

# COMMUNITY ENTOMOLOGY: INSECTS, SCIENCE AND SOCIETY

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## Abstract

Educative outreach programmes have been found to be effective ways in which to raise awareness around basic scientific concepts. The Biological Control Research Group (BCRG) in the Department of Zoology and Entomology at Rhodes University, South Africa, is involved in community engaged initiatives that aim to be interactive and informative around entomology, and more specifically, the use of biological control against invasive alien plants. As a higher education institution, Rhodes University has a civic responsibility to engage with local communities and work with them around local challenges. Three groups of activities undertaken by the BCRG in partnership with local schools and other community partners are described and assessed in this paper as a way of assessing them and exploring future research areas around the aims and outcomes of these programmes.

**Keywords:** community engagement, education, entomology, biological control, invasive alien plants

## 1. INTRODUCTION

Higher Education Institutions have a three core purpose of academic activity: (1) teaching and learning, (2) research and (3) community engagement (Hall, 2010). Community engagement is defined as a sustainable partnership between community members or organisations and higher education institutions (Jacob, Sutin, Weidman and Yeager, 2015). Pasque, Mallory, Smerek, Dwyer and Bowman (2005) add that this shared practice must be of benefit to the community partner as well as to the institution. This paper situates itself around the community engaged activities of the Biological Control Research Group (BCRG) in the Department of Zoology and Entomology at Rhodes University, South Africa. The BCRG has included community engagement work as a central theme in accompaniment to their research, placing itself within the engaged research paradigm. The group's research focusses on understanding the ecology, biology and management of alien invasive plants – primarily in the context of the biological control of these species.

Alien invasive plants have a diverse suite of negative effects on human well-being as described by Pejchar and Mooney (2009). In South Africa for example, invasive aquatic weeds pose a significant threat to the integrity of

aquatic ecosystems and affect the quantity and quality of potable water (Coetzee, Hill, Byrne and Bownes, 2011; NWRS, 2013). In recent years, invasive species have been recognised as one of the greatest threats to global biodiversity and ecosystem integrity (Richardson and Rejmánek, 2011; Branco, Videira, Branco and Paiva, 2015), often requiring some form of management. Biological control relies on the assumption that plants have become invasive in their adventive range due to release from their natural enemies and aims to control invasive alien plants by introducing host-specific insect or pathogen species, sourced from the weed's country of origin, into the adventive range (McFadyen, 1998). These insects or pathogens, known as agents, will establish populations in the adventive range and will help control invasive plant populations. One of the most internationally recognised management programmes for invasive plant species is the South African Working for Water (WfW) programme, a part of the National Resource Management Programme (NRM) of the Department of Environmental Affairs (DEA) in South Africa. The programme uses a variety of different methods to control invasive species in our ecosystems, including manual or physical removal, as well as chemical and biological control (Macdonald, 2004). Biological control is one of the most effective methods employed by WfW to manage invasive plant populations in South Africa. The WfW programme funds the research in the BCRG, where various aspects of biological control are investigated: from sourcing and testing new agents through to their mass-rearing and implementation, and ultimately the evaluation of their success of biological control on certain species in South Africa. Of equal importance however, is that marginalised communities are empowered by WfW through training and job creation to control alien invasive plants in their local environments (Buch and Dixon, 2009). It is this engaged and collaborative community-centred approach which has fundamentally shaped the work of the BCRG. The group has a strong commitment to community engagement initiatives and encourages meaningful engagement with the communities in which it is situated in, particularly around awareness and education of science in general but more specifically of entomology and biological control. The BCRG therefore aims to engage with our surrounding communities, using biological control as an interactive hands-on activity to introduce and expose community members to entomology, its application and to encourage environmental stewardship. While the BCRG runs a number of distinct and interwoven programmes, they can broadly be grouped into the following three categories: (1) The science internship and lecture series programmes, (2) various annual outreach activities and (3) short courses and mass-rearing programmes.

The community engagement activities initiated by the BCRG have evolved over time and have been responsive to expressed issues of concern or interest from local stakeholders and partners, this has assisted in situating the university more concretely within its local context. Although university or departmental small scale outreach programmes with local communities can sometimes be isolated and uncoordinated, there has been a concerted effort

to try and avoid this in the BCRG activities. Rhodes University Community Engagement Division plays an important role in recognising engaged activities and ensuring that they align with a broader common goal in promoting education. In the context of this paper, outreach programmes refer to activities that are done on intermittent occasions with an educational purpose. Hall (2010) suggests that successful community engagement by higher education institutions should possess clearly defined aims, promote reflection and is most powerful as a coordinated effort, rather than individual initiatives. Another key characteristic that engaged activities should have is to provide accessible information about the department's specific discipline (Bell, Curzon, Cutts, Dagiene and Haberman, 2011). Additionally, community outreach programmes can provide a unique platform for scientists, researchers and students where they have the opportunity to present their research to community members who are not from their disciplines (Clark, Russell, Enyeart, Gracia, Wessel, Jarmoskaite... and Rodenbusch, 2016). Clark *et al.* (2016) add that the relationship between scientists and the public are mutually beneficial to both as the communication of basic scientific research is being improved. Community engagement activities help build and strengthen relationships between community stakeholders and organisations, which tend to be more involved within the local community and aware of current challenges that they are facing (Walsh, 2006). In particular, the South African education system is failing in many ways and the quality of education is poor (Taylor, 2008). Given the state of affairs, it seems necessary that higher education institutions should form relationships with local schools to try provide support and alternative options for education. One issue the BCRG is addressing directly is that the South African school curriculum does not introduce entomology as a distinguished discipline, thus the BCRG outreach programmes can, and do play an important role in promoting entomology as a career pathway to school learners in the area. Young learners thus get exposure to alternate career pathways and academic research. Schools are important in our local communities as they play a vital role in educating future generations and thus it is important to support them. In order to engage successfully with schools in a meaningful way, the BCRG interacts extensively with other community stakeholders, including the private sector and non-governmental organisations (NGOs). Community partners also play a vital role in the sustainability of the initiatives and activities that are started by higher education institutions.

Concrete strategies and programmes have been developed, implemented and realised by the BCRG through engaging with literature around community engagement in higher education institutions and the context in which we live. Through these engaged activities, the BCRG offers substantial opportunities for hands-on, interactive learning and encourages a culture of ecological stewardship.

## 2. COMMUNITY ENGAGEMENT ACTIVITIES WITH SCHOOLS

Community engagement activities can take one of two approaches, an asset-based approach or a needs-based approach. The latter being the outdated and more charitable approach that governments and philanthropic organisations have tended to use (Mathie and Cunningham, 2003). Asset-based community development (ABCD), in contrast, is an approach that has more recently and favourably been adopted and used for successful community-driven development around the world. Mathie and Cunningham (2003) add that ABCD can be used to distribute the power of knowing which implies that everyone should have access to education which is by and large considered to be a basic human right. For the BRCG, the biological control of alien invasive plants is an action towards a better environment for all, and people should have access to know and learn about it. Following this, the BCRG has a sustained track record of implementing community engagement initiatives aimed at education, stewardship and the dissemination of weed biological control techniques to the local communities going back some ten years. This is facilitated through a science internship and lecture series programme, participation in annual educational outreach activities and invasive weed short courses as well as mass-rearing of biological control agents.

### 2.1 Science Internship and Lecture Series Programmes

The science internship programme and lecture series are structured to provide high school learners with the opportunity to engage with various aspects of entomology and science. Additionally, these programmes build and strengthen relationships between the tertiary institution and local schools. The science internship programme is a collaboration between three university science departments (Zoology and Entomology, Microbiology, and Geology), the South African Institute for Aquatic Biodiversity (SAIAB) and three Grahamstown government high schools (Victoria Girls High School, Graeme College and Ntsika Secondary School). There is potential for this programme to extend to other university departments and other schools in the Grahamstown area.

The internship is offered to Grade 10 to 12 learners over their school vacations for a total of three weeks per year. These learners compete for internship positions as there are limited spaces in the programme and the learners must have adequate science marks and write a strong motivational letter to be considered for the internship. Every year, a total of 23 learners are accepted into the programme of which 15 are placed into the BCRG. The learners actively participate in the research currently undertaken by the group and the programme is set up in order for them to experience and gain an understanding of different fields within entomology and other science related activities. The young interns are involved in a variety of activities during their internship, such as spending time with post-graduate students and

participating in their research, working at the insect mass-rearing facility, participating in microbiology experiments, and taking part in field trip excursions. Excursions include: two river outings where water quality is measured using MiniSASS, a scoring system where invertebrates are used to measure the quality of the water; a visit to the Albany Museum; and a DNA Workshop at SAIAB. These different engaged and interactive activities provide opportunities for learners to contribute to both laboratory and field work and learn about cutting edge experimental techniques and equipment at a young age. The programme aims to instil or foster an interest in science along with learners gaining experience into what scientists actually do. It also presents an opportunity for the researchers involved in the programme, who are often predominantly post graduate students, to improve their science communication skills.

In conjunction with the science internship programme, a lecture series was developed where researchers from the university and SAIAB are provided with the opportunity to present and discuss their research interests with learners and teachers from the associated schools. The lectures are held on a quarterly basis and cover diverse scientific topics. The lectures are consistently well attended and promote robust discussion, improving the science communication skills of both the learners and researchers (Clark *et al.*, 2016; Beck, Morgan, Strand and Woosley, 2006).

Two similar programmes initiated in the U.S.A.; "Shadow a Scientist" and "Present Your PhD Thesis to a 12-Year-Old", embrace a similar model to the two programmes introduced here. There is clear evidence that these programmes initiated by the university establish links between the university and local schools where the relationships were strengthened through the partnerships. Furthermore, there is evidence to suggest that similar programmes have improved the science communication skills of associated researchers and that their enthusiasm for science was shared with the young learners, hopefully encouraging them to consider science as a future career (Clark *et al.*, 2016). We aim to do the same in our programmes.

From informal discussions with the researchers and learners involved, the science internship and lecture series programmes at Rhodes University have proven to be incredibly successful and beneficial to all collaborators. For example, the Victoria Girls High School ranks in the top 25 government high schools in South Africa, due in part to its involvement with BCRG community engagement initiatives (Machlachlan, 2013). Furthermore, a number of interns have moved on to start their degrees in natural science at Rhodes University and they accredit their subject choice to this internship programme.

## **2.2 Annual Educational Outreach Activities**

As explained above, outreach activities are done on intermittent occasions with an educational purpose hence the focus on schools is really important in

the Grahamstown context as it serves to demystify Rhodes University and open the doors for the community to “look inside”. The role of a university in its community should be that of a knowledge partner for the local community members where universities could be considered as a social institution and the knowledge production process is democratised. The community engagement and outreach activities provide excellent vocational guidance to the youth in our communities and provides a space in which both the community and university partners can aim to create the ideal role and image of a higher education institution discussed above.

The BRCG participates in annual events, Sci-Fest Africa<sup>1</sup> and the National Science Week<sup>2</sup>. These annual events aim to promote the public awareness, understanding and appreciation of science, technology and innovation. The BCRG participates in both events with a specific focus on entomology and biological control of invasive alien plant species, promoting ways that citizens can play an active role in managing invasive plants in South Africa.

Sci-Fest Africa welcomes people of all ages to attend the interactive and informative exhibitions and lectures hosted by institutions from around the world. The BCRG's exhibition is manned by postgraduate students, who interact with the general public on topics regarding invasive species, biological control and ecological consequences of alien invasive plants. The BCRG received an award for the best WaterWorld exhibition in 2016 by SciFestAfrica for being the best interactive exhibition at the satellite venue.

National Science Week (NSW) is an annual week where science is celebrated among the country's schools, research institutes and higher education institutes. In 2016, the first NSW Rhodes University Science Faculty Open Day was held<sup>3</sup>. This event involves thirteen different departments in the Science Faculty, the Pharmacy Faculty and SAIAB where participants host two to three 45 minute sessions for Grade 9 learners to interact in. A total of 250 learners attended with their science teachers. The learners also received a subject choice talk from the career centre at Rhodes University, focusing on the benefits of taking the sciences and maths as matric subjects.

The BCRG also hosts quarterly outreach and scientific open days where learners from local schools are given the opportunity to view the scientific insect and animal collections and take specimens out to have a closer look. This gives learners experience with microscope work in a university setting. In 2015/2016 the BCRG in collaboration with the Entomological Society of Southern Africa's student representatives hosted educational outreach days where learners learned about entomology via discussions and interactive gameplay.

<sup>1</sup>Follow the link to find out more: <http://www.scifest.org.za/>

<sup>2</sup>Follow the link to find out more: <http://www.saasta.ac.za/programmes/focus-weeks/national-science-week/>

<sup>3</sup>Follow the link to find out more about 2016's event: [https://www.youtube.com/watch?v=Jkt\\_6FSXDC8](https://www.youtube.com/watch?v=Jkt_6FSXDC8)

### 2.3 Short courses and schools mass-rearing programme

The Weed Biological Control Short Course, sponsored by the Department of Environmental Affairs Working for Water Programme, is a Rhodes University accredited short course that is run through the BCRG. Since its inception in 2005, it has run annually and teaches basic concepts of invasive weed ecology and biological control in a hands-on setting. To date, over 232 people in 11 years have successfully completed the accredited short course. The course is designed to skill biological control implementers in the underlying tenets of the science behind biological control and has been attended by students, field rangers, interested and affected parties, researchers and implementation officers. Many of the delegates actively use the knowledge and techniques gained in managing South African invasive species in their line of work. This course is an opportunity where recent research findings are shared with people on the ground and equipping them with relevant skills, this is a perfect example of applying knowledge to solve real issues.

The provision of high numbers of healthy insects for release as biological control agents is vital for the establishment and success of weed biological control projects. These insect mass-rearing initiatives have historically been the mandate of research facilities. However, there is a need to roll these mass-rearing initiatives out to the local communities to not only ensure the provision of biological control agents, but also to obtain commitment from the communities affected by invasive alien plants. Additionally, it can provide the tools for communities to take responsibility for solving their environmental issues with our support. Thus, small scale mass-rearing programmes have been set up at two high schools, where biological control agents for invasive weeds have been mass-reared for release around the country. The mass-rearing of these biological control agents is relatively easy and can be done with little effort and maintenance, although someone needs to take ownership of the process to ensure that it is successful. The first school mass-rearing facility was initiated at Warrenton Hoërskool in Warrenton, Northern Cape in 2010, in collaboration with the BCRG, the University of Witwatersrand and the Northern Cape Department of Education. The aim of this programme was to provide a platform where teachers could use the process of biological control to teach plant-insect interactions, which would ultimately be incorporated into the school curriculum. The BCRG first hosted a workshop for Northern Cape educators and local government administrators entitled: 'Education and Awareness of Aquatic Weeds in the Northern Cape' to inform participants on how biological control of invasive plants can be incorporated into the school curriculum. The skills developed and knowledge learned has since been incorporated into the National Curriculum for Life Sciences. School teachers and learners have accepted ownership of this project, and since its inception, the Warrenton learners have released a substantial amount of biological control agents contributing to the control of water hyacinth on the Vaal River.

In collaboration with WildREACH, a Rhodes University student outreach programme, the BCRG has been involved in setting up a second small scale mass-rearing facility at Ntsika Secondary School in Grahamstown. WildREACH is run by university student volunteers where they facilitate educational outreach activities to develop an interest in wild areas, the natural environment and its importance. In 2013, the infrastructure for the facility was built. Through WildREACH, Ntsika learners are introduced to the concept of biological control through a series of interactive learning sessions facilitated by the BCRG. Grade 9s and 11s have been involved with this programme. However, there have been challenges with this initiative at the school as there has been limited investment and interest from the school teachers and learners. While WildREACH has been a strong driving force behind this initiative in 2013-2015, current student volunteers are prioritising other projects. These challenges will need to be addressed if the project is to be successful. Small scale mass-rearing facilities can be very useful for explaining difficult concepts in the Life Science curriculum and they can promote environmental stewardship amongst learners. There is scope for mass-rearing facilities to be initiated at other schools, but it will require solid commitment from all collaborators including schools, volunteers and researchers. Partners are being approached to join in this initiative in order to grow the amount of biological control agents released into invaded areas.

### 2.3.1 Focussing on ability

The WfW Programme is an Expanded Public Works Programme that also seeks to address unemployment in South Africa through the control of invasive alien plants. However, due to the physical nature of the work, the programme has found it difficult to employ people living with disabilities. The BCRG has addressed this gap by employing people living and working with disabilities in their mass-rearing facility at Rhodes University. The Grahamstown Area Distress Relief Association (GADRA) has partnered with the BCRG to offer the Persons with Disability Weed Biological Control Short Course. The course is offered to persons with disabilities from disadvantaged communities, where there are possibilities of employment upon successful completion of the course. This creates job opportunities for trained disabled people within Grahamstown and in some cases, certificate holders have been employed within BCRG. This successful process has been initiated in other parts of the country such as the City of Cape Town and the South African Sugarcane Research Institute in KwaZulu Natal.

## 3. CONCLUSIONS

The BCRG's engaged research programme has provided an opportunity for hands-on learning, allowing learners to get involved in current and environmentally relevant research and projects. It has also facilitated the dissemination of information around invasive alien plants, their removal and their effect on ecosystem health, and more importantly, the group has done

this in collaborative and inclusive ways. Moreover, the BCRG has helped to encourage a sense of environmental stewardship in the local Grahamstown community and beyond through building a spirit of collegiality between researchers and the community in which the university is situated.

The importance of sharing the methods and practices of the BCRG lies in the fact that these initiatives are replicable in other contexts. They are simple activities which involve sharing resources and knowledge with the local communities in interactive and informative ways, and they allow partnerships between academics, students and the broader community to be formed in ways that avoid a needs-based approach to community engagement, which could lead to dependency. The primary consideration in an outreach or education programme is encouraging ownership of the programme for sustainability, this also empowers community partners to make their own decisions around their involvement. The university and community partners engaging in activities need to discuss and decide on the shared goals and be aware of the aims and outcomes of the suggested and implemented programmes. The partnership must be mutually beneficial for all involved and recognition for the outcomes met through the programmes need to be shared by the partners. Opportunities should be created where partners have time and space to get together to reflect on the engaged activities that take place to fully see the value in them.

This contextual paper of the BCRG community engagement programme will inform future initiatives by university stakeholders on how to implement successful engagement strategies and to address shortcomings. Future research within the group will include deepening the evaluative elements of the programme and creating more rigorous systems to evaluate the impact of the programmes.

#### **4. ACKNOWLEDGEMENTS**

The Biological Control Research Group would like to thank their funders, Working for Water Programme of the Natural Resources Management Programme of the Department of Environmental Affairs (DEA: NRM: WfW). Further funding for this work was provided by the South African Research Chair Initiative of the Department of Science and Technology and the National Research Foundation of South Africa. Any opinion, finding, conclusion or recommendation expressed in this material is that of the authors and the NRF does not accept any liability in this regard.

The community partners that have joined in over the years of our community engaged activities have all been irreplaceable and the authors want to acknowledge their involvement. A special mention for Dr Francesca Porri and Mr David Stoloff for the conception of the internship and lecture series programmes and your passion for science education.

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