CENTRE FOR INVASION BIOLOGY

ANNUAL REPORT 2025

Stellenbosch UNIVERSITY
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Centre for
Invasion Biology

MISSION

The Centre for Invasion Biology (CIB) is a transdisciplinary, African–rooted hub that generates and applies knowledge on biological invasions to support biodiversity conservation, policy, and ecosystem management across Africa and the world. The mission of the CIB is to:

- undertake research and education that investigate changes in biological diversity as a consequence of biological invasions, their effects on ecosystems and the remediation thereof, including the effects on ecosystem services under climate, land–use, and other relevant environmental changes.
- pioneer internationally leading research regarding biological invasions by pursuing research excellence, inter–disciplinarity, and local, regional, and international exchanges.
- coordinate innovative research that is disseminated in the international literature; graduates who are sought after for their knowledge, expertise, and creative and critical thinking; a well–supported staff who are respected and trusted.
- conduct policy– and management–relevant independent research that supports managers, policymakers, and those tasked with monitoring and reporting on biodiversity change.
- be relevant to the needs of the community, focusing on Africa and the global community.
- help build an Africa–wide research community of practice on biological invasion.
- foster linkages within broader themes such as One Health and One Biosecurity, and institutional partners.

VISION

The raison d'être of the CIB is to provide the scientific understanding required to manage the rate and impacts of biological invasions in a manner that will improve the quality of life of all Africans.

CORE FEATURES

- **Context–sensitive (Ubuntu)**: Research and interventions grounded in African ecosystems, governance, and socio–economic realities from local communities to regional (and international) decision–makers.
- **Ethical and inclusive**: uphold integrity, equity and respect, ensuring diverse voices shape our research and impact**.**
- **Impact–orientated**: The scientific outputs and human–capacity produced demonstrably support evidence–based policy and management.
- **Collaborative**: Strong active research networks linking African institutions with global partners that are strategically connected to end users of research.
- **Agile and resilient**: Adaptive operational models that can pivot and diversify funding.
- **Focused on excellent science**: The research conducted is globally recognised for its quality and integrity.

STRATEGIC GOALS

- Develop financially sustainability to support, nurture, and develop researchers.
- Attain globally recognition in the science of biological invasions and become a key research centre for the African continent.
- Strengthen African research networks.
- Translate research for policy.

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https://blogs.sun.ac.za/cib/

The CIB will maintain and grow the now internationally recognised reputation of the previously DSTI-NRF–funded CIB Centre of Excellence, which has developed over more than two decades.

The CIB is a Type 2 academic and research entity of Stellenbosch University (SU) with a national, regional, and international scope and mandate. The Centre resides within the Stellenbosch University School for Climate Studies (a Type 3 entity at SU, standing alongside the ten faculties).

Project Manager and Editor: Tatenda Dalu, Dorette du Plessis, Christy Momberg
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Design and layout: Tatenda Dalu

FRONT COVER: A collage of alien invasive biota, from top left going clockwise: water hyacinth *Pontederia crassipes* and water lettuce *Pistia stratiotes* along the Letaba River, Kruger National Park (Photo credit: Tatenda Dalu; The inside of a Box Elder which had to be cut down due to the PSHB. You can see some galleries that the beetle made in the wood (Photo credit: Sabrina Kumschick); Bullfrog *Lithobates catesbeianus* (Photo by Carl D. Howe, https://commons.wikimedia.org/w/index.php?curid=528421); *Prosopis juliflora* (Photo credit: Forest and Kim Starr); Common carp Cyprinus carpio in a hyper-eutrophic reservoir, Northern Cape (Photo credit: Tatenda Dalu); Orderly plantations of pine trees in the background and invasion by escaped pines on the Garcia Pass in the southern Cape, South Africa (Photo credit: Johan Baard)

BACK COVER: Aletta Kassier, Perryn Richardson and Bridget O'Connor attended the 24th Congress of the Entomological Society of Southern Africa (ESSA) in 2025.

LIST OF ACRONYMS

ACRES	Audubon Center for Research of Endangered Species
ARSG	Aquatic Systems Research Group
BIOSCAN	International Barcode of Life Project
CIB	Centre for Invasion Biology
DFFE	Department of Forestry, Fisheries and the Environment
DNA	Deoxyribonucleic acid
EICAT	Environmental Impact Classification for Alien Taxa
GBIF	Global Biodiversity Information Facility
KNP	Kruger National Park
PSHB	Polyphagous shothole borer
QR	Quick Response (code)
SANBI	South African National Biodiversity Institute
SANParks	South African National Parks
SU	Stellenbosch University
UCT	University of Cape Town

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A YEAR OF TRANSITION, RENEWAL AND EXCELLENCE

The year 2025 marked an important milestone in the history of the Centre for Invasion Biology (CIB). Following my appointment as Director in December 2025, I was honoured to assume leadership of a Centre that has, for more than two decades, established itself as one of the world's leading hubs for invasion science. Built on a strong foundation of scientific excellence, policy engagement, capacity development and societal impact, the CIB continues to play a pivotal role in advancing our understanding of biological invasions and supporting evidence–based management across South Africa, Africa and beyond. As a Centre hosted within Stellenbosch University's School for Climate Studies, the CIB occupies a unique position at the interface of research, policy and practice.

> *"In assuming the Directorship of the Centre for Invasion Biology at the close of 2025, I do so with a clear sense of continuity and renewal. Our task is to protect and extend a globally respected legacy in invasion science while deepening our relevance to Africa's most pressing environmental challenges. My priority is to strengthen collaboration nationally and across the continent, reinforce the interface between science, policy, and practice, and ensure that the next generation of African invasion biologists is equipped to lead. The Centre's future depends not only on scientific excellence, but on our ability to turn evidence into action for biodiversity, ecosystem services, and livelihoods."*

Our mission remains clear: to generate the scientific understanding and predictive capacity needed to reduce the rates and impacts of biological invasions while simultaneously developing the next generation of African scientists and environmental leaders. My vision for the CIB builds on these foundations while strengthening several strategic priorities: enhancing collaboration across disciplines and sectors, supporting long–term ecological monitoring, expanding policy relevance, advancing freshwater and climate–linked invasion science, and increasing the CIB's footprint across the African continent. These priorities are particularly important as biological invasions increasingly interact with climate change, biodiversity loss, water insecurity and socio–economic development challenges.

SCIENTIFIC EXCELLENCE AND RESEARCH LEADERSHIP

The CIB continued to produce research of exceptional quality and international relevance during 2025 demonstrating the continued global leadership of the Centre. Core Team Members and Fellows published across many of the world's leading journals such as *Science*, *Science Advances*, *Nature Communications*, *Ecology Letters*, *Trends in Ecology and Evolution*, *Current Opinion in Insect Science*, *NeoBiota*, *Biological Invasions*, *Conservation Physiology*, and *Remote Sensing Applications: Society and Environment*.

Research undertaken by the CIB spanned a broad range of themes, including invasion ecology, climate change biology, ecological forecasting, biodiversity conservation, restoration, protected area management, invasive species risk assessment, ecological modelling, forest ecology, marine invasions, freshwater ecosystem management, and conservation physiology. Several publications contributed directly to national and international policy development, biodiversity monitoring frameworks, invasive species management strategies, and global environmental assessments.

One of the most significant achievements during this time was the continued strengthening of the evidence-base underpinning invasion science. Several publications advanced global understanding of invasive species impacts, risk assessment methodologies and management. Notable examples included contributions to the Global Invasive Alien Species Impacts Database, the development of new frameworks for ecological impact classification, refinements to the Risk Analysis for Alien Taxa framework, and evidence–based approaches for responsible tree planting.

A notable achievement was the publication of 'The Ecology and Management of Invasive *Prosopis* Trees in Eastern Africa', a synthesis volume addressing one of Africa's most damaging invasive tree genera by Urs Schaffner, Ketema Bekele, Albrecht Ehrensperger and CIB Core Team Member, Brian W. van Wilgen. The book brought together international expertise and highlighted the CIB's leadership in translating invasion science into practical management.

The influence of CIB research extended well beyond academia as research findings generated both national and international media attention, demonstrating the societal relevance of the CIB's work. The CIB also made advances in restoration ecology, with one of the most widely recognised scientific stories of the year, emerging from research demonstrating soil seed–bank resilience in endangered Sand Fynbos ecosystems after a century of pine plantation cover. The research, led by Prof. Karen Esler featured in The Conversation, IFL Science, Phys.org, and numerous conservation organisations. The study showed that native biodiversity can persist below ground for extended periods and highlighted opportunities for passive restoration following invasive tree removal. Further restoration–focused research examined riparian rehabilitation, ecosystem recovery trajectories and innovative approaches to mapping invasive species using advanced spectral and spatial remote–sensing technologies. Together, these studies are helping managers make better–informed decisions regarding restoration investments and invasive species control.

An exciting area of growth during 2025 was research exploring interactions between climate change and biodiversity. CIB researchers contributed to several high–profile studies published in journals such as *Science*, *Nature Communications*, *Science Advances* and *Conservation Physiology*. These studies examined topics including climate–driven biodiversity change, physiological responses to environmental stress, microclimate buffering, species persistence under global change and mechanisms underpinning ecological resilience. This body of work moves beyond describing ecological patterns and instead focuses on understanding the processes and mechanisms that determine species responses to environmental change. Such predictive understanding is essential for anticipating future risks and designing effective adaptation strategies in an increasingly uncertain world.

Marine and freshwater ecosystems remain among the most threatened environments globally, and strengthening CIB's marine and freshwater research portfolio is a key strategic priority. During 2025, the CIB contributed significantly to freshwater restoration science, aquatic invasion biology and ecosystem management. Our researchers, particularly Prof. Tammy Robinson–Smythe contributed to improved monitoring approaches for marine invasions, including citizen–science initiatives, invasive species surveillance and coastal ecosystem assessments. This work reflects a growing integration between marine ecology, invasion science, climate adaptation and ecosystem restoration, as such integration is increasingly important as water security and biodiversity conservation become central challenges for sustainable development throughout Africa.

BUILDING THE NEXT GENERATION OF SCIENTISTS

Capacity development remains central to the CIB's mission, as we continued to support postgraduate students, postdoctoral fellows, early–career researchers, and emerging leaders in biological invasions by funding studies or supporting conference attendance. The CIB's commitment to transformation, diversity and inclusion remained a core priority. Through mentorship, collaborative supervision, professional development opportunities and international partnerships, the CIB continued to contribute meaningfully to building scientific capacity in South Africa and across the African continent.

Professor Tammy Robinson–Smythe with recent PhD graduate Dr Clara Steyn

Ms Tania Pogue, a PhD student under Prof. Susanna Clusella–Trullas' supervision, was awarded first prize for Best PhD Presentation at the Department of Botany and Zoology's Annual Research Meeting. Similarly, Ms Perryn Richardson, PhD student also under Prof. Susanna Clusella–Trullas' supervision received Top Speaker Award at Centre for Statistics in Ecology, the Environment and Conservation (SEEC) conference at the University of Cape Town (UCT) and Top Presenter Award in the Biology category at the Stellenbosch University Science Faculty Postgraduate Conference.

Prof. Cang Hui (far right) with MSc graduate, Chris Gildenhuys, and Dr Pietro Landi at the March 2026 graduation ceremony.

PUBLIC ENGAGEMENT AND SCIENCE OUTREACH

The Iimbovane Outreach Project remained one of the CIB's flagship public engagement initiatives and continued to make a substantial contribution to science education and environmental awareness throughout the Western Cape. During 2025, Iimbovane trained 775 learners and 139 educators through environmental camps, field investigations, classroom activities, biodiversity monitoring programmes and educator development workshops. The programme hosted ten tailored day programmes and three multi–day environmental camps focused on biodiversity monitoring, invasive alien species awareness, ecological field methods, and conservation practice. Learners gained practical experience in biodiversity surveys, species identification, ecological data collection, environmental stewardship and scientific inquiry. The project also strengthened partnerships with the Western Cape Education Department, CapeNature, the Cape Leopard Trust, the Cape Winelands Biosphere Reserve and the Western Cape Environmental Education Forum. Importantly, Iimbovane contributed to the Environmental Education Association of Southern Africa (EEASA) Conference, highlighting the value of place–based environmental education and learner–led biodiversity research.

DIGITAL PRESENCE AND PUBLIC VISIBILITY

A hallmark of CIB research is its ability to influence public discourse and inform policy. During 2025, the CIB research received substantial national and international media attention, with stories appearing in major outlets including The Conversation, News24, Daily Maverick, Mail and Guardian, Nature Africa, Financial Mail, Phys.org and numerous radio and digital platforms. Topics attracting significant public interest included fynbos restoration, invasive *Prosopis* management, Working for Water impacts, invasive species in protected areas, climate–related biodiversity resilience, polyphagous shot–hole borer management and emerging invasive species threats.

The CIB maintained a strong digital presence throughout 2025, with the website attracting nearly 5 000 visitors and over 6 300 page views during the reporting period. The CIB's social media platforms continued to facilitate communication with diverse audiences, while the CIB Zenodo repository expanded access to publications, datasets, reports and theses. The CIB's *Facebook* platform reached over 20 000 views and generated more than 1 500 engagements, while the *X* account maintained an active audience interested in biological invasions, biodiversity conservation and environmental management.

The November 2025 Annual Research Meeting delegates photo, Stellenbosch University

PARTNERSHIPS, COLLABORATION AND RECOGNISING EXCELLENCE

The CIB's success continues to be underpinned by an extensive network of national and international collaborators. During 2025, researchers worked closely with government agencies, conservation organisations, research institutions, NGOs and international partners to address pressing environmental challenges. Collaborative research remained a defining feature of the CIB's activities, reflected in the large number of multi–institutional publications and international research initiatives undertaken during the year. The year also saw important recognition of scientific excellence within the CIB. Several Core Team Members achieved notable NRF rating successes, reflecting their sustained contributions to global scholarship and research leadership. On awards and recognitions, the 2025 activity collation highlights several important NRF rating developments among Core Team

Members- Professor Dave Richardson with an A1 NRF rating, Professor Sabrina Kumschick with a B2 NRF rating, Dr Thabiso Mokotjomela with a C2 NRF rating, and Professor John Wilson with a B2 NRF rating. These are significant indicators of research standing. These achievements reinforce the international standing of CIB and demonstrate the depth of expertise across the Centre's research community.

LOOKING FORWARD

As we move into the next phase of the CIB's development, we do so from a position of considerable strength. The CIB continues to be recognised internationally for excellence in invasion science, interdisciplinary research, policy engagement, and capacity development. At the same time, we face a rapidly changing environmental landscape characterised by accelerating biological invasions, climate change, biodiversity loss, water insecurity, and increasing demands for science–informed decision–making. Our strategic vision is to build on the CIB's internationally recognised legacy while expanding our contributions to emerging challenges at the biodiversity–climate–society interface. This vision will see us focusing on strengthening Africa–wide research networks, expanding long–term ecological monitoring, advancing marine–freshwater and climate–linked invasion science, enhancing policy engagement and developing practical management solutions that support biodiversity conservation and societal resilience. We will continue to strengthen interdisciplinary research, develop innovative partnerships, support the next generation of scientists, and ensure that our research contributes meaningfully to sustainable environmental futures.

The achievements highlighted in this report reflect the dedication, creativity and commitment of our researchers, students, support staff, collaborators and partners. I extend my sincere appreciation to all who contributed to the success of CIB. Together, we will continue to ensure that the CIB remains a globally recognised leader in invasion science and a catalyst for positive environmental change.

PROFESSOR TATENDA DALU
Director, Centre for Invasion Biology

Insects

REFRAMING INSECT BIODIVERSITY CHANGE THROUGH INTEGRATED EVIDENCE AND PREDICTIVE MODELLING

PROFESSOR CANG HUI
Stellenbosch University

KEYWORDS: Insect biodiversity; biodiversity change; conservation science; ecological monitoring; environmental drivers; evidence synthesis

FULL NAME OF RESEARCH PROJECT:
Global Insect Threat Response Synthesis (GLiTRS)

TEAM MEMBERS:
James G. Rodger [Sol Plaatje University]

ADDITIONAL COLLABORATIONS:
Andrew J. Bladon, Joseph Millard, Zhaoke Dong, Lynn V. Dicks [University of Cambridge]
Rob Cooke, Ellie E. Dyer, Siobhan Edney, Helen E. Roy, Ben A. Woodcock, Nick J. B. Isaac [UK Centre for Ecology and Hydrology]
Charlotte L. Outhwaite, Tim Newbold [University College London]
John F. Murphy, J. Iwan Jones [Queen Mary University of London]
Andy Purvis [Natural History Museum]

Insects provide essential services including pollination, nutrient cycling, pest regulation, and food–web support. However, growing concern over widespread insect declines has highlighted gaps in our understanding of how insect populations are changing and what factors are driving those changes. Existing evidence is often geographically biased, taxonomically incomplete, and based on fragmented monitoring data.

This research produces more robust and actionable knowledge about insect biodiversity change by proposing a framework that integrates multiple forms of evidence, including long–term monitoring, spatial comparisons, experiments, and expert knowledge. Rather than relying solely on population trends, the study demonstrates how combining complementary data sources improve our understanding of ecological drivers and strengthen conservation decision–making.

Global concern regarding insect declines has intensified due to evidence suggesting reductions in abundance, biomass, and diversity across many insect groups. However, scientific understanding remains limited because available datasets are unevenly distributed across regions and taxa, with most long–term monitoring concentrated in Europe and North America. In addition, different studies often produce contrasting conclusions because they rely on different indicators, time periods, and analytical approaches.

The research, undertaken between 2023 and 2025 by an international collaboration of scientists, synthesised existing evidence and identified limitations in current approaches to insect monitoring and assessment. A key insight was that no single source of evidence is sufficient to explain biodiversity change or identify causal drivers. Long–term time–series data provide information on trends but often lack explanatory power. Experimental studies can identify mechanisms but may not operate at realistic ecological scales. Spatial comparisons offer broad coverage but may be influenced by confounding factors. Expert knowledge can help address major taxonomic and geographic gaps but requires careful integration. As an output, the research developed a conceptual

framework that combines these complementary sources of evidence to strengthen ecological inference and support predictive understanding of biodiversity change.

A collage of insects frequenting your backyard in South Africa. From left to right, (1a) Blue emperor *Anax imperator*, (1b) European paper wasp *Polistes dominula*, (1c) *Afronycha picta*; Bottom (2a) Southern green stink bug *Nezara viridula*, (2b) Yellow–banded giant–masked bee *Hyleoides zonalis*, (2c) Cape lappet *Eutricha capensis*, (2d) Orange–winged dropwing *Trithemis kirbyi*. Credits: (1a) Alandmanson from Wikipedia; (1b) Eebee, (1c), Bunder, (2a andb) C Hui, (2c) Magriet B, (2d) Erland Nielsen, from iNaturalist.org; all under CC BY or equivalent license.

This research benefits biodiversity scientists, conservation practitioners, environmental managers, policymakers, and international biodiversity initiatives, including the Kunming–Montreal Global Biodiversity Framework. By improving the evidence base used to assess insect change, the framework supports more effective conservation planning, better–targeted management, and improved capacity to predict future biodiversity responses under environmental change. Ultimately, the work contributes toward safeguarding ecosystem services that support agriculture, natural ecosystems, and human well–being.

The impact of the research lies primarily in its influence on scientific practice and conservation planning. Publication in *Science* (DOI:10.1126/science.adq2110) provided visibility among international audience of researchers, practitioners, and policymakers. The framework is guiding future biodiversity monitoring, improve interpretation of insect trend data, and aid the development of effective interventions. By shifting attention from debates about whether insect declines are occurring toward understanding why changes occur and how responses can be predicted, the study helps build a stronger evidence base for conservation action. The research further contributes to ongoing international efforts to standardise biodiversity monitoring and strengthen ecological forecasting. As part of a wider body of work involving multiple institutions and long–term monitoring networks, the study complements empirical research on insect population trends and environmental drivers while providing an overarching framework for integrating diverse forms of ecological evidence.

Future collaboration will focus on applying the proposed framework to regional and global insect biodiversity datasets, improving predictive models of biodiversity change, and supporting the development of evidence–based conservation strategies. This work will strengthen international collaborations linking biodiversity monitoring, ecological forecasting, and conservation decision–making.

PhD candidate Abusisiwe Ndaba setting a pitfall trap at 1 200 m on the Cederberg transect

TWENTY YEARS OF CHANGE: WHAT INSECTS REVEAL ABOUT A WARMING CEDERBERG

DR CHARLENE JANION–SCHEEPERS
University of Cape Town

KEYWORDS: Climate change; elevational gradients; long–term monitoring; ants; beetles; Cape Floristic Region

STUDENT MEMBERS:
Abusisiwe Ndaba [PhD], Coskun Kucukkaragoz [MSc]

ADDITIONAL COLLABORATIONS:
Mark Robertson [University of Pretoria]
Caswell Munyai [University of KwaZulu Natal]
Lourens Swanepoel [University of Venda]
Nokuthula Mbanyana–Nhleko, Simon van Noort [Iziko Museums of South Africa]
Antoinette Botes, Jeanne Gouws [Cape Nature]
Steven Chown [Monash University]

Long–term monitoring in South Africa's Cederberg Wilderness Area is revealing surprising patterns in how insects respond to climate change. Established in 2002 by Prof. Steven Chown, an elevational transect spanning 2 000 m has tracked ground–dwelling arthropods across 17 sites from lowland Succulent Karoo to mountain fynbos. After a decade of sampling, the survey was revived between October 2022 and March 2025, allowing direct comparison across two time periods separated by 20 years. This long–term dataset supports conservation planning by Cape Nature and contributes to global efforts such as the International Barcode of Life project (BIOSCAN).

The original methods were repeated, using standardised pitfall traps, alongside measurements of temperature, vegetation cover, soil characteristics and fire history
See: https://www.youtube.com/watch?v=E9hvpXWi–kQ.

Across the transect and over 20 years, 114 ant species were recorded, with overall abundance remaining stable once natural year–to–year variation was taken into account. However, community composition changed, with only 44% of species shared between historical and recent surveys, particularly at lower and mid elevations, while ground temperatures increased by approximately 0.7 °C. Contrary to expectations, most ant species did not shift upwards in elevation in response to warming; instead, changes were limited, and where they occurred, species more often moved downslope.

Beetles showed similarly varied patterns. Three common species revealed differed in body size trends over time, suggesting that responses to environmental change depend strongly on species–specific ecological strategies. Overall beetle abundance declined markedly – 47% decrease since 2002. This trend was largely driven by a significant decline in a detritus–feeding species, coinciding warmer temperatures and increases in plant litter and vegetation cover.

Setting the transect for pitfall trap deployment. Site 8, Cederberg.

Together, these findings highlight that insect responses to environmental change cannot be explained by temperature alone. Instead, they reflect the combined effects of climate, habitat structure, resource availability and species traits.

As one of the few long–term datasets from a Southern Hemisphere biodiversity hotspot, this work addresses a major gap in global insect decline research and shows that even where total abundance appears stable, substantial underlying changes in community composition and ecosystem functioning may occur. These insights are directly relevant to conservation management in the Cederberg and to international discussions on biodiversity change.

The project also supported capacity development and knowledge exchange. MSc student Coskun Kucukkaragoz presented his work at the 24th Congress of the Entomological Society of Southern Africa in 2025, and PhD candidate Abusisiwe Ndaba was awarded an international travel grant to present at the International Mountain Conference in Innsbruck, Austria, in September 2025. Since 2022, the project provided training and fieldwork opportunities for three postgraduate students, 40 volunteers and four technical staff.

Twenty years of research and knowledge transfer. From left to right: Dr Antoinette Botes (Regional Ecologist, Cape Nature), Jeanne Gouws (Freshwater Ecologist, Cape Nature), Abusisiwe Ndaba (PhD candidate, UCT) and Coskun Kucukkaragoz (MSc candidate, UCT).

Building on this work, the Cederberg elevational transect will join the newly founded South African Mountain Resilience (SAMBAR) initiative. Together with the other transects (Sani Pass, Principal Investigator Prof. Mark Robertson and Soutpansberg (Principal Investigators Prof. Caswell Munyai and Prof. Lourens Swanepoel) this project will unify taxonomy and by–catch processing across these three transects, now funded for three years by an FBIP Large Grant. See: https://www.youtube.com/watch?v=mHvxi2Dhsrs

A LIST OF REPLACEMENT TREES FOR PLANTING

DR LUKE POTGIETER
Stellenbosch University

KEYWORDS: Safe list; polyphagous shothole borer; PSHB

ADDITIONAL COLLABORATIONS:
Francois Roets, Sabrina Kumschick, John Wilson, Dave Richardson [University of Stellenbosch] Marc Cadotte [University of Toronto], Trudy Paap [University of KwaZulu Natal]

The polyphagous shothole borer (PSHB) is a non–native ambrosia beetle introduced from Southeast Asia to South Africa over 15 years ago. It bores into trees and introduces a fungus. In trees that are susceptible, this fungus spreads through the wood, blocks water and nutrient flow, and kills the tree. The beetle attacks a wide range of hosts (native, non–native, and invasive), and unlike many wood–borers, it will attack healthy trees. Recently established in Cape Town and Stellenbosch, it is killing trees including the iconic oaks of the Western Cape, prompting the demand for replacement trees.

Potgieter et al. set out a transparent, evidence–based way to decide which trees can safely be planted as replacements, which Cape Town Biodiversity managers can use to produce a practical list of safe alternatives.

The inside of a Box Elder which had to be cut down due to the PSHB. You can see some galleries that the beetle made in the wood. Photo credit: Sabrina Kumschick

As invasion scientists, much of our message to the public is about what not to do: which species are invasive, which cause harm, and which activities spread them. In practice, we tell people what not to buy, not to plant, and not to move around. However, people are asking: what can we plant instead?

As a result of the damage caused by the arrival of PSHB, people want to replace infected and dying trees. Ideally, these replacement trees should not be susceptible to PSHB and nor should they be invasives. That is what this study delivers. Potgieter et al. assessed 444 tree species currently planted in Cape Town against national invasive–species regulations, global evidence of invasiveness, and known susceptibility to PSHB. Of these, 85 are already regulated as invasive and may not be planted.

After screening, just 49 species met every safety criterion: not regulated as invasive, not known to have spread beyond cultivation, and not known hosts of PSHB. About two–thirds can already be bought from South African nurseries. The small size of this safe list highlights how limited low–risk options currently are, and the value of a clear, repeatable method for finding them. Importantly, the same approach can be adapted to other cities, countries, and pests.

A key next step is an interactive webpage that guides users in selecting trees based on the criteria assessed, turning the safe list into a practical tool rather than a static table. Keeping it current is priority. PSHB is a recent arrival, and as it spreads it will colonise trees it has not yet been recorded on so, today's "safe" list is a snapshot. The webpage will let us update recommendations as new host records and data accumulate. The same workflow can then be applied beyond Cape Town, and pair with location–based risk maps to give planners site–applicable guidance.

GROUNDED BY THE HEAT: USING BEETLE PHYSIOLOGY TO PROTECT SOUTH AFRICAN FORESTS AND ORCHARDS

PROFESSOR JOHN S. TERBLANCHE
Stellenbosch University

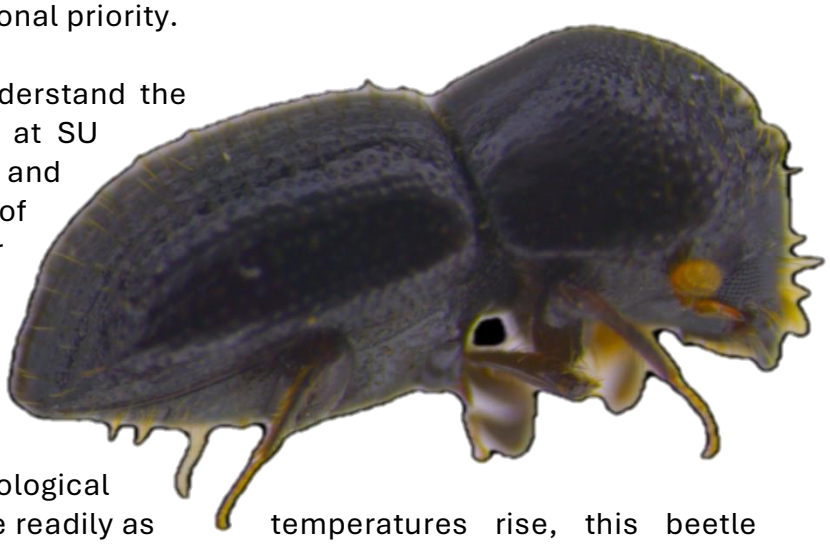
KEYWORDS: Polyphagous shot hole borer; invasive pest; flight performance; wing morphology; temperature dependence; sustainable agriculture

STUDENT MEMBERS:
Bathabile E. Masango [MSc], Anandi Bierman [Postdoctoral Fellow]

ADDITIONAL COLLABORATIONS:
Pia Addison, Francois Roets [University of Stellenbosch]

The Polyphagous Shot Hole Borer beetle *Euwallacea fornicatus* is an invasive threat causing severe economic damage across South African forests and agricultural landscapes.

The global spread of the Polyphagous Shot Hole Borer (PSHB) beetle, alongside its destructive fungal partner, represents one of the most pressing crises in modern forestry and agriculture. First detected in South Africa in 2017, this tiny wood–boring pest has rapidly expanded into eight of the country's nine provinces. The beetle attacks a staggering variety of trees, disrupting the tree's internal water transport network, causing death. The resulting financial and environmental costs to natural forests, suburban areas, and commercial avocado and fruit orchards are immense, making effective containment strategies an urgent national priority.



To combat this invasion, it is essential to understand the movement capacity of the pest. Researchers at SU Department of Conservation Ecology and Entomology evaluated the flight choices of hundreds of adult female beetles under controlled conditions using automated flight mills to measure how temperature and time of day influence the insects' willingness to fly, their speed and endurance.

The results challenged broad entomological assumptions. While many pest insects fly more readily as temperatures rise, this beetle was more active under cooler, milder conditions, peaking between midday and early afternoon; at 35 °C, flight stopped entirely. Digital imaging discovered that beetles that chose to fly had smaller wings relative to their body weight than those that remained stationary. Because small insects dry out easily, the researchers propose that smaller individuals fly during cooler, more humid windows to protect their vital body water and energy reserves.

These findings bridge laboratory science and field management. Because beetle monitoring relies on chemical traps, knowing that flight peaks during cooler midday intervals help managers to interpret trap counts and place devices where they will capture active populations most efficiently.

This research has been translated into project briefings, presentations, and direct industry correspondence with agricultural stakeholders, establishing immediate practical field protocols, for example, timber managers are now advised to fell infested trees in the morning or on exceptionally hot days when the beetles are grounded, thereby reducing the risk of pests escaping to nearby healthy trees.

Future research will measure the beetles' wingbeat frequencies to see how smaller wings compensate in cool air, and model energy and water balance constraints across environments – directly incorporating these climate variables into regional risk maps to forecast long–term invasion pathways.

THE INVASIVE LADYBEETLE *HARMONIA AXYRIDIS* SERVES AS A USEFUL MODEL TO EXPLORE THE INTERACTIONS BETWEEN CLIMATE CHANGE AND BIOLOGICAL INVASIONS IN SOUTH AFRICA AND BEYOND

PROFESSOR SUSANA CLUSELLA–TRULLAS
Stellenbosch University

STUDENT MEMBERS:
Tania Pogue [PhD], Perry Richardson [PhD], Bridget O'Connor [PhD]

ADDITIONAL COLLABORATIONS:
Sylvain Pincebourde [CNRS and University of Tours, France]
Dalene Vosloo [University of KwaZulu–Natal]

This project examines the responses of a global invasive ladybeetle, *Harmonia axyridis* f. *succinea* – listed among the world's 100 worst invasive alien insects for its negative effects on native ladybeetles and crops –to environmental change. We focus on two questions: 1. Does a flexible phenotype enhance the persistence of this beetle in changing climates? 2. By examining the temperature sensitivity of multiple traits and gathering information on microsite temperatures relevant to the species, can we improve current frameworks aiming to predict their further invasion risk and persistence in warming scenarios?

PhD student Bridget O'Connor reared hundreds of beetles under controlled temperatures to assess the locomotor performance across life–stages and temperature regimes, providing valuable information on its acclimatory capacity and ability to disperse.

In terms of plasticity, we have examined how exposure to temperature in the short term (i.e., a few days of acclimation) and longer term, such as during development, affects the phenotype of this species. We have demonstrated that the beetle's cuticle melanisation (i.e. dark coloration) tracks environmental conditions in the field and supports a thermoregulatory function, at least for some periods of the year. Furthermore, males and females differ in the extent of cuticle darkness across seasons, suggesting that the drivers of colour variation within and across generations per sex are dictated by multiple factors besides temperature. In addition, we demonstrated that adult beetles could acclimate to several days of temperature exposure, driving changes in locomotory performance. These shifts highlight the fast adaptability and dispersal capacity of this invasive species.

Invasion risk assessments under climate change scenarios rely on thermal sensitivity, how the performance of individuals changes across temperatures. however, these assessments often focus on single traits or use coarse–scale climate data that do not reflect field conditions.

To address this challenge, the project has generated extensive data on the temperature dependence of multiple traits, including biochemical, physiological and life–history traits, and collected fine resolution microclimate data for two years. By combining these datasets as well as the adaptive plastic capacity of this beetle, we should improve the ability to predict the spread of invasive insects into novel areas and climates, and their potential impacts.

Students on this project earned several Best Presenter Awards: Perryn Richardson at the Symposium on Statistical Ecology and Quantitative Biology 2025 and at the SU Science Faculty Postgraduate Conference; Bridget O'Connor at the 24th Congress of the Entomological Society of Southern Africa. Bridget O'Connor also received the ESSA 2025 Young Entomologists Essay prize on the writing of the role of AI in academic and industrial entomology. Tania Pogue and Perryn Richardson participated in a climate change awareness campaign with the Western Cape Government and Stellenbosch Academy of Design and Photography, further enhancing their communication and outreach skills.
See: https://museumstories.co.za/climate–change/

Assessing functional and performance traits of invasive species across a broad temperature range is more informative than scoring mortality limits, because survival thresholds do not incorporate a holistic understanding of individual fitness measures which can be modelled and scaled up to populations, including growth and potentially population dynamics. The next steps are to publish several outputs from these different lines of enquiry and continue engaging managers and stakeholders. Our research provides insights into this invader's local and broader impacts and illustrates how a mechanistic approach can better predict invasive species' persistence in changing climates.

Risk assessment

MAPPING IMPACT RISK OF ALIEN SPECIES

PROFESSOR SABRINA KUMSCHICK
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KEYWORDS: Impact indicator; risk assessment; acacia; wattle

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Mathieu Rouget, Antoine Becker-Scarpitta [CIRAD, La Réunion],
Christophe Botella [INRIA, Université de Montpellier]

As humans we want to know how things we are interested in change over time. This is most prominent with money and finances, exemplified in the indices provided by the stock market like the Dow Jones Index. What if we are instead interested in biodiversity, and pressures threatening it?

This work describes a novel way to map the impact risk of alien species, and to assess impact indicators for species, sites, and regions. Unlike other indicators for biological invasions which mainly focus on species distribution and richness of alien taxa, this indicator accounts for species' impact, using data collated with the Environmental Impact Classification for Alien Taxa (EICAT) framework – a global standard for impact assessment, which enables the comparison of different impacts across taxa and regions.

Tracking biological invasions and their effects over time requires certain indicators. Imagine you are interested in the state of your national park, especially concerning the alien species present there. You want to know what species are there, how widespread they are, and where the most damaging species are located. The suggested indicators can help identify high–impact species, as well as sites and regions which are at high risk. Using wattles (Acacias), introduced to South Africa as a case study to test various options of calculating an impact indicator, the suggested indicators described the assumptions upon which these different choices in variables are based. That alone was a very useful exercise, providing many people are using EICAT impact data without specifically explaining the implications of the variables they chose.

A fully described workflow enables easy reproduction of the work, which is further simplified by a ready–to–use and free R package. For species distribution records, it draws on data from the Global Biodiversity Information Facility (GBIF), making the whole approach open and accessible.

We are working towards integration of the indicators and workflows adopted into the South African Status Report on biological invasions. Together with the South African National Biodiversity Institute (SANBI), we have made adjustments to make the indicators more suitable to the national and local context. Furthermore, people around the world are gathering data for many alien taxa using EICAT, which contributes to the global, standardised database on impacts of alien taxa and the easier implementation of the indicator workflow.

Vertebrates

WHAT THE OTTER KNOWS – TWO ELUSIVE PREDATORS COULD BECOME EARLY-WARNING SENTINELS FOR RIVER HEALTH AND AQUATIC INVASIONS IN THE KRUGER NATIONAL PARK

PROFESSOR MICHAEL J. SOMERS

University of Pretoria

KEYWORDS: Biological invasions; biological indicators; red claw crayfish, African otters; health; DNA metabarcoding

RESEARCH PROJECT:
Otters as biological indicators of freshwater ecosystem health and sentinels of aquatic invasions in the Kruger National Park.

STUDENTS: Mmatsawela Ramahlo [Postdoctoral Fellow]

TEAM MEMBERS:
Andre Ganswindt [University of Pretoria]
Dumisani Khosa [SANParks]
Josie Pegg [SANParks and Organisation for Tropical Studies]

ADDITIONAL COLLABORATIONS:
South African National Parks [SANParks]; South African National Biodiversity Institute [SANBI]; University of Mpumalanga [UMP]; Department of Forestry, Fisheries and the Environment [DFFE]

South Africa's rivers face mounting pressure from drought, pollution, growing demand and increasing invasive species. Even in flagship protected areas such as the Kruger National Park (KNP), monitoring hundreds of kilometres of river is slow, costly and dangerous. This project asks whether two elusive predators can do some of that monitoring for us. African clawless otters (*Aonyx capensis*) and spotted–necked otters (*Hydrictis maculicollis*) are near the top of the freshwater food chain, so what they leave behind in their faeces reflects what is in the river. By reading the DNA in otter scats, the team can detect what otters eat, including invaders such as red claw crayfish (*Cherax quadricarinatus*), showing where this invader is spreading and how frequently it appears in the diet of a native predator, without surveying entire river systems. The work offers managers a cheaper, safer and less invasive way to monitor ecosystem health and invasions, while shedding light on two poorly studied native otter and invites the public to take part through a new citizen–science app.

Few freshwater invaders worry managers more than the red claw crayfish, which is spreading through South African rivers and has recently reached the KNP. Tracking it across so vast a park is hard, and part of the answer may lie with otters, which are likely to eat them where they co–occur. Otters are notoriously hard to study: shy, mostly nocturnal and thinly spread. There is still no published research on them in the Limpopo region; the last survey there was an informal count along the Sabie River (Somers and Kruuk, 1993). Yet both otter species occur in the KNP's rivers, offering a way to assess freshwater condition through predator diet.

Searching for otter signs along a KNP riverbank. Mmatsawela Ramahlo inspects exposed tree roots and bank–side latrines where otters deposit scats.

In 2025, the project was implemented across five perennial rivers in the park: the Luvuvhu, Letaba, Olifants, Sabie and Crocodile. Each carries a different human influence - the Olifants runs past a large phosphorus mine, the Crocodile drains farmland, towns and villages sit upstream of others, and the Sabie is more tightly managed through private concessions, making these rivers a natural laboratory for examining how human pressure and invasive species affect them and their biodiversity.

Otters are opportunistic, eating a broad cross–section of what lives in a river, but preferring crustaceans and fish. DNA metabarcoding of otter scats matches prey fragments against genetic reference libraries and read the river's food web in detail, including soft–bodied prey that traditional methods miss. It can flag invasive species such as the red claw crayfish from a single scat, reducing reliance on costly whole–system surveys. Although otter–diet metabarcoding is gaining ground in Asia, Europe and the Americas, this appears to be the first time it is being applied to otters anywhere in Africa.

Aquatic sampling during the 2025 KNP river surveys. Mmatsawela Ramahlo carries a sampling bucket and dip–net between sites; the otter work runs alongside broader freshwater biodiversity monitoring across the park's perennial rivers.

During 2025, the team created SA Otter Spotters, a web–based citizen–science app, backed by posters with identification tips, a web link and a QR code, so rangers and visitors can log their sightings and help map where otters occur. The team also partnered with a SANParks camera–trap study, deploying camera traps in December 2025, a collaboration that shares water–quality data and game–guard support and substantially lowers fieldwork costs. The app will be launched once ethical approval is granted.

By establishing otters as living indicators of freshwater health, park monitoring can become minimally invasive and use little labour. The work will deliver the first baseline map of otter distribution in the KNP, and of where they are eating red claw crayfish, plus a technical report and management recommendations for SANParks that feed directly into freshwater biodiversity planning and the early detection of aquatic invaders.

Over the next two to five years, the team aims to complete otter diet analyses across the KNP's rivers and neighbouring Limpopo farmland, and deliver distribution maps, management recommendations, and peer–reviewed papers.

A HOP, A SKIP AND A JUMP: WHAT IS REQUIRED TO PROTECT SOUTH AFRICA FROM THE IMPACTS OF THE AMERICAN BULLFROG?

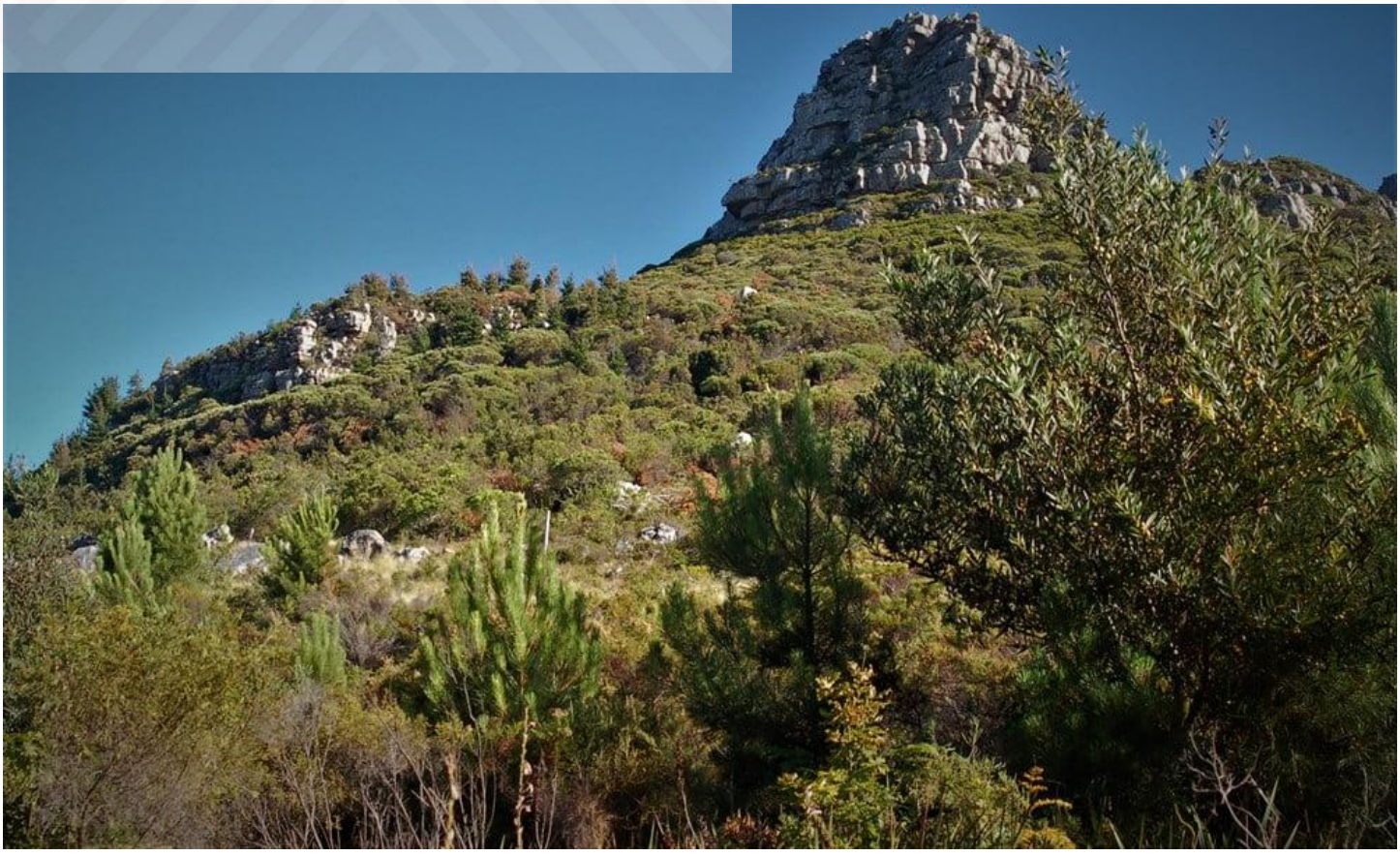
DR SARAH J. DAVIES
Council for Scientific and Industrial Research

KEYWORDS: Risk analysis; introduced amphibian; aquatic invader

South Africa has world–leading legislation addressing the impacts of invasive alien species on biodiversity and society. The implementation of the legislation depends on scientific advice being made available in a standardised, digestible form for policymakers. To this end, the Risk Analysis for Alien Taxa framework was developed. Risk analyses conducted, using this framework, on the American Bullfrog (*Aquarana catesbeiana*) provide advice on how to prevent and manage new introductions on potentially damaging species and reduce conflict between scientists, government and industry. In this study, a literature and data review was used to make recommendations on the listing category of American Bullfrog in the National Environmental Management: Biodiversity Act (regulations under Chapter 5). The impacts, should the species enter South Africa and/or become established here, were assessed. Although it is native to only three countries (USA, Canada and Mexico) the taxon now occurs in over thirty countries on five continents; only Africa does not host established populations. Should it establish in South Africa, it could find suitable habitats in water–rich natural and human–modified areas of the sub–tropical regions of the east coast and hinterland. Being larger than the majority of South African frog species, it could disrupt native frog populations through predation, competition and potential disease transmission (e.g. chytrid fungus, *Batrachochytrium dendrobatidis*).

Bullfrog *Lithobates catesbeianus*. Photo by Carl D. Howe, https://commons.wikimedia.org/w/index.php?curid=528421

Plants



THE ECONOMIC COSTS OF THE INVASIVE CACTUS *OPUNTIA STRICTA* IN AFRICA

PROFESSOR BRIAN VAN WILGEN
Stellenbosch University

KEYWORDS: Biological control; cactus; CLIMEX; economic cost; Kenya; rangelands

Invasion by a single cactus species on a single ecosystem service (grazing for free–ranging livestock) could cost USD 307 billion if not addressed. Fortunately, solutions are available in the form of biological control. Several cactus species were introduced to Africa from the Americas for ornamental purposes, fodder production, or as living fences. Once established, many have spread rapidly, into dense stands that outcompete indigenous vegetation for space, water, and nutrients, reducing biodiversity, altering grazing habitat and impeding wildlife and livestock movement. In arid and semi–arid regions, invasive cacti can modify ecosystem processes by changing patterns of resource availability and vegetation composition. Although some species provide benefits such as drought–resistant fodder and fruit for wildlife, their overall impact is mostly negative, prompting, extensive biological control and management programmes to reduce their spread.

Researchers at the CIB, in collaboration with CABI in Nairobi and CSIRO in Australia estimated the amount and value of grass forage rendered inaccessible to livestock by the invasive cactus Opuntia stricta. Its dense spiny thickets, with is sharp spines and detachable glochids that injure animal's mouths, eyes, skin, and hooves, cause cattle to avoid heavily invaded patches. As the cactus spreads, displaces forage grasses, the loss of grasses was estimated at 4.08 tonnes per hectare on average.

The study was based on an eco–climatic model and assumed that the cacti would invade a conservatively estimated proportion of climatically suitable areas across Africa. The study then used plausible scenarios of rate of spread and area likely to be invaded over the next 50 years, to extrapolate the value of lost grass forage to the rest of Africa and estimated that an area of 682 000 km^2 (2.3 % of sub–Saharan Africa) is at risk of invasion.

The current worth in today's money of a future stream of cash flows, discounted at an appropriate rate of return (i.e. the present value of losses in economic terms) arising from lost forage in sub–Saharan Africa over the next 50 years was estimated to be USD 307 billion, assuming an annual spread rate of 10% and a discount rate of 5%.

These impacts could be avoided at a fraction of the cost if widespread use could be made of biological control, the cochineal insect *Dactylopius opuntiae* already released in South Africa and Kenya, where it effectively controls the sour prickly pear.

An invasive cactus plant showing the abundance of grass which is inaccessible to livestock in an otherwise overgrazed area in Kenya. Photo credit: Arne Witt).

Despite the low control costs, relative to the potential damage, most African countries are unlikely to have the financial resources to introduce, rear, release and disseminate the cochineal. This points to the need for governments or international development or environmental agencies to fund such projects for significant livelihood and environmental benefits.

BRIDGING THE GAP BETWEEN KNOWING AND DOING: EXPLORING A RESTORATION CASE STUDY

PROFESSOR KAREN ELSER
Stellenbosch University

Evidence–based practice rests on the systematic finding, appraisal and use of evidence of effectiveness of a specific intervention in decision–making. In conservation and related fields such as ecological restoration, 'evidence' has largely been taken to only mean 'scientific or research evidence'. The science–practice gap, also known as the knowing–doing or research–implementation gap, is a hindrance to evidence–based restoration and conservation. While there are multiple drivers behind this gap, and many potential solutions proposed, most solutions focus on mainstreaming scientific information and knowledge into practice, which implies a one–way relationship between research and practice.

In our case study, a long–term research–implementation collaboration with the City of Cape Town, we have challenged this assumption. We have demonstrated that information generated through an active researcher–practitioner partnership, researching practical restoration issues, can also be valuable in bridging the knowing–doing gap. A YouTube video highlights this work: https://www.youtube.com/watch?v=Aq–vure6oUA. Over time, many scientific papers have emerged from our Lowland Restoration research work. These are the scientific outputs that have explored real questions often raised by the city practitioners.

WHEN RIVERS SPREAD INVADERS: ALIEN PLANT INVASION PATHWAYS AND IMPACT HOTSPOTS IN KRUGER'S SAVANNA

DR LLEWELLYN FOXCROFT
South African National Parks

KEYWORDS: Dispersal; ecological impact; Kruger National Park; riparian; savanna conservation

RESEARCH PROJECT:
Rivers as drivers of plant invasions in an African savanna: integrating invasiveness and impact across spatial and temporal scales

STUDENTS:
Khensani Nkuna [PhD]

TEAM MEMBERS:
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Jaco Le Roux [Macquarie University]
Ana Novoa [Estación Experimental de Zonas Áridas]

ADDITIONAL COLLABORATORS:
South African National Parks, Czech Academy of Sciences, Charles University, Macquarie University, Estación Experimental de Zonas Áridas–Consejo Superior de Investigaciones Científicas, Universidade de Vigo

Rivers are among the Kruger National Park's most important ecological features, sustaining life through the dry season, forming riparian corridors, connecting habitat, and linking the park to the wider landscape. This research examined how rivers act as pathways for invasive alien plants, and how riverbed habitats become susceptible to their impacts. It tests the premise that impact is not a simple story of 'alien plant equals ecological collapse'. Very often the importance of an invasive alien species is inferred from its abundance and associated assumption of it causing harm. The major challenge, however, arises when the number of invasive species and the extend of the area invaded, outstrips the resources to manage everything.

The work focused on three annual invaders – parthenium (*Parthenium hysterophorus*), downy thorn–apple (*Datura innoxia*) and cocklebur (*Xanthium strumarium*) – across three interconnected layers: below ground components, surface vegetation and herbivory.

All three species changed plant and below–ground community composition to varying degrees. Parthenium, however, had the greatest effect across all the indicators measured, including reducing native plant richness and altering soil conditions. This evidence helps managers move from asking 'where are alien plants present' to 'where are they causing the greatest ecological change, and what ecological roles or impacts are they exerting'.

The Kruger's large rivers are important pathways of invasion, carrying alien plant seeds from outside the park. The naturally dynamic rivers disperse the seeds downstream, depositing them across riverbeds, sandbanks, riparian habitats, an in nutrient–rich disturbed open space ideal for establishment.

Image from a camera trap of impala feeding at a site invaded by *Xanthium strumarium*. (©Invasive species impact research project photograph)

Parthenium, downy thorn–apple and cocklebur, which are easily dispersed and form dense seasonal patches along rivers, are some of the most widespread species in Kruger. To assess their potential ecosystem–wide impact, twelve populations of each were selected and paired invaded–uninvaded plots established, where the team measured changes in native plant communities, soil nutrients and enzymes, soil microbes and herbivore use or avoidance of invaded areas.

Invaded riparian communities generally had lower richness, diversity and evenness than uninvaded communities, with the strongest negative effect linked to parthenium. All three species studied, changed the native species composition, and native species richness also decreased with increasing invader cover, though the species richness of other alien were not negatively affected.

Below–ground changes matter because soil microbes and enzymes help regulate nutrient cycling, soil structure and the recovery of native vegetation after disturbance. The results are complex and difficult to disentangle. Invaded soils differed from uninvaded soils in bacterial and fungal community composition. Parthenium was associated with higher soil carbon and phosphorus, reduced microbial and reduced bacterial richness. Downy thorn–apple produced strong shifts in microbial composition and likely microbial functions, while cocklebur showed more selective effects on enzyme activity and fungal diversity.

The Letaba River showing mixed patches of cocklebur and native vegetation in the foreground, while the areas in the background are completely invaded by cocklebur. (Photograph by LC Foxcroft)

The herbivore work is still developing, but early camera–trap results suggest that some large herbivores, including elephant, buffalo and waterbuck, may avoid areas invaded by cocklebur, while others such as hippo, impala and kudu appear less selective. Further interesting questions are also emerging, for example, impala may still be able to utilize patchily invaded sites and are able to select for preferred forage species in–between the invasive species. DNA–based diet analyses indicate that the three invasive plants made up very little of the diets of the herbivores studied. Generally, however, densely invaded patches may therefore occupy valuable grazing space without providing equivalent forage.

Continued collaboration will refine the findings on soil, microbial processes, and herbivore responses. A synthesis will be developed into practical guidance for prioritising species with the highest impacts, and in priority areas to focus monitoring and management in Kruger National Park.

GETTING A HANDLE ON PLANT INVASIONS IN URBAN ECOSYSTEMS GLOBALLY

PROFESSOR DAVE M. RICHARDSON
Stellenbosch University

KEYWORDS: Invasive plants; plant invasions; urban ecology

STUDENTS:
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ADDITIONAL COLLABORATORS:
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Petr Pyšek [Czech Academy of Sciences]
Rafael D. Zenni [Universidade Federal de São Carlos]

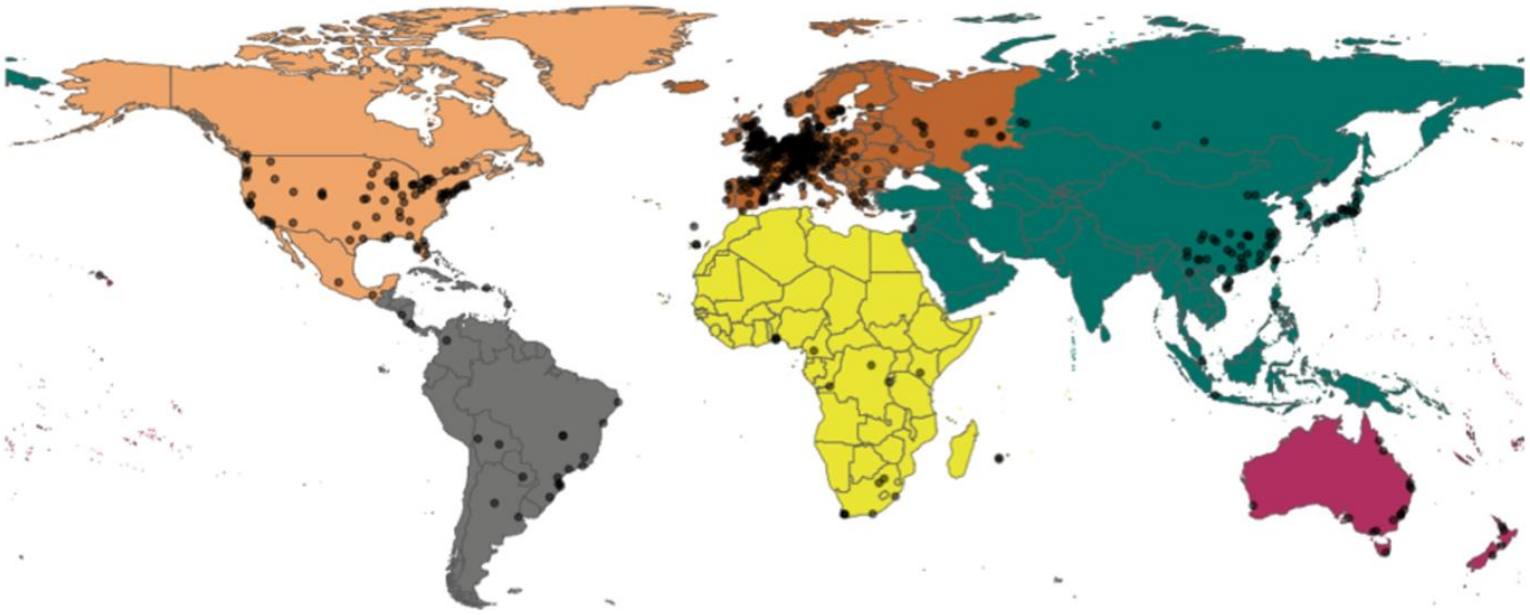
In November 2016, the CIB hosted an international workshop on non–native species in urban environments, which lead to a special issue of the journal *Biological Invasions* (Volume 19, 12; https://tinyurl.com/yahkehkh) and several substantial international collaborations. The most productive is the Global Urban Biological Invasions Consortium (GUBIC) which was launched at the 2016 workshop.

GUBIC refers to both the Global Urban Biological Invasions Consortium and Compendium – the most up–to–date and extensive database of non–native urban floras assembled to date. The compendium contains records of 8 140 established non–native plant species representing 253 families, spanning 553 urban centres across 61 countries. It harmonises plant occurrence data from multiple sources, including published literature, data repositories like Dryad, the Urban Biodiversity Research Coordination Network (UrBioNet), and the Global Biodiversity Information Facility (GBIF). The purpose of the compendium is to fill critical foundational data gaps regarding which non–native species occur in cities globally. The decade–long work on compiling the compendium were provided in a data paper (Li et al. 2025) that was co–led by CIB post–doc Dr Luke Potgieter.

The first application of the GUBIC compendium was also published in 2025. Led by CIB core team member Dave Richardson, aimed to identify the world's most widespread naturalised urban plant species, to determine whether cities on different continents shared the same naturalized non–native plant species, and to uncover their geographic origins. By filtering the GUBIC database, the study identified 302 'omnipresent' species – those that occur on all six inhabited continents.

A key product was an objectively defined list of the 96 most common naturalised plant species found in urban centres globally. This list is a valuable resource for coordinated monitoring, control global management planning. The study also coined the term 'urban florome' to define the characteristic global assemblage of naturalised non–native species that distinguishes urban ecosystems from other environments, a concept that helps us understand human–plant associations and how history and socio–economics shape urban biodiversity.

The GUBIC collaboration has been highly productive and has provide a springboard for substantial further collaborators on the increasingly important theme of biological in urban areas.



GUBIC project and collaborators

Prof. Dave M. Richardson with recent MSc graduate Mr Chris P. Gildenhuys and parents at the March 2026 graduation ceremony.

Aquatic Ecosystems

INVASION DYNAMICS AND FUNCTIONAL RESPONSES OF MACROINVERTEBRATE ASSEMBLAGES IN THE NOTWANE RIVER, BOTSWANA

PROFESSOR FRANCIS O. ARIMORO
University of Botswana

KEYWORDS: Biological invasions; freshwater macroinvertebrates; ecosystem functioning; functional feeding groups; Botswana

RESEARCH PROJECT:
Invasion dynamics and functional responses of macroinvertebrate assemblages in the Notwane River, Botswana

STUDENTS:
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TEAM MEMBERS:
Gaolethe Tsheboeng, Kelemogile Mmolawa [University of Botswana]

ADDITIONAL COLLABORATIONS:
Tatenda Dalu [Stellenbosch University]

Biological invasions are a major driver of freshwater ecosystem change, particularly in rivers exposed to human disturbance. This study investigated how invasive macroinvertebrates are restructuring ecological communities in the Notwane River, Botswana.

The results showed that invasive and disturbance–tolerant taxa including freshwater gastropods such as *Physella acuta* and *Melanoides tuberculata* are becoming dominant in nutrient–enriched sections influenced by wastewater discharge and agricultural runoff. As grazers and detritivores, they altered biofilm dynamics and nutrient cycling while displacing native species. Their proliferation was associated with reduced abundance of sensitive taxa such as Ephemeroptera and Trichoptera, indicating ecological degradation and functional simplification of the system.

The study provides baseline evidence of invasion–driven change in semi–arid African river systems that is directly relevant for water resource managers, supporting the development of biomonitoring tools and mitigation strategies.

Freshwater ecosystems across Africa are increasingly shaped by the dual pressures of biological invasions and anthropogenic disturbance, yet their coupled effects remain poorly resolved in semi–arid river systems. This research examined invasion dynamics within macroinvertebrate assemblages of the Notwane River by explicitly linking taxonomic shifts to functional reorganisation along gradients of nutrient enrichment and urban influence. Sampling across sites representing distinct disturbance regimes revealed consistent invasion signatures, whereby deteriorating water quality conditions were associated with predictable restructuring of community composition and ecological function.

A total of 1 687 macroinvertebrates from 31 genera were recorded, dominated by pollution–tolerant opportunistic taxa. Freshwater gastropods, notably *Physella acuta*, *Melanoides tuberculata*, and

Radix Auricularia – form the principal invasive guild, taxa characterised by high fecundity, rapid parthenogenetic reproduction, and broad tolerance, allowing them to exploit nutrient–rich and anthropogenically modified habitats.

Prof. Francis Arimoro guiding students during river sampling.

At a functional level, these taxa exerted disproportionate influence relative to their diversity. As dominant grazers and detritivores, invasive gastropods such as *Physella acuta* and *Tarebia granifera* intensified periphyton removal and detrital processing, redirecting energy flow toward simplified, detritus–based pathways and reduced functional redundancy. The potential establishment of higher–order invaders such as *Cherax quadricarinatus* further represents a critical invasion frontier, given its role as a predator and ecosystem engineer capable of restructuring benthic habitats and disrupting existing trophic linkages. These invasion patterns were strongly mediated by physicochemical gradients: elevated nutrient concentrations, higher electrical conductivity, and reduced dissolved oxygen, particularly in reaches influenced by wastewater discharge created environmental filters favouring invasive and tolerant taxa over sensitive groups. Consequently, Ephemeroptera and Trichoptera, declined markedly, while Chironomidae and invasive gastropods became dominant, a clear trajectory of invasion–mediated biotic homogenisation.

The ecological consequences of this transition are profound: replacing diverse, functionally complementary assemblages with a narrower set of resilient taxa alters nutrient cycling pathways, reduces habitat heterogeneity, and weakens ecosystem. Functional feeding group structure shifted

toward collector–gatherers and grazers, indicating an ecosystem increasingly reliant on detrital energy pathways and less capable of sustaining complex trophic interactions. More broadly, by integrating community composition, functional traits, and environmental drivers, this study provides mechanistic insight into how invasive macroinvertebrates exploit disturbed ecosystems and accelerate biodiversity loss. It reinforces the growing consensus that invasion impacts are not isolated phenomena but are amplified by land–use change and nutrient enrichment.

From an applied perspective, this work supports embedding invasion biology within freshwater biomonitoring frameworks. It highlights the necessity of managing nutrient inputs and hydrological disturbance to constrain invasion success and preserve ecological integrity. The findings have informed academic and institutional engagement, toward evidence–based freshwater management in Botswana.

Future work will quantify invasion thresholds, integrate molecular tools to detect cryptic invasive taxa, and develop a functional, invasion–sensitive biomonitoring index for Botswana's rivers, strengthening collaboration with CIB to address biological invasions across southern African freshwater ecosystems.

CederDiv team which are part of a long-running research project that investigates arthropod diversity along an altitudinal gradient in the Cederberg Wilderness Area of South Africa

THE TRADE-OFF BETWEEN PROMOTING NATIVE AND INVASIVE SPECIES THROUGH RIVER CONNECTIVITY RESTORATION

DR ROSS CUTHBERT
Queens University Belfast

KEYWORDS: Connectivity conundrum; dam; freshwater; restoration; weir

STUDENTS:
Ellen J. Dolan [PhD]

Freshwater ecosystems are among the most threatened globally, with habitat fragmentation and biological invasions as two major drivers of biodiversity loss. Man–made dams and weirs fragment rivers, interrupting water flow, sediment transport, and nutrient turnover, and reducing the movement of species which can lead to isolated populations, injure and delay for migratory species, and reduce habitat. Removal of these artificial barriers is increasingly promoted for restoration to provide benefits for native species, but reconnecting rivers may also spread invasive species, a dilemma known as the 'connectivity conundrum' (Dolan et al., 2025).

Low–head dam removal from River Hiitolanjoki, Finland, in 2023. Photographed by Mikko Nikkinen – Storymakers

Beginning in the United States and expanding to Europe, governments and NGOs have set ambitious targets for barrier removal efforts. The Kunming–Montreal Global Biodiversity Framework aims to restore and conserve more than 30% of Earth's surface, prioritising reconnected river networks and

wetlands. Similarly, under the EU Biodiversity Strategy, member countries intend to restore more than 25 000 km of rivers to their free–flowing state by 2030. As these projects grow and spread, research is critical to ensure efficient, sustainable strategies.

Despite the growing popularity of barrier removals, uncertainty remains regarding its consequences for biological invasions. While reconnecting rivers can improve dispersal opportunities for native species, it may also allow invasive species to expand into previously inaccessible reaches. If left unmanaged, invasive species can feed on, compete for food/space, and spread disease to native species within newly restored habitats. Understanding this trade–off is essential for ensuring that restoration achieve their intended outcomes.

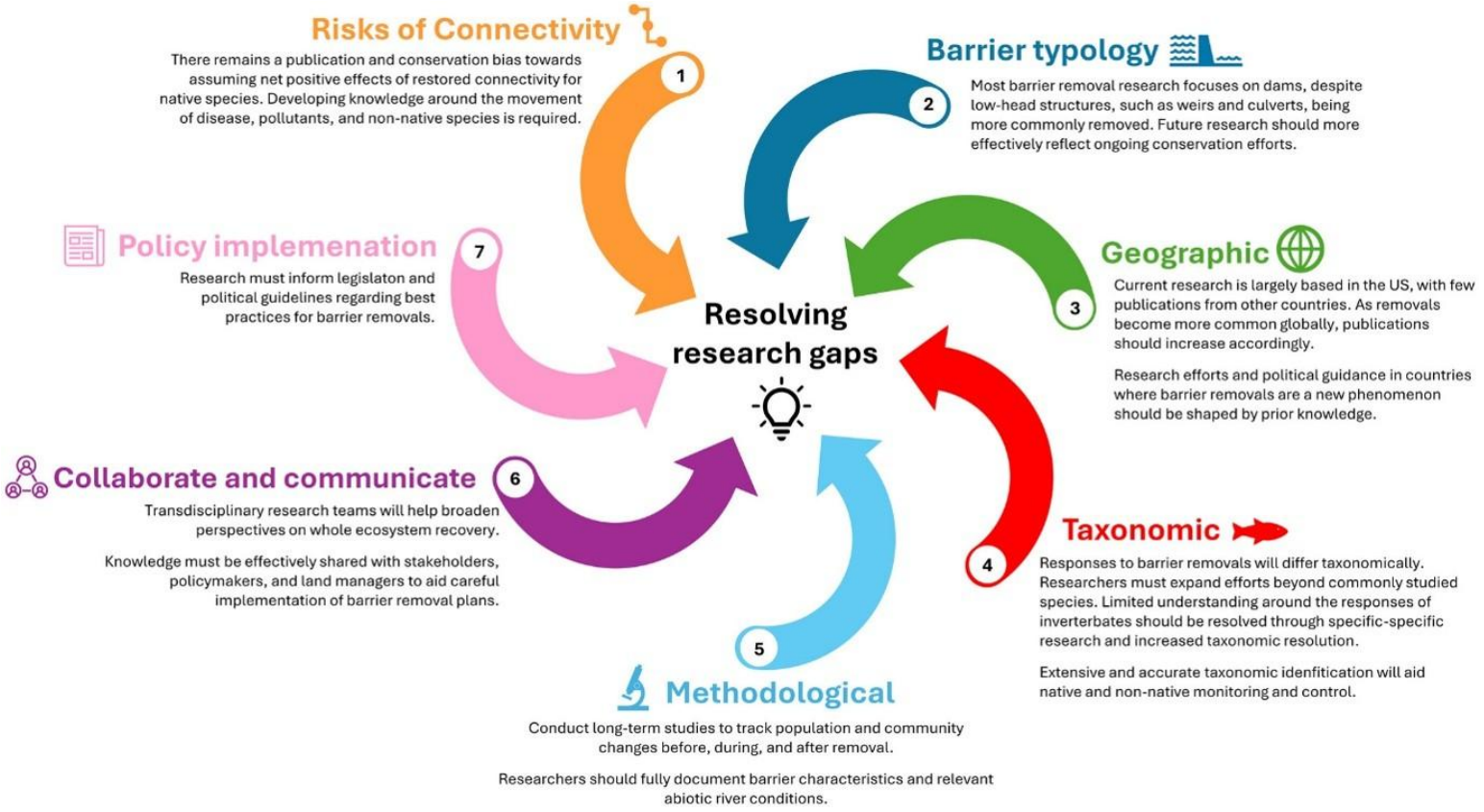
Through a global systematic review and meta–analysis (Dolan et al., 2026), we evaluated how native and invasive populations respond to barrier removals. Synthesising 45 studies across countries, taxa and barrier types. continents, taxonomic groups, and barrier types, and responses from fish, aquatic invertebrates, and aquatic plants. We initially uncovered a publication bias, with many studies centred around fish and dam removals. We found no publications that assessed the response of barrier removals on native invertebrates, and very few which explored invasive invertebrates. This imbalance reflects biases in wider ecological literature and is likely due to taxonomic identification challenges.

Overall, restoring connectivity benefitted native species more than invasive species. Although, responses varied among taxonomic groups, direction from the barriers, and diverged with time since barrier removal. Benefits for native taxa appeared within the first years, suggesting that connectivity recovery can rapidly support biodiversity conservation. Fish and plant communities generally showed stronger native recoveries and weaker invasive species responses, whereas invasive invertebrates showed a substantial increase after barrier removals.

Our results show that restoration outcomes are context–dependent, so invasion risk must be considered alongside conservation benefits in future removal projects. Barrier removals can deliver substantial ecological benefits, but success requires consideration of entire ecological communities rather than simply targeting socioeconomically important species. Incorporating monitoring and control of invasive species into restoration planning will help to minimise unintended ecological consequences.

As ecologically motivated barrier removals expand into new countries, early consideration of best–practice frameworks will pay off. This will be relevant to regions where rivers are heavily modified and already support numerous invasive freshwater species. To develop evidence–based decision–making, the research gaps that we highlight across barrier type, geography, taxonomy, and methodologies must be met, specifically, long–term monitoring upstream and downstream of the former barrier must target all life stages, taxa and invasion statuses.

We recommend that collaboration and clear communication among engineers and researchers guide the implementation of invasive species control into barrier removal projects. However, due to variations in invasion risk, propagule pressure, barrier designs, abiotic river conditions, and ecological community structures, the decision to remove a barrier must be made on a case–by–case basis, and efforts to monitor and control invasive species should remain ongoing priorities after removal.



Our recommended future directions of research regarding ecological responses to riverine barrier removals, from Dolan et al. (2026)

We encourage expansion of the connectivity conundrum concept beyond invasive species and into other forms of habitat fragmentation restoration. As reconnection of fragmented habitats continues to be encouraged across systems globally, the risks of the movement of pollutants, disease, invasive species, as well as changes in conditions due to climate change must be examined.

The demolition of the Copco 2 Dam in northern California. Photo credit: Shane Anderson and Swiftwater Films

MANAGING INVASIONS IN PROTECTED AREAS

PROFESSOR TAMMY ROBINSON–SMYTHE
Stellenbosch University

KEYWORDS: Citizen science; detections; marine alien species; monitoring; South Africa

STUDENTS:
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Emily McCulloch–Jones [Anchor Environmental Consultants]
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Ana Novoa [Czech Academy of Sciences]
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Thomas Therriault [Fisheries and Oceans Canada]

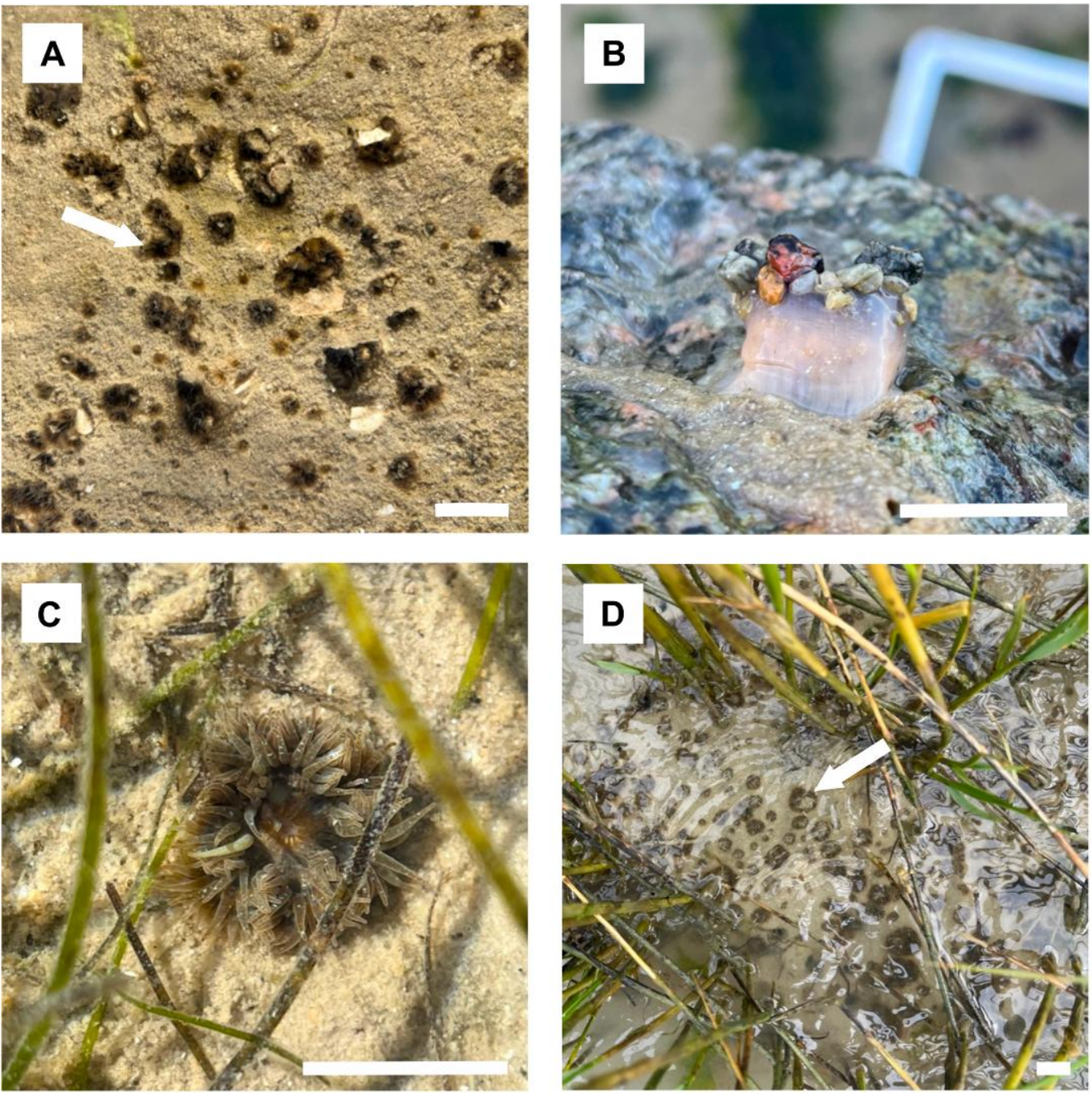
Marine alien species threaten biodiversity, ecosystem functioning and the services provided by coastal and marine environments. The Robinson Marine Lab works to improve the detection, identification and understanding of invasions across southern Africa, strengthening monitoring practices and providing evidence–based data to support conservation across marine habitats. Collectively, this work contributes to protecting marine biodiversity, in turn protecting the ecosystem services provided from such intact systems.

Accurate species identifications are fundamental to biodiversity management, as they provide the basis for understanding ecological interactions, assessing invasion risk and informing conservation planning. A key component of the work has been detecting and documenting previously unrecorded marine alien species in South Africa. The identification of the invasive bryozoan *Membranipora membranacea* in False Bay highlighted the importance of ongoing monitoring in marine environments as this species negatively impacts kelp forests causing mass mortality. This changes ecosystem structure and function and enables the establishment of other non–native taxa. Traditional taxonomy and genetics also confirmed the presence of the daisy anemone *Cereus pedunculatus* in the Langebaan Lagoon, its first record outside of its native European range.

The project also contributes to broader ecosystem assessment, with the first systematic field surveys for alien species undertaken in South African kelp forests. These recorded no species new to South Africa, but alien taxa previously thought to be restricted to harbours were detected. This work produced recommendations for a cost–effective kelp monitoring programme, valuable to researchers and managers alike. At regional scale, this project led to the first list of marine alien species for Namibia – a major milestone for marine biosecurity in the country. Baseline inventories are often the first step in understanding the scope of biological invasions and provide an essential foundation for future monitoring, research and management. By establishing a comprehensive reference point, this work supports the development of national policies and management frameworks aimed at reducing the impacts of invasive species on marine ecosystems in Namibia.

Conducting survey for the alien daisy anemone *Cereus pedunculatus*, Knysna by MSc student, Miranda Andersen.

This work also builds capacity and collaboration. Hosting an international online workshop on contingency planning for alien species incursions brought together researchers, managers, and practitioners from several countries to develop response approaches – increasingly important as global trade, transport, and environmental change continues to move species across natural biogeographical boundaries.



Individuals of *Cereus pedunculatus* in four habitat types in Langebaan Lagoon, South Africa: (a) Attached to fossilised oyster beds, (b) On the underside of an upturned rock that was semi–buried in sediment, (c) Attached to rhizomes of seagrass Zostera capensis in sediment, (d) Attached to cordgrass Spartina maritima. White arrows indicate anemones. Photo credits: Miranda A Andersen

Collectively, this research has enhanced understanding of marine alien species across southern Africa, strengthened regional monitoring and management capacity, and provided critical information needed to support conservation. Future work will continue to build on this foundation by contributing directly to improving preparedness and reducing the long–term impacts of biological invasions on marine ecosystems and society.

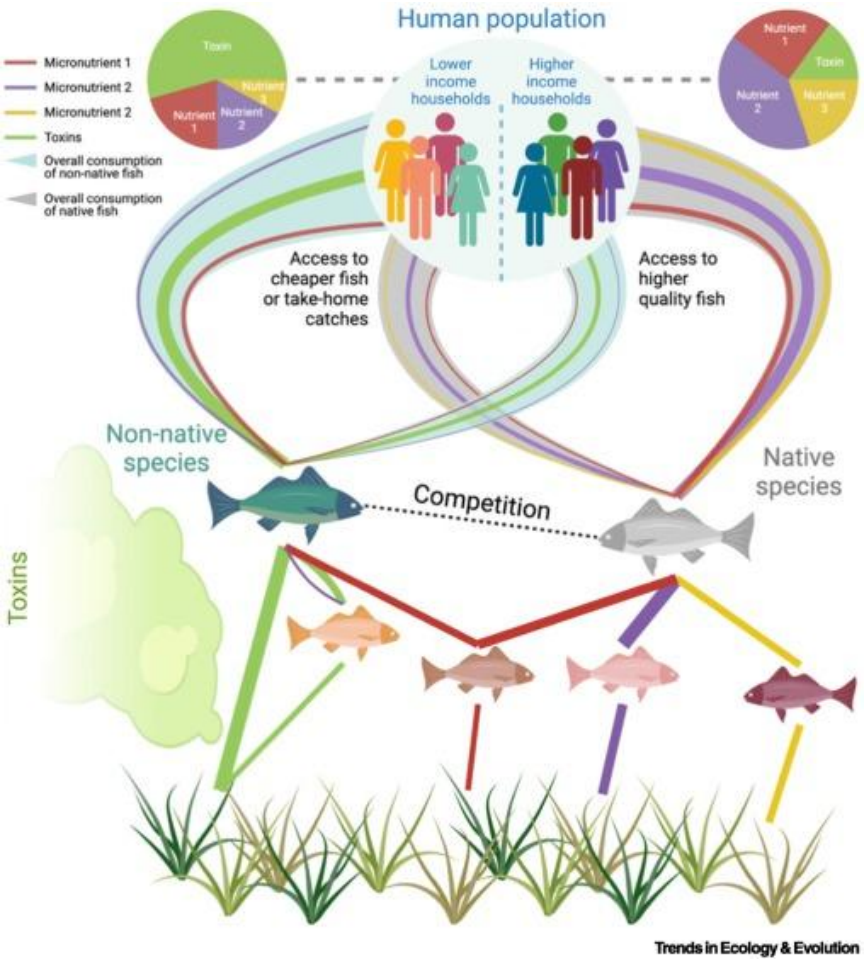
HOW ARE NON-NATIVE INVASIVE SPECIES AFFECTING AFRICA'S PEOPLE AND BIODIVERSITY?

PROFESSOR JOSIE SOUTH
University of Leeds

KEYWORDS: Food security; biological invasions; crayfish; nutrition; aquaculture; protected area

ADDITIONAL COLLABORATIONS:
Dumisani Khosa [SANParks]
Takudzwa C. Madzivanzira [University of Zimbabwe]

Non–native species have the potential to destabilise and disrupt ecosystem services for people who depend upon them. Understanding and predicting which species cause which negative impacts is essential for developing effective biodiversity and biosecurity legislation that also prioritise human wellbeing. We developed a framework to understand how non–native species introductions may exacerbate human health and nutritional inequities to better inform aquaculture policies, and through collaborative fieldwork created a baseline for understanding and mitigating the impact of invasive crayfish in the Kruger National Park.



Biodiversity and human wellbeing are linked, and non–native invasive species can disrupt these interactions and cause negative human outcomes. For example, South et al. 2025a show that

species originally introduced for aquaculture to support food security can disrupt ecological interactions which may increase exposure to toxins or decrease foods nutritional value. This re–wiring of ecological interactions have the potential to worsen originally existing inequities across demographics. Therefore, showing that aquatic biological invasions are a concern for human wellbeing and sustainability concern.

From left to right: Professor Josie South with Dr Lubabalo Mofu [SAIAB] and Dr Dumisani Khosa [SANParks]

A second fieldwork campaign was undertaken to assess the redclaw crayfish invasion in the Kruger National Park, following South et al. 2025b, involving staff and students from University of Leeds, NRF–SAIAB, Rhodes University, University of Mpumalanga, Charles Sturt University, Albany Museum and SANParks. We re–calculated spread rates throughout the park and the results showed that high–water flood events may be driving the spread of crayfish at a rate of ~35 km per year in the Sabie River compared to 3 km per year in the Crocodile River. While there is still a window to manage the before severe ecological impacts, there is already evidence that fish functional diversity is declining which has negative implications aquatic biodiversity resilience.

Based on these results, a policy brief that emphasises the need to reduce the spread of invasive crayfish around the country (South et al. 2025c), was written to guide legislation on preventing and managing crayfish invasions in South Africa, emphasising the need to reduce spread) nationally. The campaign was publicised by NRF–SAIAB and water@Leeds news and was picked up by several media outlets, including GroundUp and Daily Maverick.

https://saiab.ac.za/a-race-against-invasion-exploring-the-hidden-life-of-krugers-rivers/
https://water.leeds.ac.uk/news/race-against-invasion-the-hidden-life-of-krugers-rivers/
https://groundup.org.za/article/the-australian-crayfish-invading-our-rivers/
https://www.dailymaverick.co.za/article/2026-05-24-the-australian-crayfish-invading-our-rivers-and-threatening-the-okavango-delta/

Stable isotope samples from 2024 and 2025 are being processed to determine how invasive crayfish and hydrological change affect fish food webs in the Kruger National Park. Following reports of the red swamp crayfish (*Procambarus clarkii*) in the Western Cape, we will assess the invasion using genetic analysis and to understand where the original population came from both within and outside of South Africa. A field campaign is planned in the Barotse floodplain, Zambia, in collaboration with University of Zambia, NRF-SAIAB and the Zambian Ministry of Fisheries and Livestock, to assess how the invasion has changed over time and to predict the outcome of future invasions in Africa. Finally, a major databasing project is underway – the CRAyfish Functional Traits (CRAFT) network, to map individual trait change of native and invasive crayfish throughout time and space.

Redclaw crayfish *Cherax quadricarinatus*. Photo by Douglas Burnett

FROM ELEPHANT DUNG TO ENDANGERED DAMSELFLIES: INSIGHTS INTO FRESHWATER CONSERVATION IN AUSTRAL AFRICA

PROFESSOR SYDNEY MOYO
Louisiana State University

KEYWORDS: Freshwater biodiversity; food webs; conservation; Odonata; wetlands; ecosystem functioning

RESEARCH PROJECT:
Freshwater biodiversity, food–web ecology and conservation in African aquatic ecosystems

TEAM MEMBERS:
Tatenda Dalu [Stellenbosch University], Lenin Chari [Louisiana State University], Linton F. Munyai [University of Limpopo]

ADDITIONAL COLLABORATIONS:
Aquatic Systems Research Group [ASRG]

Freshwater ecosystems support biodiversity and provide essential ecological services, yet are increasingly threatened by climate change, altered hydrology, habitat degradation, and loss of biodiversity. Across Africa, conservation is often constrained by limited understanding of the processes that sustain freshwater biodiversity and ecosystem functioning.

Our research investigates how environmental change influences food–web structure, ecosystem functioning, and species persistence across African wetlands, and freshwater biodiversity hotspots. In 2025, we demonstrated the importance of terrestrial wildlife subsidies to aquatic food webs, revealed how hydroperiod shapes wetland ecosystem structure and biodiversity, and identified environmental factors associated with the persistence of threatened damselflies in Zimbabwe's Eastern Highlands. These findings can help practitioners, protected–area managers and policymakers, to identify priority habitats, improve conservation planning, and anticipate the consequences of environmental change for Africa's freshwater ecosystems and the communities that depend on them.

For 2025, our research focused on how environmental change influences biodiversity, ecosystem functioning, and food–web dynamics across freshwater ecosystems in southern Africa. Working across rivers, floodplain wetlands, and freshwater biodiversity hotspots in South Africa and Zimbabwe, we used field surveys, stable isotope analysis, and biodiversity assessments to address knowledge gaps. A major component examined the ecological role of terrestrial wildlife in shaping aquatic food webs. For instance, in a study conducted in the Luvuvhu River within Kruger National Park, we demonstrated that elephant dung can act as an important subsidy to river food webs, with some aquatic consumers deriving up to 51 % of their diet from elephant–derived organic matter.

Threatened damselfly species (*Psudagrion vumbaense*) from the Eastern Highlands of Zimbabwe. Damselflies can serve as important indicators of ecosystem health and biodiversity.

Among the most notable findings were that the invasive freshwater snail *Tarebia granifera* assimilated substantial amounts of elephant–derived material, suggesting that terrestrial subsidies may aid the success and ecological integration of invasive species within African river systems – revealing previously unrecognised links between terrestrial megafauna and freshwater ecosystems. We also investigated how variation in hydroperiod influences food–web structure within a South African Ramsar Wetland System. By comparing wetlands with differing periods of inundation, we found that longer hydroperiods supported greater trophic diversity and more complex food–web structures than wetlands experiencing shorter inundation periods. These findings provide an important ecological baseline for understanding how climate–driven changes in rainfall and hydrology may affect biodiversity, ecosystem functioning, and resilience in African wetlands. Alongside this work, we studied threatened freshwater insects in the Eastern Highlands of Zimbabwe with help of Agricultural Climate Resilient and Vulnerability Reduction Project.

Through field surveys and species distribution modelling, we identified conditions associated with the persistence of several threatened and range–restricted damselfly species, helping to identify priority habitats for future monitoring and conservation action under climate change. Collectively, our 2025 projects align with national and international priorities to improve freshwater conservation, protect threatened species, and strengthen ecosystem resilience under global change.

Field surveys conducted in the Eastern Highlands biodiversity hotspot to assess habitat quality and identify priority conservation areas for threatened freshwater species.

Through collaborations between the Centre for Invasion Biology, Louisiana State University, conservation organisations, and protected–area managers, the research provides a scientific foundation for evidence–based conservation planning and biodiversity monitoring. The findings from this work have been disseminated through peer–reviewed publications, extending their reach to the international freshwater science and conservation communities. Beyond scientific outputs, the research collaborations among researchers and institutions in South Africa, Zimbabwe, and the United States.

Over the next five years, we aim to expand freshwater biodiversity surveys across southern Africa, develop predictive conservation tools for threatened species, and strengthen collaborations that integrate ecological research, biodiversity monitoring, and conservation planning to improve the long–term protection of freshwater ecosystems.

Outreach

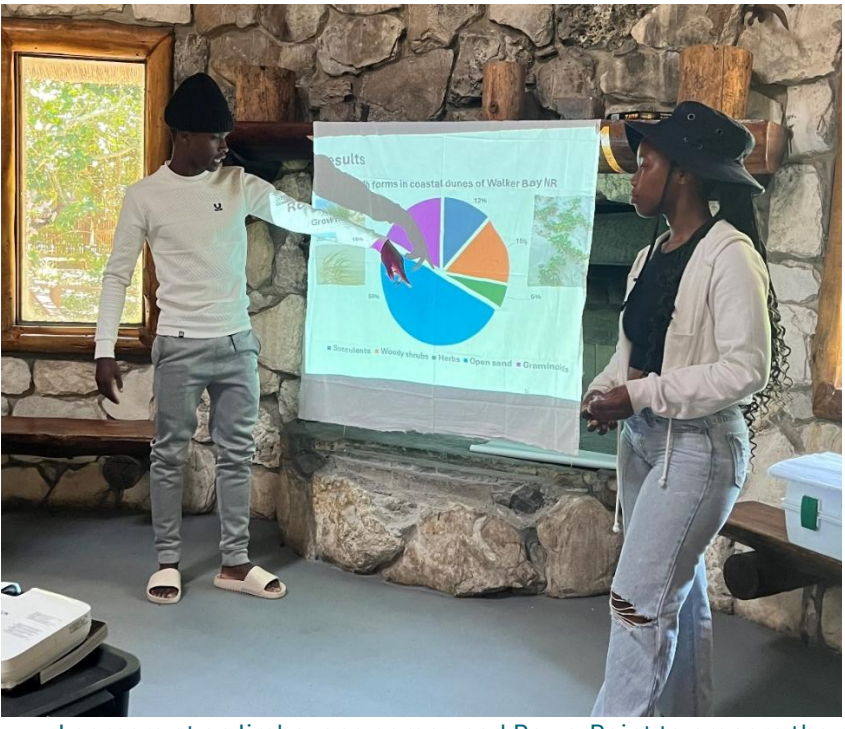
COMMUNICATION WITH THE PUBLIC – IIMBOVANE OUTREACH PROJECT

DORETTE DU PLESSIS
Stellenbosch University

TEAM MEMBERS:
Natalie S. Van der Heuvel, Londiwe M. Msomi

In 2025, Iimbovane continued to work closely with learners and educators of the Western Cape Education Department (WCED), but also with various home school groups and youth environmental groups. Iimbovane trained 775 learners and 139 educators through activities including day programmes, environmental camps, field investigations and classroom lessons. Iimbovane hosted 10 day–programmes tailored to the needs of the visiting group and covered a range of topics from invasive alien species, fynbos plant diversity and ecology, climate change, to something more creative, such as botanical and scientific illustrations.

During the 2025, Iimbovane hosted three multiday environmental camps, where 65 learners were trained in basic biodiversity monitoring and the collection of environmental data. These camps focused on invasive alien species awareness, practical conservation activities such as clearing invasive alien species and vegetation surveys to strengthen learners' practical scientific skills and environmental understanding. Through the practical fieldwork component, learners practiced the methods that ecologists use to collect biodiversity and environmental data. Learners also learned how to identify the plant and invertebrate species, giving them hands–on experience with the use of field guidebooks and microscopes. These camps were a wonderful blend of science, teamwork, and outdoor adventure – reminding learners of the important role of that biodiversity and conservation science plays in protecting biodiversity.



Learners at an Iimbovane camp used PowerPoint to prepare the results from their field study and present it to their peers.

Educator training also formed an important aspect of 2025's activities, training 139 educators and students through workshops. In April 2025, Iimbovane provided training to Stellenbosch University Post Graduate Certificate in Education (PGCE) students, the aim being to equip these future educators with the necessary skills to present practical field lessons for learners. The training consisted of two days, and both days were attended by 33 PGCE students. In addition, Iimbovane also provided practical training to the second year Stellenbosch University Biodiversity and Ecology students focusing on invertebrate sampling and identification of ant species.

Over the past years, Iimbovane has established a productive network including environmental education groups, conservation organizations and communities that work towards environmental and science education goals. This has led to the co–hosting of several training events in collaboration with the Western Cape Environmental Education Forum (WCEEF), CapeNature, Cape Leopard Trust and the Cape Winelands Biosphere Reserve in 2025.

During 2025, Iimbovane joined as proud partner in the Environmental Education Association of Southern Africa (EEASA) 43rd annual conference, which was held from 16 – 19 September in Cape Town. The project team presented on Iimbovane's activities and served on the EEASA Local Organising Committee for this 2025 conference. Celebrating this year's theme, "Celebrating and Reflecting the Successes in Education for Sustainable Development (ESD): Building on Success and Shaping the Future of ESD" called for education to lead the way in building a just and sustainable energy future. Among the panellists on the high–level opening panel discussion was Professor Guy Midgley – Director of Stellenbosch University's School for Climate Studies – who emphasized the urgent need to integrate climate knowledge into classrooms. One of Iimbovane Grade 10 learners from Manzomthombo Secondary School also participated in the conference, where he shared his experience taking part in an enquiry–based biodiversity study on his schoolgrounds. The learner's presentation demonstrated how long–term biodiversity monitoring in schoolgrounds can promote scientific literacy, place–based learning, awareness of local biodiversity, and environmental stewardship among high school learners.

Learners using a quadrant to identify and estimate the plant diversity and density during an Iimbovane learner camp in Bainskloof Pass.

Curro Durbanville visited the Iimbovane laboratory to learn more about careers and study options in biodiversity sciences at Stellenbosch University.

Homeschool learners exploring seed diversity and learning how seeds are adapted for dispersal and growth during a hands–on Iimbovane day programme.

Learners using handheld microscopes to identify ant species during an Iimbovane classroom lesson.

Learners attending an Iimbovane camp helping to control a dense stand of Rooikrans (*Acacia cyclops*) and Port Jackson (*Acacia saligna*) close to the campsite.

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CORE TEAM MEMBERS, RESEARCH FELLOWS AND POSTDOCTORAL FELLOWS (as of 31 July 2026)

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Colleen Downs (UKZN)	Ryan Blanchard	Mmatsawela Ramahlo
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John Wilson (SANBI)	Josie South	
Tsungai Zengeya (SANBI)	Sophia C. Turner	
Brian van Wilgen (SU)	Darragh Woodford	
	Naicheng Wu	

APPENDIX 1 – RESEARCH OUTPUTS

BOOKS

1. Schaffner, U., van Wilgen, B.W., Ehrensperger, A. and Bekele, K. (editors). 2025. The Ecology and Management of Invasive *Prosopis* Trees in Eastern Africa. CABI, Wallingford, United Kingdom.

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APPENDIX 2 – CONFERENCE ATTENDANCE

PLENARY OR KEYNOTE ADDRESS(ES) – INTERNATIONAL

1. Clusella–Trullas, S. 2025. Avoiding stressful temperatures: physiological and behavioural mechanisms of thermoregulation in lizards. Biologists @ 100 Years Conference, Liverpool, UK.

PLENARY OR KEYNOTE ADDRESS(ES) – NATIONAL

1. Kumschick, S. 2025 Partnerships for standardised impact assessment. National Symposium on Biological Invasions. Mahikeng, South Africa. 10 October

ORAL CONTRIBUTION(S) – INTERNATIONAL

1. Ackland, S.J. and Robinson, T.B. 2025. iNaturalist as a tool to supplement alien species monitoring: a South African perspective. International Conference on Marine Bioinvasions, Madeira, September.
2. Adams, D.L., Martin, G., Steenhuisen, S.L., Downs, C.T. 2025. Community perceptions of the fleshy–fruited alien plant *Pyracantha angustifolia* in South Africa.17th International Conference on the Ecology and Management of Alien Plant Invasions, 2–5 September 2025, New Zealand.
3. Esler, K.J. 2025. Inspiring restoration practice: benefits of a long–term research–implementation restoration partnership. Session on "Restoration reimagined: social–ecological stewardship and restoration in Africa". TC/ESG 2025 – Navigating Sustainability Transformations Toward Justice and Equity. Johannesburg, South Africa, August 2025.
4. Richardson, D.M. 2025. Here, there and everywhere. Widespread non–native plants in the world's urban ecosystems. 17th conference on the Ecology and Management of Alien Plant Invasions (EMAPI), Lincoln, New Zealand.
5. Robinson, T.B., Ackland, S.J., Andersen M.N. and van Blerk D. 2025. Evidence–based management of the alien bryozoan Amathia verticillata in a South African MPA. International Conference on Marine Bioinvasions, Madeira, September 2025.
6. Steyn, C. and Robinson T.B. 2025. Addressing the knowledge gap in relation to alien species in South African kelp forests. International Conference on Marine Bioinvasions, Madeira, September 2025.
7. Van Blerk, D and Robinson T.B. 2025. Rapid assessment of Knysna estuary identifies six species previously unknown from South Africa. International Conference on Marine Bioinvasions, Madeira, September 2025.

ORAL CONTRIBUTION(S) – NATIONAL

1. Clusella–Trullas S. 2025. Feeling the heat: examining responses of ectotherms to climate change. The Centre for Statistics in Ecology, the Environment and Conservation (SEEC) Symposium, University of Cape Town, May 2025.
2. Downs, C.T. 2025. Global trends and impacts of alien invasive birds: with a focus on Africa. BirdLife KZN Forum, Simbithi Eco–estate, Ballito, March 2025.
3. Howard, J.L., Schurr, F. and Esler, K.J. 2025. Functional and evolutionary determinants of recruitment differentiation between Fynbos *Protea* individuals, populations, and species. Fynbos Forum, August 2025
4. Mbombo, B., Holmes, P.M. and Esler, K.J. 2025. Deterrent of chili flake–coated seeds on rodent granivores using a field cafeteria experiment: implications for Lowland Fynbos restoration. Fynbos Forum, August 2025

5. O'Connor B., Pincebourde S., Vosloo D. and Clusella–Trullas S. 2025. The next top model: evaluating modelling approaches for thermal performance curves of walking speed data from an invasive ladybird beetle. SEEC Symposium, University of Cape Town, May 2025.
6. O'Connor B., Pincebourde S., Vosloo D. and Clusella–Trullas S. 2025. Surviving or thriving: Life stage and acclimation effects on the thermal sensitivity of walking speed in the beetle *Harmonia axyridis*. 24th Congress of the Entomological Society of Southern Africa, Bloemfontein, July 2025
7. Pogue T., Pincebourde S., Vosloo D. and Clusella–Trullas S. 2025. Quantifying microclimatic heat exposure and identifying thermal refugia using high–resolution time series data in a changing climate. SEEC Symposium, University of Cape Town, May 2025.
8. Richardson P. and Clusella–Trullas S. 2025. Decoding temperature–driven developmental plasticity in the Harlequin ladybeetle *Harmonia axyridis*. 24th Congress of the Entomological Society of Southern Africa, Bloemfontein, July 2025
9. Richardson P. and Clusella–Trullas S. 2025. Decoding insect melanisation through pixels, developmental plasticity and seasonal temperature patterns. SEEC Symposium, University of Cape Town, May 2025.

POSTER PRESENTATIONS – INTERNATIONAL

1. Mokotjomela, T.M., Loyd Vukeya, L.R. and Mbele, T.J. 2025. The alien and invasive plant species that may be a future conservation threat to the Lesotho Afro–alpine Drakensberg area. 2nd Southern African Mountain Conference, Champagne Sports Resort, South Africa March 2025. (https://2025.samc.africa/submissions/3061_v0.pdf)
2. Ntloko, B.R., Mokotjomela, T.M., Mphafi, S.P. and Siebert, S.J. 2025. Success in restoring native plant communities on kimberlite mining dumps in the Afro–alpine Drakensberg region of Lesotho. 2nd Southern African Mountain Conference, Champagne Sports Resort, South Africa March 2025.
3. Rebelo, A., Holmes, P., Esler, K. and Rebelo, A. 2025. Soil seed bank resilience in passively restored endangered Sand Fynbos following a century of pine plantations. Poster presentation (incl. oral), World Conference on Ecological Restoration (SER 2025), Denver, Colorado, USA, September 2025

POSTER PRESENTATIONS – NATIONAL

1. Ntloko, B.R., Mokotjomela, T.M., Mphafi, S.P. and Siebert, S.J. 2025. Success in restoring native plant communities on kimberlite mining dumps in the Afro–alpine Drakensberg region of Lesotho. Research meeting, National University of Lesotho. September 2025.
2. Kassier A., Clusella–Trullas S. and Shaik Z. 2025. Western Cape lady beetles: unveiling of diversity. 24th Congress of the Entomological Society of Southern Africa, Bloemfontein, July 2025.

APPENDIX 3 – POPULAR ARTICLES AND TALKS

POPULAR ARTICLES

1. Rebelo, A., Esler, K., Holmes, P. and Rebelo, T. 2025. Lost fynbos seeds from underground 'time capsules' in South Africa can grow again – new study. The Conversation, March 17, 2025 https://theconversation.com/lost–fynbos–seeds–from–underground–time–capsules–in–south–africa–can–grow–again–new–study–247906?utm_source=clipboardandutm_medium=bylinecopy_url_button

POPULAR TALKS

1. Downs, C.T. 2025. Global trends and impacts of alien invasive birds: with a focus on Africa. BirdLife Midlands, Ambers, Howick, August 2025.
2. Vukeya, L.R. Mokotjomela, T.M. and Pillay, N. 2025. Determining the status of ecosystem degradation trends and their implications for ecological integrity in the southern African grassland biome. CIB Annual Research Meeting, November 2025.
3. Vukeya, L.R. Mokotjomela, T.M. and Pillay, N. 2025. Determining the status of ecosystem degradation trends and their implications for ecological integrity in the southern African grassland biome. Botanical Society meeting, Free State National Botanical Garden, May 2025.

APPENDIX 4 – EDUCATION AND TRAINING

1. Former C·I·B MSc Gordon Ringani's current PhD work mentioned as part of https://www.dailymaverick.co.za/article/contentious–traps–a–human–food–addictiontion–and–the–daddy–factor–why–joburg–is/ (Chimimba)
2. Jessica Howard spent six weeks at University of Hohenheim, developing her Masters research chapters (in preparation for an upgrade in 2026) (Esler)
3. PhD candidate Clara Steyn and MSc candidate Megan van den Berg submitted their theses (to complete March/April 2026) (Robinson)
4. MSc candidate Christiaan Gildenhuys submitted his thesis (to complete March/April 2026) (Richardson)
5. Dr Geethen Singh (previous post doc) is currently doing a post doc at SAEON (Robinson).
6. Dr Taina Lourero (previous post doc) is now a lecturer at the University of Western Australia (Robinson).
7. Loyd Vukeya is CIB PhD student registered with University of the Witwatersrand – He published two papers during the year 2025 (Mokotjomela).
8. Bathabile Masango graduated with her MSc degree in 2025, has helped draft a paper draft, and has secured a DFFE Environmental Intern, EPWP programme job for 2026 (Terblanche).
9. Annelie Smit submitted her MSc in late 2025, which she defended in Jan 2026, with expected graduation March 2026 (Terblanche).
10. Ex–CIB postdoc Dr Quentin Willot has secured a faculty position at University of Namur (Belgium) and he continues to collaborate with Prof. John S. Terblanche on mechanisms of high temperature resistance in insects (Terblanche).
11. Tania Pogue (PhD project, 2nd year) was awarded first prize for Best PhD Presentation at the Department's Annual Research Meeting. She also completed a research visit to her co–supervisor's laboratory, where she was trained in new techniques to visualise DNA damage in beetle samples (Clusella–Trullas).
12. Perryn Richardson (PhD project, 3rd year) was i) Awarded top speaker at Statistical Ecology and Environment Symposium at UCT, ii) Awarded top speaker in the biology category at the Stellenbosch University Science Faculty Postgraduate Conference, iii) Sponsored by the SU postgraduate office to attend the Science Communication workshop Imidibaniso Exchange (Clusella–Trullas).
13. As part of the False Bay Underwater Club talk series, Sarah Ackland (PhD student) gave an introductory seminar on marine alien species and their impacts. The talk was well received by the club and contributed to strengthening ocean stewardship by highlighting the role that citizens can play in advancing marine alien species monitoring practices (Robinson–Smythe).

APPENDIX 5 – NETWORKING

ACADEMIC VISITORS TO CORE TEAM MEMBER

1. Prof. Marc Cadotte, University of Toronto, Canada. Collaborator on biological invasions in urban areas (Richardson)
2. Dr Kirsty MacLeod, Bangor University, UK. Collaborator on social behaviour as a predictor of climate resilience (Clusella–Trullas).
3. Dr Marc Rius, Centre for Advanced Studies of Blanes, Spain. Collaborator on invasion related projects (Robinson)
4. Prof. Dr Frank Schurr, University of Hohenheim, Germany. Collaborator on a Protea common Garden Experiment (Esler)
5. Prof. H. Arthur Woods, University of Montana. Collaborator on thermal biology of ectotherms (Terblanche)

ACADEMIC VISITS TO OTHER INSTITUTIONS

1. The relationship between social complexity and invasiveness (workshop), 10–12 November 2025 – Lanzerac Wine Estate, Stellenbosch, South Africa (Clusella–Trullas)
2. Developing FynFun proposal, and supervision of Jessica Howard. Collaborators: Prof. Karen Esler; Prof. Dr Frank Schurr, University of Hohenheim, Germany. Esler visit to U Hohenheim, September 2025, Germany (Esler)
3. Assessing the implication of global megatrends for the future of plant invasions. Collaborators: Prof. P.E. Hulme, Prof. P. Pyšek and others (Richardson)
4. How will climate change impact insect performance and survival? Lessons from 20 years chasing flies. Invited seminar given to School of Biological Sciences, Bristol University, UK. (Terblanche)
5. Fire research, to Ongava Research Centre, Namibia. November 2025 (van Wilgen)

(IAS) RESEARCH COLLABORATIONS

1. Biodiversity Building Blocks for Policy (B–cubed). Collaborators: Quentin Groom, Plantentuin Meise, Meise, Belgium; Tim Robertson, GBIF, Denmark; Peter Desmet, INBO, Brussels, Belgium; Duccio Rocchini, Universita di Bologna, Bologna, Italy; Hanno Seebens, Universität Giessen, Giessen, Germany; Cristina Preda, Department of Natural Sciences, Ovidius University of Constanta, Romania; Tsungai Zengeya, SANBI, South Africa; Cang Hui, Stellenbosch University, South Africa; Sandra MacFadyen, Stellenbosch University, South Africa; Lyubomir Penev, Pensoft Publishers, Sofia, Bulgaria; Miguel Fernandez Trigoso, iDiv, Martin–Luther–Universitat Halle–Wittenberg; Alexis Joly, INRIA, Montpellier, France; Heliana Teixeira, Universidade de Aveiro, Portugal; Melodie McGeoch, La Trobe University, Australia (Kumschick)
2. Clarifying the identity of an alien anemone in South Africa. Prof. Meg Daly, Ohio State University USA (Robinson).
3. Climate change responses of locusts in Africa. Collaborators Prof. Philipp Lehmann, Greifswald University, Germany; Prof. Marie–Pierre Chapuis (CIRAD, Montpellier France), Dr Marion Javal (IRD, France). (Terblanche)
4. Diverse studies on concepts in invasion ecology and plant invasion science. Collaborator: Prof. P. Pyšek, Academy of Sciences of the Czech Republic (Richardson)
5. Documenting AIS in Lesotho Drakensberg Wetlands. Collaborators Prof. Peter Chatanga, Department of Botany, University of Lesotho (Mokotjomela)

6. Endomicrobiome–driven evolution of plant invasiveness. Collaborator: Dr M. A. Molina–Montenegro, Universidad de Talca, Talca, Chile (Richardson)
7. Environmental Impact Classification for Alien Taxa (EICAT). Collaborators: Piero Genovesi, Chair of the IUCN SSC ISSG, Institute for Environmental Protection and Research, Italy; Ana Novoa, Institute of Botany, Czech Academy of Sciences, Průhonice, Czech Republic; Anna Probert, University of New England, Australia; Belinda Gallardo, Instituto Pirenaico de Ecología (IPE), CSIC, Spain; Bella Galil, Tel Aviv University, Israel; Cristina Preda, Department of Natural Sciences, Ovidius University of Constanta, Romania; Elena Tricarico, Department of Biology, University of Florence, Italy; Giovanni Vimercati, University of Fribourg, Switzerland; Giuseppe Brundu, Department of Agricultural Sciences, University of Sassari, Italy; Jan Pergl, Institute of Botany, Czech Academy of Sciences, Průhonice, Czech Republic; John Measey, Centre for Invasion Biology, Institute of Biodiversity, Yunnan University, China and Stellenbosch University, South Africa; Jonathan Jeschke, Leibniz Institute of Freshwater Ecology and Inland Fisheries (IGB) and Freie Universität Berlin, Germany; Katharina Lapin, Austrian Research Centre for Forests, Vienna, Austria; Maarten de Groot, Department of Forest Protection, Slovenian Forestry Institute, Slovenia; Montserrat Vilà, Estación Biológica de Doñana (EBD–CSIC) and University of Sevilla, Sevilla, Spain; Pablo González–Moreno, Department of Forest Engineering, ERSAF, University of Cordoba; Petr Pyšek, Institute of Botany, Czech Academy of Sciences, Průhonice and Department of Ecology, Faculty of Science, Charles University, Prague, Czech Republic; Sandro Bertolino, Department of Life Sciences and Systems Biology, University of Turin, Italy; Sven Bacher, University of Fribourg, Switzerland; Thomas Evans, Leibniz Institute of Freshwater Ecology and Inland Fisheries (IGB) and Freie Universität Berlin, Germany; Tim M. Blackburn, Centre for Biodiversity and Environment Research, University College London and Institute of Zoology, Zoological Society of London, UK; Wolfgang Rabitsch, Environment Agency Austria, Vienna, Austria; Kevin Smith, IUCN, Cambridge, UK; Ana Nunes, IUCN, Cambridge, UK. (Kumschick)
8. Evolutionary approach to biological invasion policy: embedding adaptive potential into governance systems, an. Collaborator: Dr J. Vicente, Centro de Investigação em Biodiversidade e Recursos Genéticos, Universidade do Porto, Portugal (Richardson)
9. Global assessment of geographic distributions, long–term trends, and data gaps. Collaborator: Prof. H. Seebens, Ecological Informatics Group, Justus–Liebig University Giessen, Germany (Richardson)
10. Global Status and Trends of Freshwater Invasive Alien Species (FRIAS): Belinda Gallardo, Instituto Pirenaico de Ecología (IPE), CSIC, Spain (Kumschick)
11. Introduction: Exotic fish. Collaborators: Prof. S. Willows–Munro, University of KwaZulu–Natal, Pietermaritzburg; Dr Matthew Burnett, Institute of Natural Resources, Pietermaritzburg; Dr Madonna Vezi, Rand Water, Johannesburg, Dr Tsungai A. Zengeya, SANBI, Cape Town. (Downs)
12. Impacts and risk assessment in invasion science. Collaborator: Prof. S. Bacher, Department of Biology, University of Fribourg, Switzerland (Richardson)
13. Invasives: fauna. Dr Tinyiko C. Shivambu, Department of Environmental Sciences, Florida Science Campus; University of South Africa; Johannesburg; Dr Ndivhuwo Shivambu, University of Pretoria, Pretoria; Dr Lorinda Hart, BirdLife SA, Durban; Mr Bheka Nxele, Ethekwini Municipality, Durban; Prof. S Willows–Munro, University of KwaZulu–Natal, Pietermaritzburg. (Downs)
14. Invasions in urban ecosystems. Collaborator: Prof. M.W. Cadotte, Department of Biological Sciences, University of Toronto Scarborough, Canada (Richardson)
15. Invasion science and the management of protected areas. Collaborator: Prof. P.E. Hulme, Bioprotection Aotearoa, Department of Pest–Management and Conservation, Lincoln University, Canterbury, New Zealand (Richardson, Robinson)
16. Manduca thermal biology and climate change responses. Collaborators Prof. Art Woods, Montana State University; Prof. Jon Harrison, Arizona State University. (Terblanche)

17. APWAPS Project. Funded by a WRC grant, this project aims to use freely–available satellite imagery and cloud computing to map alien trees in some of the strategic water source areas that do not have recent information on biological invasions and their impact. Collaborator Alanna Rebelo, ARC. (Esler)
18. Maternal effects on offspring, including nutrition and heat stress dynamics and recovery. Collaborators Prof. Sinead English, Bristol; and Prof. Joshua Benoit, Iowa State University, USA; and Prof. Fleur Ponton, Macquarie University, Australia. Prof. Terblanche co–supervises several Bristol University students. (Terblanche)
19. Metabolic flexibility of locusts in Africa. Collaborator Prof. Philipp Lehmann, Greifswald University, Germany. (Terblanche)
20. Modelling the impacts of alien and Invasive plant species. Collaborators Dr Nontobeko Dube, Department of Zoology and Entomology and Dr Dimitri Veldkornet, Department of Plant Sciences, University of Free State (Mokotjomela).
21. OneBiosecurity Systems and Technology for People, Places and Pathways (OneSTOP). Collaborators: Quentin Groom, Plantentuin Meise, Meise, Belgium; Helen Roy, UK Centre For Ecology and Hydrology, UK; Toke Høye, Aarhus Universitet, Denmark; Joana Vicente, Associacao Biopolis, Portugal; Katharina Dehnen–Schmutz, Coventry University, Coventry, UK; Angeliki F Martinou, The Cyprus Institute, Cyprus; Veronique Adriaenssens, INBO, Brussels, Belgium; Ana Novoa, Institute of Botany, Czech Academy of Sciences, Průhonice, Czech Republic; Philip Hulme, Lincoln University, New Zealand; Tom Meyers, Platform Kinetics Limited, York, UK; Lyubomir Penev, Pensoft Publishers, Sofia, Bulgaria; David Hodgson, University of Exeter, UK; Bernd Lenzner, Universität Wien, Austria; Agnes Zolyomi, GreenFormation Kft, Budapest, Hungary; Maryna Golivets, Helmholtz–Zentrum für Umweltforschung (UFZ), Leipzig, Germany; Cristina Preda, Department of Natural Sciences, Ovidius University of Constanta, Romania; Anna Poimala, LUKE – Natural Resources Institute Finland, Helsinki, Finland. (Kumschick)
22. Plant Recurrent Invasion Syndromes in Mountain Areas (PRISMA): Ana Novoa, Institute of Botany, Czech Academy of Sciences, Průhonice, Czech Republic; Pablo González–Moreno, Department of Forest Engineering, ERSAF, University of Cordoba (Kumschick)
23. Risk maps of biological invasions under climate change: Lysandre Journiac, Muséum national d'Histoire naturelle, Paris, France; Océane Boulesnane–Guengant, CIRAD, UMR PVBMT, La Réunion, France and Université de La Réunion, UMR PVBMT, La Réunion, France; Christophe Botella, Inria, Université de Montpellier, Montpellier, France; Robin Pouteau, AMAP, IRD, Pôle de Protection des Plantes, Saint–Pierre, Réunion, France; Mathieu Rouget, CIRAD, UMR PVBMT, La Réunion, France (Kumschick)
24. Sand Fynbos Ecological Restoration, Cape Floristic Region, South Africa. – ANGLO Nature Positive Grant to Esler and C·I·B Research Fellow Dr P. Holmes: Collaborators include City of Cape Town Biodiversity Branch staff members (Esler).
25. Seed dispersal: *Cotoneaster pannosus*. Collaborators: Prof. S.L. Steenhuisen, University of Free State, Qwaqwa; Dr G.D. Martin, Rhodes University, Makhanda. (Downs)
26. Sequenced, assembly and annotation of the genome of the invasive Polyphagous Shot Hole Borer. Collaborators Dr Heiko Vogel, Max Planck Institute for Chemical Ecology, Germany; and Dr Anandi Bierman, Department of Immunology, Stellenbosch University (Terblanche)
27. Sequence the genome of Eldana saccharina. Collaborator Dr Lawrence Malinga, South African Sugar Research Institute. (Terblanche)
28. Understanding historical invasions using eDNA. Dr M Rius CEAB Spain; Dr P Teske, UJ, South Africa (Robinson).
29. Unraveling the landscape genomics of the invasive Polyphagous Shot Hole Borer through whole genome SNP sequencing. Collaborators Prof. Ary Hoffmann, Dr Tom Schmidt from Melbourne

University; and former C·I·B post–doctoral fellow Dr Anandi Bierman, Department of Immunology, Stellenbosch University (Terblanche)

APPENDIX 6 – SERVICE RENDERING

INTERNATIONAL PANELS AND COMMITTEES

1. Assessor for the IUCN World Heritage Outlook v4 (for the Sanganeb Marine National Park and Dungonab Bay – Mukkawar Island Marine National Park). (Robinson)
2. GuardIAS Horizon project: Scientific Advisor (Kumschick)
3. International Commission for Large Dam – Committee G (Environment) Advisory (Mokotjomela)
4. IUCN Academy: Training Conservation Leaders (Esler)
5. IUCN EICAT Authority: Chair (Kumschick)
6. IUCN Species Survival Commission– Afrotheria specialist Group: Member (Downs)
7. IUCN Species Survival Specialist Groups on Conifers (Richardson)
8. IUCN Species Survival Commission– Crocodile specialist Group: Member (Downs)
9. IUCN Species Survival Commission– Hippo specialist Group: Member (Downs)
10. IUCN Species Survival Commission – Invasive Species Specialist Group: Member (Kumschick)
11. IUCN Species Survival Specialist Groups on Invasive Organisms (Richardson)
12. IUCN Species Survival Commission– Stork specialist Group: Member (Downs)
13. Namdeb Terrestrial Scientific Committee Member (Esler)
14. Scientific Advisory Board Member for the Centre for Advanced Studies of Blanes, Spain (Robinson)
15. Society for Ecological Restoration (SER) 2025 Programme committee (Esler)
16. British Ecological Society Grants Committee (Dalu)

NATIONAL PANELS AND COMMITTEES

1. Alien Species Risk Analysis Review Panel (ASRARP): member (Dalu, Kumschick)
2. Jennifer Ward Oppenheimer (JWO) Awards: Member– Adjudication Panel (Chimimba)
3. SANBI Ethics Committee: Member (Chimimba)
4. Royal Society of South Africa (RSSAf): Council Member (Chimimba)
5. Fynbos Forum Committee: Member (Esler)
6. Centre for Sustainability Transitions (CST) Governing Board (Esler)
7. PSHB national steering committee: member (Roets)
8. Cape Town PSHB Invasive species unit: management committee member (Roets)
9. SACNASP Professional Advisory Committee (PAC): Zoological Science per the Natural Scientific Professions Act (Act No. 27 of 2003) (Downs)
10. Zoological Society of Southern Africa: Hon. Treasurer (Downs)
11. Cape Parrot Working Group: Chair (Downs)
12. South African Council for Natural Scientific Professions (SACNASP) committee (Dalu)

NRF SERVICE PROVISION

NRF RATING AND PROJECT PROPOSAL REVIEWS

1. Five (5) NRF rating applications
2. Three (3) applications institutional support grants under focus of Natural Sciences and Conservation.

NRF PANEL AND COMMITTEE SERVICE

1. Foundational Biodiversity Information Programme (FBIP) panel meetings
2. 2 × South African Research Chairs Initiative Programme (SARChI) – Evaluation Panel, Five–Year Evaluation Performance of Grant Recipients

EDITORIAL AND REFEREEING ACTIVITIES

EDITOR

1. Conservation Biology; Regional Editor Africa (Esler)
2. NeoBiota; Editor in Chief (Robinson)
3. Journal of Experimental Biology (Terblanche)
4. Journal of Insect Physiology (Elsevier); Co–Editor–in–Chief (Terblanche)

ASSOCIATE EDITOR

1. Advances in Complex System (Hui)
2. African Journal of Ecology (Downs)
3. Biological Invasions (Hui, Kumschick, Richardson)
4. Bulletin of Mathematical Biology (Hui)
5. Fire Ecology (van Wilgen)
6. Ecological Complexity (Hui)
7. Frontiers in Mammal Science (Chimimba)
8. Global Ecology and Biogeography (Hui)
9. Global Ecology and Conservation (Downs)
10. Ibis (Journal) (Downs)
11. Journal of Ornithology (Downs)
12. Mathematics in Medical and Life Sciences (Hui)
13. NeoBiota (Kumschick, Richardson)
14. Urban Ecosystems (Journal) (Downs)
15. African Journal of Ecology (Dalu)
16. Ecology and Evolution (Dalu)
17. Global Change Biology (Dalu)
18. Aquatic Invasions (Dalu)
19. BioInvasions Records (Dalu)

EDITORIAL BOARDS

1. African Entomology, Editorial Board member (Roets)
2. AoB PLANTS (Richardson)
3. Current Research in Insect Science (Terblanche)
4. Journal of Experimental Biology, Editorial Board member (Clusella–Trullas)
5. Ostrich (Journal) (Downs)
6. BMC Ecology and Evolution (Hui)
7. Frontiers in Ecology and Evolution (Hui)
8. Journal of Dynamics and Games (Hui)
9. Science of the Total Environment (Dalu)
10. Environmental Advances (Dalu)

REVIEWING

NATIONAL JOURNALS

African Biodiversity and Conservation; African Entomology; South African Geographical Journal South African Journal of Botany (multiple reviewers); African Journal of Marine Science; Ostrich; South African Journal of Science

INTERNATIONAL JOURNALS

African Journal of Wildlife Research; African Zoology; Agriculture, Ecosystems and Environment; American Naturalist; Aquatic Invasions; Aquaculture Environment Interactions; Behavioral Ecology and Sociobiology; Biocontrol Science and Technology; Biological Conservation; Biological Invasions; Biota Neotropica; Bird Conservation International; Conservation Biology; Current Research in Insect Science; Discover Sustainability; Diversity; Ecology and Evolution; Ecology Letter; Educational studies; Fire; Food and humanity; Forests; Frontiers in Veterinary Science; Functional Ecology; Geology, ecology, and landscapes; Global ecology and conservation; International journal of applied earth observation and geoinformation; International Journal of Forestry Research; Journal of Arid Environments; Journal of Biogeography; Journal of Ecology; Journal of Experimental Biology; Journal of Herpetology; Journal of Ornithology; Journal of Pest Science; Journal of Thermal Biology; Journal of Visualized Experiments; Land; Mammalian Biology; Marine Ecology; Marine Ornithology; Nature Ecology and Evolution; Neotropical Entomology; Next sustainability; Journal of Insect Physiology; Plants; PNAS; PRSB; Restoration Ecology; South African journal of botany; Science of the total environment; Sustainability; Trends in Ecology and Evolution; African Journal of Ecology; Annals of the Brazilian Academy of Sciences; The Anthropocene Review; Biodiversity and Conservation; Biological Reviews; BioScience; Current Biology; Ecology Letters; Ecosphere; Environmental Monitoring and Assessment; Freshwater Biology; Journal of Applied Ecology; Mathematical Biosciences; Oikos; Plant and Soil; Weed Research.

GRANT REVIEWS FOR EXTERNAL BODIES

1. Biodiversa+ (Robinson)
2. European Research Commission (Hui)
3. National Research Foundation and National Science Foundation (Terblanche)
4. Leakey Foundation (Downs)
5. British Ecological Society (Dalu)

APPOINTMENT REVIEWS AND COMMITTEES

1. Committee on Scholarly Publishing in South Africa (SCPiSA) (Esler)
2. Faculty of Natural Sciences appointments committee, Stellenbosch University, various interviews (Roets)

CONSULTANCY REPORTS

1. Rebelo, A., Cogill, L., Skosana, T. and Esler, K. (2025) Mapping woody invasive alien plant species and their impacts in strategic water source areas (No. 3193/1, p. 24). WRC Report. No. 3193/1/24 visit: https://www.wrc.org.za/wp–content/uploads/mdocs/3193%20final.pdf; https://doi.org/10.6084/m9.figshare.30593438

APPENDIX 7 – MEDIA INTERACTIONS

NEWSLETTERS

1. Balfour, V., Manyama, P.A., Mokotjomela, T.M., Rahlao, S.J. and Willis, C. 2025. Strategy for the management of biological invasions within SANBI gardens. https://www.sanbi.org/wp–content/uploads/2025/06/2025_BioSeries32.pdf

ARTICLES PUBLISHED BY STELLENBOSCH UNIVERSITY

1. Media and communication. 2025. Prof Karen Esler appointed Vice Dean: Research, Innovation and Postgraduate Studies – Faculty of AgriSciences, Stellenbosch University News, [online] 17 December 2025. Available at: Prof Karen Esler Appointed Vice Dean: Research, Innovation and Postgraduate Studies – Faculty of AgriSciences
2. https://climate.sun.ac.za/uncategorized/micro–refugia–could–be–key–to–survival–of–insect–populations/

ELECTRONIC SOURCES

1. Matundu, Q. 2025. Experts fear impact of 'unusual' invasive species found in West Coast. News24, [online] 16 June 2025. Available at: https://www.news24.com/business/climate–future/news/experts–fear–impact–of–unusual–invasive–species–found–in–west–coast–20250616–0735
2. Esler, K.J. 2025. Living Lab: Where Science Meets Action. YouTube short film, [online] August 27, 2025. Available at: https://studio.youtube.com/video/Aq–vure6oUA/edit
3. Anonymous. 2025. How scientists are battling the beetle killing our trees, Financial Mail, [online] April 2025. Available at https://www.businesslive.co.za/fm/fm–fox/2025–04–17–how–scientists–are–battling–the–beetle–killing–our–trees/#google_vignette
4. Anonymous. 2025. Fresh Quarterly, [online] March 2025. Available at https://www.freshquarterly.co.za/edition/fresh–quarterly–issue–28–mar–2025/
5. Smillie, S. 2025. Contentious traps, a human food addiction and the 'daddy' factor – why Joburg is losing its war on rats. https://www.dailymaverick.co.za/article/contentious–traps–a–human–food–addictiontion–and–the–daddy–factor–why–joburg–is/) to an article recently published in the Daily Maverick on the work of our previously CIB sponsored student (Gordon Ringani).

APPENDIX 8 – MEDIA OUTPUTS

POPULAR ARTICLES AND TALKS

ARTICLES

1. Ntsonge, S. 2025. South Africa's 'working for water' programme is meant to lead to skills and jobs: why it's failing. The Conversation, [online] 24 February 2025. Available at: <https://theconversation.com/south-africas-working-for-water-programme-is-meant-to-lead-to-skills-and-jobs-why-its-failing-248694>
2. Rebelo, A. 2025. Lost fynbos seeds from underground 'time capsules' in South Africa can grow again – new study. The Conversation, [online] 17 March 2025. Available at: <https://theconversation.com/lost-fynbos-seeds-from-underground-time-capsules-in-south-africa-can-grow-again-new-study-247906>
3. Staff Reporter. 2025. Accolades for SU researchers. Stellenbosch Visio. Pp. 22. 01 September 2025.
4. Anon. 2025. Scientists tackle one of Africa's most destructive invasive trees. Water Wheel 24 (2), Pp. 4. April 2025. Online available at: <https://journals.co.za/doi/epdf/10.10520/ejc-waterb-v24-n2-a1>

TALKS

1. Robertson, M.P. 2025. Of canaries and ants: climate change research in the Maloti-Drakensberg Mountains. Talk to Mountain Club of South Africa, Magalies Section, Pretoria, 8 July 2025.
2. Vukeya, L.R. Mokotjomela, T.M. and Pillay, N. 2025. Determining the status of ecosystem degradation trends and their implications for ecological integrity in the southern African grassland biome. Botanical Society meeting, Free State National Botanical Garden, May 2025.

ELECTRONIC RESOURCES

1. Anon. 2025. Book explores the ecology and management of invasive Prosopis trees in Eastern Africa. Phys.org, [online] 20 January 2025. Available at: <https://phys.org/news/2025-01-explores-ecology-invasive-prosopis-trees.html?utm_source=chatgpt.com>
2. Anon. 2025. How scientists are battling the beetle killing our trees. Financial Mail, [online] 17 April 2025. Available at: <https://www.financialmail.businessday.co.za/fm/fm-fox/2025-04-17-how-scientists-are-battling-the-beetle-killing-our-trees/#google_vignette%202>
3. Anon. 2025. Polyphagous shot-hole borer update. Fresh Quarterly, [online] March 2025. Available at: <https://www.freshquarterly.co.za/edition/fresh-quarterly-issue-28-mar-2025/>
4. Bega, S. 2025. Rise in alien plants infesting Kruger. Mail and Guardian. 14 February 2025.
5. Bega, S. Study shows growing number of alien plants infesting Kruger Park. Mail and Guardian, [online] 12 February 2025. Available at: <https://mg.co.za/news/2025-02-12-study-shows-growing-number-of-alien-plants-infesting-kruger-park/>
6. Clark, G. 2025. Micro refugia could be key to survival of insect populations. Phys.org, [online] 31 July 2025. Available at: <https://phys.org/news/2025-07-micro-refugia-key-survival-insect.html>
7. Coles, W. 2025. New CABI book explores the ecology and management of invasive Prosopis trees in Eastern Africa. CABI, [online] 20 January 2025. Available at: <https://blog.invasive-species.org/2025/01/20/new-cabi-book-explores-the-ecology-and-management-of-invasive-prosopis-trees-in-eastern-africa/>
8. Esler, K.J. 2025. Living Lab: Where Science Meets Action. YouTube short film, [online] August 27, 2025. Available at: https://studio.youtube.com/video/Aq-vure6oUA/edit
9. Goodall, K. 2025. If Sambar deer on Table Mountain are listed as invasive, SANParks MUST act' – Brian van Wilgen, Stellenbosch University. Eyewitness News, [online] 5 March 2025. Available at:

<https://www.ewn.co.za/2025/03/05/if-sambar-deer-are-listed-as-invasive-sanparks-is-obligated-to-act-stellenbosch-professor?utm_source=chatgpt.com>
10. Hoosen, A. 2025. Underground seed banks hold key to restoring South Africa's lost fynbos. Radio Islam, [online] 24 March 2025. Available at: <https://radioislam.org.za/a/underground-seed-banks-hold-key-to-restoring-south-africas-lost-fynbos/>
11. Joubert, L. 2025. Funding cuts threaten control of invasive plants. Nature Africa, [online] 17 June 2025. Available at: <https://www.nature.com/articles/d44148-025-00186-2>
12. Joubert, L. 2025. SA government kills funding for best weapon against invasive trees. Daily Maverick, [online] 20 May 2025. Available at: <https://www.dailymaverick.co.za/article/2025-05-20-sa-government-kills-funding-for-best-weapon-against-invasive-trees/>
13. Lamprecht. H. 2025. Scientists tackle one of Africa's most destructive invasive trees. Namibian Sun, [online] 22 January 2025. Available at: <https://www.namibiansun.com/africa/scientists-tackle-one-of-africa%E2%80%99s-most-destructive-invasive-trees2025-01-22145873>
14. Large, H. 2025. Seeds discovered in natural "time capsules" in South Africa can still grow after 130 years. IFL Science, [online] 18 March 2025. Available at: <https://www.iflscience.com/seeds-discovered-in-natural-time-capsules-in-south-africa-can-still-grow-after-130-years-78469>
15. Lawrie, I. 2025. Lost fynbos seeds from underground 'time capsules' in South Africa can grow again – new study. Observatory Civic Association, [online] 24 March 2025. Available at: <https://obs.org.za/lost-fynbos-seeds-from-underground-time-capsules-in-south-africa-can-grow-again-new-study/>
16. Lee. C. 2025. Century-old fynbos seeds found viable in South Africa. Impactful Ninja, [online] 17 March 2025. Available at: <https://impactful.ninja/century-old-fynbos-seeds-south-africa/>
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