



UESM Newsletter

Autumn Edition 2021



Interactive buttons 



Editorial

Merely a year ago, we were precipitously challenged by a dark cloud of uncertainty when South Africa was set in Lockdown Level 5 due to the global outbreak of COVID-19. We humbly look back with gratitude as we observe growth in unity, despite the sudden switch to virtual meetings and lectures. Unforeseen challenges with daily adaptations not only made us more resilient, but more intuitive. We have also learned to be more patient, understanding and supportive.

Unfortunately, some colleagues were directly affected by the pandemic. We are all extremely thankful for daily health – more so than ever before! Sadly, some colleagues experienced loss of a family member, friend or colleague. Although not COVID-19 related, the passing of Prof Pieter Theron brought heartfelt loss to colleagues, friends and students. Prof Theron was an iconic, legendary academic who have impacted the lives of many NWU students, their parents and colleagues for well over 40 years. In this Autumn edition of ENVIRA, we honour his research impact in a *News Flash* article under the *Biodiversity and Conservation Ecology* sub-programme. However, his influence stretched far beyond the academia. In a *Memorial* page, staff members, students and NWU alumni have all contributed kind words and memorable photos to honour Prof Theron. To his family, we would like to express our sincerest condolences on the passing of a dear husband, father and grandfather. We trust that you will find peace and joy in this compilation of memories.

Despite our reflection on a year of challenges and losses, we are grateful to testify that **'difficult roads often lead to beautiful destinations'**.

With this Autumn edition of ENVIRA, we once again share good news. Permanent staff members who were appointed since March 2020 are formally welcomed and introduced under *New Appointments*. The *Accolades* and the *Calliper* once again serve as a strong testimony of the quality of research and teaching conducted within the UESM. Since individual research performance is strongly dependent upon the strength of research groups, we are excited to introduce a new Calliper section where we introduce the national and international standing of



research groups in the UESM. Three research groups will be showcased in each ENVIRA edition.

Our *Community Outreach* article reflects on the broader impact of one of our award-winning staff members. The latest on *Ethics* includes some interesting statistics and important reminders, while the *Facility* feature reminds us on deep impacts of the past as we learn more about the Geology Museum. What do horses, bagpipes, air quality and incineration have in common? Find out in the *Interview* section.

News Flash articles remain one of the highlights of ENVIRA, as these articles are focused on current research activities or results emanating from the UESM. We bring you exciting stories from research groups in six out of our eight sub-programmes. We would like to commend the authors of this and previous issues of ENVIRA on the way in which they managed to communicate often complex scientific concepts in a way that all readers can easily follow their fascinating, state-of-the-art research.

The season is changing; it can be felt in the air. We will soon miss the beautiful flowers, summer thunderstorms and green foliage, but what awaits us are crisp mornings, clear skies and beautiful mixtures of autumn colours.

Change is good.

*Have a prosperous second term of
2021*

Frances Siebert (Editor) and Clarissa Minnaar (Sub-editor)





Director: School of Geo- and Spatial Sciences Prof Stuart Piketh

Interview by
Clarissa Minnaar

General

What is your idea of a perfect day?
Waking up early and spending time with my horses or going to a horse show with the family nearby.

If you had the world's attention for 30 seconds, what would you say?
People probably won't imagine this but I believe the most important thing that I could say to the world is to be kind.

If you could go back ten years in your life, would you? Why or why not?
I wouldn't, because I think life has been good to me. I've tried to take on all opportunities that came my way. Some have worked out, others not, but I don't have any regrets and wouldn't want to change anything.

Have you ever met someone famous? If yes, who?

Professor Paul Crutzen, a noble prize-winner for chemistry. Sadly, he recently passed away. In 1995 I spent six months at a Max Planck institute for Biogeochemistry in Germany in the same building where he was the Director of the Institute for Air Chemistry. He won the noble prize for Chemistry while I was there. I remember him as an approachable man who had time for young people.

What are your hobbies?

I enjoy horse-riding and then I play Scottish bagpipes, which took a lot

	Flash Q's
Sweet or salty	Sweet
Summer or winter	Summer
Comedy or action	Comedy
Rollercoasters or lazy tubes	Lazy tubes
Mountains or beach	Beach
Watch sports or play sports	Play sports
Favourite physical activity	Horse riding
Favourite food	Rump
Ideal superpower	Incineration

of effort to learn.

If you could eliminate one weakness or limitation in your life, what would it be? Irritability.

If you had time to do volunteer work, what would you do?

I would like to spend time educating and helping schools that are under-resourced.

What is one guilty pleasure you enjoy too much to give up?

Drinking coffee.

Do you have any phobias?

Not really phobias as such, but I'm not a big fan of spiders.

What is your favourite quote?
"University education is about being taught the ability to play gracefully with ideas" (O. Wilde).

If you could create your own artificial intelligence (AI) personal assistant, what traits and skills would you add?

Punctuality and reliability. I don't need people to be immensely talented, I just want them to do what they commit to do.

Career/ NWU related

Where did you get your schooling?
Randfontein Primary School and then Randfontein High School. From

there I went to Wits University and stayed there until I moved to NWU in 2012.

What was your first job?

I am an academic, I've never had a job (My daughter would say that's a Dad joke). My first job was a junior researcher in the Climatology Research Group at Wits University.

What advice would you give to any young scientist on how to approach academia?

You've got to get your PhD done. It has to be your single most important thing to do, because your career hasn't started until you've finished that 'horrible document'. People often get too caught up into getting it perfect, ready to change the world. It should be significant, but you shouldn't aim to change the world.

Who has influenced you most when it comes to how you approach your work?

Firstly, my parents were hard working and gave everything for their children's education, which is something that can never be taken from you. Then I had a pipe major Jimmy Elston, who taught me to play bagpipes. I suppose what he actually taught me is that when you

don't get it right, you go back and you practice and practice and practice. Then finally the two academics that supervised my PhD greatly inspired me. The one was Professor Harold Annegarn, a nuclear physicist turned environment scientist, who taught me the nuts and bolts of doing science. He also taught me that generosity of spirit and sharing of information and opportunities without any reservation will bring many more rewards than the sole pursuit of career ambitions. The second person was Professor Peter Tyson, who was more formal and much more focused on the outputs and making sure that everything you did was done on time and as efficiently as possible. I don't think I have mastered those skills but I strive to work as efficiently as him to this day.

What is your greatest career strength?

I believe it's the ability to identify and notice what the needs of the community and industries are in terms of being able to address their research questions. As a result of that we've been blessed with substantial funding for long periods of time which has allowed us to build a very sizable suit of equipment and measurement capacity. So, I think that ability to adapt and adjust to what people need from you is my best strength.

What do you do when you lose your motivation to work?

I get up and keep doing what I am doing. Don't give up - practice, practice, practice.

What is the most exciting research project you are currently working / plan on working on in 2021?

At the moment our World Bank project and our projects associated with emissions offset. These projects are linked and aid our

understanding of what the contributing sources to air pollution are. We strive to make sure that we have the best technology to get those answers right and identify source apportionment in the ambient environment.

What do you enjoy most about being the director for the School of Geo- and Spatial Sciences?

I enjoy making sure that everybody has a common vision of where the School should be heading. We don't all have to strive personally for the same things because we have our own personal goals, but overall we should work towards a common goal for the school. My vision is to make the school one of the best schools of Geo- and Spatial Science in the country. I hope that that's what I allowed people to do and what we're all working towards.

What would you like to accomplish during your term as director?

I would like the school to, in its specific fields, be known as one of the best departments/subject groups in the country. When people inquire about the top Geography, Geology and Urban- and Regional Planning departments in the country, I would like them to mention the North West University.

Hope for the Future

What advice do you have for staff and students to prepare for possible pandemic-related challenges in 2021?

The pandemic has been tough on everybody, but we should continue with our business of delivering good quality education in the best possible way. We really need to embrace technology. A reluctance to embrace technology may result in a real stumbling block for everybody. I also think that we all just need to develop a little bit of patience. There are people that are really struggling.

In the event that unpredictable COVID-19 restrictions hinder future objectives, what strategies do you have in place that would allow your research to continue as normal as possible?

From my point of view, research needs to continue because we have an obligation to be looking at the impacts of COVID-19 on society. In our own case, COVID-19 showed us very distinctly, for example, how low activities of various things like motor vehicle activity and people being at home has impacted our air quality. We have to use the opportunities to engage and make our research relevant. The challenge is making sure that we engage carefully and that our students are not at risk.

Do you think that the pandemic will lead us into prioritizing connection with others?

It has already changed our world view and the way in which the world will function in the future. I don't think that the world is going to stick to "stay at home", "work at home", "be connected to the world via online platforms". People will get tired of it. I think we're already tired of it. I believe some form of normality will return. We'll go back to wanting to be connected with people on a personal level rather than via some screen.

What are you looking forward to most in 2021?

A happy, safe and healthy family.



Congratulations

The following awards and accolades from the international scientific community demonstrate the high quality and significant impact of research within the UESM.

National Research Foundation (NRF) rated researchers: 2021–2026

The research rating system of the NRF acknowledges the quality of South African researchers. Researchers that apply for a rating are evaluated by national and international researchers, and then rated according to the quality and impact of their research over the past eight years.

The following researchers from the UESM were rated as follow:

These ratings have effect from 2021 until 2026.



Name	Rating	Evaluation type	Sub-programme
Sandra Barnard	C2	Re-evaluation	Aquatic Ecosystem Health
Paul Beukes	B2	Re-evaluation	Climate Change, Air Quality and Impacts**
Alan Channing	B3	Re-evaluation	Biodiversity and Conservation Ecology
Connal Eardley	B3	Re-evaluation	Integrated Pest Management
Johnnie van den Berg	B1	Re-evaluation	Integrated Pest Management
Dewald van Niekerk	B3	Re-evaluation	Disaster Risk Studies

**The 8 year research upon which he was evaluated, was conducted in this UESM sub-programme



Accolades

Community outreach

Glenville Fransman, a senior administrative assistant in the School of Biological Sciences, was recently announced as one of the winners of the [Mail & Guardian's](#) top 40 list of "Why we Serve".

Read more about his impact under the [Community projects](#) section of this issue.

Teaching Excellence Awards (TEA)

The NWU Teaching Excellence programme at the Centre for Teaching and Learning recently acknowledged distinguished teaching by academic staff. This year, a total of four UESM staff members received TEA awards. **Rialet Pieters** and **Frances Siebert** (School of Biological Sciences), and **Roelof Burger** and **Dirk Cilliers** (School of Geo- and Spatial Sciences) were among the recipients of these prestigious awards. The TEA award for excellent teaching acknowledges lecturers who make important contributions to the promotion of students' learning through creating and developing innovative learning environments.



[Back to buttons](#)

Newly Appointed Permanent Staff Members since March 2020

The **School of Biological Sciences** would like to officially welcome the following permanent staff members:



Dr Kgaugelo Lekota joined Microbiology on 1 April 2020 as a Senior Lecturer.



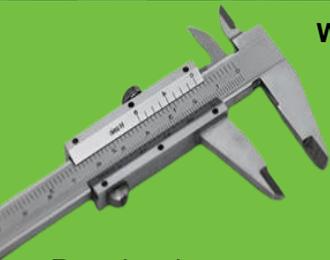
Mr Glenville Fransman joined Microbiology on 1 April 2020 as a Senior Administrative Assistant.

The **School of Geo- and Spatial Sciences** would like to officially welcome the following permanent staff member:



Ms Kobie Fourie will be joining the team as the secretary of the School of Geo- and Spatial Sciences in April 2021.

No new permanent appointments were made in the **UESM** since March 2020.



Why 'The Calliper'?

A calliper is an instrument that measures the diameter of an object. In this

Regulars item, we measure and reflect on scientific outputs in the UESM.

Special mention of Professors **Bezuidenhout, Bouwman, Du Preez, Smit, Van den Berg and Wepener** for making both top 10 lists for 2020.

You inspire us!

How the top 10 most cited researchers of 2020 were determined:

This list is based on the 2020 citations of UESM-affiliated researchers as reflected by SCOPUS on 15 February 2021. All academic staff of the UESM were considered, but excluding extra-ordinary appointments, postdoctoral fellows and postgraduate students.

How the top 10 most prolific publishers of 2020 were determined:

This list is based on the 2020 publications of UESM-affiliated researchers as reflected by SCOPUS on 15 February 2021. All academic staff of the UESM were considered, but excluding extra-ordinary appointments, postdoctoral fellows and postgraduate students.

CITATIONS

Top 10: SCOPUS 2020

Prof Sarel Cilliers	Ecological Interactions and Ecosystem Resilience	Citations 400
Prof Henk Bouwman	Aquatic Ecosystem Health	Citations 395
Prof Victor Wepener	Aquatic Ecosystem Health	Citations 369
Prof Nico Smit	Aquatic Ecosystem Health	Citations 349
Prof Johnnie van den Berg	Integrated Pest Management	Citations 332
Prof Che Weldon	Biodiversity and Conservation Ecology	Citations 329
Prof Stuart Piketh	Climate Change, Air Quality and Impacts	Citations 301
Prof Stefan Siebert	Ecological Interactions and Ecosystem Resilience	Citations 279
Prof Carlos Bezuidenhout	Aquatic Ecosystem Health	Citations 222
Prof Louis du Preez	Biodiversity and Conservation Ecology	Citations 218

PAPERS

Prof Nico Smit	Aquatic Ecosystem Health	Papers 23
Prof Victor Wepener	Aquatic Ecosystem Health	Papers 22
Prof Carlos Bezuidenhout	Aquatic Ecosystem Health	Papers 14
Prof Rasheed Adeleke	Ecological Interactions and Ecosystem Resilience	Papers 14
Prof Johnnie van den Berg	Integrated Pest Management	Papers 14
Prof Hannalene du Plessis	Integrated Pest Management	Papers 13
Prof Henk Bouwman	Aquatic Ecosystem Health	Papers 12
Prof Driekie Fourie	Integrated Pest Management	Papers 11
Prof Louis du Preez	Biodiversity and Conservation Ecology	Papers 10
Prof Francois Retief	Environmental Management	Papers 9



Research Group Showcase

Environmental Management

A [recent Scopus analysis](#) revealed that the NWU ranks first internationally in terms of EIA effectiveness research outputs. Moreover, five of the top ten authors on EIA effectiveness research are formally associated with the NWU (four as extraordinary professors and one as full time professor) namely professors **Angus Morrison-Saunders, Thomas Fischer, Alan Bond, Jenny Pope and Francois Retief**. Furthermore, a publication on EIA effectiveness led by **Dirk Cilliers** was recently nominated for the annual best paper in the journal Impact Assessment and Project Appraisal (IAPA).

Read more about EIA effectiveness research under the News Flash section of this issue.

Integrated Pest Management

Research conducted on maize pest management at the NWU is recognized internationally. A [Scopus analysis](#) revealed that the NWU ranks in the top ten internationally in terms of maize and soybean pest management research. In their respective fields, several of the authors, including a NWU extraordinary professor, **Charles Midega** and full time professor, **Johnnie van den Berg** rank in the top ten internationally.

A 2019 paper on the fall army worm, co-authored by professors **Hannalene du Plessis and Johnnie van den Berg** recently received the award for Best paper in the journal "Insects".

Water Research Group (WRG)

Research within the WRG focuses on three main themes, Ecotoxicology, Environmental Parasitology and Aquatic Ecology. These themes are routed within Environmental Toxicology that speak to the larger transdisciplinary research area on One Health. A recent highlight of the WRG was the publication of the 500th paper from the group since its inception in 2011. The international standing of the WRG is confirmed by a [Scopus and Web of Science analysis](#) that shows that the NWU ranks as number one in the world in terms of Water pollution, Ecotoxicology and Fish parasite studies in Africa. WRG group leaders **Victor Wepener** and **Nico Smit** are also the top authors in Africa on Water Pollution and Africa Fish Parasite research respectively and team members **Kerry Malherbe, Courtney Cook** and **Wynand Malherbe** are all NRF Y-rated researchers.

Invited research groups for this edition:

- Environmental Management
- Integrated Pest Management
- Water Research Group

Well done to these research groups!

*'If everyone is moving forward together,
then success takes care of itself'*

- Henry Ford

The next edition of ENVIRA will showcase another three UESM research groups.



Research Ethics in Environmental Sciences and Management

Ethics

Roelof Burger

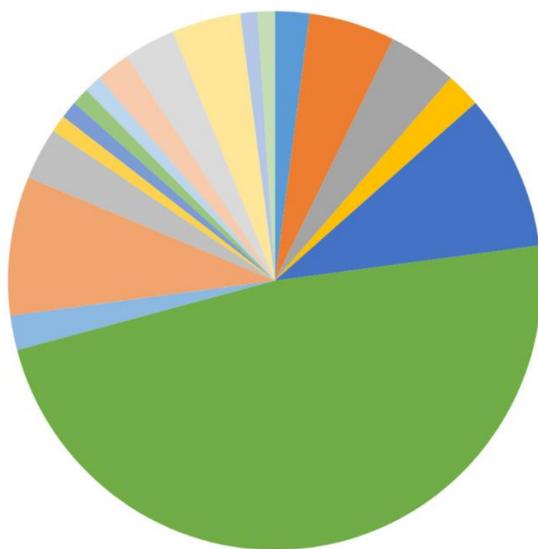
The NWU research ethics policy aims to ensure that all research is conducted in accordance with national and international ethical standards and statutory requirements. This means that all research needs to undergo both scientific and ethical review. Researchers should be ready to provide an approved ethics number when putting in special leave for research purposes or visiting a conference. Furthermore, remember that ethical clearance is only valid for 1 year and an annual review is therefore a requirement. The Faculty of Natural and Agricultural Research Ethics Committee (FNASREC) was formed to review low and no risk studies in the Faculty. Data from 97 studies in FNASREC shows that approximately 70% of studies are no risk and 30% low risk. Just more than half the studies were exposed to some kind of risk during the last year (Figure 1). The most significant risks included travel for research purposes (30% of studies), externally funded research (15.6%), human participants (12.5%) and working with material that could be harmful to the environment (11.5%). Figure 1 also shows how these risks are typically combined in research.

If you need more information on FNASREC, please search for it on eFundi: <https://efundi.nwu.ac.za/portal/site/e3baf7ed-8f8e-4fec-8cdf-cd2ebd510bb6>

What you need to know about ethics in the Unit for Environmental Science and Management

1. All research needs to be reviewed by one of the ethics committees at the NWU, including masters and doctoral students.
2. No research is allowed to start without an ethics number.
3. No student is allowed to submit his dissertation without an ethics number from one of the NWU ethics committees.
4. The ethical responsibility of student studies lies with the supervisor, not the student.
5. For low and no risk studies, the process is fairly quick and painless. Start by submitting an application to <https://tinyurl.com/fnasrec2021>
6. FNASREC will contact you with an individualised form for an annual review to save you time with the review.

What risks did you encounter during your research?



Top 5 self-reported risks

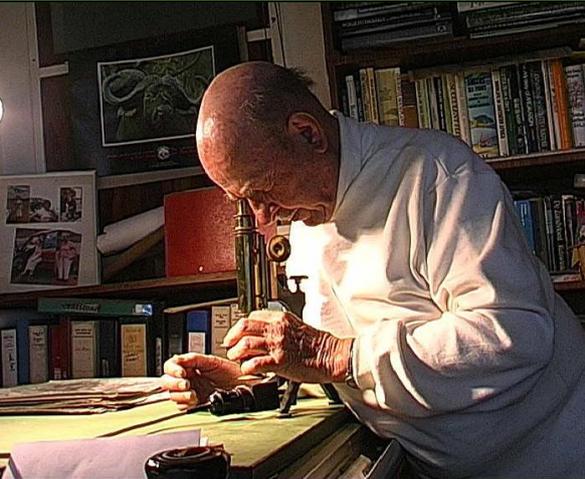
- No risk
- I had to dispose of material that could harm the environment
- I had to travel in order to collect my data
- My study is funded by an external partner
- I had to travel in order to collect my data and my study is funded by an external partner

Figure 1: The self-reported risks of the 96 FNAS studies that did annual review during 2020.

[Click here](#) for full legend and resolution of Figure 1.

The Andries Bisschoff Geology museum

Danél van Tonder



Prof Andries Bisschoff



Opening of the Andries Bisschoff Geology museum. From left to right: Daan van Wyk, Marthie Coetzee, Andries Bischoff (after whom the museum was named), Huib van Hamburg (School Director at that time)



Minerals and rocks on display

The Geology museum on the Potchefstroom Campus of the North-West University is named after Prof Andries Bisschoff. This honour was awarded to Prof Bisschoff at a glitzy ceremony in 2004. Prof Bisschoff together with Prof Piet Ackerman devoted a good part of their careers to the establishment of the Geology museum. Prof Bisschoff was the first MSc student at the NWU (then PU for CHE) in 1946 and built his academic career at the NWU and later became department head (1976-1987). He was instrumental in building the Geology Department, which became a separate department in 1947. The department was initially housed in a building situated on the site of today's cafeteria-complex. In 1971 the Geology Department moved to the JS van de Merwe building and the Geology museum was born.

The Andries Bisschoff Geology museum survived the downscaling of Geology as a major subject from 1992 to 2008. Although some economising in floor space resulted, the collection was preserved throughout these changes due to the efforts of Prof Marthie Coetzee who was subject chair intermittently up to 2016 and retired in early 2020.

What makes this museum so special? The Geology museum houses an extensive collection of rock-, ore-, mineral- and fossil specimens. The collection includes rock and mineral specimens from ~6 000 different sites across southern Africa. The collection contains specimens from ~2 400 different sites representing South African geology and the country's main economic ores. The collection of important mineral groups and some exquisite crystals are displayed in well-lit glass cabinets. A small collection of fluorescent minerals are also on display in a separate cabinet which opens a wonderland of glowing colours under UV light. The ore mineral exhibition showcases the stratigraphy and ore of all major economic occurrences in South Africa. The collection of examples of sedimentary, igneous and metamorphic rocks from around the country is extensive.

With the Vredefort Dome in our "back yard" it is only fitting that a representative collection of specimens from the different rock types from across the ~2 000 million year old impact structure are included in the display cabinets. Around 1 000 of the specimens in the collection are rocks from the Vredefort Dome, most of which were collected through Prof Bischoff's efforts. A selection of larger rocks are on display in the museum and its satellite site in the NWU Botanical garden as part of the "Walk back in time" geological rock garden.

In the past, records were kept by manually recording the details of each specimen in a book. As the collection expanded it became difficult finding a specific specimen in the drawers and shelves of the museum and storeroom. It was therefore necessary to develop a database for the museum collection to facilitate easy access to every specimen in the

Facilities



collection. The information was transferred to a GeolInfo database and recently to an Excel format with a dashboard to enter new specimens and query the data. This database contains the specimen number, type of rock and rock name, locality, number of samples, collectors name and when it was collected, as well as the unique number of the drawer or shelve box where it is stored in the museum collection.

In addition to the uniqueness of the collection and exhibits, some of the specimens are also invaluable to planetary science and economic geology research. For example, the kimberlite specimens (source of diamonds) and associated mantle inclusions were brought to the surface by magma from depths of up to 100 km and more below the Earth's surface. The comprehensive collection is also invaluable when it comes to training. Not only are the specimens and exhibits being explored in depth during practical tuition of NWU Geology students, but also by material engineering students. In the past the collection was also used by UNISA students who receive their practical Geology tuition on the Potchefstroom Campus. The collection also provides research materials to postgraduate students, staff and other researchers.

The museum is also popular for visits by school groups and during the annual Science Week. The museum is open to the public on most days but large groups should book ahead of time.

Contact details: Dr Danél van Tonder (Subject chair: Geology, School of Geo- and Spatial Science) Tel : 018 299 1092 or e-mail: danel.vantonder@nwu.ac.za



Community projects

Reaching out to the youth of Promosa

Glenville Fransman

In partnership with the Ikageng police station, Ministers Fraternal and Promosa Community Policing Forum (CPF), an outreach among the youth of the Promosa area was undertaken weekly during February and March this year. Within the context of reaching out to the youth, multiple awareness campaigns were organised. A range of topics were addressed, which included awareness of crime, bullying, domestic violence and violence against women and children. The aim of the campaign was to educate children in need of guidance and protection. To this end the campaigns were held in both Primary and Secondary schools in the area. The outreach and awareness campaigns were all accomplished with the support of the SAPS and the Justice Department's Family Violence, Child Protection and Sexual Offences (FCS) unit during "child protection week", whilst the "adopt a cop" initiative was in effect.

Treasuring the legacy of our late president, prefects (i.e. young leaders) from both Primary- and Secondary schools in Promosa were trained in practical lessons on 'reaching out' during annual Mandela Day celebrations. Members of the outreach programme accompanied these youngsters during sessions on caring for the less fortunate and extending a hand to those who need it most. The joy of giving was also extended towards local crèche's and orphanages in the area. Gifts of toys, clothing and snacks donated by local businesses, colleagues and non-profit organizations, were distributed among the friendly young faces.

Recently, members of the Reformed Church of Promosa visited Promosa Primary School and donated school uniforms and stationery packs to learners in need. The principal further urged any volunteers to assist where they can, even if only to help clean school premises or anything that could bring change and build towards a better future.

In Acts 20:35 in the Bible we read: "In everything I did, I showed you that by this kind of hard work we must help the weak, remembering the words the Lord Jesus himself said: 'It is more blessed to give than to receive'". There is joy in the act of giving when done with a grateful and pure heart.

Note from Editor: Glenville Fransman has further been acknowledged for his active engagement in the community - see our [Accolades](#) section



We aim for the future.

The Interesting Fact Box



Great apes receive COVID-19 vaccine



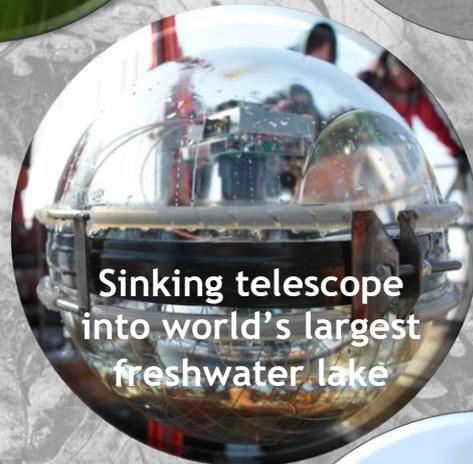
Listen to the grass



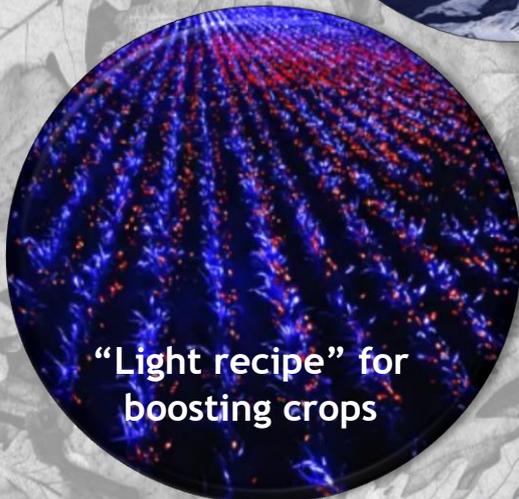
Space microbes unknown to science



Ancient Greenland plants - grim warning



Sinking telescope into world's largest freshwater lake



"Light recipe" for boosting crops



World Nature Photography Awards 2020



Self-decapitating sea slugs



Dust: A sign of trouble in maize fields



How much do flies help with pollination?

Agrochemicals and endocrine disruption—how can we narrow the knowledge gap?

Ilzé Horak, Suranie Horn & Rialet Pieters

South Africa is the largest pesticide user in sub-Saharan Africa with over 3 000 registered products. Although agrochemicals are used to reduce crop losses, the majority of pesticides are ecologically unsustainable. It is estimated that a mere 0.1% of applied pesticides reach target organisms while the remainder move into non target areas (Figure 1).

Many organochlorine pesticides (OCPs) (e.g. endosulfan and dichlorodiphenyltrichloroethane (DDT)) are still detected in South African water despite being banned for agricultural use. Several current-use pesticides, including atrazine, 2,4-dichlorophenoxyacetic acid (2,4 D) and chlorpyrifos have also been detected in the environment. Consequently, wildlife species are exposed to these pollutants through direct consumption of pesticide polluted food and drink.

One of the toxicological effects associated with pesticide pollution is endocrine disruption (ED) where chemicals interfere with normal hormone functioning leading to effects in wildlife, such as intersex, eggshell thinning and

poor sperm production. Compounds that mimic the activity of natural endogenous oestrogens or androgens have also been detected in surface, drinking and groundwater.

In a previous review by Ansara-Ross et al. (2012), less than 50 studies quantified the occurrence of pesticides in South African freshwater systems over 34 years (1977 to 2011). In a [review paper](#), we reveal that the number of studies investigating agrochemicals and/or ED effects in aquatic environments in the country increased with 41 publications in less than a decade (2011 to 2020). Of these studies, 66% solely investigated the presence of agrochemicals, 22% determined both the levels of pesticides and associated ED effects, while the remaining 12% only evaluated ED effects (Figure 2). Despite the increase, many of these studies still focused on banned OCPs (DDT, chlordane and lindane). Only 25% of studies assessed current-use pesticides—mostly triazine herbicides (Figure 3). And still we do not have a complete picture of the toxicological risks posed by many current-use agrochemicals.

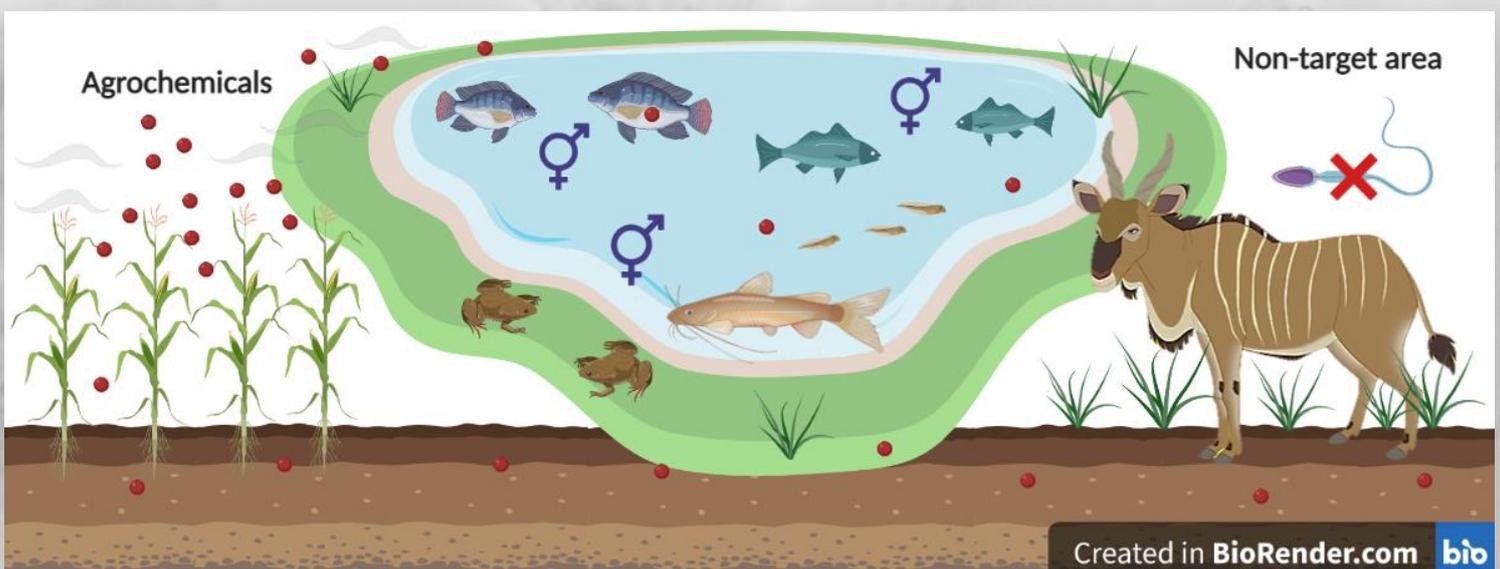


Figure 1: Agrochemicals reaching non-target areas and organisms.

One effective way of addressing the relationship between agrochemicals and their effects on unintended targets, is the use of bio-assays: Mammalian cell lines are a useful tool to study hormone receptor activity and can be used to investigate ED effects of pesticides via luminescence reporter gene and steroidogenesis assays. By providing insights into gene expression and cellular activity, luminescence reporter gene assays are used to determine whether compounds in environmental extracts mimic steroid hormones by binding to receptors and activating/inhibiting them. A steroidogenesis assay investigates chemical effects on the synthesis of steroid hormones and intermediates (e.g. progesterone, testosterone and cortisol). Some cell lines used in these assays are unique to the laboratory in which they had been developed, while others are commercially available and used in many research laboratories worldwide. In our tissue culture laboratory at the NWU, four different mammalian cell lines are used to investigate different ED end-points: binding to receptors such as aryl hydrocarbon, oestrogen, androgen, and glucocorticoid

as well as steroid metabolism. The majority of studies conducted are either laboratory-based employing *in vitro* or *in vivo* bioassays to determine ED effects of agrochemicals or studies that investigate environmental concentrations of pesticides. By combining *in vitro* bioassays with chemical screening of water-soluble extracts (using analytical instrumentation) we aim to determine which maize crop agrochemicals are likely to cause observed ED effects.

This two-pronged approach will aid in assessing the ecotoxicological risks posed by many current-use agrochemicals and facilitate the development of water quality guidelines for commonly applied pesticides—improving the ecological integrity of aquatic environments and biota.

Further reading:

Ansara-Ross, T.M., Wepener, V., Van den Brink, P.J. & Ross, M.J. 2012. Pesticides in South African fresh waters. *African Journal of Aquatic Science*, 37(1):1–16.

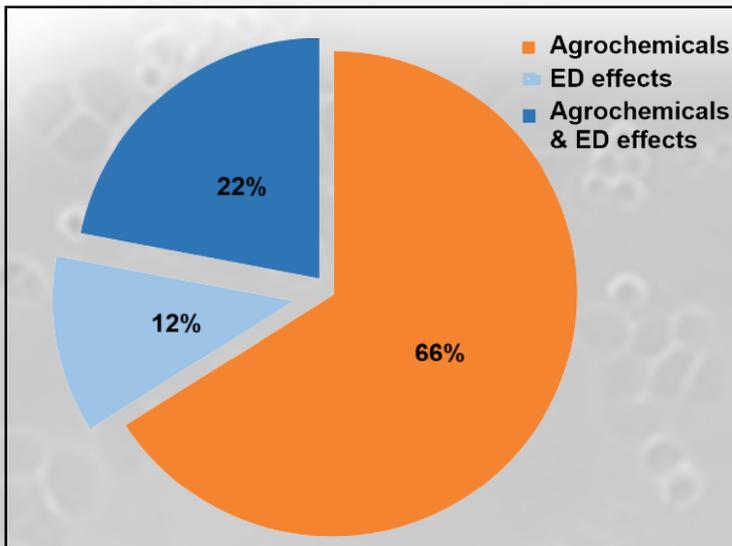


Figure 2: Studies investigating the occurrence of agrochemicals and/or ED effects in aquatic environments in South Africa from 2011 to 2020.

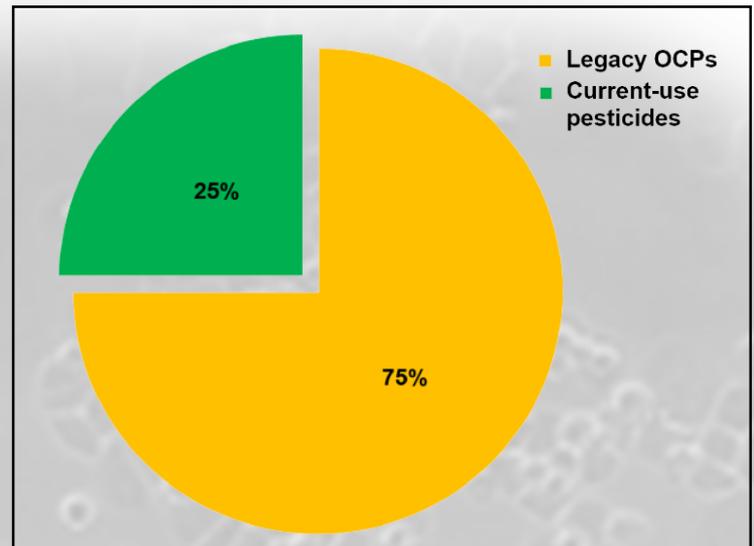


Figure 3: Studies investigating the occurrence of legacy OCPs and current-use pesticides in aquatic environments in South Africa from 2011 to 2020.

Background image: MDA-kb2 human breast carcinoma cell line used in *in vitro* bioassays to detect endocrine disruption from environmental samples.

The Biodiversity and Conservation Ecology Sub-programme salutes the late Prof Pieter Theron on his scientific contribution

Eddie Ueckermann

Prof Theron joined the then Potchefstroom University for Christian Higher Education in 1963 and completed his PhD in 1972. He specialised in the mite suborder Endeostigmata but towards the end of his career was also involved in projects on other mite families, a total 42, resulting from his collaborations with 35 co-workers. The bulk of his 71 publications were published after 2003. He was instrumental in the description of 112 new species, 23 new genera, and one new family, subfamily and tribus. The depictions in his publications were masterly composed. This served as a catalyst for the interest of other researchers in the Endeostigmata. He was the study leader for several postgraduate students. He had a long research relationship with Prof Yves Coineau of the Muséum National d'Histoire Naturelle, Arthropodes, Paris, France. Their area of interest was the rock-dwelling Adamystidae and Saxidromidae from which 5 papers resulted and additionally a number of specimens were still in the process of being described. Just before his retirement and thereafter, he collaborated with Prof Nestor Fernandez of the National Council of Scientific and Technological Research, La Rioja University, La Rioja, Argentina on several oribatid

families, which resulted in 32 papers. At the end of his career, he assisted Russian acarologists during their visit to South Africa in 2016 and 2018 in their search for mites associated with anthills. On their last visit, Prof Theron already presented with early signs of dementia. From this short collaboration 8 articles resulted and a new species was named after Prof Theron, namely *Tanytydeus theroni* (Paratydeidae). Seven additional mite species were also named after Prof Theron: *Anaplonobia theroni* and *Neopetrobia theroni* (Tetranychidae), *Stigmaeus pieteri* (Stigmaeidae), *Typhlodromus (Anthoseius) theroni* (Phytoseiidae), *Adamystis theroni* (Adamystidae), *Grandjeanicus theroni* (Grandjeanicidae) and *Uropoda theroni* (Uropodidae).

Prof Theron was also the first chair-person of the African Acarology Association established in 1998 in Pretoria, and served the association until 2004.

Uusitalo, M., Ueckermann, E.A. & Theron, P.D. (2020). A review of the family Alycidae (*Acari, Acariformes*) from South Africa. *Zootaxa* 4858 (3): 301–340, was the last article with Prof Theron's name on and he was not even

aware that this paper was at last completed. What a way to say farewell to a mentor, colleague and friend.

Prof Theron was a precise scientist with a formidable memory. A memory where he treasured memories of a life time, a lifetime of colleagues who will now remember him with fondness.

[View complete memorial for Prof Theron.](#)

Prof Theron, Dr Louwrens Tiedt, Prof Eddie Ueckermann and Prof Sultan Cobanoglu from Turkey.



Biomass burning aerosols in most climate models are too absorbing

Pieter van Zyl & Paul Beukes

In a recent paper published in *Nature Communications*, data collected at the Welgegund atmospheric monitoring station was one of 12 observational datasets utilised in a study to quantify the uncertainty in the representation of biomass burning (BB) aerosol composition and optical properties in climate models. Biomass burning aerosol (i.e. emissions produced by vegetation fires) make up a majority of primary combustion aerosol emissions, with the main sources of global BB mass being Africa (~52%), South America (~15%), Equatorial Asia (~10%), Boreal forests (~9%), and Australia (~7%). The composition, size, and mixing state of BB aerosols determine the optical properties of smoke plumes in the atmosphere, which in turn is a major factor in dictating how they perturb the energy balance in the earth system. Depending on the model, the top-of-the-atmosphere BB aerosol effect can range from cooling to warming.

By relating aerosol absorption relative to extinction and carbonaceous aerosol composition from 12 observational datasets to nine state-of-the-art Earth system models and chemical transport models, varying degrees of overestimation in BB aerosol absorptivity by these models were identified. Modifications to BB aerosol refractive index, size, and mixing state was made in the Community Atmosphere Model version 5 (CAM5), which improved the model in agreement with observational measurements (Figure 1). These improvements led to a global change in BB direct radiative effect of -0.07 W.m^{-2} , while regional changes of -2 W.m^{-2} in Africa, and -0.5 W.m^{-2} in South America and Temperate regions were observed. These findings suggest that current modelled BB contributes less to warming than previously thought, largely due to treatments of aerosol mixing state.

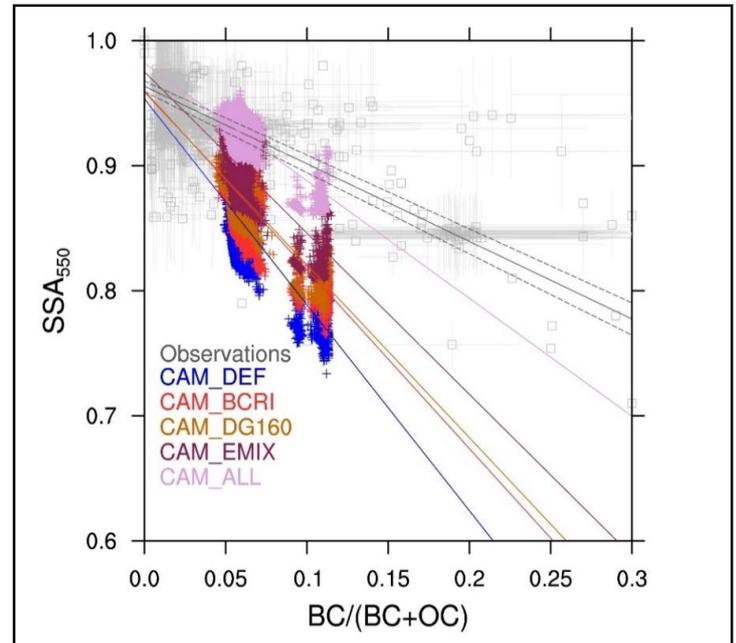


Figure 1: Model improvement compared to observations with different biomass burning microphysical and radiative properties. Comparison of observed biomass burning (BB) single scattering albedo (SSA) at 550 nm wavelength versus black carbon to total carbon ratio (BC:TC) to CAM5.4 sensitivity tests. Observations are in gray. The CAM5.4 sensitivity tests are for different BB aerosol treatments: default CAM5.4 (CAM5.4; blue), CAM5.4 with decreased BB black carbon refractive index (CAM_BCRI; red), CAM5.4 with increased BB aerosol size (CAM_DG160; gold), CAM5.4 with externally mixed, fresh BB aerosol (CAM_EMIX; maroon), and CAM5.4 with all of the previous changes (CAM_ALL; pink).

[Link to published paper](#)

Further reading:

Andreae, M. O. 2019. Emission of trace gases and aerosols from biomass burning – an updated assessment. *Atmospheric Chemistry and Physics* 19, 8523–8546.

Van der Werf, G. R. *et al.* 2010. Global fire emissions and the contribution of deforestation, savanna, forest, agricultural, and peat fires (1997–2009). *Atmospheric Chemistry and Physics* 10, 11707–11735.

Nature outside your front door: the importance of urban ecological research

Marié du Toit & Sarel Cilliers

Today, 56 % of the world population live in urban areas. For most people, it means that the only nature they experience is in their local urban area. Nature in cities provide essential [ecosystem services](#) and has been proven to enhance human health and well-. Moreover, the explicit inclusion of cities and the protection of nature in the UN Sustainable Development Goals emphasize the importance of research on urban biodiversity. Sound urban ecological knowledge is essential for [responsible urban planning](#) striving towards sustainable and resilient cities. However, urban ecologists from the NWU [highlighted the gap](#) in knowledge and research emanating from the global South and especially sub-Saharan Africa.



Conserving your backyard: Urban residential areas surrounded by natural grassland remnants.

Gardens represent a dominant part of urban green infrastructure and harbour surprisingly high biodiversity that is strongly influenced by the culture and socio-economic status of residents. Moreover, gardens provide numerous ecosystem services, whereas state-owned health clinic gardens can also play an important role in providing community networking and learning opportunities. [Global research](#), that the NWU Urban



Gladiolus elliotii an indigenous highveld wildflower observed in a remnant urban grassland patch.



Common urban residents, laughing doves (*Streptopelia senegalensis*) and Cape Turtle doves (*S. capicola*).

Ecology Research Group has participated in, indicated that despite high numbers of exotic species, the majority of birds and plants in urban areas are indigenous. In many urban areas, patches of remnant natural vegetation remain. Despite obvious disturbances and anthropogenic transformations, such areas would lend itself to conservation. For example, urban grassland patches [can be just as functional](#) as their rural counter parts and [urban wetlands](#) can still be dominated by indigenous species. Notwithstanding, recent urban long-term grassland research indicate that herbaceous indigenous species are declining in natural remnants and that pro-active management and conservation efforts will be critical to ensure their continuing survival. Next time you step outside your front door and look around, you might be astonished by the diversity and abundance of urban biodiversity in even the most surprising places.

Further reading:

Cilliers, S. S., Siebert, S. J., Du Toit, M. J., Barthel, S., Mishra, S., Cornelius, S. F. & Davoren, E. 2018. Garden ecosystem services of Sub-Saharan Africa and the role of health clinic gardens as social-ecological systems. *Landscape and Urban Planning*, 180: 294-307.

Davoren, E., Siebert, S., Cilliers, S. & Du Toit, M. J. 2016. Influence of socioeconomic status on design of Batswana home gardens and associated plant diversity patterns in northern South Africa. *Landscape and Ecological Engineering*, 12; 129-139.

Du Toit, M. J., Kotze, D. J. & Cilliers, S. S. 2020. Quantifying Long-Term Urban Grassland Dynamics: *Biotic Homogenization and Extinction Debts. Sustainability*, 12.

Lubbe, C. S., Siebert, S. J. & Cilliers, S. S. 2010. Political legacy of South Africa affects the plant diversity patterns of urban domestic gardens along a socio-economic gradient. *Scientific Research and Essays*, 5; 2900-2910.



Spectacular mass displays of indigenous flora, such as this torch lily (*Kniphofia ensifolia*) in an urban wetland, highlights the importance of conserving urban green spaces.

EIA effectiveness research

Claudine Roos & Francois Retief

Environmental Impact Assessment (EIA) is internationally considered the most successful environmental policy implementation instrument, now applied in more than 200 countries. International EIA research emerged and developed over the past 50 years into its current scientific standing of more than 100 000 EIA journal papers (Scopus). EIA research has a broad range, covering various themes dealing with theory and practice. Over the past 15 years, the Environmental Management sub-programme within the Unit for Environmental Sciences and Management (UESM) developed and implemented a specific research strategy, which is in line with international trends. This strategy focuses on two main themes, i.e. the quality of EIA (How well are we doing EIA?) and the effectiveness of EIA (What are we achieving?). Research on EIA effectiveness is particularly important internationally because it deals with fundamental questions about the need for and contribution of EIA to decision making. However, it also makes out one of the most challenging EIA research topics, mainly because of the significant methodological challenges it presents around measuring and/or demonstrating effectiveness. Therefore, although EIA effectiveness is internationally one of the most important research themes, it is also least explored empirically.

Researchers from Environmental Management at the NWU, accompanied by several extra-ordinary professors from various international institutions, have embarked on bridging the gap in research on EIA effectiveness. Their research successfully addressed key effectiveness concepts such as legitimacy, ethics, rationality, resilience, as well as the political nature of EIA decision-making, which have positioned them as international leaders in the field of effectiveness research.

Research findings from EIA effectiveness suggest that:

- EIA processes are generally efficient and administratively just;
- Weak EIA substance may lead to EIA not achieving its objectives; and
- Key weaknesses in EIA practice are dealing with significance and mitigation.

Recently, the NWU challenged long held international views about EIA effectiveness (Cilliers et al., 2020). After extensive surveys on regulator perspectives on the benefits of EIA, the study outcomes revealed that the main perceived benefits of EIA to government relate to short-term, project-specific benefits such as the protection of local biodiversity, public participation, legal compliance and enforcement, as well as certain immediate economic benefits. The study furthermore stated that the promotion of sustainable development is not considered a realistically achievable benefit for EIA, and concluded that for EIA to clearly define and achieve its potential benefits for government, it needs to rediscover and embrace its roots as a project level instrument aimed at dealing with biophysical impacts and environmental protection. This paper has been nominated for the annual best paper in the journal Impact Assessment and Project Appraisal (IAPA).

EIA effectiveness research at the NWU is further strengthened by two PhD theses from colleagues in the Environmental Management sub-programme. Their research topics included EIA system evaluation (Reece Alberts) and effectiveness of EIA in the renewable energy sector (Carli Steenkamp).

Regular writing workshops within the sub-programme have culminated in several EIA effectiveness research outputs. The next step for the EIA effectiveness research is to use strong international networks to collate all country-specific results towards global EIA effectiveness.



Dirk Cilliers, Francois Retief and Reece Alberts working effectively on 'effectiveness research' during a writing workshop.

An absolutely ‘nemastonishing’ world!

Driekie Fourie

Postdoctoral fellows and students, under the supervision of Prof Driekie Fourie, focus on fundamental and applied nematological research as part of the IPM sub-programme. Research activities include studying the morphological and ecological characteristics of beneficial and plant-parasitic nematodes (PPN), also the management of the latter group. Dr Gerhard du Preez, now a senior lecturer at Agronomy, is focusing on the use of beneficial nematodes as bioindicators of soil health in conservation and regenerative agriculture farmlands. Ané Loggenberg’s MSc study, for example, focused on the use of various soil health parameters, including nematodes, as bio-indicators of soil ecosystem functionality in croplands under regenerative agriculture (Figure 1).



Figure 1: Ané Loggenberg and DannyBoy Steyn sampling nematodes in a natural veld field near Vrede

Applying his molecular expertise, Dr Milad Rashidifard contributed to the identification of four new nematode species in the last two years. Currently, he is evaluating the effect of a new crop rotation approach for controlling of PPN in maize production areas.

New insights into the life stage development and life cycle duration of an emerging root-knot nematode species *Meloidogyne enterolobii* were furthermore made by MSc student Raymond Collett. The shorter life cycle

of this species in roots of maize (Figure 2 and 3) and soybean is novel and will contribute to its management.

With the main focus being on the management of nematode pests, various projects are dealing with this topic, namely: an extensive nematode survey in grain production areas (Figure 4) conducted by MSc students Bongiwe Mhlongo and Lindokhule Qwabe; the identification of nematode pests associated with grain crops in the Highveld region and correlation of their abundance and incidence with naturally occurring fungi



Figure 2: Evaluating the effect of different microbial communities for root-knot nematodes control

and bacteria as potential bio-control agents done by PhD student Gerhard Engelbrecht; PhD student James Kisaakye focuses on the evaluation of antagonistic microbes for managing economically important insect and nematode pests in East African bananas; screening of soybean cultivars for resistance to *M. enterolobii* by MSc student P.R. van Rensburg; evaluation of microbial communities associated with different host plants for their suppression effects on root-knot nematodes by Milad Rashidifard; and evaluation of endemic fungal species for their adverse effects on the reproduction of root-knot nematodes by MSc student Marné Pretorius.

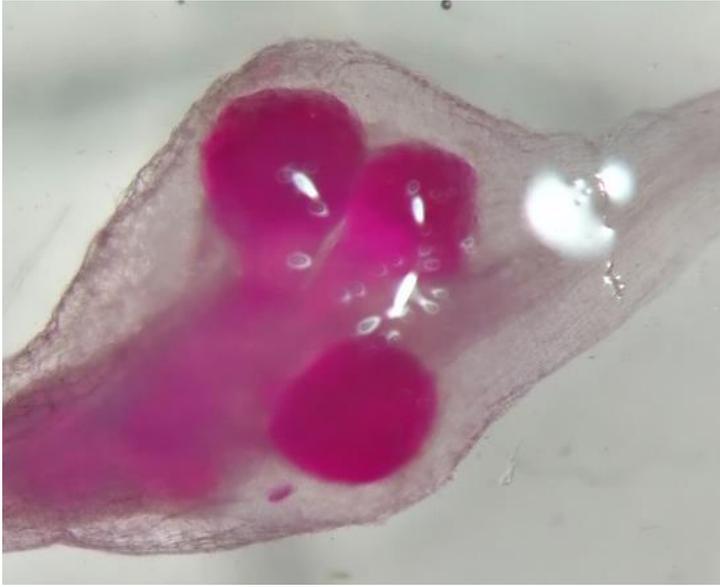


Figure 3. *Meloidogyne enterolobii* females in roots of maize.

The team has various local (ARC, GrainSA, SUN, UKZN, UFS) and international networks (e.g. IITA, UGent, UJaen, JKI) with experts in related disciplines to ensure a high standard of cutting-edge research is conducted. Research as well as teaching and learning projects are funded by local and international institutions and companies (e.g. GrainSA, NRF, EU, chemical companies).



Figure 4. Prof Driekie and Sakkie Montsho actively involved in nematode sampling.

Photo credits:

Gerhard du Preez; Milad Rashidifard; Raymond Collett; Marné Pretorius.

Acknowledgements

We would like to thank the following people who have made invaluable contributions towards the *Autumn* edition of ENVIRA:

- Prof Stuart Piketh for his willingness to participate in this edition's School Director's Interview.
- All the authors who willingly shared their stories with readers of the Autumn edition.
- All acquaintances, colleagues and friends of Prof Pieter Theron for their contributions to his memorial contained in this edition.
- Willie Landman for providing various special writings and sketches that once belonged to Prof Pieter Theron.

We appreciate every contribution.

We are proud to know that this issue completes our first seasonal collection of ENVIRA Newsletters.

Look out for the *Winter* edition of 2021.

Frances and Clarissa

Photo credits:

Gerhard du Preez; Milad Rashidifard; Raymond Collett; Marné Pretorius. Additional photos were obtained from websites providing freely available stock photos: <https://unsplash.com>; <https://pixabay.com>; <https://www.pexels.com>; <https://www.freeimages.com>; <https://www.canva.com>