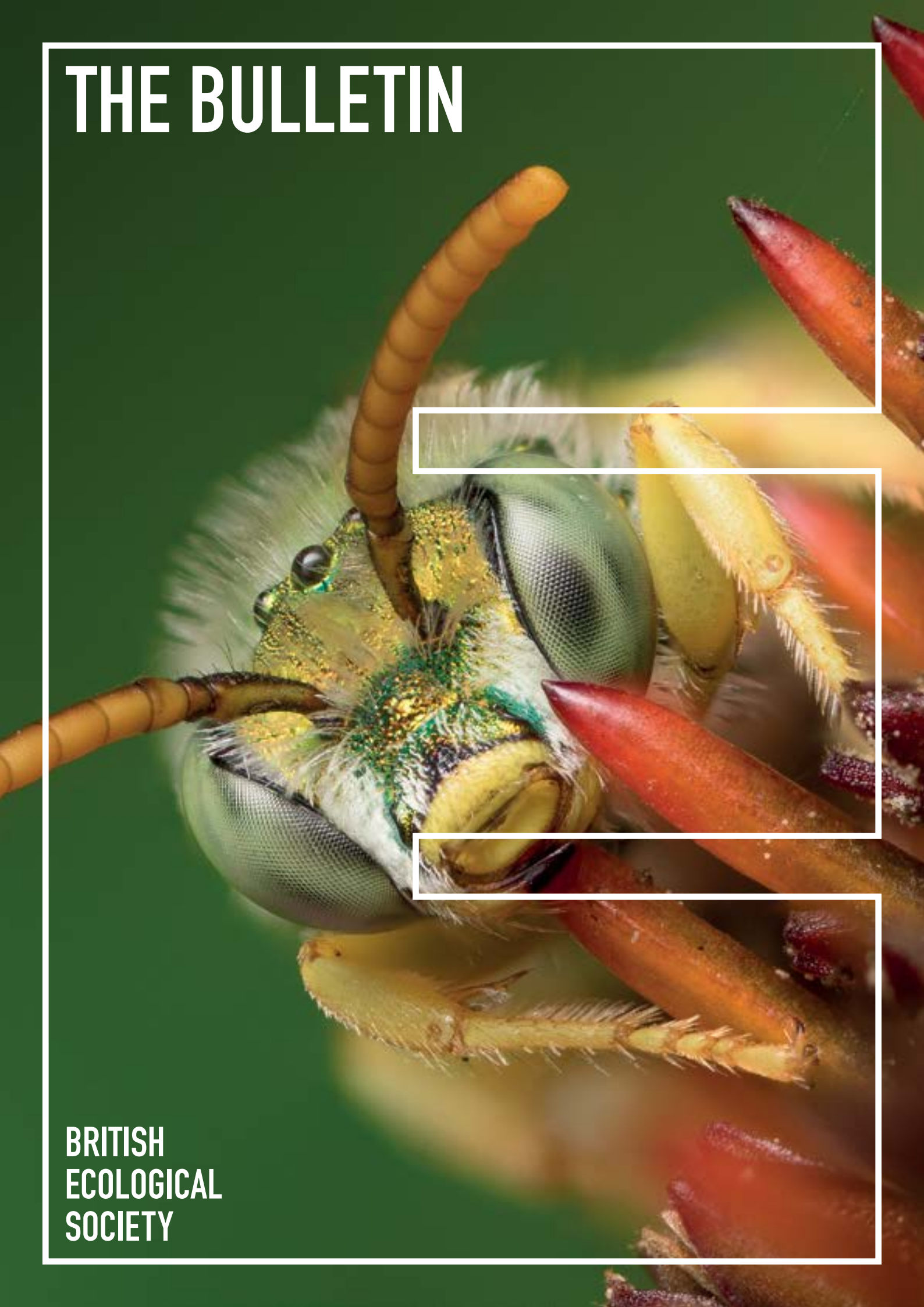


THE BULLETIN



BRITISH
ECOLOGICAL
SOCIETY

InFOCUS

The excellent BES stand at the RHS Flower Show in May is described in more detail on p18 onwards, but we couldn't resist opening this issue with an image of the new BES logo in the form of a green wall, which featured in the BBC television coverage of the event.



CONTENTS

JULY 2017

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PUBLISHING IN THE BES BULLETIN

The *Bulletin* is published four times a year in March, June, August and December. Contributions of all types are welcomed, but if you are planning to write we recommend you contact one of the editorial team in advance to discuss your plans (Bulletin@BritishEcologicalSociety.org).

Material should be sent to the editor by email or on a disk in Word or rtf format. Pictures should be sent as jpeg or TIFF (*tif) files suitable for printing at 300dpi.

Design: madenoise.com
Print Management:
H2 Associates (Cambridge) Ltd.

REGULARS

Welcome Alan Crowden.....	4
President's Piece: Innovation Sue Hartley.....	5
Equality and Diversity Data in the BES.....	8
Early Career Researcher Awards 2016.....	10
Policy: General Election 2017: An unexpected election and an unpredictable outcome Ben Connor.....	14
Ecology Across Borders – Bigger and More Diverse Paul Bower.....	16

Delight in the Dark Jessica Bays.....	18
Special Interest Group News.....	22
The Chartered Institute of Ecology and Environmental Management Sally Hayns.....	50
Publications: A look back on Early Career Researcher Awards Jennifer Meyer.....	52
Publications News.....	58
Book Reviews.....	60

FEATURES

Science for society at South Africa's Centre for Invasion Biology Engela Duvenage.....	28
Agri-Environment – A Need for Detailed Scrutiny Stephen Peel.....	36
Post-Brexit 25 Year Environment Plan for Agriculture – but what's the policy outcome? Neil Humphries.....	40
Field Notes: Moor House (A personal view) Bill Block.....	44
Last Ecologist in the Woods? John Wiens and Charley Krebs.....	46



SCIENCE **FOR SOCIETY** **AT SOUTH** **AFRICA'S** **CENTRE FOR** **INVASION** **BIOLOGY**

Engela Duvenage | Science writer
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*PhD candidate, Ingrid Minnaar, sampling aphids for her project on invasive *Harmonia axyridis* ladybirds (Western Cape, South Africa).
Photo: Corneile Minnaar*

As technical manager and research coordinator of the South African Subtropical Producers' Association (SUBTROP), entomologist Dr Elsje Joubert has a lot on her plate. Her job entails coordinating research on how to improve the quality of litchis, mangoes, avocados and macadamia nuts, but also about providing specialists with technical advice on the subtropical fruit industry. Major agricultural pests such as the fall army worm (*Spodoptera frugiperda*) and the oriental fruit fly (*Bactocera dorsalis*) currently occupy her attention. Dr Joubert's job requires passion for and insights into the interplay between species and the environments in which they find themselves.

Luckily Dr Joubert honed these skills as a postgraduate student of the DST-NRF Centre of Excellence for Invasion Biology (the Centre for Invasion Biology or C-I-B for short) which has its headquarters at Stellenbosch University in South Africa - arguably the world's most productive research and training unit in the field of invasion science worldwide.

The Centre was set up in 2004 to do research on invasion science, a branch of science that addresses the causes and consequences of introducing organisms to new environments. It asks questions about why some species persist and spread unaided, often to the detriment of native species and invaded ecosystems. The C-I-B addresses topics such as biodiversity conservation and environmental change, but also cuts through issues such as human health, water provision, food security, tourism, job creation, agricultural economics and the habitability of certain parts of the earth.

Climate change was central to Dr Joubert's postgraduate research. She studied how changing climate influences the movement of a major sugarcane pest and of tsetse flies that carry sleeping sickness to humans and animals, and the insects' possible spread to areas where they are not traditionally found. And, does she still get to work with species that are spreading beyond their normal home grounds? "Every day," notes Dr Joubert, who completed her PhD

part-time while already working for SUBTROP, referring to the fall army worm and oriental fruit fly among others.

FOCUS ON STUDENT DEVELOPMENT

Elsje Joubert is one of 176 graduates who have graduated from a network of South African universities since 2004 after researching matters related to invasive species under the auspices of the C-I-B. Like Elsje, most C-I-B alumni are ploughing back their knowledge into the local conservation, agriculture or biodiversity sectors – and beyond. Some work for the South African National Biodiversity Institute or in academia, others work alongside citizen science programmes, managers or consultants.

At Stellenbosch University, host of the C-I-B's administrative headquarters (another satellite hub is at the University of Pretoria), an interest in invasive species is already cultivated at undergraduate level. Lecturers in the University's Department of Botany and Zoology who are C-I-B team members teach modules to final year BSc students to introduce them to the ever-changing field of invasion science. From 2006 to 2012 the C-I-B and the Centre of Excellence for Birds as Keys to Biodiversity at the University of Cape Town presented an annual Biodiversity Conservation Academy to undergraduate students in conservation and natural sciences from underrepresented groups at South African universities.

"Our work is not only about getting to know more about doing the science, but also about developing people who can contribute to the science capacity of the country," notes C-I-B Director Professor Dave Richardson, who says that opportunities to attend international workshops, conferences or symposiums on for instance invasive birds or alien species in urban areas all play a part in students' development.

Last year C-I-B students also received training in science communication, to help them more succinctly translate their findings into popular articles and guidelines for management. "The thrust of these endeavours is

to help our students translate their findings into accessible forms such as non-technical presentations and really readable articles for the public, citizen scientists and policy makers to use and enjoy," adds C-I-B Deputy Director Dr Sarah Davies.

These efforts have already paid off, with two C-I-B students taking top honours in South Africa's 2017 Young Science Communicator's Competition for articles about invasive Harmonia ladybirds and the Acoustic Spatial Capture-Recapture technique for sampling elusive yet quite vocal frog species.

Providing practical experience to students – often in collaborations with partners – also forms an essential part of how things are done at the C-I-B. Earlier this year, for instance, students and researchers spent three weeks monitoring alien fish, plants and invertebrates in a variety of rivers, dams and wetlands in the Cederberg mountains of western South Africa. Officially this field excursion formed part of a long-term monitoring project funded by the South African Water Research Commission and co-ordinated by C-I-B postdoctoral fellow Dr Sean Marr of the South African Institute for Aquatic Biodiversity (SAIAB). In the process, C-I-B-funded undergraduate students from the Universities of Venda, Fort Hare, Stellenbosch and the Western Cape learnt to snorkel in freshwater dams, how to use underwater cameras and seine nets, and how electro-fishing and aquatic insect monitoring and identification are done. They received guidance throughout from leading local ecologists on how to complete their own research projects.

COMBINED EFFORTS

Collaboration and networking is another C-I-B cornerstone. "Our inter-institutional network of researchers located in universities and research institutions around South Africa trains up to 60 postgraduate students and hosts up to 15 postdoctoral researchers each year, through whom much of the Centre's research is conducted," explains Prof. Richardson. "Working between institutions also allows us



Students from all over South Africa participate in a training workshop on fish sampling. Photo copyright: Olaf Weyl

to collaborate with universities and institutions beyond the borders of South Africa.”

The C-I-B's network of research associates and research fellows come from all over the world, and work in South Africa, Canada, Australia, the USA, the UK, Kenya, Portugal, Switzerland, the Czech Republic and Austria. In the UK, these include the Centre for Biodiversity and Environment Research at University College London, Imperial College London, and the University of the West of Scotland. Such collaborations make it possible for the C-I-B's team members to participate in key global projects.

RESEARCH OUTPUT

The C-I-B was one of the first six national Centres of Excellence set up by South Africa's Department of Science and Technology (DST) through the National Research Foundation (NRF). Although contractually this core funding will end in 2019 the C-I-B has established itself as one of the jewels in the crown of a network that has since expanded to include 15 such centres.

For starters, the C-I-B's Information Retrieval and Submission System is quite an impressive affair that shows that collectively things get done. By March 2017, C-I-B associates and students had already published 1318 papers in Web of Science indexed journals, including many in high-impact journals such as *Nature*, *Nature Communications*, *Proceedings of the National Academy of Sciences of the USA*, *Proceedings of the Royal Society B*, *Science*, and *Trends in Ecology & Evolution*. The impact of these papers is reflected in their 26 992 citations, with a combined h-index of 73. Findings are regularly taken up in regional and national management guidelines and into environmental policy.

C-I-B core members serve on editorial boards, and also produce synthesis volumes and semi-popular texts. Recent books such as *Invasion Dynamics* (Oxford University Press, 2017) by Dr Cang Hui and Professor Dave Richardson draw theoretic concepts about the field together into one handbook. Others put theory

into practice, such as *Detecting and Responding to Alien Plant Incursion* (Cambridge University Press, 2016), with C-I-B research associate Dr John Wilson of the South African National Biodiversity Institute as lead author.

C-I-B team members host regular workshops and symposiums – often at an international level. Among the recent ones was a workshop on functional responses as a tool in invasion ecology, while others have addressed the evolutionary dynamics of tree invasions, and the drivers and impacts of insect invasions. In July 2017 it will again co-sponsor the 44th Annual Research Symposium on the Management of Biological Invasions in Southern Africa to be held in Pretoria, South Africa. These efforts all significantly contribute to knowledge about invasive species worldwide - from the evolution and ecological processes involved to conservation and management matters.

Increasingly, this also includes the use of molecular methods. “Molecular ecology provides exciting opportunities to reconstruct the history of introductions and invasions of many groups of alien species. It is a fundamental component of the C-I-B's toolbox, and contributes substantially to many of our research projects,” explains Dave Richardson.

“We realise that special tools, insights and types of study are needed for each stage in the invasion process, be it pre-introduction, initial incursion, expansion or dominance,” he adds.

At the time of its establishment there was nothing quite like the C-I-B in the world. “And there probably still isn't a place that is so dedicated and focused on invasive species as the C-I-B,” says Professor Tim Blackburn, Chair of Invasion Biology at University College London in the UK, who served as one of the international science advisors to the C-I-B's Steering Committee in its early years and is currently a research associate. It's the singular focus and the drive of those involved in the C-I-B that impresses him every time he visits South Africa.

For more information, visit www.sun.ac.za/cib

BEYOND SOUTH AFRICA'S BORDERS

Senior scientist Professor Brian van Wilgen and co-authors recently wrote in the *South African Journal of Science* the following about the C-I-B's endeavours: “A focus on invasions requires research to extend beyond the narrower fields of biology and ecology, and to embrace sociological and economic aspects of the problem that must be understood to develop effective policies and management solutions. This has led to the scope of the work being broadened from ‘invasion biology’ to ‘invasion science’, and has allowed the C-I-B to develop unique solutions that have had impact at international, national and local scales.” Its sphere of influence is increasingly extending beyond the South African borders further onto the African continent, not only through its student body but through the projects being pursued. The negative effects of Siam weed (*Chromolaena odorata*) on the people and environment in Tanzania was the topic of a recent paper in *Biological Invasions* led by C-I-B postdoctoral fellow Ross Shackleton. Another postdoc, Ana Nunes, was the lead author of a paper *Frontiers in Ecology and the Environment* about the devastating consequences that an invasive freshwater crayfish could have on the ecology of the Okavango Delta, an UNESCO World Heritage Site in Botswana.

PhD student Jane Rugwiro is pursuing her degree through C-I-B partner institution, the University of the Witwatersrand in Johannesburg, South Africa. She uses satellite images and remote sensing techniques to determine the extent of water hyacinth infestations in lakes and rivers in her motherland, Rwanda. “I hope my research will help the Rwandan government and partners to take a decision on how to control the invasion of these weeds,” explains Rugwiro, who'd also like to raise awareness about the use of biological control methods that could be used to do so.



BRIDGING THE GAP BETWEEN RESEARCH AND IMPLEMENTATION

C-I-B researchers and students had quite a few ideas to share with Cape Town city officials and environmental managers when they met in December 2016 for a workshop amongst the last 5% of critically endangered Cape Flats Sand Fynbos left in the world.

The setting was the Blaauwberg Nature Reserve across the bay from Table Mountain. Biodiversity-wise the reserve is by no means in a pristine condition because it is overgrown with invasive acacias from Australia, but restoration efforts are underway. The nature reserve is one of the C-I-B's many “outdoor classrooms” across the country. Research conducted here is about more than just data gathering. The projects aim to provide managers and practitioners with much needed know-how on how best to remove invasive plants and restore the area to its former species-rich glory.

PhD student Stuart Hall compared the benefits of different restoration methods that can be used to help native species find a footing again after alien plants have been cleared. He found that active sowing after alien plants have been removed helps the native fynbos shrubs to recover best, even if such initiatives add

substantially to the cost of restoration. Mlungu Nsikani is studying the legacy effects of invasion (effects that linger long after the invaders themselves have been cleared or removed) and the impact of secondary invaders.

Partnerships are a core part of how the C-I-B fulfils its mandate – and excels. Much of the research being done at Blaauwberg is for instance funded by Kew Gardens in the UK, while co-funding was also received through an ongoing research collaboration between the C-I-B and the South African Department of Environmental Affairs (DEA). This has been in place since 2008 and provides research support and practical guidelines to the DEA's Working for Water (WfW) management team about how best to tackle alien plant and animal clearing and control, and how to restore damaged ecosystems after these operations have finished.

Working for Water was launched in 1995 to clear invasive plants from South Africa's catchment areas and to thereby also help with water provision in this semi-arid country. It also provides much needed employment opportunities to people living in

rural areas. South Africa is a country suffering from the introduction and spread of thousands of different plant species.

As part of the WfW collaboration, the C-I-B works with the South African National Biodiversity Institute and other partner organisations on various projects – from mapping the distribution of species, investigating the interests and economic benefits of invasive species for local communities to studies about the role of commercial forestry in biological invasion. A range of biomes are addressed, each with its own particular needs – from the fynbos areas of the Cape and the Knysna forests to the northern savannas of the Kruger National Park and the Vhembe region of Limpopo province. Species such as Australian acacias, *Eucalyptus*, *Prosopis*, *Solanum mauritianum* and several cacti are in the research spotlight.

In 2017 alone the DEA contract supports the research of 76 honours students, postgraduates and postdoctoral associates. A key focus of this collaborative project is to provide highly skilled human capacity for managing invasive species.

OUTREACH IN SOUTH AFRICA

THE ANT-ICS OF THE IIMBOVANE OUTREACH TEAM

Engela Duvenage | Science writer

To have been longlisted as one of the last six projects in line for the 2017 St Andrew's Prize for the Environment is a feather in the cap of the team behind the C-I-B's schools outreach project Iimbovane. It is also a finalist in South Africa's 2017 National Science and Technology Forum Awards.



Iimbovane learners sampling ants in their school grounds.

Accolades are however not what brings the greatest satisfaction to the small Iimbovane team of Dorette du Plessis, Londiwe Msomi, and Sophia Turner. "There's nothing quite like hearing a group of teenagers gasp in absolute wonder when they peer through a microscope's lens for their first time, close-up, glimpse of an ant," explains Iimbovane's outreach manager Dorette du Plessis. "The detail that makes up the insect, the minute hairs on its body, its spines and the features of its abdomen astound them every time."

Iimbovane means "ants" in isiXhosa, one of South Africa's many indigenous languages. The project uses ants to teach learners what it is like to be a researcher, and to put the scientific method into practice. They are taught how to go about planning a research project, how data about specific species are collected and analysed, and how the final results should be presented.

"Iimbovane aims to increase environmental literacy and inspire secondary school learners

to take up scientific careers through facilitating field and laboratory work that is embedded in the life science curriculum," explains C-I-B Deputy Director Dr Sarah Davies in a chapter in the book *Biodiversity and Education for Sustainable Development* (Springer, 2016) co-written with Du Plessis and others at the C-I-B.

Through collaboration with the Western Cape Province Department of Education, Iimbovane has a presence in 18 partner schools. Thirteen of these are in towns outside of metropolitan areas, and 93% are located in under-resourced communities. The Iimbovane team and its loyal volunteers (some who were introduced to the project at school, and have gone on to study biological sciences at university) regularly represent the C-I-B at science expos and festivals such as Scifest Africa. Holiday camps are also held for learners and teachers.

Iimbovane was established in 2006 with support from the UK's Darwin Foundation, and has since enjoyed solid support from South Africa's Rand Merchant Bank and the cement company AfriSam. These donors, among others, have made it possible to provide equipment and compile educational resources for educators and learners that can be used at home and in class.

The multi-tiered project also has a strong science component. By setting out pitfall traps at or near their schools, learners have helped researchers establish that at least 170 ant species that are distinguishable based on their morphology (so-called morphospecies) occur in the Western Cape. New species have also been identified, and the endeavours of Iimbovane have been the subject of several journal papers.

For more information see:
www.sun.ac.za/iimbovane



Iimbovane learners visit Stellenbosch to learn about fynbos vegetation and sampling in a public park near the university.