of wastewater and general dilution for improved water quality. The National Biodiversity Assessment 2018 recognised that wetlands are among of the most threatened ecosystems. This has a negative effect on the country's biodiversity. Therefore, it is essential to have monitoring programmes that enable detection and reporting of status and trends related to wetland ecosystem function. Most of the degraded or threatened wetlands are on communal land and a source of livelihood for vulnerable communities. It is important that these wetlands are rehabilitated to restore their ecosystem function for the benefit of society.

The Mpophomeni and Dartmoor wetland ecosystems associated with the Mthinzima Stream on the uMngeni catchment upstream of Midmar Dam in KwaZulu-Natal have been under rehabilitation since 2018. One of the challenges is the need for information related to wetland ecosystem function to enable the detection of positive or negative trends related to ecosystem function, that would strengthen the evaluation of the wetland rehabilitation process. In most cases, wetland rehabilitation allows for monitoring of wetland structure as well as the rehabilitation processes but leaves out the evaluation of ecosystem function (i.e. looking at the effectiveness, efficiency, or sustainability of the rehabilitation process). As part of implementing the Ecological Infrastructure for Water Security Project, SANBI has been working with the Mpophomeni community through EnviroChamps and other stakeholders to monitor wetland function of the Mthinzima wetland ecosystems under rehabilitation, using citizen science monitoring tools. The wetland system is on communal land owned by a Community Trust and wetland monitoring through citizen science provides an opportunity for community education and awareness related to the importance of wetland management for people's livelihoods. It also provides an opportunity for the community to see the wetland as an integrated socio-ecological system that they should monitor and manage by incorporating the information that they have collected and analysed in a way that incorporates their values and makes sense to them.

Keywords: Community-based monitoring, wetland ecosystems, wetland function, citizen science

Pearl Gola is a Senior Specialist: Ecological Infrastructure under the Ecological Infrastructure for Water Security Project at the South African National Biodiversity Institute (SANBI). She holds a PhD in Water Resource Science from Rhodes University. Her key responsibilities include supporting and coordinating research to monitor ecological infrastructure rehabilitation and restoration activities and provide evidence for improvements in water security in the Greater uMngeni catchment. She also supports efforts of multiple actors to control invasive alien plants, rehabilitate riparian and wetland ecosystems and related ecological infrastructure activities across the catchment. This requires looking at the Greater uMngeni catchment as an integrated socio-ecological system to improve capacity at all points along the science-society-policy-practice continuum. It also involves providing sound policy advice that is driven by good science and based on the practicality of implementation through a cohesive bottom-up and top-down approach.

USING GEOGRAPHIC INFORMATION SYSTEMS (GIS) TO ASSESS THE BIODIVERSITY AND PROTECTION LEVELS OF AFRICA'S RIVERS

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ABSTRACT

The negative impacts of anthropogenic and climate changes on Africa's river ecosystems have become a growing concern, yet the biodiversity of these systems is poorly understood. To enable reporting on Targets 1 (degradation), 2 (restoration), and 3 (protection) of the GBF, it is important to do river ecosystem typing at a continental scale, something that has not been done yet. This study assesses the biodiversity and protection levels of Africa's rivers using GIS.

Firstly, the 10 Major Habitat Types (MHTs) and 85 Freshwater Ecoregions of the World (FEOWs) in Africa were combined with the RiverAtlas version 1 lines. This allowed for the calculation of the six Longitudinal Geomorphic Zones (LGZs). The Global Intermittent Rivers and Ephemeral Streams (GIRES) version 10 dataset was used to differentiate between permanent, seasonal, and episodic flows. These datasets were integrated to categorise African rivers based on the IUCN global ecosystem types at the Ecosystem Functional Types level. Secondly, the River Ecosystem Types (RETs) were overlaid with the World Database on Protected Areas (WDPA) to determine the extent of their protection in meeting the 30% of Target 3 by 2030 outlined in the GBF. The assessment used the protection level categories formulated based on the GBF, namely; exceed target protection (≥30%), protected (≥15%<30%), and only half protected (≥0%<15%). The number of RETs meeting the GBF protection level category is reported.

The regions, flows, and LGZs information produce 141 coarser-scale (using the MHTs) and 892 finer-scale (using the FEOWs) RETs. A total of 7 273 728.2 km of rivers are found in Africa, with 139 MHT RETs (<10% extent), making up 71% of the total extent and possibly range-restricted areas. At a coarser scale, the analysis revealed that 15 RETs (or 10% of the MHT RETs), covered 75% of Africa and with predominantly seasonal flow within the tropical and subtropical floodplain rivers and wetlands MHT regions. The LGZs - upper foothills, lower foothills, and lowland rivers - were uniformly distributed across the continent, while 126, or 90% of the MHT RETs, covered 25% of Africa and predominantly permanent flow, with a roughly even distribution across all MHT regions and LGZs. The results indicate that only 11.3% of the 141 RETs exceed target protection, 35.5% are protected, and 53.2% are only half protected. Further work is underway to assess the ecological condition of the RETs to inform both the threat status and protection levels.

Keywords: continental scale; Global Biodiversity Framework (GBF); global ecosystem types (GETs); International Union for Conservation of Nature (IUCN); red listing of ecosystems; river ecosystem types; target 3 of GBF

Lukho Goso is an MSc in Geoinformatics student at the University of Pretoria. She is a member of the South African Wetland Society and part of the 2023 GreenMatter Fellowship. Her research focuses on using GIS to assess biodiversity and protection levels in Africa's rivers.

TOWARDS CHARACTERISING POLLUTION IN MANGROVE-DOMINATED ESTUARIES IN THE CONTEXT OF ANTHROPOGENIC DISTURBANCE: A SOUTH AFRICAN CASE STUDY ON MICROPLASTICS

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ABSTRACT

Mangrove-dominated estuaries in South Africa and globally are under threat due to both climate change and anthropogenic activities, particularly if they occur within urban matrices. The Ramsar definition of a wetland recognizes mangrove systems as wetlands (Ramsar Convention on Wetlands, 1971) and these systems were the focus of the study. Plastic, and particularly microplastic (MP) pollution, is a growing research theme, dedicated largely to marine systems. Occurring at the land-sea interface, estuarine habitats such as mangrove forests are at risk of plastic pollution.

This study compared MP pollution (level, morphotype, polymer composition, size and colour) across included the iSiphingo Estuary, uMngeni Estuary, Durban Bay (all occurring in urban matrices) and St. Lucia Estuary, which is regarded as semi-rural. Mouth status, surrounding human population densities and land-use practices influenced the level and type of MP pollution. Systems that were most at risk were predominantly open estuaries surrounded by high population densities and diverse land use types. Microplastic levels and the diversity of MP types detected increased with increasing levels of anthropogenic disturbance. Overall, microfibres dominated estuarine water (69%) and mangrove sediment (51%) samples. Polyethylene (43%) and polypropylene (23%) were the dominant polymers. Weathered fishing gear, weathered packaging items and run-off from urban/industrial centres are the most probable sources of MP pollution. Increased run-off and river input during the wet/rainy season may explain the markedly higher MP loads in estuarine waters relative to the dry season. By contrast, MP deposition in mangrove sediment was higher during the dry season. Sediment MP abundance was significantly positively correlated with both pneumatophore density and sediment size (500–2000 µm).

This study highlighted the role of mangroves as MP sinks, which may limit the movement of MPs into adjacent environments. However, under conditions such as flooding and extreme wave action, mangroves may shift from sinks to sources of plastic pollution. This study provided valuable baseline pollution levels regarding microplastics and additionally, heavy metal and macro/micro nutrients. It highlighted the need for an evidence-based pollution monitoring programme across mangrove-dominated estuaries in the country, in order to contribute to wetland restoration.

Keywords: plastic; disturbance; South Africa; estuaries; mangroves; sediment

Joelene Govender is an assistant Wetlands and Soils consultant in the Mine Closure and Rehabilitation Division at Digby Wells Environmental. She received her BSc. in Environmental Science, BSc Hons. in Biological Science and MSc. in Biological Science from the University of KwaZulu-Natal. Her Masters research focused on assessing the health of wetlands by characterising various pollutants across mangrove-dominated estuaries along the east coast of South Africa, in relation to abiotic parameters and the type and intensity of disturbance the systems encounter.. She joined Digby Wells in 2022 to gain experience in conducting various wetland and soil assessments, compiling proposals and reports. She is currently involved in several mining projects.

READING BETWEEN THE MOUNDS: THE BIOGEOMORPHOLOGY/BIOGEOCHEMISTRY INTERFACE OF WETLANDS IN DRYLANDS

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ABSTRACT

The biogeomorphic template of wetland systems may be viewed as a mosaic of component surfaces with distinctive patterning, and which combine hierarchically to influence system-level wetland hydrogeomorphic, biogeochemical and ecological diversity. However, in recognising and characterising the distinct patterning evident in features with positive relief, are we ignoring the significance of processes and their products that shape the spaces between? This presentation explores the hydrogeomorphic, biogeomorphic and biogeochemical dynamics of heuweltjie backswamp on a floodplain of the Nuwejaars River, Cape Agulhas. Geospatial pattern analyses from LiDAR and high-resolution image data are combined with investigations of hydrogeomorphology, sedimentology and sediment geochemistry to uncover the significance of interactions between mounds and hollows in shaping ecosystem processes and ecosystem service provision (most notably the sequestration of inorganic carbon, a poorly-documented feature of some wetlands in drylands). The observations presented highlight the distinctiveness and diversity of floodplain wetlands of the Agulhas Plains, and motivate for their ongoing protection.

Keywords: Biogeomorphology; biogeochemistry, chemical sedimentation

Michael Grenfell is an Associate Professor of Environmental and Water Science at the University of the Western Cape, South Africa. His research focuses on rivers and wetlands at the interface between geomorphology and ecology.

IN THE FACE OF A TOTAL SEWAGE ONSLAUGHT: IS THERE STILL A ROLE TO PLAY FOR NATURAL WETLANDS IN CONTAMINATED WATERCOURSES?

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ABSTRACT

Wetlands contribute significantly to South Africa's biodiversity, ranging from species to habitat diversity; whilst locally, on a catchment basis, ecosystem services such as flood attenuation, water flow augmentation, carbon storage and filtration might be of importance depending on the wetland characteristics. However, the National Biodiversity Assessment 2018 confirmed that wetlands are the most threatened South African ecosystems with only15% of the extent in a near-natural ecological condition, 18% moderately modified with 67% heavily to severely/critically modified; with 62% of wetland ecosystem types critically endangered. Furthermore about 73% of inland wetlands are threatened and unprotected.

Currently the disruption of modern services necessary in urbanised environments such as electricity, water supply, stormwater flow management and wastewater treatment works (WWTW) are impacting negatively on wetlands, resulting in pollution and degradation of the natural environment. These impacts include, amongst others, erosion and desiccation of wetlands, loss of biodiversity and contamination by pollutants ranging from industrial waste to sewage.

It is especially the latter that is of serious concern, as dysfunctional WWTWs and sewage spills are a countrywide environmental disaster. It begs the question: In the face of a total sewage onslaught: is there still a role to play for natural wetlands in contaminated watercourses? This presentation will focus on the role of natural wetlands in these anthropogenic-induced disasters across the landscape, showcasing the outcome of water analyses used in various criminal investigations involving point source wastewater discharge into wetlands.

Keywords: Natural wetlands, wastewater, contamination, functions.

Piet-Louis Grundling has a PhD in natural science (Geography: Wetland Hydrology) with 28 years' experience in wetland research, rehabilitation, protection, training and wise use. He was seconded to the Environmental Management Inspectorate (EMI) in September 2019 and before that for three years managedthe implementation of projects within Working for Wetlands Programme, Department of Environmental Affairs (DEA). During this time (and also in the years leading up to his appointment in DEA) he provided technical support and expert advice to the EMI particularly in the area of wetlands.

AN ASSESSMENT OF LONG-TERM AND LARGE-SCALE WETLAND CHANGE DYNAMICS IN THE LIMPOPO TRANSBOUNDARY RIVER BASIN USING CLOUD BASED EARTH OBSERVATION DATA

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ABSTRACT

Significant progress has been made in monitoring the effects of Land Use and Land Cover (LULC) changes on wetland extent. However, our understanding of transboundary wetlands has been limited by the scarcity of available data in shared river basins. This study aimed at analysing the long-term and large-scale dynamics of wetland changes in the Limpopo Transboundary River Basin over a 20-year period (2000-2020) using Google Earth Engine (GEE) cloud-computing platform and multi-source remotely sensed data.

The study had two objectives namely, to examine LULC changes over time using machine learning algorithms applied to multisource remotely sensed data in GEE, and to assess the relationship between LULC transitions in the catchment and the extent of wetlands in the basin. A total of nine land cover classes were characterized, including shrublands, croplands, bare-surface, wetlands, sparse vegetation, tree cover, built-up, and grasslands. Shrublands were found to be the dominant land cover class throughout the study period, covering proportions ranging from 76% to 82%, while wetlands and sparse vegetation were the least dominant, with proportions ranging from 0.3% to 2%. The overall accuracy of the classification results was within acceptable ranging from 77% to 78%. However, the wetlands and sparse vegetation classes exhibited lower accuracies, which can be attributed to the limited availability of training data for these classes. The study also revealed a continuing decline in wetlands extent and sparse vegetation, with average rates of 19% and 44%, respectively. Conversely, shrublands, croplands, and savannah grasslands showed an increase, with average rates of 0.4% and 12.4% respectively. A significant finding was the replacement of a substantial portion (40%) of wetland areas with built-up areas, indicating that urban expansion is a major driver of wetland degradation in the study area.

These results provide valuable insights into the diminishing state of wetlands in the Limpopo Transboundary River Basin. Such findings are crucial for environmental conservation efforts, as they contribute to the development of strategies aimed at mitigating the negative impacts of LULC changes on ecosystems, particularly wetlands, in the region. The study underscores the importance of considering wetland conservation in the context of broader biodiversity conservation efforts and the Sustainable Development Goals (SDGs). By understanding the dynamics of wetland changes and their underlying drivers, decision-makers and conservation practitioners can develop targeted interventions to protect and restore these vital ecosystems, thus contributing to the conservation of biodiversity and the achievement of SDGs related to environmental sustainability.

Keywords: Big data analytics; dryland wetlands; google earth engine; wetland shrinkage; wetland management

Siyamthanda Gxokwe is a post-doctoral researcher at the South African National Biodiversity Institute hosted at the University of the Western Cape, Institute for Water Studies. He holds a PhD in environmental and water science with the specific focus on wetlands hydrology and remote sensing. Siyamthanda's research interest include the application of remote sensing tools and big data analytics in modelling the environmental changes, including wetlands. He has published a number of papers relating to the use of geospatial tools in understanding wetlands systems, and he also serves as a reviewer for a number of journals including physics and chemistry of the earth, remote sensing applications: society and environment, ecological informatics and he International Journal of Remote Rensing and Geoinfomation.

THE DISTRIBUTION AND TAXONOMY OF SPHAERIIDAE BIVALVES IN SOUTH AFRICAN WETLAND SYSTEMS

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ABSTRACT

Small freshwater bivalves, belonging to the family Sphaeriidae, are known to inhabit permanent and temporary wetlands in South Africa. In temporary systems, sphaeriids have been known to burrow into the sediment to avoid desiccation, however residual moisture is needed to survive the dry season. With this, we can assume that they will not be found in wetlands that are characterised as highly ephemeral. Sphaeriids can disperse by attaching to active invertebrates or water birds while they are hermaphrodites that can self-fertilise as well. These adaptations allow them to utilise temporary environments such as wetlands. However, the Sphaeriidae family taxonomy needs revision since the last comprehensive survey concerning their distribution was in 2007, and a myriad of taxonomic changes have been made since. To address this, methods for molecular analyses were developed to distinguish between species utilising the cytochrome-c-oxidase I (COI) gene. However, limited reference sequences were available for the family on GenBank and BOLD. For morphological analyses existing keys were used, as well as holotypes and paratypes in museums such as the Iziko Museum. Morphological characteristics e.g., umbo orientation, teeth and grooves were considered when identifying them up to species level. Phylogenetic trees were constructed to determine the genetic relatedness between organisms by considering the Bayesian inference and maximum likelihood values. After obtaining this information, the molecular- and morphological identification were unified to postulate a species identification for sphaeriids in South Africa. With this, the accuracy is immensely increased to determine which species in the Sphaeriidae family are present in South African wetlands and can aid in their conservation.

Keywords: Sphaeriidae bivalves, wetlands, morphological-, molecular-, phylogenetic analyses

Sone Janse van Rensburg is a Masters student at the North-West University, Potchefstroom Campus.

DETERMINING THE SOURCE, PATHWAYS AND RECEPTORS OF METALS AND SULPHATE IN THE BOTTOM SEDIMENT OF AN ECOLOGICALLY ENGINEERED WETLAND THAT RECEIVES ACID MINE DRAINAGE.

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ABSTRACT

The Zaalklapspruit valley bottom wetland in the Mpumalanga Province, South Africa is an ecologically engineered wetland that was and continues to be affected by acid mine drainage (AMD) from an abandoned coal mine upstream. However, a significant improvement in water quality parameters has been observed since the implementation of concrete structures that decrease the water flow and increase water resident time. Wetlands have the natural ability to remove contaminants from AMD-polluted water through their various mechanisms, but little is known about the fate of contaminants in a valley-bottom wetland that has been ecologically engineered. Wetland bottom sediment is considered an accumulator of contaminants and was therefore studied to determine the pathways and receptors of AMD contaminants in the sediment itself as well as its immediate environment. Bottom sediment samples were collected for physical, chemical, and microbiological analyses whilst roots of the macrophyte, *Typha capensis*, were analysed to determine the sorption of metals onto the root surface and into the root tissue. Results indicated relatively constant pH values, highly negative oxidation-reduction measurements and great organic matter load in the bottom sediment. Furthermore, metals were adsorbed onto the root surface of *T. capensis* in the following order Mn>Fe>Al and absorbed into the root tissue in the following order Fe>Al>Mn. Overall, absorption concentrations were greater than adsorption concentrations. Moreover, a diverse community of microorganisms was detected in the first 8 cm of bottom sediment around the macrophyte roots, which includes metal and sulphate reducers and oxidisers. The bottom sediment provides a stable medium for the growth of macrophytes, while it accumulates contaminants from the water as well as decomposed plant material. The latter provides nutrients to microorganisms that contribute to alteration of metals and sulphate. From the study, it was evident that a series of biogeochemical reactions occur simultaneously within multiple wetland compartments all of which are interdependent. However, the success of these complex processes requires time to interact with one another which is thought to be established by the slow water flow rate of the ecologically engineered wetland.

Keywords: acid mine drainage, ecological engineering, wetland, bottom sediment, macrophytes, microbiological communities

Mariette Jansen van Vuuren is a postgraduate student at the University of the Free State with a great passion for nature, conservation and community, and an enthusiastic naturalist with a special interest in ecosystem functionality and rehabilitation. She has a background in agriculture, majoring in animal science, and developing a passion for wildlife and wildlife conservation. She seeks to integrate the ever-growing needs of the human population and the natural world. Her great ambition is to coordinate her knowledge and hobbies in the production of educational short films for the purpose of giving a voice to nature and the community.

AN INTEGRATED APPROACH TO THE MAPPING, CONSERVATION AND MANAGEMENT OF SOUTH AFRICA'S FRESHWATER ECOSYSTEMS

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ABSTRACT

This presentation introduces the three SANBI-associated presentations of Adwoa Awuah, Nacelle Collins, and Syamthanda Gxokwe as part of an emerging, integrated framework for achieving sustained progress on South Africa's national wetland map. The presentation also explores integration across wetland, river and riparian ecosystem environments, in the pursuit of a biophysical template and range of variables linking ecosystem structure and function across these ecosystems, supporting a more coordinated approach to management. Finally, the work is framed within the national, and global, requirements of setting of management targets and objectives for freshwater ecosystems.

Keywords: national reporting, ecosystem types, ecosystem drivers, management targets

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USING SOCIAL LEARNING TO IMPROVE SUSTAINABILITY ASPECTS OF OUR WETLAND MANAGEMENT PRACTICES

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ABSTRACT

The Ecological Infrastructure for Water Security Project is dedicated to enhancing water security through the incorporation of ecological infrastructure into the various aspects of planning, financing, and development within the water sector. The Water Research Commission has taken up the responsibility of facilitating knowledge management and promoting social learning, aiming to transform the engagement, mindset, and integration of ecological infrastructure among targeted stakeholders and decision-makers in both the public and private sectors involved in water sector development planning and financing. To effectively achieve these goals, a comprehensive and contextualized strategy along with an implementation plan was initiated, which involves close collaboration with people and stakeholders. This approach encompasses six key practices known as Social Learning Knowledge Management and Mediation (SLKMM) practices. These practices are integrated into the project's activities, allowing for the effective exchange of knowledge, active learning, and constructive dialogue among participants. One of the essential aspects of this initiative involves understanding and evaluating the learning and transformative changes that occur throughout the project. We demonstrate how social learning not only adds value within the project itself but also extends its positive impact to numerous organisations and catchment contexts. By harnessing the power of social learning, the project aims to foster greater awareness, collaboration, and innovation, thereby creating lasting value for the water sector and beyond, particularly during times of change and complexity. The experiences gained from the implementation and integration of social learning, knowledge management, and mediation practices within this project are poised to offer valuable insights for the broader work and research carried out in the water sector. The lessons learned from this project can provide meaningful guidance, shaping future endeavours and enabling more effective decision-making processes.

Keywords: Social learning; Ecological Infrastructure for Water Security

Roderick Juba is a postdoctoral researcher at the Water Research Commission. He has experience in complex social-ecological systems, catchment management, and invasive alien plant research. He is also a past recipient of the SAWS Young Professional award for his work on the Papenkuils wetland near Worcester on the Breede River.

REHABILITATION OF HIGH-ALTITUDE PEATLANDS - OBSERVATIONS AND INSIGHTS FROM AN ONGOING REHABILITATION PLANNING STUDY WITHIN THE LESOTHO HIGHLANDS.

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ABSTRACT

The high-altitude peat forming fens of the Lesotho Highlands are unique within the southern African context, and similarly, rehabilitation of these wetlands faces unique challenges linked to their geographical setting, climatic variability and users. The occurrence of these wetlands in a narrow altitudinal band atop the Maloti Mountains makes them especially susceptible to climatic change, at a time when their positions as headwater wetlands feeding into streams in a Strategic Water Source Area of significant value to South Africa (via the Lesotho Highlands Water Project (LHWP)) are of elevated importance.

This presentation stems from a project currently underway focused on the rehabilitation of wetlands in the Lesotho Highlands aimed primarily at securing water delivery for the LHWP Phase II Polihali Dam currently under construction, and aims to provide a description of the wetlands occurring within the catchment, identify threats faced by these wetlands, detail the degradation that has occurred and is ongoing, highlight some of the challenges to rehabilitation, and suggest a way forward in tackling these challenges to achieve effective and sustainable rehabilitation outcomes.

Keywords: rehabilitation, Lesotho, peatlands, high-altitude fens, climate change

Shavaughn Davis (M.Sc. Zoology, Pr. Sci. Nat.) has worked as a wetland ecologist since 2007. She has been involved in a diverse array of consulting projects informing EIA and WUL applications as well as wetland rehabilitation planning and development of wetland offset strategies and contributing to Reserve studies. She has enjoyed working on the wetlands of the South African Highveld, as well as wetlands in diverse settings stretching from the Lesotho Highlands to the coastal plain of Mozambique. In addition to her work as a wetland ecologist, she is a qualified and keen zoologist and has undertaken numerous faunal surveys, both as part of wetland ecology assessments, and as part of larger biodiversity assessments for both urban and mining projects across Gauteng, Mpumalanga and Limpopo. Working in the Okavango Delta on the Okavango Buffalo Research Project has also been a highlight.

Dieter Kassier (BSc. Hons. Environmental Science, Pr. Sci. Nat.) has been working as a wetland ecologist for the past 16 years. He has gained extensive experience in the delineation, assessment, management and rehabilitation of wetlands and riparian zones across a wide range of landscapes and projects. His experience is focused on the wetlands of the Highveld region and adjacent Bushveld of South Africa but extends to include the high-altitude fens and peatlands of Lesotho, dambos of the Copperbelt in the Democratic Republic of the Congo, peatlands on the coastal plain of Mozambique, Sierra Leone's inland valley swamps, as well as ephemeral systems of the South African arid zone. Dieter is passionate about his work and enjoys sharing his experience and observations.

THE GEOMORPHIC CHARACTERISATION OF WETLANDS ON VARIOUS LANDSCAPES IN MARAKELE NATIONAL PARK, LIMPOPO PROVINCE, SOUTH AFRICA

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ABSTRACT

The distribution and characteristics of wetlands in Marakele National Park (MNP) are largely dominated by the Waterberg Mountain in the south-eastern parts of the Park and the undulating to flat plains in the northwest. Numerous smaller wetlands occur scattered across the landscape of the MNP, the largest of which is the Matlabas, which is in a nearly pristine state with few threats such as erosion. Wetlands are complex systems formed by a combination of factors such as geomorphology, hydrology and biological processes. Wetlands are universally recognized for their significant contribution to biodiversity as well as natural goods and services related to water resource preservation, especially in strategic water resources area such as the Waterberg Mountains.

The primary aim of the study was to characterise the wetlands of the MNP on a diversity of landscapes and understand how they function within the MNP landscape. The most common wetlands in upper plateau areas towards mid-plateaus (benches) are seep wetlands, with channelled and non-channelled valley bottom wetlands in lower lying valleys and plains. This investigation will assist park management in making informed decisions by providing a better understanding of the diversity of wetlands in the Park and how they function.

Keywords: Marakele National Park, landscapes, wetlands, geomorphic.

Steven Khosa works as a bio technician in SANParks. He is responsible for surveys and monitoring in Marakele, Golden Gate, and Mapungubwe, as well as additional parks as required. His research focuses particularly on wetland ecology, plant and animal ecology, restoration ecology and student mentorship, among other things. He also contributes to the capacity building of BSP Environmental Monitors and teams. He plays a significant role in environmental education and stakeholder engagement for local schools and communities.

INFLUENCE OF WETLAND CONVERSION ON GREENHOUSE GAS EMISSIONS IN VALLEY-BOTTOM WETLANDS IN TAITA HILLS, KENYA

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ABSTRACT

Wetlands serve an important role in reducing atmospheric greenhouse gases (GHG) and supporting communities whose livelihoods depend on them. However, the conversion of wetlands to agricultural land is increasing at a rapid rate at local, regional, and global scales, driven by the increasing human population and the need to tackle food insecurity problems. In East Africa, the valley-bottom wetlands in the highland systems continue to face degradation through intensive small shareholder agricultural practices, but little is known about how this impacts GHG.

To partly fill this knowledge gap, this study was conducted in the valley-bottom wetlands of Wundanyi, a small catchment located in the Taita hills Southeast of Kenya. The study was done in November 2022, December 2022, and January 2023 during the short rain season. Three specific objectives were addressed during the study:

(i) To assess wetland use and management by small shareholder farmers in valley-bottom wetlands in the Wundanyi catchment;
(ii) To compare GHG fluxes (CO_2, CH_4 and N_2O) in the intact and converted wetland plots, and
(iii) To relate soil characteristics to GHG fluxes in the converted and intact wetlands to assess potential controls.

Fifty-nine farmers owning land in the valley bottom wetlands were interviewed on the use and management of wetlands. Among the key information gathered was the time since the wetlands were converted, type of agricultural activities, soil, crop, and water management approaches. Results showed that most wetlands have been used for small-shareholder mixed farming for more than 10 years with maize, beans and vegetables being the dominant crops. Crop rotation, intercropping and manure/fertilizer application were the main soil and crop management approaches. Flood and drought events were managed through channelization and irrigation in the wet and dry seasons, respectively. Soil GHG fluxes were determined using the static chamber method in seven intact and converted wetlands. The results showed significantly higher CH_4 flux in the intact than the converted plots (mean ± SE of intact compared with converted: 6.51 ± 1.25 and 0.01 ± 0.02 mg C m^{-2} h^{-1}). N_2O flux was significantly higher in the converted plots than the intact plots (mean ± SE of intact compared with converted: 3.80 ± 1.97 and 29.57 ± 5.99 µg m^{-2} h^{-1}). CO_2 did not vary significantly between intact and converted plots (mean ± SE of intact compared with converted: 173.66 ± 12.72 and 183.47 ± 11.21 mg C m^{-2} h^{-1}). CO_2 flux showed a negative relationship with moisture, CH_4 showed a positive relationship with soil moisture, temperature, and organic carbon to nitrogen molar ratio, and N_2O was positively correlated with NO_3.

Keywords: Greenhouse gas, valley bottom wetland, livelihood, management, ecology

Damaris Kisha holds a master's degree in Limnology and Wetland Management offered jointly by the University of Natural Resources (BOKU), Austria, Egerton University, Kenya and the Institute for Water Education (IHE), the Netherlands. She has had two years of experience working to conserve the endangered grey crowned crane and wetlands in Western Kenya under the Western Kenya crane and wetland conservation programme. She is passionate in understanding wetland ecology and its associated biogeochemical processes to advise on the best intervention measures for their restoration and management.

UPDATING THE NORTH WEST PROVINCIAL WETLAND INVENTORY USING FIELD DATA COLLECTION, DESKTOP MAPPING AND REMOTE SENSING TECHNIQUES

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ABSTRACT

The North West Provincial Department of Economic Development, Environment, Conservation and Tourism (DEDECT) has contracted Eco-Pulse Consulting to update their wetland inventory. The motivation behind this initiative stems from the recognized significance of wetlands in providing ecosystem services, the increasing global and local pressures on wetlands leading to their loss, the realization that the existing provincial wetland inventory is incomplete and inaccurate, and the ongoing update of the Biodiversity Sector Plan (BSP) in the province. The objective of the project was to contribute to an accurate and comprehensive wetland inventory, which is crucial for the BSP and land use planning and decision-making processes. Additionally, the 2018 National Biodiversity Assessment (NBA) emphasized the need for a more comprehensive inventory of South African inland aquatic ecosystems.

The team initially familiarized themselves with the study area and associated data sets. They reviewed the available data to determine the need for additional validation during field work. A prioritization process was employed based on the review to select sub-quaternary catchments for detailed mapping. These priority areas were visited during field efforts, where data were gathered on the characteristics, extent, and distribution of wetlands in the study area. Field trips also revealed variations in wetland characteristics across regions of the study area. This informed the subsequent desktop mapping at a fine scale. Additional steps were taken to collect validation data that could be used to train models and support desktop mapping. This involved collecting additional desktop non-wetland and wetland data from all visited features. These data points will be used in training machine learning algorithms, in validating outputs as well as in informing the desktop mapping of wetlands. To support the on-screen digitising of wetland features, Eco-Pulse has utilized existing data as well as undertaking a range of remote sensing-based tasks to generate products that can support mapping work. This included using 1) the Normalized Differential Water Index (NDWI) to generate a surface water coverage, using 2) the Maximum Likelihood Classification, 3) the Random Forest algorithm and 4) dynamic time warping algorithms (all trained using the majority of data points collected in the field) to support wetland identification and classification. These data are particularly important in lower priority catchments and areas which have not been physically visited. The project aims to produce an updated and refined wetland inventory for the North West Province by combining field data, desktop mapping, and desktop modelling techniques.

Keywords: Wetlands, Wetland Inventory, Desktop Mapping, Remote Sensing, North West, DEDECT

Ryan Kok is a Scientist and Wetland / Aquatic Ecologist at Eco-Pulse with a BSc degree in Environmental Science, BSc Honours and MSc degree in Biological and Ecological Sciences. He is a registered Professional Natural Scientist (Pr. Sci. Nat.) with more than six years' experience, having worked extensively on numerous specialist ecological assessment projects, for wetland/aquatic habitats in KZN, the Free State, Gauteng, Eastern Cape, the North West and Mpumalanga.

LOCAL STAKEHOLDERS INVEST IN ECOLOGICAL INFRASTRUCTURE: A PILOT INITIATIVE FROM THE KLEIN SWARTBERG MOUNTAINS, LADISMITH

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ABSTRACT

The greatest immediate threat facing mountain fynbos and its associated wetlands are Invasive Alien Plants (IAPs), which increase fire severity, alter habitats through direct competition, and reduce the availability of water, both for mountain ecosystems, e.g. seep wetlands, and for downstream water users. The Klein Swartberg Mountains above Ladismith, Western Cape, lie in largely government-owned land, and through the coordination of Cape Nature, IAPs (mainly Hakea sericea) were actively cleared with state funding. However, from about a decade ago, state funds available for this clearing have drastically shrunk, prompting the need to seek alternatives. Thus, initiated by Mountain Club of South Africa volunteers, and undertaken in collaboration with Cape Nature, partnerships with local stakeholders have been gradually established and built, and the active support of local farmers and businesses has been harnessed.

The presentation will share experiences from this ongoing small-scale initiative, where the local businesses most directly threatened by water insecurity (Lactalis and Ladismith Cheese) and nearby local farmers have been investing back into the catchment area which supplies them with water. In this way, a circular economy is being supported. Gouritz Cluster Biosphere Reserve (GCBR) has assisted with clearing equipment and monitoring and reporting, and the initiative will be documented as part of a broader Water Research Commission project on investment in Ecological Infrastructure (EI).

The initiative has contributed to: (1) reducing the risks of degradation of mountain ecosystems, including its seep wetlands and their flagship endangered species, Stirtonanthus chrysanthus (Ladismith Yellow Keurtjie); (2) securing Ladismith's water supply through the clearing of IAPs. An app developed by SAEON is being used annually to rapidly estimate the water savings associated with the year's clearing. This evidence of the outcome of the EI intervention is then reported to the local businesses funding the interventions, and the reported annual savings of water contributes to sustaining the funding. At a practical level, the initiative has been working with key farmers to develop a locally-tailored approach, involving the mobilisation of temporary farm workers to undertake the IAP clearing during periods when demand for labour on the farms is lowest. Contributions have been made (albeit small) to multiple aspects and levels of resilience, including: (1) increased resilience to droughts and wild fires for the ecosystem and dependent businesses and households; and (2) increased resilience for temporary workers through an additional income source at a critical time of year when few alternatives exist.

Keywords: investment in ecological infrastructure, circular economy, invasive alien plant clearing, mountain seep wetlands

After completing a PhD on wetland ecology in 2000, the focus of **Donovan Kotze'**s work has remained on wetlands and their sustainable use. He has gained much experience in a great variety of wetlands under many different land-uses, mainly in South Africa, but also across eastern and southern Africa. He has worked extensively on wetland ecosystem characterization and the assessment of wetland ecosystem services and ecological integrity for many purposes, including evaluation of rehabilitation projects and sustainability assessments. Donovan has participated in many wetland research projects and in the development of several assessment methods such as WET-Health and WET-EcoServices.

ASSESSING THE IMPACTS OF WASTEWATER ON WETLAND ECOSYSTEM SERVICES SUPPLY IN SOUTH AFRICA TO INFORM WETLAND MANAGEMENT AND RESTORATION/REHABILITATION DECISIONS.

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ASTRACT

Wetlands provide important services which contribute to assimilating wastewater (WW) and physically trapping solid waste (SW). At the same time, however, this WW and SW typically diminishes the ecological health of a wetland and negatively impacts most of the other ecosystem services generally associated with wetlands. However, some of these services may be positively affected, e.g. where increased nutrients from WW leads to increased primary productivity of the emergent vegetation which, in turn, increases carbon stores in the wetland sediments. To date, there appears to have been little assessment of the impacts of WW and SW across multiple ecosystem services, especially for situations where data are deficient and effects uncertain. Thus, as part of a UK-funded Joint Nature Conservation Committee (JNCC) project on the impacts of solid waste and wastewater on water resources in South Africa, a Bayesian network model is being developed to assist with identifying key trade-offs between WW and SW inputs to a wetland and the multiple ecosystem services supplied by the wetland. The presentation will describe the model and some preliminary outputs when applied at a national level, to give an overview of the situation for South Africa.

The trade-offs between WW and multiple ecosystem services will also be described at a local-scale case study for the Kluitjieskraal wetland in the Breede River catchment, drawing from the results of a Western Cape Department of Environmental Affairs and Development Planning project on the evaluation and management of the Kluitjieskraal Wetland. This wetland includes a historically-transformed wetland portion located immediately downstream of a wastewater treatment works and directly receiving urban and agricultural runoff, and which is now strongly dominated by bulrushes (Typha capensis). This “hard-working” wetland portion, rehabilitated by Working for Wetlands in 2006 in terms of increased flow retention, is helping to ameliorate the WW inputs to the benefit of downstream ecosystems and water users. The wetland also includes a much less historically-transformed area supporting an intact fragment of the Critically-endangered Breede Alluvium Fynbos. This intact portion is currently relatively well buffered against catchment impacts but is nevertheless sensitive to changes in water quantity and quality and is in urgent need of protection from multiple threats, including WW inputs.

The presentation will end by discussing how an understanding of WW impacts on wetland ecosystem services can inform wetland management and restoration/rehabilitation decisions, both at an individual site and more broadly at provincial and national scales.

Keywords: Water pollution impacts, multiple ecosystem services, wetland management, wetland rehabilitation, Bayesian network model

After completing a PhD on wetland ecology in 2000, the focus of **Donovan Kotze’**s work has remained on wetlands and their sustainable use. He has gained much experience in a great variety of wetlands under many different land-uses, mainly in South Africa, but also across eastern and southern Africa. He has worked extensively on wetland ecosystem characterization and the assessment of wetland ecosystem services and ecological integrity for many purposes, including evaluation of rehabilitation projects and sustainability assessments. Donovan has participated in many wetland research projects and in the development of several assessment methods such as WET-Health and WET-EcoServices.

EXTRAPOLATION OF DIGITAL SOIL MAPPING APPROACHES FOR SOIL ORGANIC CARBON STOCK PREDICTIONS IN THE ALPINE WETLANDS OF THE NORTHERN MALOTI-DRAKENSBERG: AN AFROMONTANE ENVIRONMENT

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ABSTRACT

Soil scientists play a crucial role in ecological conservation and rehabilitation in wetland studies by assessing soil properties, such as soil organic carbon (SOC). Alpine wetlands in the northern Maloti-Drakensberg are vital for providing ecosystem services such as protecting and improving water quality, and they also mitigate the effects of climate change through effective carbon sequestration. However, quantifying soil properties can be challenging and expensive due to these wetlands' complex terrain and remote nature. Obtaining sufficient data or developing predictive Digital Soil Mapping (DSM) models in such areas is tedious.

One approach to overcoming these challenges is to extrapolate DSM models from relatively accessible regions to remote alpine wetlands. This study investigates the feasibility of extrapolating calibrated DSM models from the uThukela headwater catchment to other catchments in the northern Maloti-Drakensberg region while maintaining acceptable accuracy. Four headwater catchments were selected for this purpose, including three near the Motete River (M1, M2, and M3) in Lesotho and one in the Vemvane catchment adjacent to the uThukela headwater catchment. The DSM approaches that were considered included: Soil Land Inference Model's rule-based (SoLIM-RB) and sample-based (SoLIM-SB) approaches, Random Forest (RF), Regression Kriging with Cubist Model (RK-CB), Least Absolute Shrinkage and Selection Operator (LASSO), Universal Kriging (UK).

Predictions generated by the extrapolated models were compared with measured SOC stocks obtained from soil sampling sites across the various catchments. The results revealed that UK (R2 = 0.66, NRMSE = 0.200, and ρc = 0.72), LASSO (R2 = 0.67, NRMSE = 0.191, and ρc = 0.73), and RK-CB (R2 = 0.61, NRMSE = 0.184, and ρc = 0.65) yielded on average the most satisfactory outcomes. Notably, the models applied in the Vemvane catchment performed poorly, highlighting that proximity alone does not guarantee similarity.

In conclusion, this study demonstrates that DSM models calibrated in one catchment can be effectively extrapolated to other catchments within the same alpine wetland environment. However, selecting a calibration catchment that is representative of the larger region is crucial to avoid over- or under-prediction of SOC stocks. The successful extrapolation of models to remote areas will enable scientists to make valuable predictions that can aid in the rehabilitation and conservation efforts of vulnerable alpine wetland areas to avoid the loss of ecosystem services.

Keywords: soil organic carbon, digital soil mapping, alpine wetlands

Jaco Kotzé is a PhD candidate at the University of the Free State (UFS), focusing on soil science and remote sensing. He aims to conduct landslide susceptibility mapping by incorporating hydrological modelling. In 2022, he completed his master's degree in Soil Science with distinction. The thesis was titled: "Quantifying soil carbon stocks in alpine areas of the Maloti-Drakensberg Mountains using digital soil mapping approaches". He is fond of the outdoors, especially being near mountainous areas. The fresh air and cool temperatures are perfect for thinking.

A HYDROLOGICAL INVESTIGATION INTO A HISTORIC AT FIRE ON THE MAPUTALAND COASTAL PLAIN.

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ABSTRACT

Peatlands of the Maputaland Coastal Plain, where over 60% of South Africa's peatlands occur, are currently under threat due to lowered water tables across the region resulting in many desiccated peatlands and subsequent peat fires. To date, there is little understanding regarding the long-term effects of severe peat degradation and burning, as well as the recovery of these systems, in order to guide restoration. Apart from the current ecosystem services that peatlands provide, they also serve as archives of past environmental conditions. A historic peat fire was recorded during a previous survey of the Mfabeni Mire where it was documented that a 0.5m ash layer is present below 4m of peat which accumulated on top of the ash. The bottom of the ash layer was dated at 25 700 BP, and the layer on top of the ash at 12 430 BP, indicating that the ancient peat fire/s occurred during the end of the Younger Dryas, and that peat formation continued from the onset of the Holocene.

This study investigated the stratigraphy and hydraulic properties of the ancient ash layer, as well as adjacent unburnt layers and those below and on top of the ash. Preliminary results indicate that patterns of degradation and burning resemble those of Vasi Pan, which is currently the most degraded and burnt peatland on the Maputaland Coastal Plain and is characterised by deep (+1 m) desiccation cracks filled with dehydrated crumbly peat and residual ash. Hydraulic characteristics of the different peat and ash layers indicate that the burning of severely degraded peat may serve to improve the hydrological functioning of a peatland by creating preferential flow paths for inflowing groundwater and a substrate with an improved amount of available water capacity, therefore providing better conditions for the establishment of aquatic vegetation.

Keywords: Peatland hydrology, peatland restoration, peat fires

Jason le Roux is a PhD student at the Agricultural Research Council. His PhD focuses on the hydrological effects of peat fires.

BRING YOUR FIRE

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ABSTRACT

The strength of fraternity, the cohesion of power, and the knowledge that accompanies it, will ultimately shape the being of South Africa's wetlands. It is crucial to keep gateways and pathways open not only to record experiences but also to facilitate progress and the exploration of new innovations. What is the current state of health and integrity of the community responsible for the management of South Africa's wetlands? Communities consist of unique individuals, each possessing their own spirit shaped by personal experiences. Through exposure, one becomes a storyteller, driven by the hunger to share, learn, and teach. This desire acts as the wind that fuels the fire. An ancient rhythm echoes, summoning us all to come together, share, and rekindle a collective commitment to healing and unity.

Keywords: Wetland health, wetland fraternity, collective commitment.

Anton Linström is a highly experienced Wetland Ecologist who has dedicated many years to conservation and his passion for wetlands. With a background in both conservation and consultancy, he has extensive knowledge of wetlands in general. He serves as a wetland ecologist for the Working for Wetland Rehabilitation Programme in the Mpumalanga and Limpopo Provinces and actively participates in biomonitoring projects for Sasol in the mining sector, overseeing operations at eight different mining sites. He is involved in the annual State of Biodiversity project for the Sasol Secunda Industrial site. Anton's lectures at the Wetland Rehabilitation Course through WETREST. He is a registered Professional Natural Scientist with the South African Council for Natural Scientific Professions (Registration number: 400275/11) and proudly holds membership in the South African Wetland Society.

HOW SPECIES CONSERVATION CAN SAFEGUARD OUR WETLANDS - THE CASE OF THE WHITE-WINGED FLUFFTAIL

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ABSTRACT

The White-winged Flufftail (*Sarothrura ayresi*) is listed as a globally Critically Endangered bird endemic to Africa. It is considered one of the rarest and most threatened waterbirds on the continent. The total global population was estimated at no more than 250 breeding adults in 2013. Ethiopia and, more recently, South Africa are the only two countries where White-winged Flufftail are known to breed. The species is a wetland specialist preferring healthy, intact, dense sedge habitat.

Population abundances and distributions have likely decreased over the years due to wetland destruction and degradation by various anthropogenic activities such as mining, pollution, drainage, mismanagement of wetland drivers and alien invasive species. South Africa likely hosts the larger of two populations, with Ethiopia only having enough suitable habitat to support 55 breeding pairs. The International Single Species Action Plan (ISSAP) for the Conservation of the White-winged Flufftail found that the lack of knowledge about the species was one of the major obstacles to its effective conservation. Little was done to conserve the species in South Africa until 1994 when a group of citizen scientists formed the Middelpunt Wetland Trust to safeguard the only known site where the bird was regularly seen.

BirdLife South Africa began administering the trust in 2012 and has since then made leaps in studying and understanding the ecology of this cryptic bird. BirdLife South Africa was also instrumental in assisting the Department of Forestry, Fisheries and the Environment in coordinating the 3rd White-winged Flufftail International Working Group meeting held in 2019 where input was given in structuring the 2020-2022 Implementation Plan. BirdLife South Africa's White-winged Flufftail Conservation Project is now in the phase of implementing initiatives at a local scale through applied research and adaptive management. The main objectives of the project are to: (1) reduce uncertainty about White-winged Flufftail biology to better inform conservation efforts; (2) manage, rehabilitate, protect, steward and safeguard, through policy and advocacy, White-winged Flufftail wetland habitat across private and public sectors; and (3) raise awareness about water issues across socio-economic classes by using the White-winged Flufftail as an ambassador of wetland conservation. By protecting and promoting healthy wetlands for White-winged Flufftail, intact habitat is preserved for other wildlife species as well as the ecosystem services that people derive from wetlands. Our presentation details past successes and how the above objectives are being met.

Keywords: applied research, biodiversity stewardship, Critically Endangered, flagship species, nature conservation, peatlands

Kyle Lloyd is the Wetland Conservation Project Manager and Rockjumper Fellow of White-winged Flufftail Conservation at BirdLife South Africa. Much of his training stems from the MSc Conservation Biology course that he completed at the University of Cape Town in 2015. He obtained a PhD in Zoology in 2020 from the University of Pretoria where he investigated the population ecology of male Southern Elephant Seals following an overwintering expedition at Marion Island. His primary responsibilities are the research and conservation of White-winged Flufftail and its specialised wetland habitat. To accomplish this, Kyle is based in Dullstroom, Mpumalanga, where he engages with management authorities and landowners to help protect and steward wetlands.

APPLICATION OF ENVIRONMENTAL DNA AS BIODIVERSITY MONITORING TOOL IN AFRICAN AQUATIC ECOSYSTEMS: CHALLENGES AND OPPORTUNITIES

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ABSTRACT

The research and development of environmental DNA (eDNA) approaches for routine monitoring and conservation has been extensive, especially in Europe and North America. However, the uptake in Africa has been slower with only a few studies on the subject in freshwater environments. Therefore, this study investigated eDNA applications in Africa to determine the potential and challenges of incorporating it into frameworks for monitoring and conservation of aquatic ecosystems.
This study used a case study in South Africa to highlight these challenges and opportunities. Five water samples were taken from the Letaba River in the Limpopo Province with 0.5 µm (sampled 1 L) and 0.25 µm (sampled 0.6 L) filters. Analytical procedures for eDNA analysis were completed by Nature Metrics Pty (Ltd) and comprised three different bioassays i.e. eukaryotic (18S rRNA), aquatic macroinvertebrate (COI) and vertebrates (12S rRNA). Commercially available extraction and clean-up kits were used and it was followed by in-house Nature Metrics PCR and sequencing methods. A custom bioinformatics pipeline was used for quality control, OTU clustering and taxonomic assignment. The taxonomic assignment was completed with similarity searches using the NCBI nt (Genbank) reference libraries. If similar matches were detected, the GBIF library was used to identify species known to occur in South Africa.

Overall, at five sampling sites the three assays identified 455 taxa or operational taxonomic units (OTUs) at varying taxonomic resolutions from order to species level depending on the reference data available. The macroinvertebrate assay yielded 163 taxa but only 7.4% of the taxa was identified (>98% match) to a species in the reference database. A further 12.3% was identified to genus and 76.7% to family level. The average taxon richness per site varied from 28 to 66. The eDNA results were compared to national monitoring data of the Letaba River from 1999 to 2007. The average taxon richness from this data was found to range from 15 to 30 taxa from 13 different sites sampled multiple times. This data is based on family level identification following a standardised, accredited sampling method. Therefore, it is evident that the eDNA approach has potential as it resulted in more taxa than the traditional monitoring methods, even if very little species identifications were possible. Environmental DNA is another tool in the monitoring and conservation toolbox, but care should be taken as reference libraries for African taxa were found to be limited in this case study.

Keywords: wetlands, eDNA, next generation sequencing, management

Wynand Malherbe is an aquatic ecologist working in wetlands and rivers using various ecosystem components and tools to assess the ecological health of aquatic ecosystems.

VEGETATION CLASSIFICATION OF THE HYDROGEOMORPHIC WETLAND TYPES IN THE KGASWANE MOUNTAIN RESERVE

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ABSTRACT

Wetlands are considered to be one of the most valuable ecosystems in terms of biodiversity, water storage and carbon sinks. A broad vegetation description and mapping of the Kgaswane Mountain Reserve (near Rustenburg, North West Province), a Ramsar site, were done but no detailed vegetation descriptions have been conducted of the hydrogeomorphic wetland types mapped in the reserve. To understand the relationship between vegetation, soil organic carbon and water levels in the Waterkloofspruit Peatland system within Kgaswane Mountain Reserve, a research study was conducted.

This presentation will focus on Phase 1 of the study – the vegetation component. Different plant communities found on hydrogeomorphic wetland types in the Waterkloofspruit Peatland system were identified, classified and mapped. To identify the homogenous physiognomic-physiographic units, historical aerial photographs of the Kgaswane Mountain Reserve were used. Sample plots (9 m^2) were placed randomly within identified homogenous units. Plant species present in the 53 sample plots were recorded and allocated a modified Braun-Blanquet cover-abundance scale value. Data were captured into MS Excel and exported for editing, classification and processing in the JUICE program. A modified TWINSPAN classification was applied to derive a first approximation of the plant communities using Braun-Blanquet procedures. Diagnostic, constant and dominant species were statistically determined from the synoptic table. Threshold values for fidelity, frequency and canopy cover were set and a final phytosociological table was produced for describing the plant species composition for the different plant communities.

The following five plant communities were identified in the Waterkloofspruit Peatland system: *Verbena bonariensis-Imperata cylindrica* along the channel wetland, *Cyperus esculentus-Pteridium aquilinum* on the seepage areas, *Leersia hexandra-Bolboschoenus maritimus* at the valley bottom adjacent to central basin reeds, *Hyparrhenia dregeana-Miscanthus junceus* in the channel wetland and *Thelypteris palustris-Phragmites australis* in the unchanneled valley bottom. The soil organic carbon and water level data will be concluded in the next phase of the research study.

Keywords: Hydrogeomorphic wetland types, TWINSPAN, Phytosociological table, Vegetation communities description, Waterkloof Spruit Peatland system

Tshifhiwa Malise is a wildlife monitoring officer at Northwest Parks and Tourism Board with 13 years' experience in the field as a field ranger, and currently working in the ecological department dealing with monitoring wildlife and ecological management. She is also a part-time master's student at UNISA.

SEDIMENT AND WATER QUALITY INVESTIGATION IN THE KAMFERS DAM KIMBERLEY, THE ONLY BREEDING SITE FOR LESSER FLAMINGO (PHOENICONAIAS MINOR) IN SOUTH AFRICA

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ABSTRACT

This paper presents a proposal to investigate sediment and water quality in the Kamfers Dam in Kimberley which is an ecologically important site for breeding of Lesser Flamingo (*Phoeniconaias minor*) in South Africa. This dam is located in the outskirts of the city of Kimberley and receives 25% of run-off from the city and most of its "processed" sewerage water. Flamingos consume algae growing in the dam and build their nets using mud from their habitat. Sediment and water pollution could have widespread impacts on this sensitive habitat.

The study aims to characterize the chemical, radiometric and microplastics in the sediment and water samples. A boat will be used to sample water and sediment in a grid framework with the sampling sites 200 m apart. A van Veen grab sediment sampler will be used for bed sediment sampling while plastic bottles will be used to sample water simultaneously. The sediment will be freeze dried, manually disaggregated using a mortar and pestle and dry sieved to isolate the fine-grained fraction (<63 µm). Inductively coupled plasma mass spectrometry (ICP-MS) will be used for geochemical characterization, Organic Carbon (TOC) will be determined using the Walkley and Black method, nitrates (NO3) by the Brucine Method and phosphates by the Bray and Kurt method. A Zircon microscope will be used to identify and classify the microplastics, while HPGe gamma spectrometry will be used for radionuclides. Various pollution indices and sediment quality guidelines will be used to assess the potential ecological impact of sediment and water pollution in the study area. The study will contribute to the understanding of the risks to this important habitat site and help authorities to address them.

Keywords: Kamfers Dam; Flamingo; sediment and water pollution; ecological risk

Munyaradzk Manjoro is an applied geomorphologist with interest in hillslope and catchment processes with special emphasis on soil erosion and sediment dynamics, using various techniques that include sediment source fingerprinting, mineral magnetism, environmental radionuclides, geochemistry, remote sensing, and GIS.

WATER USE EFFICIENCY OF RIPARIAN PLANTS AND THEIR INFLUENCE ON AQUATIC BIOTA IN THE RIET AND LOWER VAAL RIVER SYSTEMS

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ABSTRACT

Freshwater ecosystems have degraded over the years and they experience water scarcity due to invasive plant species and human pressure on aquatic biodiversity. Invasive plant species are the leading cause of the water scarcity problem in the Northern Cape Region, as they use excessive amounts of water, leaving the rivers at low levels. Native and invasive plant species in the riparian vegetation communities absorb large amounts of water and cause a decrease in the river levels, and degradation of water quality as more salts are left behind.

This study aimed at comparing the Lower Vaal (28.418304 S, 24.2903272 E) and Riet River (28.999090 S, 24.47968 E) systems in different seasons and in terms of their physio-chemical components, riparian plants' water use efficiency and fish and benthic macroinvertebrate diversity. Sampling was done for the physio-chemical components (pH, turbidity, dissolved oxygen, temperature, conductivity, density, and salinity) using HL7, (HydroLab) and the plant water use efficiency through transpiration using Li-COR (LI-6800, Biosciences) with R Studio. Benthic macroinvertebrate sampling was done using a SASS 5 protocol to family level while the LR-24 Electrofisher (Smith-root, USA) was used to sample fish. DJI (Mavic Pro) drone was used to do biotope mapping using remote sensing of the study site and take note of the photosynthetic plants. Fish morphometrics and species identification were done and a total of seven fish species and twelve benthic macroinvertebrate taxa were found. The study revealed the riparian vegetation dominant plants were invasive, the *Vachellia* in the Riet River and the *Eucalyptus* in the Lower Vaal River. The *Vachellia* plants in the Riet River transpiration were $2{,}5x10^{-5}$ to $7{,}4x10^{-5}$ mol m^{-2} s^{-1} and the Lower Vaal River were $3.1x10^{-5}$ mol m^{-2} s^{-1}. The *Eucalyptus* trees' transpiration rates in the Lower Vaal River were $1{,}4x10^{-4}$ mol m^{-2} s^{-1} and $11x10^{-5}$ mol m^{-2} s^{-1} in the Riet River. Only two fish species, *Tilapia sparrmanii* and *Clarias gariepinus,* were found in the Lower Vaal River whereas mudfish species dominated both river systems. The macroinvertebrate taxon Baetidae dominated the Riet River with a SASS score of 46 while the Lower Vaal River system had a SASS score of 55 with the dominant taxon being Simuliidae.

Keywords: Invertebrates, river systems, water quality

Owami Mashaba,is an honours student at Sol Plaatje University majoring in Zoology. She has been a tutor from second year (2021) onwards for modules such as Human Geography and Invertebrate Life and Evolution. She has volunteered at various projects in the Northern Cape such as the Sociable weaver project in Benfontein Nature Reserve and the Vulture project in Dronfield Nature Reserve, and taken taken part in a snake handling course, currently on level 2. She is a level 3 First Aider.

EFFECTIVENESS OF PERI-URBAN WETLANDS IN PROVIDING ECOSYSTEM SERVICES: MANKWENG, AS A CASE STUDY

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ABSTRACT

Wetlands have been characterized as kidneys of the earth. They play a pivotal role in the environment by providing habitats for aquatic species, storing water, and through their services and functions, they are well-suited for water regulation of hydrological regimes such as recharge of groundwater, mitigation of flood challenges, provision of habitats, climate regulation and water purification. They also provide socio-economic benefits such as recreational opportunities, livestock grazing, and are of support for agriculture and fishery activities.

The Mankweng wetlands are considered rich for their biodiversity and hydrological functions. However, with the current increase in anthropogenic, agricultural, and industrial development activities, the wetlands are experiencing degradation and loss of ecosystem services and functions. This study aims to assess the current effectiveness of Mankweng wetlands in providing ecosystem services. This will be achieved by determining the health of the wetlands through the analysis of water quality parameters, sediment quality, diatoms, microbial diversity, and eDNA. The results will assist to ascertain whether the Mankweng wetlands are providing ecosystem services and functions to the environment and the community. This research will improve the lack of comprehensive studies conducted on the Mankweng wetlands' services and functions, by providing a record of baseline conditions. The findings will add to the body of knowledge that will assist in the conservation and restoration strategies that can be implemented by relevant government departments, policymakers, researchers, and conservationists.

Keywords: Wetlands, Services, and Functions, Environmental DNA, Mankweng

Masego Montwedi is a researcher,and a lecturer in the Department of Water and Sanitation at the University of Limpopo. She holds a Master's degree from North-West University (Mahikeng Campus), in the Biological Sciences field, specializing in molecular microbiology. She is a Ph.D. candidate, registered in a dual programme with the North West University (Potchefstroom Campus) and Keele University (United Kingdom). She is passionate and active in projects (VLIR-UOS and KU Leuven - Belgium) and collaborations (IKUDU COIL and the University of Cape Town) related to student development, learning, and support. She is looking to diversify her skill set, and hence her research interests are wetland ecology, water quality, environmental policies, resources and sustainability.

FROM BITTERNS TO WIDOWBIRDS: A REVIEW OF WETLAND BIRDS TO INFORM MANAGEMENT GUIDELINES

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ABSTRACT

Wetlands provide numerous ecosystem services, including water purification, carbon sequestration and storage, moderation of extreme events, habitats for species, tourism, and recreation. Even so, wetlands have been damaged and destroyed by various anthropogenic activities such as agriculture, mining, pollution, drainage, mismanagement of wetland drivers, and alien invasive species.
Lack of knowledge about wetlands and the crucial ecosystem services they offer leads to the mismanagement of wetlands, which has played a significant role in wetland decline. Mismanagement of wetlands involves incorrectly timed burns and grazing of livestock, installing or building of infrastructure (roads, fences, bridges, pipes, dams, etc) incorrectly, and cultivation in wetlands. To improve the use and management of wetlands, BirdLife South Africa is in the process of writing Best Practice Guidelines for High-Elevation Wetland and Peatland Management in southern Africa. The intention of the guidelines is to give landowners and management authorities the knowledge and resources they need to independently manage wetlands in a way that enhances and sustains the delivery of ecosystem services. The guidelines' motivation is to ensure that sufficient wetland habitat is created and maintained for the conservation of species.

The mismanagement of wetlands negatively affects both the wetlands and the species they house. For example, incorrect timing of burns in the summer months could damage the peat layer of a wetland but can also disrupt the breeding of bird species. Furthermore, incorrect grazing regimes could lead to important bird habitats being trampled during the breeding season. Management interventions need to be aligned with avifaunal phenology to ensure that management practices do not unnecessarily disrupt these natural phenomena. To inform the management guidelines, especially grazing and burning practices, a literature review was conducted to better understand the habitat requirements of avifauna dependent on inland wetlands. A species list was compiled of all birds in southern Africa that use wetlands for breeding, foraging or both. Metadata were collected for these species, including conservation status, distribution, and other behavioural and life history traits. Our presentation details the review process and main findings.

Keywords: Biodiversity conservation, Ecosystem services, Flagship species, Inland wetlands, Phenology.

Marlize Muller is the Conservation Biology Intern at BirdLife South Africa. She studied Botany and Zoology at the North-West University, and completed her honours and MSc in urban ecology, investigating the actual and perceived value of ecosystem services provided by gardens at health clinic gardens. She is currently completing her PhD in grassland ecology, investigating the effects of climate variability, land-use change and management practices on plant diversity and ecosystem functioning. Her primary responsibilities are to assist with the research and conservation of the White-winged Flufftail and its specialised wetland habitat. Marlize is based in Dullstroom, Mpumalanga, where she works with Kyle Lloyd, the Wetland Conservation Project Manager and Rockjumper Fellow of White-winged Flufftail Conservation at BirdLife South Africa.

LINKING ECOLOGICAL RESTORATION ACTIVITIES TO VEGETATION DEVELOPMENT IN A RAMSAR WETLAND

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ABSTRACT

The functioning of wetland ecosystems is negatively impacted by human anthropogenic activities, which affect wetland vegetation development and its ability to offer ecosystem services. The paper examined wetland restoration efforts to establish whether they reflect the intended restoration outcomes in Nylsvley. Three project sites, A61C-01, A61C-02 and A61C-03 with various interventions were investigated. All restoration objectives were analysed and evaluated for their success against project site-document review; the processes were linked to restoration phases (planning, implementation, and monitoring) and data were obtained through field photographs.

Initial results from the monitoring showed restored sites with clear impacts on hydrology, geomorphology and vegetation and their change score was based on the WET-health assessment recorded. Photographs of the wetland status before restoration were obtained through document reviews. Aerial photographs and previous documents played key roles in providing wetland status before and during evaluation, in addition to WET-Health data. The restoration process, including the monitoring strategies, were critically reviewed in the project reports. To improve flood attenuation, road strips with reno gabion structures were constructed across the wetland. To curb soil loss, berms and road strips were constructed on most roads and some degraded roads were closed for alternative access. The natural hydrological function of the wetland was improved by destroying berms previously constructed to divert water from the floodplain. Local plant biodiversity was improved by fencing off previously degraded areas from grazers and old trees along berms were kept. This study proposes the establishment of long-term vegetation monitoring sites within the reserve to monitor vegetation development.

Keywords: Ecosystems; monitoring; Nylsvley; restoration; vegetation; wetland.

Florence Murungweni;s distinct knowledge is in application of modern technologies such as RS and GIS as applied to various societal sectors. Her current research interests are in ecological restoration/rehabilitation of freshwater wetlands, climate change impacts and land use/ cover changes. She holds a PhD in Environmental Sciences, MSc in Geo-Information Science and Earth Observation; Natural Resource Management. She currently works at the University of Venda as a Senior Lecturer in the Department of Geography and Environmental Sciences.

COMPARING DIFFERENCES IN THE ECOHYDROLOGY, PHYSICAL AND CHEMICAL CHARACTERISTICS OF TWO DIFFERENTLY MANAGED PEATLANDS IN ESWATINI

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ABSTRACT

The classification of peatlands is often based on several factors such as: the source of water, geomorphic features, vegetation, and climate. This study, therefore, is assessing and comparing land use management-driven differences in the ecohydrology, physical and chemical composition of two peatlands in Eswatini. The first peatland occurs in the Malolotja Nature reserve, while the second, occurs within Motjane communal land, and hence falls under Swazi Nation Land.

A total of two and four monitoring transects were established at the Malolotja and Motjane peatlands, respectively. The decision on the number of transects established was made on the basis of site complexity (Landscape, topographic relief, hydrology, vegetation, and soil types), objectives of the monitoring project, as well as the size of the peatlands. On both peatlands, wells and piezometers were installed to monitor, amongst others, hydrological parameters including water levels, electrical conductivity, water temperature, as well as to sample surface and groundwater for isotope analysis. Multiple peat and soil samples were also collected at different depths from the two peatlands for the elemental analysis of carbon, nitrogen, hydrogen and sulphur, analysis of major ions, phosphorus and pH.

Initial findings suggest a shallower and more stable water table at the Malolotja peatland with persistent groundwater input, and so the peatlands are classified as fens. Additionally, the Malolotja peatland contains a higher percentage of the elements carbon and nitrogen in comparison to the Motjane community peatland. The average pH and phosphorus levels of the peat from the Motjane peatland were however higher than that of the Malolotja peatland. A long term, detailed monitoring of the variables is still underway, and this will allow for comparison of such results with similar parameters in southern Africa and elsewhere.

Keywords: peatlands, land-use, ecohydrology, physical, chemical composition

Thandkas Ndlela is a PhD student, a researcher and budding academic with skills in the management of environmental resources, especially land and water resources. For her MSc, she characterized the hydrology of the first documented peatland in Eswatini. She currently researches the degree to which climate change and climate variability as well as land-use management impacts on the ecohydrology, carbon dynamics and green-house gas emissions in different wetland ecosystems in Eswatini.

ASSESSING CHANGES IN THE HYDROLOGICAL REGIME OF LACUSTRINE WETLANDS ON THE MAPUTALAND COASTAL PLAIN, SOUTH AFRICA

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ABSTRACT

The hydrological regime of wetlands plays a critical role in understanding the ecological functions and ecosystem services of these systems. It describes the spatiotemporal variation in water flow and storage within wetlands, including the inter- and intra-annual variations of water availability. Understanding the cycles of inundation of wetlands are useful to inform biodiversity typing and would be valuable for measuring the impact of climate change and anthropogenic pressures on wetlands. The Maputaland Coastal Plain (MCP) is a region located in the north-eastern part of KwaZulu-Natal, South Africa. Many diverse estuarine and freshwater ecosystems are found here, with extensive habitats highly dependent on the groundwater aquifer. Changes in the inter- and intra-annual hydrological metrics of lacustrine wetlands within the MCP, however, are poorly understood.

This study aims to assess whether any changes in the inter- and intra-annual hydrological regime of the MCP's lacustrine wetlands have occurred between 2016 and 2022. As a first step, the mean monthly rainfall data were collected from various organisations to determine inter- and intra-annual changes in rainfall patterns during this time. Subsequently, the Google Earth Engine platform will be used to extract the monthly extent of lacustrine wetlands from Sentinel-1 and -2 images at a 10-m spatial resolution to derive hydrological metrics, and to see how surface water bodies respond to rainfall dynamics. The correspondence between the intra-annual, inter-annual and variation in range of rainfall and the open water bodies, the lag between these, and changes over time will be quantified. The outputs are intended to inform biodiversity typing and monitoring of estuarine and freshwater wetlands of the MCP.

Keywords: Ecosystem services, goal A of the GBF, hydrological regime, lacustrine wetlands, Maputaland Coastal Plain, SDG 6.6.1a, wetland monitoring

Nkosingizwile Ndlovu is a highly motivated MSc Geoinformatics student at the University of Pretoria. She has a passion for environmental conservation and is an active member of the South African Wetlands Society. Her research interests include the use of remote sensing and GIS technologies to support wetland conservation efforts. Nkosingizwile is a dedicated student who strives for excellence in all aspects of her academic and professional life. She is committed to making a positive impact on society through her work in the field of Geoinformatics.

COMMUNITY-BASED MONITORING BY MPOPHOMENI ENVIRO-CHAMPS

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ABSTRACT

Community-Based Monitoring is a mechanism that allows community members to gather information, driven by local needs and community values, to increase accountability to contribute to the management of natural resources. It is the process of identifying and addressing concerns at a local and community level for implementing development programs in the long run. As part of implementing the Ecological Infrastructure for Water Security Project, the South African National Biodiversity Institute (SANBI) has been working with the community of Mpophomeni, upstream of Midmar Dam in the uMngeni catchment in KwaZulu-Natal, to undertake monitoring on the Mpophomeni and Dartmoor wetlands that are under rehabilitation.

The wetlands under rehabilitation are on communal land and it is important for the community to understand and monitor wetland function so that the gains are not lost when the rehabilitation process is completed. Enviro-Champs, as the youth of the community, undertake monitoring of wetland functions under the management of SANBI and Umgeni Water, as part of a comprehensive community-based monitoring intervention using biomonitoring citizen science tools as well as monitoring and reporting issues such as wastewater spillage, water leaks, and solid waste dump sites. This Community-Based Monitoring approach is also part of a collaborative effort to address socio-ecological issues within the catchment including youth unemployment and natural resource management. Through this monitoring intervention, the Enviro-Champs have also been capacitated to improve their knowledge and understanding of natural resource management. The Enviro-Champs also play a community liaison function that facilitates connecting uMngeni Water and SANBI to the community leaders and community members to enable tackling issues related to grazing management of livestock (particularly on the wetland under rehabilitation). The community liaison role also facilitates engaging livestock farmers' associations on issues related to wetland protection, conservation, and management.

Keywords: Community-based monitoring, Wetland, Enviro-Champs, Ecological Infrastructure

Anele Ngcobo is a young professional and Water Policy Intern at the South African National Biodiversity Institute, under the Ecological Infrastructure for Water Security (EI4WS) Project.
Her passion for the environment led her to pursue a BSc degree in Environmental science and an Honours degree in Environmental Management. The implementation work they do on the ground as the EI4WS team has sparked her interest in the conservation, restoration, rehabilitation, and management of our biodiversity.

SEASONAL VARIATION OF CARBON DIOXIDE NET ECOSYSTEM EXCHANGE ON WATERKLOOFSPRUIT PEATLAND, KGASW, TLOTLISANG ANE MOUNTAIN RESERVE

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ABSTRACT

Wetlands store large amounts of carbon and therefore play a major role in carbon sequestration and the mitigation of climate change. The stored carbon can be lost or more carbon can be sequestrated depending on the state of the wetland. A pristine wetland absorbs carbon in the form of carbon dioxide (CO2) but a degraded wetland releases more CO2 than it gains. Due to the limited data available on CO2 net ecosystem exchange (NEE) in South African wetlands, this study examined the seasonal variation of CO2 NEE in both permanent and seasonal wetness zones of the Waterkloofspruit Peatland in Kgaswane Mountain Reserve, near Rustenburg in North West Province.

A chamber method with an ADC SRS 1000 analyzer was used. The CO2 NEE measurements were done at 2-3 week intervals, commencing in June 2022 and ending in May 2023. Data were subjected to one-way analysis of variance (ANOVA) to determine whether CO2 NEE differs significantly among seasons. Preliminary results show that for both the permanent and seasonal wetness zones of a peatland, the ecosystem is a sink of CO2 during spring, summer and autumn. In winter, both permanent and seasonal wetness zones become sources of CO2, although the emissions were low due to low microbial activity associated with low temperatures in winter. For the permanent wetness zone, summer and autumn sinks were not significantly different but both were significantly higher than the spring sinks. Summer sinks for the seasonal wetness zone were only significantly higher than the spring sinks, while autumn sinks were substantially higher than the spring sinks but not significantly different. Summer had the highest mean sinks: 0.1895 and 0.1660 Umol s-1 m-2 for the permanent and seasonal wetness zones, respectively. Autumn had the second highest mean sinks: 0.1164 and 0.1123 Umol s-1 m-2 for the permanent and seasonal wetness zones, respectively. The lowest mean sinks occurred during spring, with mean values of 0.0037 and 0.0540 Umol s-1 m-2 for the permanent and seasonal wetness zones, respectively. Winter mean emission values were 0.0118 and 0.0032 Umol s-1 m-2 for the permanent and seasonal wetness zones, respectively. It is therefore concluded that there is seasonal variability in CO2 NEE, but overall, the peatland is a net sink for CO2.

Keywords: Soil temperature; season; Photosynthetically active radiation

Tlotlisang Nkhase is a PhD student studying agrometeorology at the University of KwaZulu-Natal. Ihe has a Master's degree in Agronomy and an Honours degree in Environmental Soil science.

MANAGING WETLAND ECOSYSTEMS DURING THE AGE OF SOUTH AFRICA'S RENEWABLE ENERGY TRANSITION

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ABSTRACT

South Africa is a country that derives electricity supply directly from a state owned enterprise. The management and supply of electricity from this state owned enterprise is desperately struggling to meet the demands of its citizens. Enter renewable energy sources - a perceived silver bullet aimed to supply electricity driven by harnessing the earth's natural sources of energy generated by solar, wind and a host of alternatives, with the ultimate goal being to increase the supply of electricity to the country, whilst reducing the environmental impact from its processes and infrastructure.

The introduction of renewable energy infrastructure has gained large scale momentum within recent years. Industries ranging from mining houses, large scale factories and even agriculture to small scale urban residential and farming households, have all recently begun embarking on moving "off the grid" to ensure a stable supply of energy. One such solution, Solar Photovoltaic (Solar PV) facilities have gained major traction within the South African context.

As with any development in the country, due regulatory environmental processes need to be followed in order to reduce the environmental impact of the associated developments on the surrounding landscape. This presentation aims to illustrate the challenges faced when considering the feasibility of Solar PV developments, typically constricted by what is deemed to be one of the main environmental sensitivities requiring consideration during the regulatory processes namely, wetland ecosystems. As wetland ecosystems and associated processes are considered complex and dynamic, this presentation aims to use practical, case study examples to indicate the diversity and intricacies of wetlands throughout different parts of the country, all of which are subjected to varying ecoregional characteristics and are host to a multitude of different biota. Considering the vast differences amongst wetlands within different parts of the country, the presentation aims to tackle the manner in which these freshwater ecosystems are affected by Solar PV and other renewable developments. Additionally, attention is drawn toward the legislative changes that have occurred, tailored towards streamlining the advancement of renewable energy projects within the South African context. Overall, the presentation aims to challenge dialogue from the audience, to engage on how best to proceed with renewable energy developments whilst strongly considering wetland conservation within a country currently faced with a major shortage of electricity supply versus the demand.

Keywords: Renewable Energy, Solar Photovoltaic developments Wetland ecosystems

Sashin Pillay is a member of SAWS and SACNASP and practices as an Environmental Scientist with a focus on wetland and aquatic ecology.

SUCCESSES AND DOWNFALLS IN THE PROCESS OF WETLAND RESUSCITATION IN THE SOUTHERN PART OF LESOTHO USING MOHALE'S HOEK DISTRICT AS A CASE STUDY

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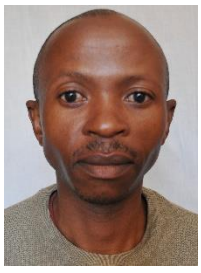
ABSTRACT

Lesotho is home to a system of unique wetlands found nowhere else in the world, mostly in the eastern alpine areas (Drakensberg Alfroalpine Heathland). These wetlands support a network of unique high altitude peatlands which are a key contributor to the water system of the country. The country is therefore well endowed with water, a resource that is nationally referred to as white gold.

The Letsa-la-Letsie Wetland in the Quthing District, is designated as a Ramsar site, and thus accorded protection. This therefore shows how crucial it is to look at conservation (of which conservation of wetlands is no exemption) in Lesotho as the best approach to protect the wetlands, and hence protect aquatic life in general. This is due to the fact that Lesotho is a territory that possesses a lot of biodiversity as well as various wetlands both in the mountains and in the lowlands. There are various funded projects that have been implemented in Lesotho to respond to the impacts of climate change and most of these projects are being directed in the southern part of Lesotho, particularly in Mohale's Hoek District, because this is the district that has been adversely impacted by climate change and water sources, and the wetlands are at risk.

Projects that were implemented were: (1) Reducing Vulnerability from Climate Change (RVCC), which has phased out in 2021; (2) the LOcAL project which is currently being implemented, building resilience for climate change among the communities in the project area, with the main focus being on protection of wetlands as water sources, and (3) Integrated Catchment Management (ICM), which is the project that advocates for a holistic approach towards management of different ecosystems including wetlands. Delegates were sent from Lesotho (Mohale's Hoek district) under the RVCC project to attend the South African Wetlands Indaba 2018. The paper will present the lessons learned from the Wetland Indaba 2018, which was first learning platform for Lesotho RVCC project delegates. It will also describe the exercise that the project embarked on using the knowledge gained from the Wetlands Indaba. Furthermore this study shares the ups and downs in the process of protecting our wetlands especially in the southern region, and discusses the initiatives taken to protect the wetlands and how these initiatives will benefit other SADC countries.

Keywords: Wetlands, Water resources, Conservation projects, Community Engagement.



Relebohile Ramokoatsi works as District Environment Officer in the Ministry of Tourism Environment and Culture in the Department of Environment. He has a Bachelor's degree in environmental studies, and is about to embark on his MSc in Conservation Biology at the University of the Western Cape, since it has been his lifelong desire to engage in environmental stewardship and to contribute significantly to the protection and restoration of wetlands in Lesotho, which is regarded as the water tower for te SADC region. Since his attendance at the wetlands Indaba in Northern Cape 2018 andhis passion for wetlands stewardship has escalated!

COMMUNITY CONSERVATION INITIATIVES FOR THE WISE USE OF WETLANDS

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ABSTRACT

The eastern Soutpansberg area (Venda) in the Limpopo is blessed with a variety of landscapes and wetlands. These range from the sacred Lake Fundudzi to the Mutale peatland, various springs and extensive valley bottom wetlands such as the Mutale and Lambwe. Most of these wetlands are flanked by highly productive soils with steep mountain slopes beyond. The area's high rainfall coupled with its productive soils and mild winters have resulted in intense subsistence small-scale farming practices, historically, adjacent to wetlands. However, productive agriculture has led to an ever-increasing population with semi-urban sprawl now encroaching onto grazing and cultivation areas. As such, the wetlands have become prime grazing lands and where soils allowed, have been drained for agricultural practices. Urbanization of the catchment has led to deforestation of steep mountain slopes, increased runoff and subsequent erosion of the catchment and wetlands alike. Furthermore, sediment and nutrient input from sewage and washing effluent as well as sand and clay extraction are also impacting negatively on wetland biodiversity.

The deterioration of their natural environment due to urban sprawl has progressively become a concern of many local members of the Venda community, and members started to express their concern. Consequently, the Thulamela Makhado Adopt A River Forum (TMAC) was established. It is a non-profit organization established in 2015 with the support of both DWS and DEA, empowering the community to voluntarily rehabilitate wetlands, removing waste from rivers and water bodies as well as addressing waste and environmental degradation. TMAC has approximately 456 volunteers (426 females, 30 males) who are working across 88 villages in the Vhembe District Municipality.

The purpose of this presentation is to give an overview of the approach of TMAC to address the degradation of water resources by removing waste in rivers, wetlands and on land by implementing waste minimisation skills to reduce littering and pollutants. The presentation will focus on the successes achieved thus far, the challenges that need to be addressed, and the role that small, locally-based NPOs can play in the conservation and wise use of wetlands, through creating jobs.

Keywords: Wetlands Waste Management, Community, Conservation, Wise Use

Pfarelo Rebecca Ramugondo completed a business management diploma at the Institution of Business studies at Wits University in 1998. She worked as a contractor for Working for Water at Albasini under the Mutshundudi Project.
In 2010 she became the founder of Tshikofokofo Adopt A River, and in 2014 became the chairperson of Vhembe District Adopt A River.
In 2019 Pfarelo was awarded the certificate of Appreciation by the Department of Local Economic Development Environment & Tourism (LEDET)

GLOBAL APPLICATIONS OF ENVIRONMENTAL DNA (EDNA) FOR ECOSYSTEM MONITORING

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ABSTRACT

Environmental DNA (eDNA) is a relatively new technique that has revolutionized the way we monitor biodiversity. It is a non-invasive method of detecting and quantifying species in an ecosystem by analyzing the genetic material they leave behind in their environment. eDNA can be extracted from soil, water, snow, or even air samples, and can provide us with all kinds of information about the species living in an ecosystem. A single sample containing eDNA can be used to detect endangered species, study the impacts of climate change, alert us to invisible threats such as pathogens, and assess the overall health of aquatic and terrestrial ecosystems.
Specifically, the use of eDNA is a game changer because it is more efficient and sensitive than traditional methods for monitoring biodiversity such as camera traps or aerial surveys. These traditional methods are labor-intensive and often costly. With threats to biodiversity mounting, it is now more important than ever to monitor ecological systems quickly and efficiently, especially in biodiverse yet data-poor countries, to help us protect and conserve the planet for nature and people and to objectively evaluate the success of our restoration efforts over the long term.
The application of eDNA globally has been growing enormously in recent years with a bias towards studies having been undertaken in the global north, while single species analyses have seen a slow decline. It has played a significant role in the nature positive economy by providing a means to obtain “big data” on biodiversity and at unprecedented rates and scales – from local to regional, site to landscape/catchment. The technique has been used in many novel ways in monitoring biodiversity for restoration projects around the globe. For instance, eDNA has been used to detect the presence of invasive species in water bodies, assess the impact of climate change, evaluate biotic responses to impacts and restoration efforts, monitor the distribution of rare and elusive species , and even identify new species .
In conclusion this novel technology will be presented from a contextual and introductory perspective to that of an applied outcomes-based perspective. Insights, outcomes and considerations will be presented by drawing on projects ranging from site-scale examples in South Africa and elsewhere to global landscape-scale examples and from those lead by multinational corporations to citizen scientists.
Key phrases: Introduction to eDNA; why is it a game changer? application of eDNA globally; role in the nature positive economy.

Vere Ross-Gillespie is an aquatic ecologist and entomologist with a PhD from the University of Cape Town. He has extensive experience in the consulting and applied research realm having worked on aquatic and terrestrial ecosystems across southern and eastern Africa, the sub-tropics and the Indian Ocean Islands. He has over a decade combined applied research and consulting experience in the water sector within southern Africa and SADC member states. He joined the NatureMetrics team in February 2020 and is currently responsible for managing strategic accounts across the extractives and onshore industrials sector. He is interested in DNA-based applications for aquatic, riparian and terrestrial biodiversity management and monitoring, conservation and restoration projects, capacity development and citizen science, in the SADC region and globally.

ASSESSING GAPS IN THE NATIONAL WETLAND INVENTORIES OF AFRICAN COUNTRIES FOR RESPONDING TO THE GLOBAL BIODIVERSITY FRAMEWORK TARGETS 1-3

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ABSTRACT

Wetland inventories play a crucial role in achieving the Global Biodiversity Framework (GBF) Goal A targets 1-3, which aim to halt biodiversity loss, restore ecosystems, and ensure 30% protection by 2030. However, the extent to which wetland biodiversity has been mapped at the biome or ecosystem functional group (EFG) levels remains unclear.

Analysis of National Reports submitted to COP14 reveals that 46% of Contracting Parties completed national wetland inventories, consistent with previous COP figures. In Africa, there has been a modest improvement, with 45% of Parties completing inventories for COP14 compared to 35% for COP13. However, it remains uncertain whether these inventories have mapped wetland biodiversity to the biome or ecosystem functional group (EFG levels) of the global ecosystem types classification system. The use of the Global Surface Water (GSW) product for reporting the extent of wetland biomes to SDG 6.6.1a exposed significant underrepresentation of palustrine wetlands, up to 87%, in South Africa's inland ecosystems compared to the South African National Wetland Map version 5 (NWM5). Such statistics may also prevail for the rest of African countries, if not globally too.

This assessment seeks to assess the geographic gaps in wetland biodiversity typing in Africa. It will begin by reporting the percentage of countries with national wetland inventories (NWIs) and their coverage of the African continent. Next, it will examine the percentage of countries with NWIs that have achieved ecosystem functional group (EFG) level mapping according to the IUCN. Lastly, it will evaluate the extent to which new remote sensing outputs generated in Africa in the past decade have addressed the gaps identified in the reported NWI.

Preliminary findings indicate that only six countries have updated their national wetland inventories in the past decade, with limited accessibility to the data. While remote sensing has shown promise in addressing biodiversity mapping gaps, global datasets lack specific differentiation of palustrine and lake wetlands, which are the focus of this study. However, there are certain datasets such as the GWL_FCS30 that offer some stratification for wetland types. Notably, mapping efforts focussed on coastal wetland types such as mangroves and salt marshes are more common, leaving a significant gap in mapping palustrine and lake biomes for inland freshwater wetlands. While remote sensing outputs for African countries have increased in recent years, their alignment with IUCN's global ecosystem types and EFGs remains to be assessed. National and regional mapping efforts in Congo Basin, Eswatini, Kenya, Nigeria, South Africa hold the potential to contribute valuable data in bridging this gap.

Keywords: Wetland inventories, Wetland biodiversity, Ecosystem functional groups, Biodiversity mapping, Global Biodiversity Framework

Mpho Sadiki is an Earth Observation (EO) Data Scientist at Digital Earth Africa, creating, managing, and delivering continental services and products using earth observation and geospatial data. Her work involves utilizing satellite imagery and data to provide insights supporting sustainable food management, agricultural practices, food security, and urbanization on the African continent. Mpho's career began as a Knowledge Transfer Partnership Associate, where she worked on utilizing earth observation data to develop data science capabilities for analysing crop spectral signatures. This enabled the identification and yield estimation of maize crops. She holds a Masters in Geoinformatics from the University of Pretoria and is currently pursuing a PhD in the same field. Her research focuses on using geospatial technologies to map the biodiversity of wetland ecosystem functional groups across Africa.

A REVIEW OF THE MIRE TYPES OF LESOTHO FOR CURRENT AND FUTURE CONTRIBUTION TO MANAGEMENT

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ABSTRACT

The high-altitude alpine areas of Lesotho host mires that provide critical services such as (1) groundwater storage, recharge, and discharge; (2) flood-flow attenuation; (3) animal grazing; (4) sediment retention; (5) carbon storage, and (6) biodiversity. This paper aims at investigating the different characteristics of the mire types (bogs and fens) of the high-altitude alpine areas of Lesotho in order to provide management guidelines for bog and fen restoration in Lesotho and to analyze contradictions in identifying these different types appropriately.

The following characteristics were studied: source of water, plant available nutrients, and vegetation cover. The source of water is influenced by the wetland's geomorphic position and the local climatic conditions. On the other hand, the source of water influences the plant available nutrients and water chemistry of the mire types. The distribution of plant species in the different mires that influence their spatial diversity and temporal variation is controlled by three hydrochemical factors: variation in base-richness, fertility (productivity), and moisture. Early research on Lesotho mires dating back to the 1950s-1990s referred to these as bogs based on surface topography, whilst the more recent studies in the 2000s recognized the importance of groundwater as the driver of wetland hydrology and fens then featured. Generally, the mires in the high-altitude alpine areas of Lesotho are groundwater dependent, and their water chemistry is slightly acidic ranging between 5.0 and 7.0. They are high in plant-available nutrients such as phosphorus. Nonetheless, not many studies have discussed the productivity component of the mires of Lesotho. Vegetation is mostly marsh-like and comprised of herbs and sedges. It can be concluded that the mires are fens and not bogs, therefore, management measures recommended include mire conservation, controlling overgrazing and stormwater inflow, de-activating soil erosion, re-wetting, filling-in drainage channels, re-establishment of wetland vegetation and removal of invasive alien species.

Keywords: bogs, fens, source of water, nutrient availability, vegetation cover, restoration

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IDENTIFYING *PROSOPIS* SPECIES INVADING THE MOLOPO AREA (NORTH WEST, SOUTH AFRICA).

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ABSTRACT

Prosopis species (mesquite) were introduced into South Africa in the late 1800's and were widely dispersed and planted until 1960 to provide shade and fodder during severe drought sessions. The species have successfully colonized the Molopo area, forming dense thickets because their pods are palatable and seeds are distributed by livestock, especially goats and cattle. *Prosopis* species also invade the riparian areas due to dynamic hydrology, and also some terrestrial areas of North West Province, due to the species' ability to resist drought and soil salinity. *Prosopis* species, however, lost their value when impenetrable thickets of densely packed, thin-stemmed plants started to develop, providing minimal shade and producing fewer pods either as a result of climate change or hybridization. Additionally, mesquite has a detrimental effect on South Africa's limited water supplies. According to estimates, dense stands of *Prosopis* requires an amount equivalent to 1100 mm of rainfall water annually, particularly in the drier regions. Other recorded negative impacts of *Prosopis* include degradation of the ecosystem services such as soil quality and grazing capacity, increased native trees mortality and reduction of species richness (Shackleton et al., 2015). *Prosopis* species and their hybrids are among the aggressive IAPS found around the world, especially in semi-arid and desert areas. *Prosopis julifora* is among the *Prosopis* species that has been planted; other *Prosopis* species have also become invasive, displacing native plants, decreasing biodiversity, destroying wetlands and adversely affecting rural livelihoods. Additionally, *Prosopis* species have been described as the most water-hungry plant species. Due to their extremely deep taproots, studies carried out in South Africa have shown that invasive *Prosopis* tree species and hybrids significantly affect groundwater levels and wetlands. As a result, water is becoming a more precious resource due to rising demands from a growing human population. Human societies are particularly vulnerable to water scarcity throughout some seasons in arid and semi-arid regions. This is common for the communities along Molopo area and Botswana border.

Keywords: Prosopis, South Africa, thickets, hybridization, mesquite & IAPS

Nqobile Sithole was born and bred in a small town called KwaMhlanga in Mpumalanga .After completing matric in 2016, she relocated to Mafikeng in 2017 for her first undergraduate degree (BSc in Biology & Geography). As a student facilitator she worked while completing an Honours degree in Biology majoring in Botany. She is currently in the final year of a Master's degree.

THE IMPACT OF HYDROLOGICAL SOIL INFORMATION ON WETLAND WATER REGIMES IN THE SABIE CATCHMENT, SOUTH AFRICA

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ABSTRACT

Hydropedological soil information is increasingly sought after for watershed-scale hydrological modelling, to better understand the soil-water interactions at a landscape level. In South Africa, 8% of the surface area is responsible for 50% of the mean annual runoff. Thus, understanding the soil-water dynamics in these catchments remains imperative to future water resource planning in a changing climate.

In this study the value of hydropedological information is tested by comparing a detailed hydrological soil map based on infield hydropedological soil information to the best readily available soil information using the SWAT+ model in the Sabie River catchment, South Africa. The aim was to determine the value of hydropedological information for determining streamflow accuracy and highlight the linkages between hydropedology and wetland water regimes. Outputs statistically evaluated long-term streamflow values and compared soil-water balances of selected wetlands at different positions in the landscape. Hydropedological information significantly improved long-term streamflow, which is primarily due to improved internal process representation using hydrological soil information. This is illustrated by the improved quantification and representation of wetland water regimes in the Sabie catchment and how hydropedology forms an important soft data tool in hydrology. These results highlight the spatial and temporal nature of hydrological processes across the catchment and the ability of hydropedological soil information to capture these processes at different scales, which holds the key to improved water resource management under a changing climate.

Keywords: Hydropedology; SWAT+ modelling; Wetland water regimes

Edward Smit is a soil science PhD candidate and research assistant at the University of the Free State. His research focuses on the impact of soil information on hydrological modelling, particularly on scaling hydrological processes from the soil to landscape level.
He completed a BSc Agriculture and MSc Agriculture, both in soil science at the University of the Free State where he grew to enjoy environmental soil science and hydropedology at undergrad and postgraduate level.

DUST OFF THE DATASETS! REPURPOSING WETLAND DATA THROUGH THE FRESHWATER BIODIVERSITY INFORMATION SYSTEM (FBIS)

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ABSTRACT

Many of us are sitting on data goldmines! We enthusiastically tackle the next wetland project, while the maps, spreadsheets and pages of text for the last project are left to gather dust. However, there is a solution which, with a bit of work, will enrich the state of our wetland knowledge. The Freshwater Biodiversity Information System, or FBIS, as promised, has digested the latest National Wetland Map and along with it, wetland biodiversity data for all to use and the chance to add your own.

The FBIS wetland team, comprising Freshwater Research Centre (FRC) and SANBI researchers, is excited to draw your attention to new functionality within FBIS that is specific to wetlands. A beta version of National Wetland Map 6 has been loaded, appearing on the FBIS as a visual layer, colour-coded according to hydrogeomorphic type. Key attribute data are available for each polygon, providing information on other levels of wetland classification, and ecosystem threat status (ETS; from NBA 2018), amongst other variables. These attributes can be used to filter the data within FBIS, in search of particular wetlands, or wetlands of a particular type or threat status. A plant biodiversity module has been added to FBIS, which currently carries with it a Master List of 1044 obligate wetland plants. More plant species continue to be added, with the aim of extending the list to facultative and riparian species. Wetland algae dta have been added to the algal biodiversity module, while the anuran, invertebrate, odonate and fish modules continue to grow.

The team is particularly excited about the maps and summary data reports that can be generated by FBIS, for use in research and consulting reports. Overviews and summaries can be generated for single or multiple sites, including information such as wetland Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS), where this information has been added by users or included on national databases. The FBIS outputs neatly add to the information generated by the DFFE's EIA Screening Tool, thereby assisting in the fulfilment of the requirements for Aquatic Biodiversity Assessments. The true potential of FBIS lies in the richness of data added by users. We encourage you to have a look at the map and the current wetland data on FBIS, register as users, and start adding your own data!

Keywords: Wetland data; information system; biodiversity; wetland map;

Kate graduated with an MSc in freshwater ecology from the University of Cape Town in 1998. Her specialist skills lie in the areas of wetland and river ecology, freshwater macroinvertebrate identification and analysis, biomonitoring, wetland mapping and classification, conservation planning for the aquatic environment, and urban river and wetland management and rehabilitation. Kate is currently a consultant with the Freshwater Consulting Group, and a researcher with the Freshwater Research Centre in Cape Town. She has a particular interest in monitoring the response of wetlands to climate change, and how biodiversity and ecosystem functioning will shift. Kate is SASS5 accredited and has been registered as an Ecologist with the South African Council for Natural Scientific Professions (SACNASP) since 2006.

A MOVING TARGET: THE PROTECTION AND MANAGEMENT OF THE ESTUARINE / FRESHWATER INTERFACE WHILE MINING IN TROPICAL SIERRA LEONE

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ABSTRACT

The Sierra Leone coastline is characterised by large estuaries and extensive mangrove forests (Critical Habitat and 100 times in extent to those found in South Africa) that extend far inland. Along the upstream edge of these mangrove forests extensive inland valley swamps occur – Raphia palm dominated freshwater wetlands. Strongly seasonal rainfall (up to 2000 mm in the wet season) results in seasonal inundation of these wetlands, creating habitat for a diverse array of endemic species, including colourful, endemic killifish.

Strong seasonal variability in flow from rivers and wetlands into the tidal mangrove forests results in a naturally dynamic freshwater/saltwater interface that supports a sequence of habitats and vegetation zones along the salinity gradient, which also includes extensive areas of peat accumulation within the mangroves. During the wet season the estuaries are freshwater dominated, and the salinity profile is relatively mixed, whilst during the dry season the saline water penetrates further into these systems. This seasonal variability impacts the floral and faunal species distribution, for example many of the fish species identified in these systems have a very narrow range of salinity, with most freshwater fish species only colonising the estuarine habitat when low salinities exist.

Climate change and resulting sea level rise pose a significant threat to these ecosystems, resulting in saltwater intrusion (SWI) to the marginal freshwater habitats. Direct utilisation of resources through extensive logging, harvesting of material, clearing for subsistence agriculture, and conversion of wetlands to commercial rice farms contributes further pressures on these wetlands.

Added to this is the impact of mining. In addition to direct loss, a change in the flow dynamics and water quality are the most significant impacts that mining will have. To understand and holistically assess these impacts a diverse array of specialists are required. Mining will result in a redistribution of flows, a reduction in freshwater flows, an increase in SWI and a change in the sediment distribution in the systems. These changes may result in, amongst others, a loss of the freshwater fish community during the dry season, a change in mangrove species distribution, a loss of marine fish species due to salt tolerance sensitivity, an impact on sensitive species abundance due to water turbidity and the deposition of sediment in the mangrove forests impacting the mangrove peat. Management and mitigation measures need to be adaptable and ensure that the spatial and seasonal variations that drive these systems are maintained.

Keywords: Estuary, mangrove, inland valley swamp, peat, salt water intrusion, mining, Sierra Leone

Kathy Taggart holds a MSc in Resource Conservation Biology from the University of the Witwatersrand and is a registered professional Natural Scientist in the fields of ecology and environmental science. Kathy is a wetland ecologist within the Environmental Management division at Jones & Wagener. She has experience with managing and conducting wetland assessments and integrating these findings with other specialist disciplines to ensure that environmental solutions are optimized.

Dieter Kassier (BSc. Hons. Environmental Science, Pr. Sci. Nat.) has been working as a wetland ecologist for the past 16 years. He has gained extensive experience in the delineation, assessment, management and rehabilitation of wetlands and riparian zones across a wide range of landscapes and projects. His experience is focused on the wetlands of the Highveld region and adjacent Bushveld of South Africa but extends to include the high-altitude fens and peatlands of Lesotho, dambos of the Copperbelt in the Democratic Republic of the Congo, peatlands on the coastal plain of Mozambique, Sierra Leone's inland valley swamps, as well as ephemeral systems of the South African arid zone. Dieter is passionate about his work and enjoys sharing his experience and observations.

ENGAGING COMMUNITIES IN WETLAND CONSERVATION: THE ROLE OF VILLAGE-BASED WETLAND MANAGEMENT COMMITTEES AND CONSERVATION AGREEMENT GROUPS WITHIN KIYANJA-KAKU WETLAND IN UGANDA

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ABSTRACT

Kiyanja-Kaku wetland is a vital ecosystem located in south central Uganda, covering an area of approximately 63 square kilometres. The wetland provides a range of essential ecosystem services, including breeding habitat for various birds, animals, and insects, food for household consumption (traditional fishing is among the significant activities in this wetland), and grass harvesting for mulching since the area lies within Uganda's dry cattle corridor. The wetland is also home to a diverse array of plant and animal species, including several endangered species, such as the Grey Crowned Crane and the shoebill stork. However, like many wetlands worldwide, Kiyanja-Kaku is threatened by human activities such as agriculture, urbanization, resource extraction, and excessive use of agrochemicals to boost crop production within and around the wetland. These activities have led to the degradation of the wetland ecosystem and the loss of essential ecosystem services. The International Crane Foundation/Endangered Wildlife Trust partnership has engaged local communities and established management groups, including village-based wetland management committees and conservation agreement groups to address these challenges. These groups are responsible for monitoring wetland health, reporting and managing human-wildlife conflicts, identifying threats to wetland ecosystems, and educating the public about the importance of wetlands. The management groups work closely with government agencies, NGOs, and other stakeholders to develop and implement conservation plans that balance wetland ecosystems with local communities' needs. By involving local communities in wetland management, these groups help ensure sustainable and effective conservation efforts.

The presentation will explore the current role of these groups, the current status of the Kiyanja-Kaku Wetland and biodiversity in the wetland, including lessons learned.

Keywords: Wetlands, community engagement, wetland management committees, conservation agreements, Kiyanja-Kaku wetland

Gilbert Tayebwa is a senior field officer for the International Crane Foundation/Endangered Wildlife Trust partnership. He works under the African Crane Conservation Program (ACCP) in South-Central Uganda. With a passion for scientific research and data analysis, Gilbert has dedicated his career to conserving wetland ecosystems. He has eight years of extensive experience in the field. Gilbert's work involves monitoring wetlands, identifying and addressing threats to wetland ecosystems and educating communities about the importance of wetlands. In addition to his conservation work, he enjoys reading scientific articles, conducting scientific research, and developing computer scripts for data analysis. Gilbert is committed to promoting sustainable wetland management practices and protecting these critical ecosystems for future generations.

CRITICAL REVIEW OF THE SOIL WETNESS AND SOIL FORM CRITERIA FOR WETLAND DELINEATION

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ABSTRACT

The concept of wetland delineation is firmly engrained in the assessment process of wetland assessment in South Africa. The accepted assessment and delineation tools require description of soil form (soil classification in the national system) and soil redox morphology (soil wetness indicator) to determine the outer edges and hydrological functioning of a wetland. Recent growth in and acceptance of the field of hydropedology in administrative processes amplifies the need for adequate soil description, expansion of soil and wetland hydrological knowledge, and focused training.

Despite the concepts of redox morphology being well understood and communicated technically amongst soil scientists, a dedicated description of the redox morphology implicit in the South African soil classification system is lacking within the wetland research environment. The South African soil classification system has evolved through three editions over the past 50 years while retaining, and expanding, the same redox morphology understanding. However, the broader understanding and acceptance of the specifics and implications of redox morphology in the South African context is limited outside the soil science fraternity. This is due to the fact that the classification system is structured differently from other international systems, and that the South African landscape is geologically ancient with mature soils, introducing challenges to resource assessment specialists who rely on international norms and approaches for wetland assessment.

This paper elucidates the various components of formal soil classification and redox morphology on the basis of Fe (and Mn) minerals and morphology within the context of the South African soil classification system. We provide a correlation between the various classification categories, diagnostic horizons and materials in the system, and the related redox morphology contexts that are relevant to wetland assessment, delineation, and protection in South Africa.

Keywords: Wetland delineation, hydropedology, soil classification, redox morphology, soil form indicator, soil wetness indicator

Johan van der Waals holds a PhD in Soil Science and has worked in wetland delineation, soil chemistry and soil pollution, and soil fertility and crop production environment for 25 years. He is a member of the Soil Classification Working Group of the Soil Science Society of South Africa and focuses on soil form and redox morphology indicators for various land use applications. He is often involved in legislative and criminal compliance matters pertaining to wetlands, agricultural amendments and soil and land uses.

MAPPING CHANGES IN ESTUARINE ECOSYSTEM FUNCTIONAL TYPES WITH LANDSAT AND SENTINEL-1 AND -2 TO ALIGN WITH SOUTH AFRICA'S FOUR NATIONAL LAND COVERS OF 1990, 2014, 2018 AND 2020

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ABSTRACT

The feasibility of monitoring changes in estuarine and freshwater ecosystem functional groups (EFGs) within South Africa's Estuarine Functional Zones (EFZs) with remote sensing was assessed. South Africa's national land cover (NLC) layers of 1990, 2014, 2018 and 2020 have mapped some wetland types, but a more detailed assessment is required to align with global biodiversity and carbon reporting.

The Landsat and Sentinel-1 and -2 image collections in Google Earth Engine (GEE) were used to generate output layers for each year. Image composites of each year's two growth seasons and one dry season, and vegetation indices were generated for four subregions combining those with or without mangroves and submerged macrophytes. These methods have previously shown to improve the classification accuracy of other wetland vegetation. A Random Forest classification algorithm was used to split the data into 70% calibration and 30% testing, with 1000 trees and msplit as the square root of the number of variables (4 for Landsat and 5 for Sentinel).

Changes in the extent and accuracies of three estuarine (mangroves, saltmarshes and submerged macrophytes) and three freshwater (large macrophytes, forested wetlands and freshwater marshes) EFGs are presented in light of the visual comparison to other previously manually mapped outputs (e.g. the Nelson Mandela University's integrated estuarine habitat layer updated 7 March 2023). Estuarine EFGs comprised between 10-18% of the extent of the EFGs, while freshwater EFGs made up 15%. The overall accuracies across the subregions of 1990 attained <64% compared to the >71% attained for 2014, 2018 and 2020. Changes in the extent of the six EFGs and their related user's accuracies varied across subregions and years. For example, mangroves showed an overall increase in extent between 1990 and 2018, but thereafter decreased, with user's accuracies attaining <53% for the 1990 classifications and ≥81% for 2014, 2018 and 2020. In comparison to the NMU layer and images, estuarine EFGs were still overpredicted by 150-230% and would require additional post-processing for adjustments before reporting. Severe changes in the extent of wetlands within two protected areas were clearly visible and quantifiable with the outputs generated, including the loss of forested wetlands to cropland in the iMfolozi/uMsunduzi EFZ and a decrease in open water extent to bare soil at Verlorenvlei EFZ. Further opportunities for testing other sensors and methods are underway, including those related to some estuaries included in the NASA Bioscape campaign of October-November 2023.

Keywords: Blue carbon ecosystems (BCE); earth observation (EO); google earth engine (GEE); Post-2020 Global Biodiversity Framework (GBF); teal carbon ecosystems (TCEs); remote sensing (RS)

Heidi van Deventer is a principal researcher at the CSIR who focuses on the use of remote sensing and spatial data for the mapping and monitoring of estuarine and freshwater ecosystems.

REPORTING THE EXTENT OF WETLAND RESTORATION INTERVENTIONS RELATIVE TO PRESSURES AND IMPACTS FOR TARGET 2 OF THE GBF, USING THE MAPUTALAND COASTAL PLAIN AS AN EXAMPLE

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ABSTRACT

Target 2 of the Global Biodiversity Framework (GBF) requires that membership countries of the Convention on Biological Diversity (CBD) should have at least 30% of the extent of degraded ecosystems under restoration by 2030. The South African Department of Forestry, Fisheries and the Environment (DFFE) had invested in five types of intervention programmes over more than a decade, including those related to the coast, ecosystems, fire, water (invasive species removal), and wetlands. Two of these programmes focused on inland water restoration: The Working for Water programme prioritised the removal of alien invasive tree species to improve infiltration and run-off in South Africa, that is predominantly an arid to semi-arid country. The Working for Wetlands programme focused on erosion control and flow management of wetlands.

The extent of transformation of six wetland ecosystem functional groups of the Maputaland Coastal Plain (MCP) between 1990 and 2022 have now been quantified as part of a Water Research Commission (WRC) project C2020-2021-00427. Using these transformed extents, we estimate the extent of DFFE's intervention programmes on the MCP to report to Target 2 of the GBD. Data from Working for the Coast, Water and Wetlands were used to calculate the percentage of the transformed extent and total extent of all wetlands and each ecosystem functional group. Considering that removal of illegal timber plantations by Working for the Coast, reported non-spatially, could potentially overlap with the Working for Water programme's interventions to date (spatially explicit), we only use the Working for Water and Wetland programme's spatial extent reported. The results showed that a total of 4% and 12% of the extent of all wetlands on the MCP had some level of intervention to date. Further work is required to expand on underrepresentation of historic interventions of these programmes, to obtain a more accurate representation of meeting the 30% target.

Half of the Working for Wetlands interventions were done within the protected areas of the MCP, whereas the Working for Water programme had most of their intervention programmes located inside protected areas. Interestingly, 90% of the extent of the wetland groups remaining in 2022, were located within the MCP's protected areas, and transformations are also evident within the protected areas
Hotspots of changes identified through remote sensing mapping between 1990 and 2022 can inform future restoration efforts. However, infield assessments of the ecological condition of these wetlands are critical to compliment the coarse-scale, landscape level remote sensing work, to confirm the degree of ecological degradation of types, both within and outside the protected areas.

Keywords: Biodiversity monitoring, global biodiversity framework (GBF), inland water realm, restoration, wetland ecosystem types

Heidi van Deventer is a principal researcher at the CSIR who focuses on the use of remote sensing and spatial data for the mapping and monitoring of estuarine and freshwater ecosystems.

INTRODUCING THE HYDROPEDOLOGICAL GUIDELINES FOR WETLAND MANAGEMENT AND DEVELOPMENT AUTHORIZATION FROM SITE TO CATCHMENT SCALE

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ABSTRACT

Effective protection and management of water-linked ecosystems, particularly wetlands, necessitate a comprehensive understanding of the hydrological cycle's prominent processes. The field of hydropedology offers valuable insights for integrated environmental management of wetland resources, and it is now being incorporated into Environmental Impact Assessments to evaluate the potential impact of land-use changes on water resources. However, clear guidelines for conducting hydropedological studies or consulting services are currently unavailable. In response to this gap, the Water Research Commission has funded a project aimed at developing comprehensive guidelines that outline the incorporation of hydropedology in wetland management and development authorization across various scales. This paper serves as an introduction to the guidelines, targeting practitioners and decision makers. The guidelines provide a detailed background on soil hydrological processes and flowpaths, along with a theoretical framework on the genesis of soil properties and their hydrological behaviour. Additionally, the guidelines establish connections between soils in the new South African Soil Classification System and Hydropedological groups. Furthermore, the procedures for developing conceptual hillslope hydrological response classes are outlined, demonstrating their application in understanding terrestrial/wetland interactions. The second part of the guidelines offers step-by-step instructions for conducting hydropedological assessments and determining the sensitivity of wetlands in different hillslope classes to various types of developments. Lastly, decision makers are provided with guidance on assessing the impact of new developments on wetland resources from a hydropedological perspective, assisting in determining whether such developments should be authorized.

Keywords: Flowpaths, hillslope hydrology, hydroperiod, soil classification, soil types

Johan van Tol is an Associate Professor in soil science at the University of the Free State. His research focus is on hydropedology, soil erosion and digital soil mapping.

FROM COMMUNITY ENGAGEMENT TO ACTIVE CITIZENSHIP AND PARTICIPATORY GOVERNANCE

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ABSTRACT

The Stanford community was largely unaware of the poor condition of the Mill Stream until a citizen science frog monitoring project flagged a problem. The Stanford Ward Committee commissioned a river study to determine the problem(s) and recommend remedial action. The river and hydrology study reports and a summary of the findings of five different types of monitoring, were submitted to the Ward Committee. Hampered by cultural-historically rooted conflicts the members however, disagreed on the way forward and the rehabilitation project stalled. This case study explores how a formative social science research intervention, informed by Cultural-Historical Activity Theory and using an Expansive Learning inspired methodology, enabled the conceptualisation of a co-created community development plan for the Mill Stream and its associated wetlands. Coupled to this, the Mill Stream Greenways Master Concept Plan formulates the social aspirations for outdoor education and recreation spaces, to achieve better integration of a community emerging from a post-colonial and post-Apartheid context. Subsequently the formalised document was adopted by the larger Ward Committee and later a presentation to the Municipal Council resulted in the project being voted onto the Municipal Integrated Development Plan for full rehabilitation. Subsequent to the formation of the concept document, collaborative river rehabilitation and wetland restoration activities have rested on the strength of this community owned artifact. The Mill Stream Rehabilitation Project has strengthened active citizenship and participatory governance and has enjoyed many conservation successes.

Keywords: Cultural-historical Activity Theory; Expansive Learning; active citizenship; participatory governance

Sheraine van Wyk is the Eco-Learning and GreenHouse Awareness Centre Manager for Whale Coast Conservation in Hermanus, Western Province. She holds a B.Sc Hons degree from UCT and a MEd in Environmental Education from Rhodes University. Currently she is completing a doctoral study in Environmental Education, exploring the ethico-moral and ethico-political dimensions of an expansive learning process, which shapes the co-created community development plan, in the case study of the Mill Stream Rehabilitation Project.

DRAGONFLIES AND DAMSELFLIES AS INDICATORS OF HUMAN IMPACTS IN MAGALIESBERG STREAMS

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ABSTRACT

Bioindicators such as aquatic macroinvertebrates play an important role in assessing the health of freshwater ecosystems. Odonates (dragonflies and damselflies) show great potential as bioindicators of human disturbance to aquatic ecosystems, both locally and globally, yet in South Africa they have not been assessed widely for this purpose outside of the Cape region. This study investigates their use in the biological assessment of human impacts on streams and their associated riparian areas in the Gwathle catchment in the North West Province. Streams in this catchment initially drain the pristine core area of the Magaliesberg UNESCO Biosphere Reserve before encountering agricultural, mining and urban impacts downstream. Adult odonate abundance, richness and the Dragonfly Biotic Index (DBI) were determined per site during the wet and dry seasons of 2022/2023 in conjunction with the South African Scoring System (SASS5) macroinvertebrate bioassessment protocol. Our results indicated an overall decline in odonate abundance and richness downstream as human impacts became more severe. DBI scores were low in general, which appears to be due to the dominance of widespread resilient species throughout the sites. Pristine sites generally had higher SASS5 scores and ASPT values than sites with intensive surrounding land use. Therefore, it appears that streams and riparian areas of the Magaliesberg are being negatively affected by human impacts, particularly at downstream sites where impacts have an accumulative effect on these ecosystems. This finding seems to agree with the general trend in the literature depicting a decline in adult odonate abundance and richness with increasing land-use impacts.

Keywords: Odonates; South Africa; Bioindicators; land use; abundance; richness

Theodor van Wyk tries to understand if odonates (dragonflies and damselflies) can be used as effective bioindicators in the Magaliesberg. This area has high levels of human impacts that threaten the streams in the area. He wants to establish how to conserve the freshwater ecosystems in this area and prevent further impacts from occurring. He studied Conservation Ecology at Stellenbosch University, a four-year BSc including an honours year. At University his main interests were entomology and conservation ecology. He is currently completing an MSc in Biodiversity and Conservation at the University of Johannesburg., hoping that combining biodiversity and conservation can be managed and implemented more successfully.

HISTORICAL HYDROLOGICAL TRENDS IN THE OLIFANTS RIVER CATCHMENT, WESTERN CAPE: IMPLICATIONS FOR FLOODPLAINS IN A CHANGING CLIMATE

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ABSRACT

In water-stressed South Africa, a thorough understanding of catchment hydrology is needed for effective water resource management, especially in the face of a rapidly changing climate. The Olifants River in the Western Cape is home to endangered endemic species, hosts several wetlands along its length, and provides water for a wide range of anthropogenic activities. However, not much is known about its historical hydrological trends and rainfall/runoff response relationships in the context of climate change. In this study, a desktop analysis employing statistical software (R, XLSTAT and Microsoft Excel) was performed to establish the Olifants' natural flow regime and evaluate to what extent climate change may have altered its hydrological trends. Eight modified versions of the Mann-Kendall test were performed to determine long-term hydrological trends, and the catchment rainfall/runoff response relationships were investigated using Pearson's correlation coefficient. Results indicate that the catchment experiences rapid runoff rates, but that highly variable rainfall and streamflow in the region make significant trend detection challenging.

Furthermore, an increase in rainfall event intensity suggests climate-driven changes are already taking place in the catchment. While changes in rainfall patterns are mostly congruent with both observed and projected climate conditions, this has not yet translated into a marked streamflow response – instead, it is likely that local factors such as vegetation cover and soil characteristics have a more immediate impact on this metric. In order to expand our understanding of the impact of climate change on flow hydrology, and therefore floodplain ecosystem service provision, a catchment inclusive methodology using hydrological modelling is recommended.

Keywords: Mann-Kendall; observed hydrological trends; rainfall/runoff response relationships; climate change; floodplains

Carli van Zyl is a BSc Earth Science graduate currently completing an MSc degree in Geography and Environmental Studies at Stellenbosch University under the tutelage of Dr Suzanne Grenfell. She aims to learn more about wetlands and freshwater systems over the course ofher studies, and as such her research interest lies in fluvial geomorphology and surface water hydrology. Her Masters project concerns modelling the effects of climate change on the hydrology of the Olifants River, Western Cape, and investigating relative changes in the river's sediment yield using SWAT+.

THE WIDESPREAD FRESHWATER CLAM *CORBICULA* SP. AS POTENTIAL BIOINDICATOR SPECIES FOR MERCURY POLLUTION IN SOUTH AFRICA

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ABSTRACT

Studies have shown that bivalves are able to accumulate contaminants such as metals from their surrounding environment. Mercury is a particularly concerning metal since most of South Africa's water resources are in close proximity to anthropogenic mercury sources such as emissions from coal-fired power stations and artisanal gold mining. Mercury is highly toxic and can have serious health effects on animals if it enters the food chain. The freshwater bivalve genus *Corbicula* has a widespread distribution across South Africa and, is often relatively abundant within the ecosystems it inhabits. Given the widespread presence of *Corbicula* clams across South Africa, they can potentially serve as effective bioindicators for mercury pollution in freshwater ecosystems. *Corbicula* clams were sampled using snail samplers from sites situated in the northeastern part of South Africa. The selection of these sites was based on the knowledge of different anthropogenic mercury sources. At each site, a minimum of five clams was collected, along with water and sediment samples, and stored at -20°C. Following freeze drying and microwave digestion of the sediment and clams, the total mercury concentrations were determined in all matrices with a Flow Injection Mercury System. The collected data were analysed using GraphPad Prism v7 software and two-way ANOVAs. Results show that there was mercury present in the *Corbicula* at the different sampled sites and correlated with the different anthropogenic mercury sources. This study has shown significant potential in using *Corbicula* clams as a bioindicator for mercury pollution in South Africa.

Keywords: Corbicula, mercury, freshwater, bioindicator

Chelsea Withfield is an MSc student at North-West University Potchefstroom campus, where she graduated with a BSc degree in Environmental Sciences majoring in zoology and tourism in 2021. She graduated with her BSc Honours degree in Environmental Sciences the following year. She grew up in Pretoria but spent every winter holiday at her grandparents' home in Marloth Park, surrounded by the bushveld, where she woke up every morning with the bellows of the hippos in the Crocodile River and morning water birds along the banks of the river, which inspired her to become a freshwater ecologist to learn more about these beautiful and diverse ecosystems and also to conserve them for generations to come.

WORKSHOP ABSTRACTS

Workshop 1
FRESHWATER BIODIVERSITY INFORMATION SYSTEM (FBIS) WORKSHOP: AN INTERACTIVE WALK THROUGH THE WETLAND-RELATED FUNCTIONALITY

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ABSTRACT

Following the success of the largely river-focused first phase of the Freshwater Biodiversity Information System (FBIS) since 2020, the current Phase 2 of the FBIS project sees the addition of several additional spatial layers, filters, and dashboards.

A range of wetland-focused datasets have been added during FBIS Phase 2, including the National Wetland Map 6 (NWM6) Beta version and a new plants module. FBIS users can now view spatially, as well as interrogate key attributes such as wetland HGM type, condition, threat status and protection level, through the inclusion of the wetland-specific datasets. In addition, temperature time series and water quality datasets have been added to FBIS, which are also of relevance to wetlands.

We invite you to an interactive workshop session to introduce these new components of the FBIS platform. This session will include a demonstration of the wetland-related layers, and how the spatial layers and filters can be viewed and used for your project needs. We will walk you through the single site- and multi-site dashboards, and demonstrate how site and species data can be added, and how you can provide feedback on the wetland map itself. We welcome your ideas and interaction so that we can make the information system as useful as possible for South Africa's wetlanders!

Keywords: web platform, biodiversity information, monitoring

Nancy Job leads the Freshwater Biodiversity Programme at the South African National Biodiversity Institute

Workshop 2
WETLANDS AND LAND USE: COMMUNITY-BASED CONSERVATION MANAGEMENT THROUGH NPOs

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ABSTRACT

South Africa is endowed with a variety of wetlands as diverse as its landscapes, from the moist tropical coastal plain on the Eastern Seaboard, the wet temperate coastal zone of the southern Cape to the arid zones of the West Coast. The inland plateau with its high mountains, bushveld, grasslands through to the Karoo add to this diversity. Nestled in these diverse landscapes are communities dependent on the land in various manners. Although agriculture is acknowledged as being the main cause of wetland degradation, other impacts can also trigger degradation, including uncontrolled development, nutrient and pollutant inputs, and alien invasives. While some types of wetland use must be completely avoided (e.g. commercial crops), other forms of wetland use can be done more sustainably (e.g. tourism, subsistence farming in areas with low soil productivity, etc). Effectively conserving wetlands in a communal landscape can be complex, and may involve numerous interested and affected parties. Working with, and creating awareness among communities and authorities alike has proven to be the most effective to achieve buy-in, commitment and local ownership of wetland custodianship and management. Not-for-profit organisations can play an integral part in facilitating such forms of community-based conservation management, but smaller NPOs often lack skillsets, capacity and/or proper resourcing to achieve maximum potential. The purpose of this workshop will be to facilitate the discussion around community-based conservation management approaches specifically with regards to wetland conservation. Four NPOs will use case studies to present the skillsets and capacities required in community-based conservation management, discuss financing mechanisms, and share innovative means to address challenges.

Keywords: Not-for-profit organisations, wetland management, community-based wetland conservation, challenges and opportunities

Lulu van Rooyen is an honorary fellow with the University of KwaZulu-Natal and a free lance consultant specializing in wetland management and urban climate change adaptation. She is a trustee of the Centre for Wetland Research and Training, as well as the Wetland Society of South Africa.

Damian Walters is the South African Regional Manager of the Africa Crane Conservation Programme at Endangered Wildlife Trust/International Crane Foundation. He has a wetland ecology and wetland biogeomorphology background with a particular interest in wetlands, people and thresholds.

Ramugondo Pfarelo worked for nine years as a contractor for Working for Water, whereafter she established the Tshikofokofo Adopt A River. In 2018 she became the chairperson of TMAC Forum and Ngwenani SANCO deputy chairperson. She has won numerous awards and is widely recognized for her work in water and communities.

Sheraine van Wyk works as an ecologist and environmental educator for Whale Coast Conservation, an environmental services NGO operating in Hermanus, Overstrand in the Southern Cape. She is known for the work she does in wetlands conservation and monitoring (particularly through citizen science), community engagement and stakeholder collaboration.

Workshop 3
CONVERSATION CAFE TO ALLOW INTERACTION BETWEEN STAKEHOLDERS AND PEOPLE WHO HAVE GENERATED INLAND WATER MAPS AND OTHER PRODUCTS

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ABSTRACT

This workshop allows interaction and discussion between people who have mapped inland water types (estuaries, freshwater wetlands and rivers) and would like to show and discuss these results with any interested and affected party. It is a conversation cafe style interaction, where the data generated will facilitate discussion around a map and laptop and can facilitate zooming in and out on the screen for anyone's interest. The discussions would ideally enhance understanding of the outputs, while also provide feedback to those who have generated the products, on the perception of the products, where anything may have been missed, underrepresented or overrepresented, or other feedback. We are offering five tables of interaction, as listed below, but invite other data generated to also come and offer interaction with their data.

As a minimum, five tables of interaction will be facilitated:

i) Dr Heidi van Deventer on her presentation '*Mapping the extent of mangroves, seagrasses and salt marshes for South African estuaries for 1990, 2014, 2018 and 2020*';
ii) Mr Philani Apleni, UP, on his MSc work and presentation '*Quantifying changes in the extent of wetland types of the Maputaland Coastal Plain using remote sensing: Implications for Restoration and Conservation*';
iii) Ms Lukho Goso on her MSc work and presentation '*Using Geographic Information Systems (GIS) to assess the biodiversity and protection levels of Africa's rivers*';
iv) Ms Nkosingizwile Ndlovu on her MSc work and presentation '*Asessing changes in the hydrological regime of lacustrine wetlands on the Maputaland Coastal Plain, South Africa*', and
v) Ms Mpho Sadiki on her PhD work and presentation '*Assessing gaps in the National Wetland Inventories of African countries for responding to the Global Biodiversity Framework Targets 1-3*'.

Keywords: Africa, biodiversity typing, geographical information systems (GIS), global biodiversity framework (GBF), inland water realm, Maputaland Coastal Plain, remote sensing, river ecosystem types, wetland ecosystem types

Heidi van Deventer is a principal researcher at the CSIR focusing on the use of remote sensing and spatial data for the mapping and monitoring of estuarine and freshwater ecosystems.

Workshop 4:
DRAFT PROTOCOLS ("DECISION TREES") FOR PEATLAND MANAGEMENT AND REHABILITATION

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ABSTRACT

The Global Peatland Assessment highlighted the need for action to conserve, restore and manage peatland systems in a sustainable manner. Research findings from a Water Research Commission (WRC) funded project titled Development of management and rehabilitation protocols for peatlands in South Africa: Case studies of peat fires (WRC project no. 2019/2020-00098) showed that land use changes influence the hydrology of peatlands and can have a negative impact on the peatland, causing its degradation either by drying out, eroding or burning. The case studies presented in this report confirm that lowered water tables, due to land use change, have negative implications for peatland functionality and the related provision of ecosystem services. The project findings, as well as the collective experience of the project team, were used to develop recommendations for controlling peat fires, as well as for the prevention, management and rehabilitation of degraded peatlands. These were then incorporated into a draft set of protocols for these two topics in the form of "decision tree" frameworks. These draft frameworks may be used as guidelines by regulators, managers, landowners or communities to prevent peatland degradation (Framework 1) and for controlling peat fires (Framework 2). Each step has a question which requires answering, which aids people working through the framework. These "decision trees" are presented as a foundation to build upon. One of the recommendations listed in the WRC report is to workshop the draft protocols ("decision trees") with mandated authorities for refinement and finalisation to support the draft South African Peat Protocol. The protocols that various institutions should follow once they suspect that a peatland has the potential to burn or has begun to burn will assist in the conservation and management of these systems. This study has also provided substantial evidence to give input to the envisaged wetland policy for management and rehabilitation.

Keywords: peat; fire; degradation; management; rehabilitation.

Alanna Rebelo is a senior researcher in the Water Science unit with the Agricultural Research Council, Natural Resources and Engineering. She concurrently holds a research fellow position in the Conservation Ecology and Entomology Department at Stellenbosch University. Her major research theme is on understanding the benefits of nature-based solutions, such as wetland restoration and clearing of biological invasions, using applied remote sensing and hydrological modelling approaches.

Althea Grundling is the Research Team Manager for the Water Science Unit at the Agricultural Research Council - Natural Resources and Engineering (ARC-NRE) in Pretoria, South Africa. She has worked at the ARC for almost 20 years. The Water Science Unit focus on holistic catchment management that include multi-disciplinary approach in water resource management and information that include mapping, modelling, monitoring and rehabilitation. Dr Grundling is member of the International Mire Conservation Group. She is also Research Fellow at the Applied Behavioural Ecology and Ecosystem Research Unit University of South Africa and Research Fellow at the Centre for Environment Management, University of the Free State, Bloemfontein, South Africa

Jason le Roux is a PhD student registered at the University of the Free State and based in the Water Science unit at the Agricultural Research Council - Natural Resources and Engineering. His research focuses on peatland mapping, hydrology and degradational processes. Mr le Roux is affiliated with the International Mire Conservation Group, the South African Wetland Society, and the South African Association of Geomorphologist.

Piet-Louis Grundling works for the Regulatory, Compliance and Sector Monitoring Unit, Department of Forestry, Fisheries and the Environment, and is also Research Fellow at the Centre for Environment Management, University of the Free State, Bloemfontein, South Africa.

MAPPING THE SPATIAL DISTRIBUTION AND FRAGMENTATION OF VEGETATION IN URBAN WETLANDS: A CASE STUDY OF THE KHAYELITSHA WETLANDS IN CAPE TOWN, SOUTH AFRICA

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ABSTRACT

Urban wetlands play a vital role in providing ecosystem services and supporting biodiversity as a habitat. However, rapid urbanization and human encroachment pose significant threats to these fragile ecosystems, leading to their fragmentation and degradation. In the case of the Khayelitsha Wetlands, one of the largest wetlands in Cape Town, informal settlements have encroached into the wetland area, resulting in substantial changes over the years. This study aims to assess the classification and fragmentation of the Khayelitsha Wetlands using remotely sensed data and wetland vegetation fragmentation statistics. By integrating satellite imagery and wetland fragmentation analysis techniques, we seek to understand the extent and patterns of wetland fragmentation caused by informal dwellers within the wetland area between the years 2000 and 2020. Landsat earth observation was combined with the Random Forest and Support Vector Machine (SVM) algorithms in mapping the spatial distribution patterns of vegetation between the years 2000 and 2020. Land cover classes such as wetland vegetation, water bodies, bare land and built-up areas were considered in this study. Fragmentation indices such as patch density, edge density, and mean patch size was computed and used to understand the fragmentation extent of wetland vegetation. Overall classification accuracies ranging between 68 and 80% were attained in this study. Results also showed that the spatial extent of built-up areas (informal settlements) significantly increased, replacing wetland vegetation. The patch metrics such as the number of patches, patch density and edge density have increased significantly indicating high levels of fragmentation. Meanwhile, patch metrics such as patch size and mean patch size of wetland vegetation significantly decreased between 2000 and 2020. RF outperformed SVM in characterizing land cover changes in the wetland. The findings of this study underscore the prospects of remotely sensed data in mapping and monitoring urban wetlands and vegetation reserves within them.

Keywords: Urban Wetlands, Land Use Land Cover (LULC) changes, Random Forest (RF) classifier, Support Vector Machine (SVM), Google Earth Engine, Landsat 8 OLI, Landsat 7

Nande Bija is passionate about academia and environmental conservation. He completed studies in Geography and Environmental Studies, gaining a comprehensive understanding of the interactions between humans and the environment. Thereafter he pursued an honours degree specialising in Geographic Information Systems and Environmental Management. This allowed him to develop advanced skills in utilising spatial data and technology to analyse and manage environmental resources effectively. He has also gained valuable experience as a research intern at HSRC, where he contributed to various research projects. He spends time tutoring second and third-year university students, assisting them in their studies. Recognizing the importance of environmental preservation, he actively engages as a member of the Western Cape Wetland Forum.

BUILDING BLOCKS TO A GREAT NATIONAL WETLAND MAP

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ABSTRACT

The South African National Wetland Map (NWM6) provides information on the location, spatial extent and ecosystem types of two of the three broad aquatic ecosystems, namely, estuarine and inland aquatic (freshwater) ecosystems. Data cleaning plays a crucial role in ensuring the accuracy and reliability of spatial data for NWM6 using GIS. In wetland analysis, data quality issues such as topological errors, geometry problems, and slivers can significantly affect the integrity of wetland datasets. This abstract presents an overview of the data cleaning protocol developed by the SANBI NWM team to address these challenges in NWM6 mapping and analysis.

The cleaning methods include firstly setting up the environments, followed by topology, geometric, and sliver checks. Using satellite imagery and the attribute table, careful attention is paid to identifying and reviewing errors spatially in ArcGIS. All the errors are documented by exporting them to an excel sheet and as a shapefile. Overlapping polygons were addressed by aligning the boundaries and duplicate polygons are checked with steps in place to select and retain critical attribute information before deletion. Slivers were predominantly identified to be smaller than 0.01ha and were deleted. The results show that there were 352 topology errors and 3514 slivers which were identified and reviewed individually for the Beta version of the NWM 6. Of the 27 subset areas, 10 had topology errors, while 6 subset areas had no slivers. The NWM team spent approximately three weeks undertaking a thorough check of the dataset and will run similar checks at critical points when new datasets are integrated into the NWM, and especially before each updated version is released.

By applying these data cleaning techniques in ArcGIS, wetland analysts can enhance the quality and reliability of their datasets. Correcting topological errors, improving geometry, and addressing slivers ensure the accuracy of NWM6, enabling more accurate spatial analysis and decision-making processes related to wetland conservation, management, and restoration in South Africa. Through this poster, we also hope to alert potential contributors on what to look out for in cleaning their data before submitting it to the NWM.

Keywords: National wetland map, ArcGIS, wetlands, data cleaning protocol, topological errors, geometry check, spatial analysis, wetland conservation.

Asive Bomvu is a practical learner and a hard worker with a background in Geology and Geographic Information System(GIS). His academic journey began at the University Fort Hare, where he pursued a Bachelor's degree in Geology and GIS, majoring in both. He completed postgraduate studies in Applied Remote Sensing an GIS. He currently serves as a Freshwater intern at the South African National Biodiversity Institute (SANBI), working under the supervision of Nancy Job, and is actively involved in a project focused on the mapping and conservation of freshwater ecosystems. Through data cleaning, spatial analysis, and the application of GIS tools, he contributes to preserving the wetlands.

Phumla Mayekiso is a BSc Honors graduate with GIS and Remote Sensing background. She is a SANBI intern under Groen Sebenza Phase II within the Freshwater Biodiversity Planning unit based at Kirstenbosch National Botanical Gardens, Cape Town. Her role is to support the National Wetland Map 6 and other projects through delineation of wetlands, their extent, data processing and cleaning. The purpose of the work is the protection and conservation of wetlands and the National Biodiversity Assessment.

ASSESSING THE EFFECTS OF ENVIRONMENTAL STRESSORS ON FISH GROWTH USING FISH OTOLITHS IN TWO IMPOUNDMENTS IN THE NORTH-WEST PROVINCE.

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ABSTRACT

Aquatic environments are susceptible to degradation in the presence of various pollutants or environmental stressors. These stressors include nutrients such as total nitrogen (ammonium, nitrates, nitrites), sulphate, and phosphates, as well as elements such as arsenic, cadmium, chromium, copper, lead, nickel, platinum and zinc. These stressors can originate from urban and agricultural run-off, mine drainage, land development, poor wastewater management, industrial discharge, and natural weathering of rocks and minerals, among other sources.

Fish in aquatic ecosystems are exposed to these stressors, which can enter their bodies through different routes, including food, water, sediment, gills, and skin. The bioavailability of elements and nutrients to organisms in the ecosystem leads to bioaccumulation, that can have adverse effects on fish growth. The Department of Forestry, Fisheries and the Environment recognized the reliance of rural communities on inland waterbodies for food security and has granted small-scale fisheries the rights to access these resources. Understanding how different nutrients and elements can affect fish growth can provide a better understanding of the potential impact on fisheries and food security. Otoliths, ear stones found in fish, can be utilized for age determination, and provide valuable information about fish growth and their life history. By using the total mass, total length, and age, growth curves can be created and compared between different sites and known growth curves. These data will indicate whether environmental stressors have a significant impact on fish health. This study focused on three fish species: common carp, African sharptooth catfish, and Mozambique tilapia, that represent different trophic levels in the ecosystems in which they are found. Fishes were collected from two impoundments in the North West Province together with the associated water and sediment quality data. Three surveys were completed during 2017 and 2018.This study aimed to understand the relationship between environmental stressors and fish growth patterns. The research contributes to our knowledge of the impacts of environmental stressors on fish and provide insights into the overall health and dynamics of the inland waterbodies.

Keywords: Environmental stressors; Otoliths; *Cyprinus carpio; Clarias gariepinus; Oreochromis mossambicus*

Corné Carinus is currently doinng an Honours degree at North-West University. His main project title is: "Using otoliths to assess the effects of environmental stressors on fish growth from the Hex River system".

He was raised on a farm in Bethal, Mpumalanga where he learned to love animals and work with animals from a very young age. He is fascinated with what he is learning at the North-West University and loves what he is doing.

INTEGRATING REMOTELY SENSED AND CITIZEN SCIENCE DATA TO MONITOR SUITABLE HABITATS FOR WATERBIRDS

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Presented by Nancy Job

ABSTRACT

The integration of hydrological and species diversity data allows greater insight into how flooding regimes may influence bird populations. With a variable climate, and within agricultural landscapes where the use of surface and groundwater resources may alter the hydrological regime of wetlands, a better understanding of how water level fluctuation influences waterbird diversity can inform adaptive and proactive strategies to manage water levels. With hydrological data such as water levels not available for many lakes and wetlands, the main aim of this study was to assess the utility of remotely sensed data in understanding how inundation influences habitat provision for waterbirds at coastal lakes in the Nuwejaars catchment. With no access to *in situ* hydrological data for the Nuwejaars catchment prior to 2015, satellite imagery was processed using the Modified Normalized Difference Water Index (MNDWI) to assess the spatial variation in flooding. The integration of bird counts with wetland inundation for Voëlvlei and Soetendalsvlei demonstrated the importance of the hydroperiod in influencing bird richness and diversity. A change in wetland inundation influences the habitat types and availability of food, with a significant correlation between inundation and the different functional traits of waterbirds. Findings from this present study show that the depression wetlands of Voëlvlei and Soetendalsvlei provide a functional role as suitable habitats for waterbird species. The results of the integration of wetland inundation and avifauna data highlights the complex interactions among the different biotic and abiotic components, but also demonstrates the opportunities to further our understanding of the dynamic ecosystems.

Keywords: habitat suitability; diversity; abundance; remote sensing

Mandy Carolissen is a lecturer in the Department of Geography, Environmental Studies and Tourism, with teaching and research interests in the dynamic physical processes that shape our landscapes, integrated water resource management and wetlands. Her current research focuses on understanding the spatial and temporal availability of water and storage of depression wetlands using in-situ hydrological data and remote sensing, and to relate these to ecosystem services.

PROPOSED ANTHROPOGEOMORPHOLOGICAL WETLAND CLASSIFICATION SYSTEM

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ABSTRACT

The influence of humans on the environment is becoming more pronounced as populations, particularly urban populations, increase. The imprint humans leave behind is so pronounced that a new geological epoch, the Anthropocene, has been created to accommodate human (i.e., anthropogenic) changes in the Holocene or recent geological timeline. Anthropogeomorphology is the study of how humans modify and create landform and landform processes. Wetlands are generally seen as natural geomorphological features, but wetlands can be formed and modified due to human activities and may therefore be attributed to anthropogeomorphology. This project analyses the variety of anthropogeomorphological wetlands in Gauteng Province, South Africa, based on geomorphological variety. The aim is to improve the current wetland classification system - with the input gathered from the previous National Indaba's workshop session on anthropogeomorphological wetlands.

Keywords: wetlands, geomorphology, anthropogeomorphology

Renée Grundling is an MSc student at the University of Pretoria, researching anthropogeomorphological wetland processes and classification in South Africa. She is the chair and founder of the Southern African Young Geomorphologists and council member and early career representative of the Southern African Association of Geomorphologists.

AN INVITATION FOR INPUT ON A NUMBER OF CURRENT NATIONAL INITIATIVES

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ABSTRACT

Scientific research, collation of evidence and robust discourse is essential to inform good decision-making and for establishing the context for sustainable freshwater ecosystem management. This requires improved understanding and communication of all facets of freshwater biodiversity. A central goal of the SANBI Freshwater Programme is to synthesise and generate information that aids in better freshwater management, restoration and conservation decisions, and to regularly provide a freshwater ecosystem status update as part of the National Biodiversity Assessment.

This poster is an opportunity to communicate recent work by this relatively new programme within SANBI, including a synthesis of wetland rehabilitation-related outputs, emerging work on riparian ecosystems, a lexicon of freshwater-related terminology and more. The poster hopes to provide a platform to invite feedback and discussion on recent projects during the poster session as well as to facilitate comments through a number of quick polls associated with QR codes.

Keywords: wetland rehabilitation, standardised terminology, policy, implementation.

Nancy Job leads the Freshwater Biodiversity Programme at the South African National Biodiversity Institute.

CLASSIFICATION AND ECOLOGY OF WETLANDS IN A SECTION OF THE SOUTHERN WATERBERG

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ABSTRACT

Wetlands in the Waterberg (Limpopo) are understudied, with the only studied wetlands of this region being in Marakele National Park. This region is known to be sandstone-rich with generally nutrient poor soils. In this study, we examine wetlands in the southern Waterberg, immediately south of the Waterberg Biosphere Reserve, near Marakele National Park, following the protocol of the National Wetland Classification System commissioned by SANBI. In addition to classification of these wetlands, this study also examines soil characteristics and their relationship with wetland vegetation types. This research aims to shed light on the relationship between vegetation and soil in wetlands including the classification of wetlands in a portion of the Waterberg area.

The soil characteristics that appear to be most important in affecting the vegetation communities were focused on. The impacts of soil constituents on vegetation types in wetlands are discussed, with a focus on nutrients, organic matter, salinity, and the acidity of the soil. Wetland classification was informed by the difference in plant cover, abundance, and species richness in various wetland patches in the study site.

Widespread species occurring across the assessed wetlands were the grasses *Sacciolepis typhura*, *Imperata cylindrica*, and the sedge *Kyllinga melanosperma*. Soil pH was positively correlated with cations in the soil such as Ca, Na, K, and Mg and associated with certain plant species, while other plant species were associated more with metals in the soil, such as Al, Cu, and Pb. Permanova analyses revealed that species composition across wetland patches significantly varied with altitude ($p<0.05$, $R2 = 11\%$) and other topographic and edaphic parameters were not significantly related to species composition. These findings inform how soil characteristics impact vegetation community composition in wetlands of the Waterberg region.

Keywords: Soil characteristics, species composition, hydric soils, Waterberg, wetland classification

Arni le Roux completed his bachelor's degree in Ecology at the University of Pretoria in 2022 and is currently undertaking research in Wetland ecology and classification for his Honours in Plant Sciences. Arni is a nature enthusiast and passionate about educating people about the natural world.

A VEGETATION CLASSIFICATION AND DESCRIPTION OF WHITE-WINGED FLUFFTAIL (*SAROTHRURA AYRESI*) HABITAT AT SELECTED HIGH-ALTITUDE PEATLANDS IN SOUTH AFRICA

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ABSTRACT

The white-winged flufftail is listed as critically endangered, and limited knowledge about the species' ecology has been identified as a limiting factor to effectively conserving the bird. Little is known about the vegetation inhabited by the white-winged flufftail, which hampers the identification and management of its habitat. This study presents a fine-scale classification and description of the vegetation of wetland sites where the bird is known to be present.

A plant phytosociological study was conducted to describe the plant communities and vegetation structure of the habitat. Three sites were selected at Verloren Valei Nature Reserve and two at Middelpunt Wetland, Mpumalanga, South Africa, shortly after the white-winged flufftail breeding season. A total of 60 sample plots were placed within the study sites, where all plant species present were recorded and identified. Other aspects such as plant height, water depth and anthropogenic influences were also documented. A modified TWINSPAN analysis resulted in the identification of three sub-communities that can be grouped into one major community. The Cyperaceae, Asteraceae and Poaceae families dominate the vegetation, with the sedges *Carex austro-africana* and *Cyperus denudatus* being dominant, and the grasses *Leersia hexandra* and *Arundinella nepalensis* co-dominant. The broad habitat structure consisted of medium to tall herbaceous plants (0.5–0.7 m) with shallow slow-flowing water.

Keywords: plant communities, vegetation structure, plant traits, Verloren Valei nature reserve, Middelpunt Wetland, Lakenvlei wetland

Hannes Marais has been in Nature Conservation since 1988, wetland scientist since 2010 and Chairperson of the Mpumalanga Wetland Forum

ASSESSMENT OF WETLAND CHARACTERISTICS AND STREAM POWER INDEX USING TauDEM IN THE BREEDE CATCHMENT

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ABSTRACT

The preservation and sustainable management of wetlands play a crucial role in maintaining ecosystem health and water resource management. In this pilot study, we will employ TauDEM, a widely used software package for hydrologic analysis, to assess wetland dynamics -using the Topographic Wetness Index (TWI). The study is focused on the Breede catchment.

Using TauDEM, we derived a high-resolution stream network and generated a digital elevation model (DEM) to calculate the Stream Power Index (SPI), which quantifies the erosive power of streams. The results will allow us to identify areas of high stream power, indicating potential erosion hotspots and highlighting areas where restoration efforts should be prioritised. For wetland analysis, we will compare the performance of the TWI to current NWM6 outputs.

The findings provide a foundation for future research and conservation efforts in the region to refine and support wetland analysis methodologies, considering the specific characteristics and challenges of the study area.

Keywords: TauDEM, wetlands, stream power index, Breede catchment, stream network.

Bongani Mkhize, a Groen Sebenza Phase II Intern a delighted and dedicated young professional with a BSc Honours in Hydrology, currently specialising in catchment modelling at Cape Town's Kirstenbosch Research Centre, Fresh Water Biodiversity Programme. Bongani's passion lies in utilising digital tools to tackle real-world challenges in geodesy and spatial analyses. Using tools like TauDEM and programming languages such as R and Python, Bongani possesses a unique skills set that enables the application of advanced techniques in hydrological analysis. Bongani's commitment to harnessing the power of technology to address complex issues in water resource management and environmental planning makes them an invaluable asset in the field.

APPLICATION OF REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEM TOOLS FOR ASSESSING LAND USE AND LAND COVER IMPACTS IN DUTHUNI WETLAND, THOHOYANDOU

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ABSTRACT

Wetland ecosystems play pivotal functions for environmental well-being, social perspectives and the country's economy. Changes in wetland dynamics over time have prompted the inclusion of wetland protection in natural resource management policies. As such, the accurate assessment of changes in wetland ecosystems is vital, as policies address the issue of the sustainable use of wetlands in various contexts such as resource management, land-use planning, sustainable development, and ecosystem conservation.

This research aims to assess land use-land cover (LULC) impacts on Duthuni Wetland using Remote Sensing (RS) and Geographic Information Systems (GIS). The specific objectives are: (i) to identify and map land use and land cover activities in Duthuni Wetland using Landsat sensor for 2003, 2013 and 2023, (ii) to determine the change in land use-land cover on the wetland for the period 2003, 2013 and 2023 using Landsat sensor and (iii) to assess the impacts of land use-land cover change on the wetland area during the study period.

For data collection, Landsat satellite images will be acquired through the United States Geological Survey website and Google Earth, as well as field work. ArcGIS will be used to analyse the collected data through identifying LULC and creating maps, creating trend analysis of LULC for the study period to study the patterns of change and calculate the areas of change to assess the impacts of LULC and their extent on the wetland. The recommendations from the study will assist in the development of management strategies to protect this and other wetlands within the region.

Keywords: Geographic Information System, Land use-land Cover (LULC), Ramsar, remote sensing, Wetland.

Kagiso Moteke is an Honours student at the University of Venda majoring in ecology and resource management. In 2022, she completed her undergraduate degree in Environmental Science. Her interest in natural resources began when she was studying for the Diploma in Freshwater Technology in 2017. She developed various skills in biomonitoring, wetland delineation, mapping, environmental restoration and management. Kagiso joined the Vhembe Biosphere Reserve Youth Network and became a youth champion who learnt about conservation and shared with her community how they can interact with nature sustainably,

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TOWARDS BRIDGING THE GAP BETWEEN POLICY MAKERS AND COMMUNITY MEMBERS TO RESTORE WETLANDS: ASSESSING THE UNDERSTANDING OF WETLAND IMPORTANCE IN VHEMBE DISTRICT

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ABSTRACT

In South Africa and globally, people continue to rely on wetlands for numerous needs such as provision of food, water, construction materials, and a variety of other products. Coastal wetlands provide a wide range of ecosystem services including the support of commercial fisheries, carbon sequestration, natural coastal protection, and water quality improvement. With the use of remote sensing, the extent of wetlands and how they have been impacted can be determined. Understanding these impacts and the subsequent risks to these wetlands is important when designing restoration measures.

The aim of the study is to determine the role that community engagements can assist towards wetlands restoration. To better understand the factors that contribute to wetland degradation, inform policy and decision-making, encourage sustainable resource management, and protect the ecological integrity and socioeconomic well-being related to wetland ecosystems, it is essential to conduct research on the effects of wetland utilization and socioeconomic characteristics. In this study, data will be collected through a comprehensive questionnaire covering a wide array of socio-economic characteristics and questions on how the wetlands are utilised along with understanding the importance of wetlands from the communities' perspectives. Random sampling will be used to select the participants.

Satellite images will be used to assess the extent to which wetlands have changed, and to identify the activities that are contributing towards wetland degradation. The satellite images produced by the United States Geological Survey (USGS) will be used. These data will help to test whether the wetlands are over-exploited or not, and if communities understand the importance of wetlands. Data will be analysed through descriptive and inferential statistics. Where possible, correlation matrices will be constructed in Quantum Geographic Information System (QGIS). Interesting variables from correlation matrices will be selected for further testing. Multiple linear regression analysis will be used to test for the significance of correlations between variables.

Keywords: Coastal Wetlands, QGIS, Remote Sensing, Wetland utilisation, Wetland restoration.

Ntsemeni Rainah Mudzanani is a Master's student at the University of Venda, focusing on the impact of climate change. She is currently identifying issues she wants to address in her PhD next year. The knowledge that there is enough for me to do for planet earth everyday as we prepare it for the future generations, is crucial and motivating.

LOSING THE JARGON - COMMUNICATING HOW WETLANDS WORK, HOW WE IMPACT THEM, AND HOW THEY WORK FOR US, TO LOCAL COMMUNITIES

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ABSTRACT

Local community engagement in conservation plays a fundamental role in the sustainable use of natural resources because people primarily use them for their sustenance and economic well-being. However, environmental conservation programs sometimes fail to effectively address and involve the community in the process of conserving wetlands. Even from the outset, the way wetlands are described and the terminology can be a barrier to further engagement. Local participation is, therefore, an effective and critical tool for establishing an ecologically balanced use of available freshwater ecosystems such as wetlands. Although there is a vast pool of existing information about wetlands, their mapped extent, available management tools, and much more, there seems to be a gap, for example, in the effective transmission of this information to the general public living close to wetland areas and integrating it with their indigenous knowledge. The consequence is that many wetlands in local areas are severely threatened, for example where wetlands are exposed to excess pollution, draining for the construction of infrastructure, invasive species and more. This exposes communities to floods, water-borne diseases, and loss of livelihoods. Therefore, knowledge dissemination to inform local stakeholders on ways to protect and restore the ecological value of local wetlands is essential.

This poster aims to provide preliminary information on wetlands to the people who live close to wetlands, in order to increase the success of protecting the most vulnerable freshwater ecosystems in South Africa, focusing in areas such as Philippi (Browns farm), Samora, Gugulethu, and Betty's Bay, all in the Western Cape.

Keywords: Community participation, wetland, freshwater ecosystems, and natural resources.

Nokubonga Mzimela is an intern at SANBI under the Groen Sebenza Programme. She is in the Freshwater Water Biodiversity Programme based at Kirstenbosch Botanical Garden (Kirstenbosch Research Centre) in Cape Town. Her role entails her involvement in freshwater ecosystem projects that aim to find solutions in conserving wetlands in South Africa, i e delineating and mapping the extent of wetlands.

SPECIES MONITORING USING iNATURALIST IN THE LIVING CATCHMENTS PROJECT (LCP).

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ABSTRACT

The Living Catchments Project (LCP) is a collaborative project implemented and led by the South African National Biodiversity Institute (SANBI) in partnership with the Water Research Commission (WRC) through funding from the Department of Science and Innovation (DSI). The primary goals of the project are to develop relationships, co-learn, and coordinate various partners' programs, organizations, and research activities that improve water security both locally and nationally. As part of partnership and co-learning, iNaturalist has been used to establish a database of species within catchments selected for LCP.

iNaturalist is a mobile application that can be used to capture, record, monitor, and share biodiversity observations. It records a picture or a sound clip, date, and location to provide a simple form of identification and add to the species database. Through the LCP, iNaturalist has been introduced in Matatiele, Bizana (EC), KwaNovuka, Mpophomeni (KZN), and Phiring (Limpopo) as a citizen science tool. It has been used to create a local species database for biodiversity in wetlands.

Youth in these areas, also known as Eco-champs & Enviro-champs, have been trained on how to utilise iNaturalist to more thoroughly investigate local biodiversity. International bioblitz, like the City Nature Challenge (CNC) and the Great Southern BioBlitz (GSB), have also been used as part of collecting more observations and co-learning with international platforms. Results have shown an increase in the number of observations recorded in these areas. The data also revealed a high concentration of alien invasive species (AIS). This information will aid in the planning of AIS removal. This poster will showcase examples of the species database in wetlands collated using iNaturalist.

Keywords: Wetland species; iNaturalist; Living Catchments

Lucy Ngubeni is a catchment biodiversity mainstreaming officer with the South African National Biodiversity Institute (SANBI).She supports all freshwater work at SANBI, which involves visiting strategic water source areas in South Africa and developing relationships with the communities in those areas, with the goal of ensuring sustainable conservation of resources and biodiversity for all those who rely on it.

EVALUATING THE IMPACT OF WETLAND UTILISATION AND SOCIO-ECONOMIC CHARACTERISTICS ON WETLAND CONDITION

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ABSTRACT

Globally, many communities in the world rely on the productivity of wetlands for provision of food, water, construction materials, and a variety of other products. A general understanding of the impacts of wetland utilisation and socio-economic characteristics on wetland condition exists. However, more research is needed to improve this understanding at wetland-level.

The aim of the study is to determine the role played by wetland utilisation and socio-economic factors on the condition of Nylsvlei Ramsar wetland, in Limpopo Province of South Africa. The increasing rate of poverty and unemployment in South Africa means that the reliance of people on natural resources such as wetlands may increase. This means that continuous research and development is needed. Therefore, research on the impact of wetland utilisation and socio-economic characteristics on wetland condition is critical for an improved understanding of the drivers of wetland degradation, informing policy and decision-making, promoting sustainable resource management, and safeguarding the ecological integrity and socio-economic well-being associated with wetland ecosystems. The data will be collected through a comprehensive questionnaire covering a wide array of socio-economic characteristics and questions on how the wetland is utilised. Random sampling will be used. This data will help to test whether the wetland is overexploited or not. Data will be analysed through descriptive and inferential statistics. Correlation matrices will be constructed. Interesting variables from correlation matrices will be selected for further testing. Simple and multiple linear regression analysis will be used to test for the significance of correlations between variables.

Keywords: Wetland utilisation, Socioeconomic characteristics, Wetland condition.

Oscar Tshilidzi Tshivhombela obtained his Honours in Environmental Sciences at Univen and is currently busy with his Master of Environmental Sciences in Ecology and Resource Management.