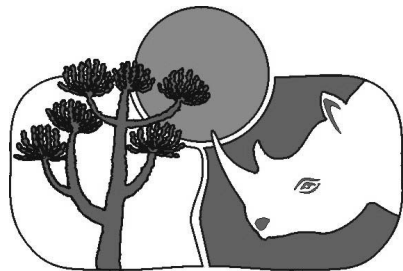


TERRESTRIAL ECOLOGY RESEARCH UNIT

ANNUAL REPORT 2004

University of Port Elizabeth



**TERRESTRIAL ECOLOGY
RESEARCH UNIT**



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INTRODUCTION

The formation of the Terrestrial Ecology Research Unit (TERU) was approved by the Council of the University of Port Elizabeth in 1991, in response to a need for terrestrial ecology training opportunities for postgraduate students and for terrestrial ecological research by conservation and environmental management agencies. TERU began operating in 1992, within the Zoology Department, and in 1997 it received Council recognition as a research unit within the Faculty of Science.

TERU comprises staff and postgraduate students of the Botany, Geography and Zoology Departments, with an Advisory Board comprising representatives of State, NGO and private conservation and environmental management interests.

This is the thirteenth Annual Report and deals with the activities of TERU during 2004.

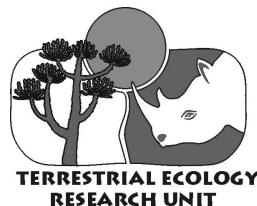
VISION

The Vision of TERU is to achieve, by 2006, national and international recognition as a terrestrial ecology research and postgraduate training unit of excellence.

MISSION

The Mission of TERU is to develop scientific knowledge of the ecology and conservation of terrestrial ecosystems, especially in the Eastern Cape and adjacent regions of high biodiversity, which will enable communities to make wise environmental management decisions. In achieving its Mission TERU will build human capacity through postgraduate training.

The mission and vision of the Terrestrial Ecology Research Unit were formulated in the context of the University of Port Elizabeth's mission and strategic directions, which the Unit is committed to the achievement of, in the context of the fields in which TERU operates.



DIRECTOR'S REPORT

Another year has passed and it is again time to reflect on the progress that TERU has made towards achieving its goals. The most direct measure is that of research outputs. In 2004 TERU staff and students produced 6 refereed scientific articles, 4 book chapters, 4 contributions in conference proceedings, 10 reports, and 1 popular article, with 21 conference presentations being delivered. Furthermore, 7 Honours students, 8 MSc students and 4 PhD students participated in TERU research programmes during the year under review. While the output of refereed scientific articles is down on the record output in 2003, this is to some extent offset by the fact that 4 MSc students and 1 PhD student graduated in 2004. Our congratulations and thanks go to these students.

Funding is also down, and for the first time in a number of years is below R1 million. This reflects the completion of the funding cycle for the World Bank/GEF funded STEP project, although it should be noted that sufficient funds were carried over from 2003 for this project to run for six months during 2004. In the medium term, funding at the 2004 level is probably sufficient to sustain TERU's current level of productivity, but attention needs to be paid to mobilising substantial funding to provide for administrative and research support for TERU. Such support is critical to allow for the further growth and development of the Unit.

There have been a number of developments in the area of staffing in TERU this year. Firstly and very significantly, we welcome the participation of Prof Vincent Kakembo in TERU's activities. Vincent, the incoming Head of the Geography Department, brings a very valuable spatial and remote sensing set of skills to TERU and I am sure that this will lead to significant growth in this area. I trust that Vincent will have a long and productive association with TERU. In an attempt to spread the responsibilities of running TERU, Eileen Campbell graciously agreed to serve as Deputy-Director, and she has proved to be invaluable in helping out in many respects.

Other staffing developments are that Michelle Hearne was appointed as part-time Administration Assistant for the year, and this appointment has highlighted how critical this support position is. Other appointments include that of Kirsten Bond, Chris Kelly and Dale Airton as field research assistants for the black rhino programme and Anthony Uithaler was appointed as a field research assistant for the springbok project. Wayne Linklater completed his stint as post-doctoral fellow funded through the San Diego Zoological Society, and is to be congratulated on his appointment at the Victoria University of Wellington in New Zealand. Fortunately, Wayne is committed to maintaining his ties with TERU so we will not be losing his valuable input. Serban Proches is also coming to the end of his post-doctoral fellowship and he will be moving to the University of Stellenbosch. Matt Hayward is thriving as a post-doctoral fellow out at Addo Elephant National Park and starting to generate publications from this work.

Vincent Kakembo and Eileen Campbell are to be congratulated on their promotions to Associate Professor, as is Richard Cowling, who received the Botanical Society's Flora Conservation Award.

The World Bank/Global Environment Facility funded STEP project came to an end in midyear, but it is important to note that the next phase of this project is to be run by the South African National Biodiversity Institute. This project was a high profile opportunity for TERU that has had numerous benefits for the Unit and the University. I would therefore like to thank André Boshoff and Sharon Wilson for the outstanding way they have run this project, often in the face of considerable administrative and contractual difficulties. In addition, Richard Cowling is to be thanked for the scientific leadership that he provided.

The success of an entity such as TERU depends heavily on the commitment and contribution of the participants, and I am pleased to be able to thank all of the staff and students for the positive roles that they have played in this last year. Finally, I would like to thank all the funding agencies, particularly the University of Port Elizabeth, that support TERU's training and research activities and facilities.

Prof. G I H KERLEY
DIRECTOR: TERRESTRIAL ECOLOGY RESEARCH UNIT

AWARDS

- Richard Cowling was awarded the Flora Conservation Award by the Botanical Society of South Africa.
- Marietjie Landman was awarded a Prestige National Research Foundation Bursary.
- Graham Kerley and Richard Cowling were recognized as being in the "Top Twenty Researchers" at the University of Port Elizabeth.

RESEARCH ACTIVITIES

Research activities are grouped into themes, and are reported within these on a biome or project specific basis.

STEP: A TERU FLAGSHIP PROJECT

Subtropical thicket vegetation (also known as valley bushveld), is a prominent feature of the Eastern Cape. It is a critically important resource for the angora and boergoat farming industries in the region, as well as for the growing number of ventures associated with the non-consumptive and consumptive use of game, for example ecotourism, trophy and meat hunting and game breeding. These industries are worth many millions of rands annually, and they provide direct or indirect jobs for many thousands of people. Thicket also contains plant and animal biodiversity that is of national and global importance.

Owing to a range of factors, especially unsustainable management practices, the plant cover provided by thicket is decreasing significantly, leading to desertification and loss of production potential in many areas.

Funding was mobilised by TERU to research the causes and extent of the decline of thicket, and to compile a plan to promote the conservation of this valuable resource. This led to the Subtropical Thicket Ecosystem Planning (STEP) project, co-funded by the Global Environment Facility in Washington, USA, and implemented through the World Bank. The R7 million project, which commenced in July 2000 and ended in June 2004, covers an area of 105 500 km².

The STEP team – comprising leading specialists in the biological, ecological, conservation planning and social fields – worked closely with key stakeholders from local, regional and national government, conservation parastatals, NGOs and representatives of the formal and informal agricultural sectors.

Key outcomes and products from STEP include a detailed map of 112 types of thicket vegetation (previously only 5 types were recognized), a list of 1558 types of plants recorded, of which some 20% are endemic (i.e. occur here and nowhere else in the world), and a highly diverse (48 species) array of the medium- to large-sized terrestrial mammals, a Conservation Priority Map that depicts areas where sustainable and biodiversity-friendly land-use practices are essential if thicket is to survive into the future, a Handbook that presents the Conservation Priority Map in a user-friendly format to municipalities, and a Framework and Co-operative Strategy for conserving landscapes and enhancing rural livelihoods. All of these products, and more, are available at <http://cpu.uwc.ac.za>.

By employing highly innovative concepts, principles and techniques, the STEP team delivered a set of world class products. For the first time, biodiversity information has been produced in a format that can be easily incorporated into spatial planning frameworks. This has given planners in the STEP region a huge advantage in complying with the terms of South Africa's new Biodiversity Act. The STEP products also have significant implications for the maintenance of a

sustainable biodiversity-based economy that offers many opportunities for socio-economic development.

The STEP spatial planning outcomes have been formally adopted as the implementation standard by national, provincial and local government in the STEP planning region. STEP also facilitated the creation of the post of Bioregional Programmes Co-ordinator (Eastern Cape); this position, which falls within the South African National Biodiversity Institute, is located in Port Elizabeth and deals with, *inter alia*, the implementation of the STEP Strategy.

The research and planning phase of the STEP Project ended with the successful holding of the first Thicket Forum, in May 2004. This annual event, which was attended by delegates representing a wide range of interests, organisations and institutions involved in some way with thicket vegetation, serves as a forum to exchange ideas and information, and to guide and align activities.

Through its involvement in the STEP Project, TERU has made a significant contribution to promoting sustainable livelihoods.

CONSERVATION BIOLOGY

This theme seeks to investigate the processes which render species vulnerable to extinction and identify priorities in terms of areas and implementation options for the efficient and effective long-term conservation of populations, species, habitats, and the ecological and evolutionary processes that maintain them.

Elephant: Katie Gough (MSc student) has been continuing her data collection on the interactions among the Addo elephants. A key finding has been that elephant bulls do not seem to exhibit reduced interaction with their natal herds, suggesting that they are not displaying inbreeding avoidance. This has significant implications for the conservation management of small, enclosed elephant populations. Katie has also further developed the computer based identification key for the Addo elephants. Katie was part of a TERU delegation that were invited to the Elephant Management Association Symposium where the seven presentations by TERU members were very well received.

Black rhinoceros: Wayne Linklater's post-doctoral research on chemical communication in translocated black rhinoceros has focused on the behaviour of a large number of translocated black rhinos, with ongoing support from the Center for the Reproduction of Endangered Species (San Diego Zoological Society – CRES/ZSSD). Excitingly, his data suggests that it is possible to modify translocated black rhino's behaviour through his technique of introducing them to each other and their new ranges through faeces, and this may be invaluable in reducing mortalities in translocated animals. Wayne has come to the end of his postdoc and has been appointed to an academic post in New Zealand, but will be continuing his collaboration with TERU.

Taking the Next STEP: Towards Opportunities for the Conservation of Subtropical Thicket in the Fish River Catchment: Excellent progress continues to be made with this project. Two papers were submitted towards the end of 2004. Andrew Knight (MSc student) spent three weeks in late November

with Dr Bruce Campbell at the University of Darwin (Australia) in order to build a model to guide his research in the Fish-Kowie Megaconservancy area.

Systematic conservation planning: a new vision for the marine environment. Mariette Bause completed her MSc and graduated in 2004, and a paper is in preparation.

The Nelson Mandela Metropolitan Open Space System: A strategic conservation plan: Warwick Stewart's MSc project is now completed and he will submit his MSc thesis at the end of 2004 and one paper will be submitted for publication during 2005.

The design and development of an ecologically, economically and socially sustainable nature reserve system in the Greater Cape St Francis area: Brian Reeves (MSc student) is doing pioneering research on developing an expert system for guiding spatial priorities for land management in the context of a virtual commons, namely a conservancy.

Conservation planning in Namaqualand: This project, a collaboration between Richard Cowling and Phil Desmet, is now complete and Phil has completed his PhD. A paper is in press.

Incorporating socio-economically significant biodiversity (critical natural capital) into municipal-level conservation plans: a pilot study in the Kouga Municipality: This project is being undertaken by Richard Cowling in collaboration with Warwick Stewart (Biodiversity Conservation Unit of WESSA) and Adam Welz, an MSc student from the University of Cape Town. The aim of the project is to empower stakeholders in various sectors (water affairs, tourism, agriculture etc.) to identify biodiversity features that are critical for their sustainability, and then to map these as inputs to Integrated Development Plans and Spatial Development Frameworks. Ultimately, the aim is to shift the burden of biodiversity conservation to other sectors, using this process. Progress has been slow, and the project will start in earnest next year.

Mainstreaming biodiversity in production landscapes and sectors: Richard Cowling collaborated with BJ Huntley, K Maze, T Sandwith, S Frazee, C Peterson and N Sekran on this project to organise a symposium and workshop to identify – for the benefit of the Scientific and Technical Advisory Panel - key research areas for funding by the Global Environment Facility's Strategic Priority 2. A paper has been written and will appear in a book on the conference proceedings, due to be published in early 2005.

National Biodiversity Spatial Assessment(NBSA) Richard Cowling collaborated with Mandy Driver, Kristal Maze, Mathieu Rouget and Mandy Lombard on South Africa's first attempt to produce a comprehensive and integrated national biodiversity assessment (co-funded by DEAT and SANBI), an obligation as a signatory to the Convention on Biological Diversity. His role in this process was to provide specialist scientific advice and to participate in the terrestrial and marine components, and he is co-author on these and the summary report. There is an intention to produce a special issue of the journal *Diversity and Distributions* on the outcomes of the NBSA.

ANIMAL-PLANT INTERACTIONS

This theme seeks to develop an understanding of the nature of the interactions between animals and plants, and a predictive understanding of perturbations associated with animal impacts on communities and ecosystems.

Foraging behaviour of Thicket Biome browsers: Joan Lessing (MSc student) has been investigating the feeding impact of elephant. As part of this study she has shown that elephant actually prefer feeding at ground level, and has challenged the accepted wisdom that elephant feeding behaviour is "top-down" in thicket. Shavaughn Davis (BSc(Hons)) student) has shown that elephant shift their diet when moved to new areas, but she has found limited utilization of the plants commonly considered to be at risk through elephant herbivory.

Black rhinoceros: Marietjie Landman (PhD student) has been focusing on the foraging ecology of black rhinoceros, and has nearly completed her fieldwork. She has shown that there is considerable scope for dietary competition between elephant and black rhino, and this may explain the high degree of variability that she has been observing in black rhino diet. She has also been measuring landscape level foraging behaviour by black rhino.

Comparative feeding behaviour of domestic animals (sheep and goats): Mpumzi Mayekiso (MSc student) has continued analyzing his data and preparing his thesis, slowed down somewhat by his accepting a position within the Department of Agriculture. He has clearly shown that the assumption of the National Grazing Strategy that herbivore impacts can be standardized in terms of metabolic equivalents can not be supported, as he has shown that Angora goats, boer goats and dorper sheep all have different feeding impacts despite their similar body sizes.

Habitat models for indigenous mammals in the Eastern Karoo: An van Cauter completed her MSc project and graduated in 2004. She is currently preparing two manuscripts from this work.

The contribution of herbivory to maintain thicket clumps in Bontveld: Johann Gerber completed a BSc(Hons) project in which he describes the winter browsing patterns of ungulates in Bontveld at Shamwari. He showed that animals prefer to browse from the thicket clump fringes, thereby contributing to the maintenance of these clumps. Summer surveys are planned for 2005 after which this work will be published.

RESOURCE ECOLOGY

This theme seeks to develop a predictive understanding of the responses of biota to different forms of utilization, and of how these natural resources are utilized.

Many of the projects listed under other themes also contribute towards the goals of this theme.

Changing land use trends in the Thicket Biome - pastoralism to game farming: Rebecca Sims-Castley and Graham Kerley completed an analysis of

the socio-economic impacts of private nature reserves in the Eastern Cape, showing considerable benefits of this form of landuse. A report has been submitted and this has attracted considerable attention as it clearly demonstrates the socioeconomic benefits of private nature reserves.

PREDATOR PREY INTERACTIONS

This theme seeks to understand the nature and consequences of predator prey interactions, to provide guidelines for the management of predators and their prey.

Impacts of reintroduced predators in Thicket: Matt Hayward, assisted by volunteer Gina Davis, has been leading this project as part of his postdoctoral research. He has been monitoring lion and spotted hyaena predation in the Addo Elephant National Park, amassing considerable information on their diet and resource use. He has also been analyzing published information on prey preferences by predators and has been preparing a number of manuscripts on this topic, one of which has been accepted to date.

Diet of leopard in the Baviaanskloof and adjacent rangelands. Teri Ott (BScHons) was able to collect a sample of leopard faeces, and she has shown that within the Baviaanskloof Nature Reserve this species preys primarily on medium-sized ungulates. In contrast, leopards in the adjacent rangelands shifted their diet to focus more on small mammals. Overall, domestic herbivores formed less than three percent of leopard diet. Teri has submitted a manuscript for publication.

TRANSFORMATION AND RESTORATION ECOLOGY

This theme seeks to understand the causes and consequences of ecosystem transformation across all levels of integration, to provide guidelines for the restoration of biodiversity and ecosystem function.

Seed dynamics in transformed thicket: Ayanda Sigwela completed his PhD thesis on the processes influencing seed dynamics in thicket, and this has now been submitted for examination. His work has clearly shown that thicket regeneration via seedling recruitment is more important than previously recognized, and that this process is significantly impaired by thicket transformation.

The effects of transformation on ecosystem services within transformed thicket: Richard Lechmere-Oertel was awarded a PhD for his study on the effects of transformation on ecological processes in thicket, and he graduated in April. He has had three papers accepted for publication.

Transformation of biodiversity and critical natural capital in the Little Karoo: Ms Sims-Castley suspended her PhD registration, owing to family commitments. Her component of the research has been taken up by Mark Thompson. Vegetation mapping by Mr Jan Vlok is complete and the transformation mapping will soon be completed. A workshop will be held with stakeholders in early 2005 to decide how best to develop this project further.

Assessing costs, benefits and feasibility of subtropical thicket restoration in the Eastern Cape

Richard Cowling is serving as scientific advisor to this project which is being run in collaboration with Anthony Mills, Mike Powell and Christo Marais and aims to investigate the opportunities and constraints of restoring degraded subtropical thicket, using spekboom (*Portulacaria afra*) as the material for the restoration initiative. The overall aim is to kick start a carbon economy, based on the incredible potential of spekboom to capture carbon rapidly, both above- and below-ground. Good progress has been made with setting up experiments, and three papers (two in press, one submitted), which provide the background and context for this project, have been produced.

A vegetation monitoring programme for Shamwari: John O'Brien and Eileen Campbell have completed the development of a vegetation monitoring programme for the private game reserve, Shamwari. A detailed vegetation map of Shamwari is now complete, showing that two highly endangered vegetation types are conserved within the reserve (Calcrete Bontveld and Calcrete Fynbos). These vegetation units contain several endemics and also constitute the only populations of several Red Data Book plant species known to be in conservation areas.

Rehabilitation of Bontveld following limestone mining: Eileen Campbell continues to monitor the rehabilitation of Grassridge following PPC Cement's mining of limestone. Conservation efforts on Grassridge include translocation of Red Data Book plants prior to mining and their return to mined areas; control of alien species; the establishment of thicket clumps in the rehabilitated areas so as to retain a patchy landscape.

Impacts of introduced species on Subtropical Thicket: Evert Jacobs' MSc study on the diet and feeding impacts of giraffe in thicket vegetation has slowed down as he has elected to continue with his studies on a part time basis. He will complete his field data collection in the 2004/2005 summer and then analyse and write-up his thesis.

Global Climate change and herbivore physiological responses: In an increasingly exciting collaboration with Duncan Mitchell, Andrea Fowler (Wits Medical School) and Shane Molony (University of Western Australia), Graham Kerley has been part of a team investigating the responses free ranging ungulates to the stresses predicted under global change scenarios. This has exploited the availability of intact (pre-change scenario) and transformed (a desertified landscape predicted under global change) thicket sites adjacent to each other. Robyn Hetem, a PhD student at Wits, will be measured the thermal response of kudu, using implanted temperature loggers, to these conditions and her study animals were implanted in December.

BIODIVERSITY

This theme seeks to gain a predictive understanding of the patterns, determinants and functions of biodiversity.

Biodiversity and rarity in South Africa's south-eastern temperate (upland) grasslands: The objective of this project is develop a predictive

understanding of the patterns of various components of biodiversity within grasslands. Dave Hoare (PhD) is making good progress and will submit his PhD in 2005.

Weevil (Curculionidae)-plant diversity relationships: As part of his postdoctoral research, Serban Proches is investigating cross-scale patterns of species diversity and turnover in plants and weevils in several vegetation types in the Cape. This project is now completed and a paper is in an advanced state of preparation.

Geophyte diversity, bulb size, and environmental factors in the winter rainfall region of southern Africa: A further aspect of Serban Proches's postdoctoral research is his study of species diversity in the world's foremost geophyte hotspot: the winter rainfall region of southern Africa. This project is now completed. Two papers have been produced, one in press and one under review.

Population age structure and distribution models for tree euphorbias in subtropical thicket: Abigail Kamineth's MSc study on the population age structure and distribution modeling of three species of tree euphorbias in thicket vegetation has progressed well. She completed her thesis and graduated this year.

Developing habitat suitability indices for mammalian herbivores at Augrabies Falls National Park: This project uses an animal's assessment of patch specific opportunities and risks, based on optimal foraging theory, to develop habitat suitability indices. This is being undertaken for springbok by Caroline Reid (MSc) and for klipspringer and rock hyrax by David Druce (PhD, registered at the University of KwazuluNatal), and they have both completed their fieldwork at the Augrabies Falls National Park. Caroline has completed her thesis and submitted it for examination, and has two manuscripts in preparation.

FUNDAMENTAL RESEARCH

This theme seeks to encourage research on any intellectually interesting ecological or evolutionary question.

The role of rainfall variability in explaining post-fire regeneration traits and diversification processes in Mediterranean-climate ecosystems: This project of Richard Cowlings, has been comparing indices of rainfall reliability and plant regeneration traits in all five Mediterranean-climate rainfall regimes, is complete and formed the basis of an invited keynote address at the X MEDECOS conference in Greece in April.

Changes in community structure and composition of monkey beetle (Scarabaeidae: Hopliini) communities along floristic gradients in Namaqualand Richard Cowling is co-supervising JF Colville's PhD project (registered at UCT) together with Mike Picker and Simon Ferrier. Slow but steady progress is being made and one paper has thus far been published.

Is Bontveld controlled by fire? Eileen Campbell and Clayton Weatherall-Thomas were fortunate to locate four portions of Bontveld on Grassridge where

fires occurred at different times. This presented an opportunity to investigate whether fire contributes to the patchiness of Bontveld landscapes in a similar way to savannas. This work will be repeated after a further two years of post-fire recovery.

Pollination ecology and coexistence: *Aloe* and *Satyrium* spp as model systems: Christo Botes' MSc research, supervised by Richard Cowling and Prof Steve Johnson (University of KwaZulu Natal) has made excellent progress thus far in that (i) the reproductive phenology of five *Aloe* spp has been monitored, in monocultures and mixtures in the Gamtoos Valley (there is evidence for shifts in phenophases in mixtures), (ii) reproductive phenology has been monitored; and breeding and crossing experiments and reciprocal transplants have been conducted for the sister taxa, *Satyrium princeps* (bird-pollinated – calcareous sands) and *S. membranaceum* (moth-pollinated – clay-loams). An exciting component of the study is the location of a population of *S. membranaceum* (coexisting with *S. princeps*) that is reverting to the basal bird-pollinated syndrome.

Physiological responses of springbok colour morphs: The question as to how the different colour morphs of springbok (common, black and white morphs) respond to thermoregulatory challenges is being addressed through a collaborative project set up with Duncan Mitchell and his team of the Wits Medical School working with Graham Kerley. A sample of springbok of each colour morph were implanted with temperature loggers and data collected for a three month period on the UPE campus, before the animals were moved to the Karoo. The initial data clearly show that the black and white colour morphs were more sensitive to environmental temperatures than the common colour morphs.

CONTRACT RESEARCH

Herbivores in Eastern Cape reserves: TERU was commissioned by the Eastern Cape's Department of Economic Affairs, Environment and Tourism to compile a report that addressed a range of topics relating to the medium- to large herbivores on the 24 protected areas (reserves) managed by the Eastern Cape Parks Board. These topics include the broad habitat types present in each reserve, the species that are currently present and that could potentially be re-introduced, the ecological status (i.e. alien or indigenous) of the currently present species, the occurrence of genetic variants, selected conservation management issues and the ecological requirements of appropriate indigenous species. A list of recommended management priorities was included in the report.

Potential impact of wind turbines: TERU was commissioned by the Environmental Evaluation Unit at the University of Cape Town to investigate the potential impact of an experimental wind farm on the birds of the Darling-Yzerfontein area, Western Cape Province.

Management plans for Samara: Plans for the introduction and management of brown hyena onto the Samara Private Nature reserve were completed.

SCIENCE MANAGEMENT

- Richard Cowling chaired the Scientific Advisory Committee of the National Botanical Institute, and served on the Succulent Karoo Ecosystem Planning Project: Technical Committee and Scientific Advisory Committee. He was also appointed as a member of the Scientific and Technical Advisory Panel (STAP) for the Global Environment Facility (GEF): World Bank, and served on the Local Organizing Committee: NBI - GEF: STAP Workshop: Mainstreaming Biodiversity in Production Landscapes.
- Graham Kerley served on the Advisory Board of the Mammal Research Institute, University of Pretoria and on the Postdoctoral Selection Panel for the National Research Foundation.
- Richard Cowling served as a member of the editorial boards of *South African Journal of Environmental Law and Policy*, *Global Ecology & Biogeography*, *Ecological Economics*, *Oryx*; *Conservation Biology*, *Plant Ecology*, *Ecology Letters*, *Diversity and Distribution* and *South African Journal of Botany*.
- Graham Kerley served on the editorial boards of the *Journal of Arid Environments*, *African Zoology*, *African Journal of Range and Forage Science* and the *South African Journal of Wildlife Research*.
- TERU members are actively involved in the review of scientific papers, this being critical to the maintenance of high standards of science, and also reflects the recognition of the members of TERU by these journals. To this end TERU members provided one or more reviews for the following journals: *African Journal of Ecology*, *African Journal of Range and Forage Science*, *African Zoology*, *Annals of the South African Museums*, *Austral Ecology*, *Bothalia*, *Conservation Biology*, *Environmental and Experimental Botany*, *Functional Ecology*, *Journal of Arid Environments*, *Journal of Vegetation Science*, *Journal of Zoology*, *Plant Ecology*, *Rangeland Ecology and Management*, *Restoration Ecology*, *Oryx*, *South African Journal of Botany*, *South African Journal of Science*, *South African Journal of Wildlife Research*.
- TERU members provided project, proposal and personnel reviews to the following organizations: Critical Ecosystem Partnership Fund, Rhodes University, National Research Foundation, Wilderness Foundation, CNRS-NRF, Rufford Foundation, UK, Israel Science Foundation, University of Cape Town, University of Connecticut, University of Stellenbosch, University of the Witwatersrand, Eureka prize (Australia).
- TERU staff and students participated in a large number of workshops and working group meetings, and made presentations and provided advice on a wide range of scientific and related matters.

COMMUNITY SERVICE

- Graham Kerley served on the University of Port Elizabeth Safety, Health and Environment Committee, Financial Aid Committee and as Chairman of the University of Port Elizabeth Nature Reserve Committee. He continued to act as manager of the Grysbok Environmental Education Trail on the UPE Campus: over 6500 school children have now participated in this trail since its inception in 1996. The Trail was again the sole UPE representation at the 2004 Sasol Scifest. Graham was appointed as a non-executive director of the Eastern Cape Parks Board and chairs the Conservation and Marketing Committee of the board. In addition, he was appointed to the National Advisory Committee of the Sasol Scifest.

- Richard Cowling continues to serve on the Board of the National Botanical Institute and chaired the Scientific Advisory Committee of the NBI. He also served on the committee of Friends of the St Francis Nature Areas, the Huisklip Nature Reserve Advisory Board and as a trustee of the Grootbos Foundation.
- Sharon Wilson served on the Conservation Committee of the Wildlife and Environment Society of South Africa (Eastern Cape Branch).
- Public presentations by TERU members were provided to a very wide range of civil society groups, and in addition TERU members provided advice to a range of organizations, including conservation agencies, private reserves and NGOs.
- TERU is represented on the Addo Planning Forum and the Advisory Committee of the Wildlife and Environment Society of South Africa's Biodiversity Conservation Unit, and as an *ex officio* member of the Steering Committee of the Baviaanskloof Mega-reserve Project.

External Academic Activities

- Graham Kerley served as external examiner for the BSc and BSc(Hons) degrees for both the Department of Animal, Plant and Environmental Sciences, University of Witwatersrand and the School of Botany and Zoology, University of KwaZulu-Natal (Pietermaritzburg), and also served as examiner for an MSc degree at the University of KwaZulu-Natal (Durban).
- Richard Cowling served as an examiner for an MSc degree at the University of Stellenbosch.

External Student Supervision

TERU members served as supervisors for students registered at universities other than the University of Port Elizabeth, reflecting the levels of collaboration being achieved. These students are:

- Richard Cowling served as co-supervisor for John Colville (PhD, University of Cape Town), Phil Desmet (PhD, University of Cape Town), Amre von Hase (PhD, University of Cape Town), D Berliner (PhD, University of Cape Town), Adam Wertz (Msc, University of Cape Town), Tracey Cumming (MSc, Rhodes University)
- Graham Kerley served as co-supervisor for David Druce (PhD, University of Kwazulu-Natal) and Robyn Hetem (PhD, University of the Witwatersrand).

2004 PRODUCTS

REFEREED SCIENTIFIC PUBLICATIONS

1. KERLEY, GIH, WHITFORD, W.G. & KAY F.R. 2004. Impact of pocket gophers on soils and vegetation in the Chihuahuan and Sonoran Deserts. *J. Arid Environ.* 58:154-165.
2. LINKLATER, W. L. 2004. Wanted for conservation research: behavioral ecologists with a broader perspective. *BioScience* 54: 352-360.

3. RODRIGUES A.S.L., ANDELMAN S.J., BAKARR M.I., BOLTANI L., BROOKS T.M., COWLING R.M., FISHPOOL, L.D.C., DA FONSECA, G.A.B., GASTON, K.J., HOFFMANN, M., LONG, J.S., MARQUET, P.A., PILGRIM, J.D., PRESSEY, R.L., SCHIPPER, J., SECHEREST, W., STUART, S.N., UNDERHILL, L.G., WALLER, R.W., WATTS, M.E. & YAN, X. 2004. Effectiveness of the global protected area network in representing species diversity. *Nature* 428, 640-643.
4. PROCHES, S. 2004. Ecological associations between organisms of different evolutionary history: mangrove pneumatophore arthropods as a case study. *J. Mar. Biol. Ass.* 84:341-344.
5. BERRY, M.G., ROBERTSON, B.L. & CAMPBELL, E.E 2004: Aspects on the history and development of informal settlements in the south-eastern Cape Coastal Zone. *South African Geographical Journal* 86:23-39.
6. ROWNTREE, K.M., KAKEMBO, V., DUMA, M. & THORNES, J., 2004: Debunking the Myth of Overgrazing and Soil Erosion, *Land degradation & Development*, **15**: 203-214.

Book Chapters

1. Pierce, S.M. & Cowling, R.M. 2004. Succulent Karoo. In: Burgess, N., D'Amicio Holes, J., Underwood, E., Dinerstein, E., Olson, D., Itona, I., Schipper, J. & Ricketts, T. (eds), *Terrestrial Ecoregions of Africa and Madagascar. A conservation assessment*. Island Press and WWF USA, Washington, DC.
2. Pierce, S.M. & Cowling, R.M. 2004. Lowland Fynbos and Renosterveld. In: Burgess, N., D'Amicio Holes, J., Underwood, E., Dinerstein, E., Olson, D., Itona, I., Schipper, J. & Ricketts, T. (eds), *Terrestrial Ecoregions of Africa and Madagascar. A conservation assessment*. Island Press and WWF USA, Washington, DC.
3. Pierce, S.M. & Cowling, R.M. 2004. Montane Fynbos and Renosterveld. In: Burgess, N., D'Amicio Holes, J., Underwood, E., Dinerstein, E., Olson, D., Itona, I., Schipper, J. & Ricketts, T. (eds), *Terrestrial Ecoregions of Africa and Madagascar. A conservation assessment*. Island Press and WWF USA, Washington, DC.
4. Cowling, R.M., Pressey, R.L. & Lombard, A.T. 2004. Planning for persistence: designing conservation areas for diversification processes in the species-rich, winter-rainfall ecoregions of southern Africa. In: Burgess, N., D'Amicio Holes, J., Underwood, E., Dinerstein, E., Olson, D., Itona, I., Schipper, J. & Ricketts, T. (eds), *Terrestrial Ecoregions of Africa and Madagascar. A conservation assessment*. Island Press and WWF USA, Washington, DC.

PUBLISHED CONFERENCE PROCEEDINGS

1. BOSHOFF, A.F. 2004. Seven years hence – a review of progress since the 1997 Workshop. In: MONADJEM, A., ANDERSON, M.D., PIPER, S.E. & BOSHOFF, A. (eds). *The Vultures of Southern Africa - Quo Vadis? Proceedings of a Workshop on Vulture Research and Conservation in Southern Africa*. Kimberley, South Africa. Vulture Study Group, Johannesburg.
2. MONADJEM, A., ANDERSON, M.D., PIPER, S.E. & BOSHOFF, A. F. (eds). *The Vultures of Southern Africa - Quo Vadis? Proceedings of a Workshop on Vulture Research and Conservation in Southern Africa*. Kimberley, South Africa. Vulture Study Group, Johannesburg.
3. COWLING R.M., OJEDA, F., LAMONT, B.B. & RUNDEL, P.W. 2004. Climate stability in mediterranean-type ecosystems: implications for the evolution and conservation of biodiversity. In: ARIANOUTSOU, M. (ed), *Proceedings 10' MEDECOS – International Conference on Ecology, Conservation and Management of Mediterranean Climate Ecosystems, Rhodes Island, Greece, 25 April – 1 May 2004*. Millpress, Rotterdam.
4. PROCHES, S. & COWLING, R.M. 2004. Cape geophytes: putting the pieces together. In: ARIANOUTSOU, M. (ed), *Proceedings 10' MEDECOS – International Conference on Ecology, Conservation and Management of Mediterranean Climate Ecosystems, Rhodes Island, Greece, 25 April – 1 May 2004*. Millpress, Rotterdam

REPORTS

1. BOSHOFF, A.F. & WILSON, S.L. 2004. The STEP Stakeholder Participation programme: summary, comments and some lessons learned. *Terrestrial Ecology Research Unit Report No. 50*. 19 pp.
2. SIMS-CASTLEY, R., KERLEY, G. I.H. & GEACH, B.G.S. 2004. The Socio-economic significance of eco-tourism-based Private Game Reserves in the Eastern Cape. *Terrestrial Ecology Research Unit Report No. 51*. (also C103. 21 pp).
3. BOSHOFF, A.F. 2004. Land-use and ecological advice for the property "Gerald's Gift", Addo district. *Terrestrial Ecology Research Unit Report No. C102*. 16 pp.
4. BOSHOFF, A.F. 2004. Review of, and comments on, studies commissioned to estimate the potential impact of an experimental wind farm on the birds of the Darling-Yzerfontein area, Western Cape Province. *Terrestrial Ecology Research Unit Report No. C104*. 10 pp.
5. KERLEY, G.I.H. 2004. Brown hyaena re-introduction and management plan for Samara Private Game Reserve. *Terrestrial Ecology Research Unit Rep. No.C105* 29 pp.
6. BOSHOFF, A.F., WILSON, S.L. & SKEAD, C.J. 2004. Medium- to large-sized mammalian herbivores in provincial nature reserves in the Eastern Cape Province: broad habitat types, potential species, inappropriate species and selected management recommendations. *Terrestrial Ecology Research Unit Report No. C106*. 102 pp.
7. STEWART, W.I., COWLING, R.M., MARTIN, A.P., DU PREEZ, D.R. & LOMBARD, A.T. 2004. A biodiversity conservation assessment and framework for the open space system for the Nelson Mandela Metropole, Cape Floristic Region, South Africa. Biodiversity Conservation Unit, Wildlife and Environment Society, Port Elizabeth.
8. Driver, A., Maze, K., Cowling, R.M., Goodman, P., Harris, J., Jonas, Z., Lombard, A.T., Nel, J., Reyers, B., Rouget, M., Sink, K., Strauss, T. & Turpie, J.K. 2004. South African National Biodiversity Spatial Assessment 2004: summary report. South African National Biodiversity Institute, Pretoria.
9. Rouget, M., Reyers, B., Jonas, Z., Driver, A., Desmet, P., Maze, K., Egoh, B. & Cowling, R.M. 2004. South African National Biodiversity Spatial Assessment 2004: Technical Report Vol 1: terrestrial component. South African National Biodiversity Institute, Pretoria.
10. LOMBARD, A.T., STRAUSS, T., HARRIS, J., SINK, K., ATTWOOD, C., HUTCHINGS, L., ANDERSON, R.J., BOLTON, J., BRANCH, G., COWLING, R.M., GOODMAN, P., GRIFFITHS, C., MANN, B. & TURPIE, J. 2004. South African National Biodiversity Spatial Assessment 2004: Technical Report Vol 4: marine component. South African National Biodiversity Institute, Pretoria.

POPULAR ARTICLES

- BOSHOFF, A.F. & KERLEY, G.I.H. 2004. Nature-based ventures in South Africa – are we playing the game? *African Wildlife* Vol. 58 (2): 8-9.

MISCELLANEOUS PAPERS

- Cowling RM 2004. Review of Win-Win Ecology. How the Earth's Species Can Survive in the Midst of Human Enterprise by Michael L. Rosenzweig (2003). *Oryx* 38, 223.

CONFERENCE PRESENTATIONS

1. PRESSEY, R.L., NICOLSON, E. & KERLEY, G.I.H. Types of approaches to incorporating biodiversity processes into conservation planning. **Invited oral presentation**. Southern Connections, Cape Town, January.
2. PRESSEY, R.L, WATTS, M. & COWLING, R.M. Scheduling conservation action on the ground: the need to make difficult choices between biodiversity features in day-to-day planning. **Invited oral presentation**. Southern Connections, Cape Town, January.
3. COWLING, R.M. Identifying the spatial components of processes for conservation assessments: data, expert knowledge and uncertainty. **Invited oral presentation**. Southern Connections, Cape Town, January.

4. COWLING, R.M., OJEDA, F., LAMONT, B.B. & RUNDEL, P.W. 2004. Climate stability in mediterranean-type ecosystems: implications for the evolution and conservation of biodiversity. **Invited keynote presentation**, 10' MEDECOS – International Conference on Ecology, Conservation and Management of Mediterranean Climate Ecosystems, Rhodes Island, Greece, April/May.
5. PROCHES, S. & COWLING, R.M. 2004. Cape geophytes: putting the pieces together. Oral presentation, 10' MEDECOS – International Conference on Ecology, Conservation and Management of Mediterranean Climate Ecosystems, Rhodes Island, Greece, April/May
6. KNIGHT, A. Towards implementing effective conservation planning: an approach from the Subtropical Thicket Biome, South Africa. Southern Connections, Oral presentation. Southern Connections, Cape Town, January.
7. KERLEY, G.I.H., BOSHOFF, A.F., SIMS-CASTLEY, R. WILSON, S.L. Modelling the historic distribution and abundance of elephants in the Eastern Cape. Oral Presentation, EMOA Symposium, Bakgatla, Pilanesberg National Park, 13-16 September 2004.
8. KERLEY, G.I.H. & WHITEHOUSE, A.M. Management by hypothesis: can we afford to avoid lessons learnt? Oral Presentation, EMOA Symposium, Bakgatla, Pilanesberg National Park, 13-16 September 2004.
9. LANDMAN, M. & KERLEY, G.I.H. Diet of elephant in the Addo Elephant National Park: do they eat threatened plants? Oral Presentation, EMOA Symposium, Bakgatla, Pilanesberg National Park, 13-16 September 2004.
10. LANDMAN, M. & KERLEY, G.I.H. Impact of elephant on black rhinoceros foraging opportunities; conflicts in megaherbivore conservation. Oral Presentation, EMOA Symposium, Bakgatla, Pilanesberg National Park, 13-16 September 2004.
11. GOUGH, K.F. & KERLEY, G.I.H. Testing for inbreeding avoidance: do bulls associate with their natal family groups? Oral Presentation, EMOA Symposium, Bakgatla, Pilanesberg National Park, 13-16 September 2004.
12. GOUGH, K.F. & KERLEY, G.I.H. Developing a laptop-based individual identification key for use in elephant research and management. Oral Presentation, EMOA Symposium, Bakgatla, Pilanesberg National Park, 13-16 September 2004.
13. DAVIS, S., KERLEY, G.I.H. & LANDMAN, M. Dietary shifts of elephants recently introduced into the Nyati section of the Addo Elephant National Park. Oral Presentation, EMOA Symposium, Bakgatla, Pilanesberg National Park, 13-16 September 2004.
14. COWLING, R. 2004. Thicket research: *quo vadis?* Oral presentation, 1st Thicket Forum, Zuurberg, May.
15. KERLEY, G.I.H., LANDMAN, M., WILSON, S. & BOSHOFF, A.F. 2004 Mammalian herbivores as drivers of thicket. Oral presentation, 1st Thicket Forum, Zuurberg, May.
16. KNIGHT, A. 2004 Planning for Implementation in the Thicket Biome: Making Conservation Planning Relevant for Stakeholders in the Great Fish River Catchment. Oral presentation, 1st Thicket Forum, Zuurberg, May.
17. PALMER, A.R., KAKEMBO, V., LLOYD, W. & AINSLIE, A. 2004 Degradation patterns and trends in the Succulent Thicket. Oral presentation, 1st Thicket Forum, Zuurberg, May.
18. SIGWELA, A.M. 2004 Conservation farming options in thicket vegetation. Oral presentation, 1st Thicket Forum, Zuurberg, May.
19. KAKEMBO, V. Local topographic controls on the invasion of *Pteronia incana* (Blue bush) onto hillslopes in Ngqushwa (formerly Peddie) district, Eastern Cape. Paper presented at Southern African Association of Geomorphologists' Biennial Conference, Knysna, April 4 – 6.
20. KAKEMBO, V. The relationship between *Pteronia incana* invader shrub species and soil moisture, and the implications for soil surface conditions and erosion in Peddie District, Eastern Cape, South Africa. Paper presented at the 13th International Soil Conservation Organisation Conference (ISCO2004), Brisbane, Queensland, Australia, July 4 – 9.

21. LINKLATER, W.L. Wanted: behavioural ecologists for conservation research: broader perspective and approach advantageous. International Society for Behavioral Ecology Congress, Jyväskylä, Finland, July.

POST-GRADUATE TRAINING

Honours Projects

1. DAVIS, S. 2004. Diet of Elephants in the Nyati Concession Area, Addo Elephant National Park. BSc(Hons) project, University of Port Elizabeth
2. KIETZMANN, M. 2004. Testing Umbrella Concept using mammal distribution and abundance data from the Cape Floristic Region, South Africa. BSc(Hons) project, University of Port Elizabeth.
3. GERBER, J. 2004. Faunal impacts on Bontveld physiognomy in Shamwari Game Reserve. BSc (Hons.) Project, University of Port Elizabeth, 42 pp.
4. MAMFENGU, P.F. 2004. Assessing Vegetation Change in Relation to Land Tenure in Ngqushwa (Formerly Peddie) District, Eastern Cape. BSc (Hons) project, University of Port Elizabeth.
5. OTT, T. 2004. Diet of leopard (*Panthera pardus*) from conservation and adjacent rangelands in the Baviaanskloof, Eastern Cape Province. BSc(Hons) project, University of Port Elizabeth
6. RAVNSBORG, R. 2004. Assessing the diet of wild lions (*Panthera leo*) in the Addo Elephant National Park. BSc(Hons) project, University of Port Elizabeth
7. VINCENT, Z. 2004. Contrasting effects of management strategies for African elephant population persistence. BSc(Hons) project, University of Port Elizabeth

Postgraduate degrees completed

1. BAUSE, M. The challenge of applying systematic conservation planning to the marine environment; using expert knowledge (focus: Sparidae) MSc thesis, University of Port Elizabeth.
2. KAMINETH, A. The population-age structure and distribution of tree euphorbias in subtropical thicket. MSc thesis, University of Port Elizabeth.
3. VAN CAUTER, A. Modeling large mammal distribution and abundance in the Eastern Karoo. MSc thesis, University of Port Elizabeth.
4. LECHMERE-OERTEL, R.L. The effects of goat browsing on ecosystem patterns and processes in succulent thicket, South Africa. PhD thesis, Univ. Port Elizabeth.
5. O'BRIEN, J.W. 2004. Vegetation Classification, Mapping and Condition Assessment of Shamwari Game Reserve, Eastern Cape. MSc thesis, University of Port Elizabeth 145 pp.

Postgraduate degrees in progress

1. LANDMAN, M. Foraging behaviour of the black rhinoceros (*Diceros bicornis bicornis*) in the Thicket vegetation of the Eastern Cape. PhD. thesis, Univ. Port Elizabeth.
2. SIGWELA, A.M. Animal-seed interactions in the Thicket Biome: consequences of faunal replacement and land use on seed dynamics. PhD thesis, Univ. Port Elizabeth.
3. SIMELANE, T.S. The role of National Parks in conserving traditional natural resources. PhD thesis, Univ. Port Elizabeth.
4. GOUGH, K. Association patterns of elephants: do behavioural patterns reflect genetic relationships? MSc thesis, University of Port Elizabeth.
5. HOARE, D. Patterns and determinants of plant biodiversity in temperate, mesic grasslands of South Africa PhD thesis, Univ. Port Elizabeth.
6. JACOBS, EP The impact of giraffe as an introduced herbivore in the Thicket Biome. MSc thesis, University of Port Elizabeth.
7. KNIGHT, A. On the road to persistence: on implementing conservation action in the Subtropical Thicket Biome. MSc thesis, University of Port Elizabeth.
8. MAYEKISO, M.H. Foraging behaviour of different breeds of domestic herbivores. MSc thesis, University of Port Elizabeth.
9. REEVES, B. Designing and implementing a conservancy in a vulnerable priority region of the Cape Floristic Region. MSc thesis, University of Port Elizabeth.

10. REID, C. Developing habitat suitability indices for springbok (*Antidorcas marsupialis*) at Auwabes Falls National Park, South Africa. MSc thesis, University of Port Elizabeth.
11. STEWART, W.I. The Nelson Mandela Metropolitan Open Space System: A strategic conservation planning project. MSc thesis, University of Port Elizabeth.
12. LESSING, J. The feeding behaviour of elephant in the Addo Elephant National Park. MSc thesis, Nelson Mandela Metropolitan University.

FINANCIAL SUPPORT 2004

Research Grants	Programme	Amount (R)
National Research Foundation		
(G Kerley)		35 000
(R Cowling)		128 611
(V Kakembo)		80 000
Zoological Society of San Diego	Black rhino	313 907
	conservation biology	
International Fund for Animal Welfare	Elephant conservation	200 000
	biology	
University of Port Elizabeth	Research Committee	75 281
	grant to G Kerley & R	
	Cowling	
Contracts		72 720
Bursaries		
National Research Foundation		
M. Landman	50 000	
C Reid	7 000	
University of Port Elizabeth		
M. Landman	12 500	
C Reid	5 000	
	Bursary total	74 500
TOTAL		R980 019

*Note that National Research Foundation Grant-Holder Bursaries are included within the NRF Programme amounts listed above.

In Kind Contributions

The loan and maintenance of the 4x4 pickup by the Mazda Wildlife Fund represents a saving of about R25 000 on transport expenses.

Budget Rent-A-Car donated the use of a 4x4 pickup for the Addo predator project.

Gentyre donated a set of Continental tyres for the vehicles, valued at R5 000.

South African National Parks provides access and accommodation for TERU research in the Addo Elephant National Park.

ADVISORY BOARD, STAFF AND ASSOCIATED STUDENTS 2004

Advisory Board

Prof. B.L. Robertson, Director: Research, University of Port Elizabeth (Chair)
Mr A. Sigwela, South African National Parks
Prof. T. Wooldridge, Zoology Department, University of Port Elizabeth
Dr D. Du Preez, Botany Department, University of Port Elizabeth
Mr L. Els, Department of Economic Affairs, Environment & Tourism (Eastern Cape)
Dr J. Gambiza, Environmental Sciences, Rhodes University
Mr R. Gush, Indalo - Eastern Cape Private Nature Reserves Association
Mr N. de Ridder, Department of Agriculture (Eastern Cape)
Mr D. Langman, Nelson Mandela Metropole Municipality
Dr R. Little, WorldWide Fund for Nature-South Africa
Mr Mactavish Makwarela, National Research Foundation
Dr A. R. Palmer, Agricultural Research Council
Mr C.J. Pieterse, AgriEC

Staff

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Dr. A. F. Boshoff	Dr. S. L. Wilson	Ms K. Bond
Prof. R. M. Cowling	Mrs M. Hearne	Mr A. Uithaler
Prof. E. E. Campbell	Mr D. Airton	

Research Associate

Dr A. M. Whitehouse

Scientific Collaborator

Dr C. J. Skead

Postdoctoral Researchers

Dr M. Hayward	Dr S. Proches
Dr W. Linklater	

Visiting Scientists

Prof. D. Mitchell, Wits
Dr A. Fowler, Wits

Postgraduate students (and their academic departments)

MSc		PhD	
Mr E.P. Jacobs	Zoology & Botany	Mr D Hoare	Botany
Ms K Gough	Zoology	Ms M. Landman	Zoology
Ms J Lessing	Zoology	Mr A. Sigwela	Zoology & Botany
Mr A. Knight	Botany	Mr T. S. Simelane	Zoology
Mr M. H. Mayekiso	Zoology		
Mr B Reeves	Botany		
Ms C. Reid	Zoology		
Mr W. Stewart	Botany		
Mr J. O'Brien	Botany		

Volunteers

Ms G Davis