DST-NRF Centre of Excellence for Invasion Biology

UNIVERSITEIT STELLENBOSCH UNIVERSITY

DST-NRF Centre of Excellence for Invasion Biology

ANNUAL REPORT 2006

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REPUBLIC OF SOUTH AFRICA

NRF National Research Foundation

DST-NRF Centre of Excellence for Invasion Biology

Annual Report (1 January 2006 - 31 December 2006)

CONTENTS

Identification

Name of Director	:	Professor Steven L. Chown
Name of CoE	:	DST-NRF Centre of Excellence for Invasion Biology
Abbreviated CoE Name	:	Centre for Invasion Biology
Host institution	:	Stellenbosch University
Date completed	:	Report: 6 March 2007
	:	Financials: 8 March 2007

EXECUTIVE SUMMARY

1. Financial Information (Funding of the CoE)

Total NRF funding for 2006	:	R 4 654 680.00
Funding from Host institution in 2006	:	R 579 184.00
Funding from other sources for the CoE in 2006	:	R 1 335 928.77
Total funding	:	R 6 569 792.77

2. Summary of progress against 5 KPAs

(i) Research

All of the long- and short-term research has been initiated, and further substantive work is being developed in collaboration with the Working for Water Programme. Forty-three papers were published in a range of journals, including the top disciplinary journals in the field. These were supplemented by two book chapters, five conference proceedings, and two CIB Occasional Papers. Core Team Members presented six invited/keynote addresses at international conferences, and four such papers at national meetings. Eight international conference presentations and 12 national conference presentations were made, whilst two posters were presented at international meetings and eight at national meetings. Four national and one international workshop was organized and run by the C·I·B.

(ii) Education and Training

Student support has continued to increase and the Open Bursary programme has contributed to the success of the C·I·B in attracting students to the general field. In 2006, 51 students (ten 3rd years; nine 4th year/Hons.; 20 M.Sc.; 12 Ph.D.) and 11 post-doctoral associates were supported. Of the students, the majority are women, and close to half are from the designated groups. Most of the post-doctoral associates are male, and none are from the designated groups. The C·I·B 'graduated' the first five M.Sc. students, of which four received their degrees with distinction. C·I·B graduates and post-doctoral associates have taken up positions at CapeNature, the South African National Biodiversity Institute, Ezemvelo KwaZulu-Natal Wildlife; DIVERSITAS, and Stellenbosch University.

(iii) Information Brokerage

The C·I·B has received substantial media coverage thanks especially to the award of the Hans Sigrist Prize for 2006 to Dave Richardson. A variety of other research outputs and programmes have engendered media interest ranging from local newspapers to television interviews. The Iimbovane programme has been adopted by the Western Cape Education Department and 13 schools are part of the programme. The delivery of microscopes and laptop computers to these schools and the completion of a full sampling and identification process, including the provision of lesson plans, have drawn substantial praise for the programme. A fully functional Document Management System is in place and the C·I·B took delivery of its Information Retrieval and Submission System at the end of 2006.

(iv) Networking

A collaborative proposal for research with the Working for Water Programme was developed, submitted and accepted in principle by the Programme. The C·I·B signed memoranda of understanding with the Western Cape Nature Conservation Board and the South African Institute for Aquatic Biodiversity (SAIAB), and the C·I·B's Open Bursary programme was launched in 2006. A Biodiversity Academy was jointly run with the DST-NRF Centre of Excellence for Birds as Keys to Biodiversity.

(v) Service rendering

The Prince Edward Islands Environmental Management Plan was successfully delivered, on time, by the C·I·B. Much time was contributed to the development of regulations for Chapter 5 of the National Environmental Management: Biodiversity Act. Although the process was initially halted by the National Department of Environmental Affairs and Tourism, and the Task Team to which the C·I·B contributed was disbanded, the process has been resumed and further developments are expected in 2007. Service rendering in a wide variety of other roles was undertaken, including editorial functions for international and national journals, reviewing for the National Research Foundation and other granting agencies, and consultancy work.

3. What was the gender impact of your work?

The C·I·B continues to invest in the further development of women in science and science management. Of the 28 core team and core staff members of the Centre, 13 are women, as are 38 of the 62 post-doctoral associates and students supported in 2006. Five masters students completed their degrees in 2006, all of whom are women. C·I·B core team members continue to make large impacts and serve as role models in science management. The gender impacts of the research of the C·I·B cannot yet be quantified in any objective fashion. At a foundation level, the Iimbovane programme's enthusiastic adoption by the Western Cape Education Department and the partner schools has meant broad access by young women to an improved perspective on the importance, career benefits, and fun of biodiversity science.

4. Red Flags. Please indicate any major concerns you have for the future of your CoE

The Core Team Member approach adopted by the C·I·B is working well in some instances, but requires attention in others.

5. General Comments

The C·I·B wishes to express its considerable thanks to the National Department of Science and Technology, the National Research Foundation, Stellenbosch University, and its various collaborators and partners for their support over the past year. The Director wishes to convey special thanks to Dr. Guy Preston and Prof. Brian Huntley for their resolute and ongoing enthusiasm for the science of biodiversity and biological invasions, its downstream policy implications, and the need to reduce the rate and impacts of biological invasions.

2006 ANNUAL REPORT

1. SCIENTIFIC RESEARCH

A. Objectives

The major objective of the research undertaken by the C·I·B is to understand the biodiversity consequences of biological invasions. A combination of long- and short-term research on biodiversity patterns and processes, the way invasive species alter these, the lessons invasions can teach about biodiversity processes, and the approaches that need to be taken to reduce the scale and impact of invasions form the key elements of this research. The sections below describe some highlights of research in 2006.

B. Progress

Highlights of long-term work

a. Listing and mapping of invasive species

Understanding the ecology of invasive species and developing effective management strategies for them always requires good information on the distribution of the species. Challenges involved in acquiring useful distribution data vary considerably among and within major taxonomic groups. A variety of projects undertaken during 2006 explored the distribution of invasive alien species in South Africa.

Invertebrates - ants and snails

Considerable work was done on the Argentine ant (*Linepithema humile)*. The collation of museum and literature records, and field surveys along roads and in urban areas showed that the Argentine ant occurs in six of South Africa's nine provinces. It occurs over about half of the country's land surface area, much more than was previously thought to be invaded. Discontinuities in Argentine ant distribution across the country suggest that range expansion has occurred mainly via human-mediated jump dispersal, rather than via nest diffusion. The surveys also revealed the presence of the ant in parts of the Western Cape from which it had not been recorded previously. To improve the understanding of its distribution in this province, detailed studies were undertaken at three localities: Jonkershoek Nature Reserve, Helderberg Nature Reserve, and Kogelberg Biosphere Reserve. Striking differences in fine-scale patterns were observed in these sites. For example, altitudinal limits were markedly different, and human-modified sites were most densely invaded. By contrast with investigations in California, the Western Cape study found no evidence for spread along watercourses. The natural rate of spread of the Argentine ant in the three protected areas appears to generally be low, consistent with the slow rates of natural spread via diffusion shown elsewhere in the world. The results suggest several precautions that could slow the further spread of the species in protected areas.

Mapping was also undertaken to determine the extent of the alien snail *Theba pisana* in the West Coast National Park as a basis for the evaluation of the impact of these invaders as grazers. The survey showed that large areas of the park have low-level invasions, with several small patches (<100 m across) of very dense snails (> 500 m^{-2}).

Kruger National Park invaders mapped

Considerable work was done to collate distribution data for invasive plants in the Kruger National Park (KNP). A large dataset was compiled from Cybertracker® records gathered by rangers over the past five years. These data were merged with all historical data. The resulting dataset is probably the most detailed set for invasive plant species available for any large protected area anywhere in the world and is being used in various studies and to improve management. A detailed survey was undertaken of all alien ornamental plants in the 27 tourist camps and staff villages across the park. Two hundred and fifty eight alien plant species were recorded; of these at least 85 taxa are well known as invasive plants somewhere in the world. The distribution of alien plant species between camps was strongly nested, with species present in camps with fewer species forming a subset of those in camps with more species. The number of alien species present in a village was strongly positively related to the number of staff residing in the village, but older camps did not have significantly more ornamental alien plants. Similarly, the length of time since the date of first record of a species in the park did not significantly affect the number of camps in which it occurred. These results were used to evaluate the effectiveness of past and ongoing management actions and will feed into management policy for the park.

Abundance-occupancy relationships examined

Spatial ecology forms both the theoretical and methodological foundation for understanding species distributions and range dynamics. Biological invasions involve propagule movement, population growth and dispersal, migration and range expansion - all spatial processes. Investment in understanding these processes is essential for devising effective mapping/monitoring protocols and for drawing maximum value from available distribution data. Two key features of any distribution information are occupancy and abundance. The C·I·B is engaged in a variety of studies of occupancy and abundance, of which three are highlighted here.

The first aimed to capture the 'droopy tail' in the occupancy-abundance relationship. The intraspecific occupancy-abundance relationship has significant value to invasion ecology for predicting species abundance from occurrence data. A new model (the 'droopy-tail model' or DTM) was developed to improve estimates of occupancy at coarse scales, by taking the percolation effect of scale on the occupancy-abundance relationship into account. The DTM is a fundamental departure from traditional and commonly used models, provides a better description of empirical abundance-occupancy relationships, and is likely to facilitate more accurate estimates of species abundance from measures of their occupancy. A second project developed a spatially explicit model, the spatial scaling occupancy model, to estimate species occupancy and spatial correlation based on join-count statistics. The model presents a step towards a general scaling model for occupancy, and demonstrates that the inclusion of spatially explicit information in macroecological models warrants further attention. Finally, an occupancy-probability transition model was developed to investigate the effect of sampling scale (i.e. sample grain) and species saturation (strongly positively correlated with the fractal dimension) on the shape of occupancy frequency distributions.

Value added to existing distribution data for invasive plants

Besides the collection and analysis of original distribution data for invasive species, ongoing work by C·I·B team members is adding value to existing distribution datasets. For plants, data from the South African Plant Invader Atlas (SAPIA) has already yielded much valuable information for improving our understanding of plant invasion ecology and for guiding management. Two additional studies were undertaken in 2006 using SAPIA data. The first explored the relative importance of, and interactions between, environmental factors, land use, life-history traits of the invaders, residence time, origin, and

human usage in shaping the spatial pattern of invasive alien plant species in South Africa. Multivariate analyses revealed that, after accounting for environmental factors, the spatial pattern of species was driven by human uses, life forms, and reproductive traits. Results of this study were published in the journal *Ecology*. A second study examined how all of the above-mentioned factors could be used to explain invasion patterns while accounting for several crucial factors that shape invasions, namely residence time; the extent of potentially invasible habitat in the region; the frequency and intensity of introductions (propagule pressure); the position of founder populations in relation to the potential range; the spatial distribution of the potential range. The SAPIA data and other datasets assembled especially for this project provided a unique opportunity to address this issue. Results showed that including residence time and potential range in models significantly increased their explanatory power. Whether residence time and potential range were included in the models affected which factors emerged as significant determinants of invasiveness, suggesting that different factors are important at different stages of invasion and depending where, within the total area of invasible habitat, particular species are introduced and disseminated. The crucial message from this work, published in *Diversity and Distributions*, is that generalizations that are useful for management can be generated, but only when appropriate null models are considered.

b. Risk Assessment and scenario planning

A Global indicator for biological invasion

Biological invasions are included among the threats to biodiversity in the Convention on Biological Diversity's (CBD) framework for monitoring progress toward the 2010 target, i.e., 'the commitment to achieve by 2010 a significant reduction in the current rate of biodiversity loss at the global, regional and national level, as a contribution to poverty alleviation and to the benefit of all life on earth'. This target was adopted by some 180 nations in 2001 and endorsed by the World Summit on Sustainable Development in 2002. Monitoring trends in invasive alien species was identified as a priority by the CBD, and headline indicators needed to be developed for this purpose. The CBD 2010 target and headline indicator framework was used to develop a rationale for the form and characteristics of an indicator of trends in invasive alien species that will meet the 2010 framework goal and targets.

Research conducted by the C·I·B contributed to the design phase of indicator development and to the debate on the development of global standards for invasive species monitoring. This work resulted in the formulation of a Global Indicator for Biological Invasion (GIBI) which may be applied at the scale of nations, regions, ecosystems, or globally. The GIBI includes two types of indicators (problem status and management status) and three single measures (number of invasive alien species (IAS); number of IAS with operational management plans; and number of potential introduction pathways with operational management plans). These three measures are used together to produce a composite IAS indicator (Figure 1). Global trends in IAS may be quantified as the progress of nations towards the IAS target of a decline (or asymptote) in the number of IAS and implementation of comprehensive IAS management plans. The GIBI was tested using invasive alien plant species and management data for seven countries and found to be readily implementable. Nonetheless, challenges for the global implementation of the indicator include the adoption of a single, objective definition of IAS for all taxon groups, and the collection of time-series information for each of the measures to provide an estimate of trends in IAS. The indicators proposed represent a minimum information set for establishing trends in invasive alien species at both national and global scales. The indicator developed thus forms a component of the foundation of strategic responses identified by the CBD to address the global problem of biological invasion. A paper on the GIBI was published in *Conservation Biology*.

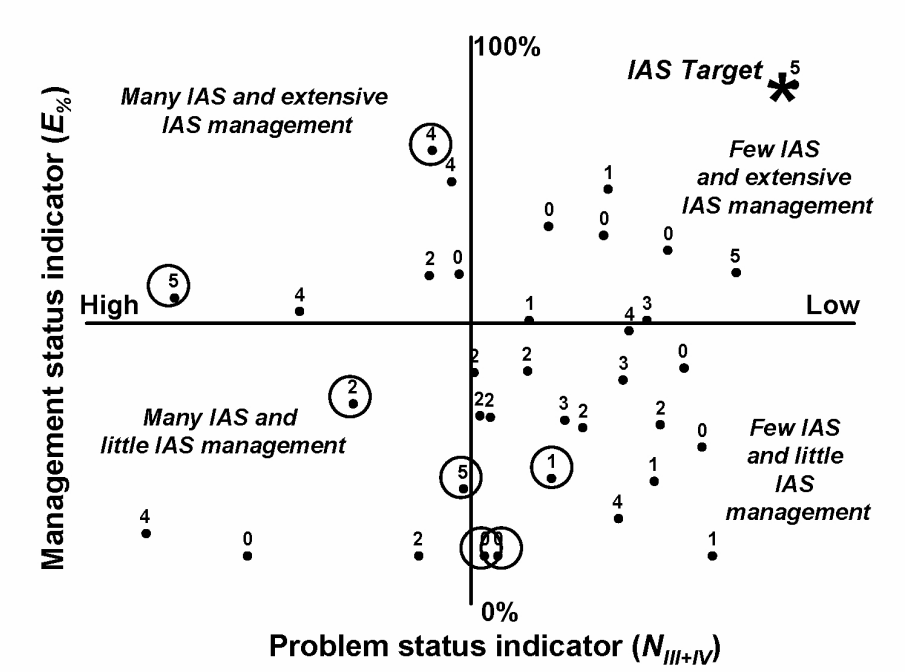

Figure 1. Composite indicator of global trends in invasive alien species (IAS) showing relative positions of nations (points) with respect to the IAS target, based on their problem- and management-status indicators. P (number of introduction pathways with operational management plans) is presented numerically (0-5) alongside each nation on the cross-plot. Points include data for seven countries (circled, from left to right: Australia, South Africa, New Zealand, Canada, Swaziland, Namibia, and the United Kingdom and simulated country data.

Ecological risk assessment for genetically modified organisms (GMOs)

South Africa is among the top countries globally in terms of total area planted to genetically modified crops, and is rapidly adopting GM technology. It is widely acknowledged that GM technology is associated with particular environmental risks. Several recent legislative and policy developments have addressed the biosafety of GMOs in South Africa. These initiatives recognize that the development of the biotechnology sector in South Africa must be balanced by the development and implementation of biosafety policies and frameworks. However, legislative and policy frameworks remain to be rationalized. Also, procedures have yet to be developed and implemented in South Africa to ensure the effective management and control of GMOs to minimize the potential risks that they pose to biodiversity and the environment. C·I·B-funded researchers undertook a review and assessment of existing legislation and policy in South Africa related to GMO environmental risk and its management, and the role players concerned. The aim was to identify priority areas for attention to ensure effective implementation of existing legislation and to avoid unintended and unwanted environmental consequences as a result of the application of GM technology.

A number of procedural uncertainties were defined (Figure 2) and several priority issues, which are necessary to expedite the implementation of an effective, integrated environmental management system for GMOs in South Africa, were described. These included: (i) the rationalization and clarification of roles and processes; and (ii) the development of guidelines and protocols for ecological risk assessment of GMOs in South Africa. While some procedural uncertainties remain, the process is at the point where substantial, science-based guidelines must be compiled to support effective implementation of the current

legislative and policy framework. This will require significant harnessing of existing scientific expertise in relevant fields, as well as the development of, particularly multidisciplinary, capacity to design, implement and monitor progress with ecological risk assessment for GMOs in South Africa. A report on this topic was published online in the C·I·B Occasional Report series.

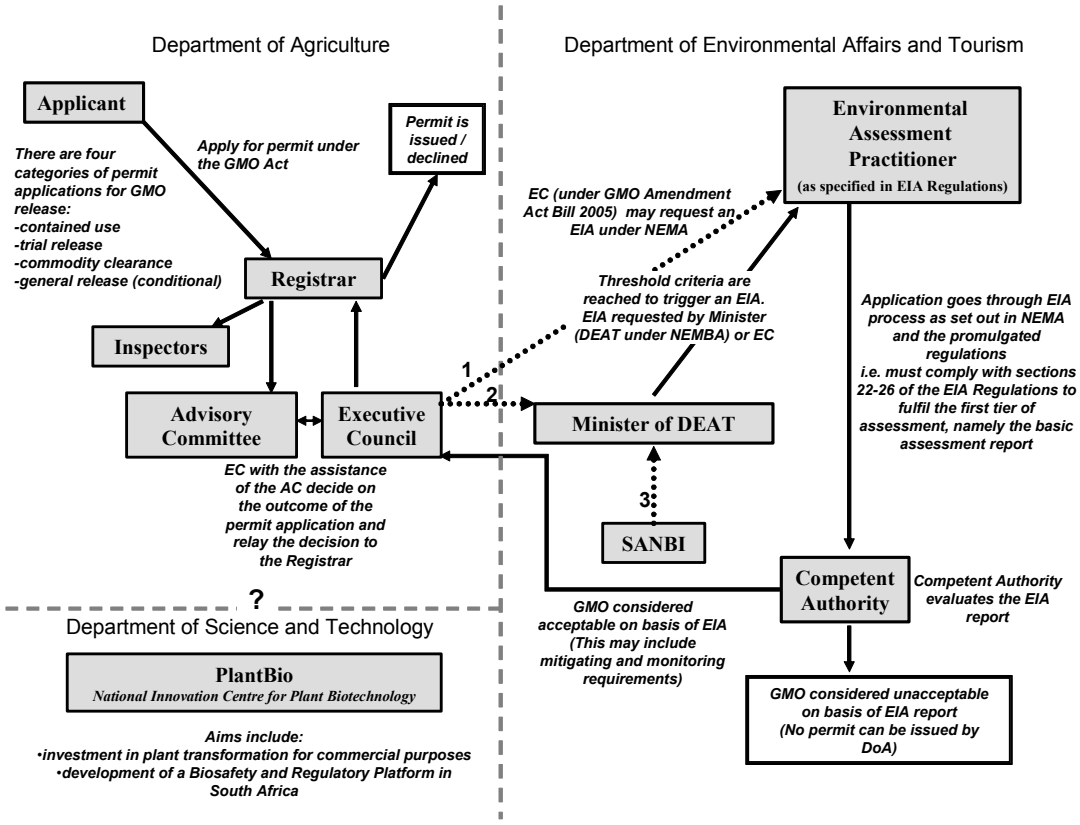

Figure 2. Interpretation of the relationships between role players and the legal and policy framework governing the ecological risk assessment process for GMOs in South Africa (see http://academic.sun.ac.za/cib/occasion/occasion002.pdf for terms and explanations).

Quantifying the risk of invasion of protected areas from surrounding areas

Protected areas are becoming increasingly isolated. River corridors represent crucial links to the surrounding landscape but are also major conduits for the spread of alien species. This is a major, and increasing, problem for the management of protected areas. C·I·B researchers developed a framework for assessing the risk of alien plants being introduced to a protected area along rivers from adjacent watersheds. The framework combines species- and landscape-level approaches and involves: (i) definition of the geographical area of interest (the domain); (ii) delineation of the domain into ecologically meaningful zones; (iii) identification of the appropriate landscape units; (iv) categorization of alien species and mapping of their distribution and abundance; and (v) definition of management options. The framework guides the determination of species distribution and abundance through easily followed steps, providing the means to assess areas of concern. The framework was tested in the KNP, which is facing increasing pressure from alien species in the upper regions of the drainage areas of neighbouring watersheds.

For the KNP case study, 231 invasive alien plant species (79 of them major invaders) were identified in the domain. Bioclimatic modelling showed that most major riparian invaders could spread into and within the KNP. The framework provides a practical tool for identifying areas for proactive intervention, monitoring, and wise resource allocation.

c. Invasive and remediation effects on biodiversity

Riparian vegetation - degraded, invaded, transformed

One of the greatest challenges for managers of alien plant invasions in South Africa is how to deal with invasive plants in riparian ecosystems. As is the case in most parts of the world, riparian systems in South Africa are severely invaded. Given that rivers are highly dynamic, frequently disturbed conduits for materials and energy, effective management of alien species in these systems is highly complex. A collaborative project jointly funded by the C·I·B and the Working for Water Programme, and involving researchers from Australia, the Czech Republic and the USA, focused on deriving key principles for the repair of riparian vegetation after alien clearing. One product was a paper examining the biogeography of these systems, the determinants of composition and structure of riparian vegetation, with a view to conceptualising the components of resilience. A new framework for accommodating such complexity to derive decision-making protocols was developed. This work was presented in a keynote address at the Australian Weeds Conference in September 2006.

Knowledge of the seed banks of both native and alien plant species is crucial for formulating effective control and restoration operations. A study on seed banks that involved detailed sampling along four rivers in the Western Cape to compare reference and invaded sites was completed. The impact of invasion on the riparian seed bank was illustrated using correspondence analyses for the 20 most frequently occurring species (Figure 3). The seed bank assembly patterns were clearly defined by the state of the river (reference or invaded). Interestingly, this pattern was clear at all three spatial scales: landscape (rivers), reach (mountain stream and foothill sections) and habitat (dry, wet and transitional zones). The seed bank assemblage in reference (non-invaded) systems was more tightly grouped, implying that the species were more closely associated with each other and less variable than is the case for seed banks in invaded areas. Species groupings within invaded sites were influenced by variables such as reach and zone, whereas the assemblages from reference systems were less influenced by these variables.

This work showed that the presence of invasive alien plants adds additional variation to the seed bank. At a broad scale, seed banks in invaded systems comprised fewer species, implying not only that the resulting seedling community will be harder to predict, but that it will also have fewer species. Interestingly, although generally lower in species richness, the seed banks from almost all invaded rivers showed a higher diversity of indigenous species than their reference counterparts. This is very encouraging for rehabilitation prospects in cleared riparian sites. However, since the seed bank assemblages are dominated by short-lived, herbaceous species that are not representative of the aboveground indigenous riparian community, keystone species not represented in the seed bank may need to be re-introduced.

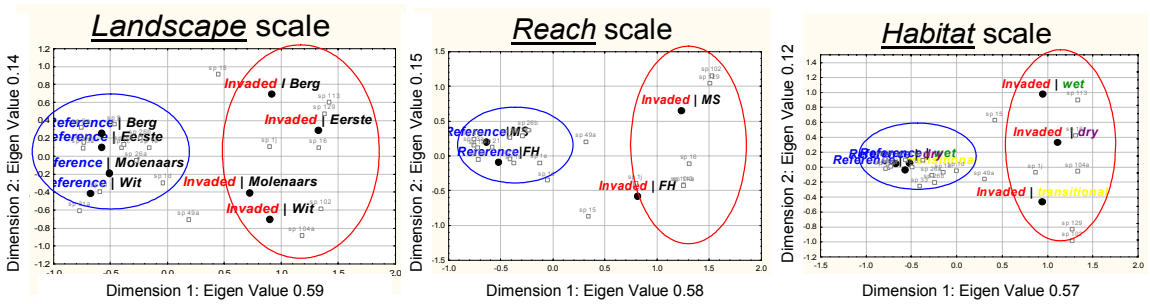

Figure 3. Seed bank assembly patterns are clearly defined by river state. Invasive alien plants in heavily invaded riparian zones of the south western Cape generate additional variation within the seed bank at all spatial scales. This is shown by the outcome of correspondence analyses of the top twenty species occurring in seed banks of reference (<25 % alien plant canopy cover) and heavily invaded (>75 %) sites along four rivers in the South Western Cape. Landscape scale is a comparison of the four rivers: Berg, Eerste, Molenaars and Wit; reach scale is a comparison between foothill and mountain stream sites; habitat scale is a comparison between longitudinal habitats: wet bank, dry bank and transitional zones

Chromolaena odorata *in Hluhluwe-iMfolozi Park – impacts on small mammals and spiders*

Chromolaena odorata (triffid weed) is one of the most widespread invasive alien plants in South Africa, but little is known of the impacts of this invader, other than its capacity to carry fires into the fire-sensitive crowns of native savanna trees. The impacts of this invader on biodiversity and ecosystem processes in the Hluhluwe-iMfolozi Park (HiP) in KwaZulu-Natal, with special reference to effects on small mammals and spiders, are being investigated.

Small mammals are sensitive to changes in their habitats, which may result in changed species composition. Small mammal communities were studied along a chronosequence of triffid weed in HiP (in areas with different invasion durations: 2 years, 10 years, 20 years and with different post-clearing ages: <2 years; 3-5 years). Results showed that the species diversity of small mammals decreased with increasing duration of triffid-weed invasion. Cleared areas had higher small-mammal diversity than invaded areas, but areas cleared for 3-5 years had fewer species than areas cleared for less than two years. Triffid weed populations recover rapidly and delayed follow-up work negates any benefits of clearing.

Spiders, often used as bioindicators, were also investigated in sites invaded by *C. odorata* and with different histories of control. Preliminary results showed that invasion of *C. odorata* alters native spider abundance, assemblage patterns, diversity, and species richness, with the strongest effects evident with increasing invasion duration. Native spider assemblages were found to re-establish after clearing without further management intervention, although small differences remained between non-invaded and cleared sites, suggesting that other features of the habitat may have been affected by the invasion and clearing. Clearing of triffid weed is clearly beneficial for spider diversity and presumably for biodiversity in general.

Infiltration of bird-generated shrub nucleation processes and superiority in competition for light – key elements explaining invasion success and impacts of the alien tree Schinus molle *in South African arid savannas*

Natural experiments often present the only opportunity to address key issues in invasion ecology. One such opportunity was exploited around the Kimberley military base where numerous alien trees with

fleshy fruits were planted several decades ago. Several species have invaded the adjoining natural semi-arid savanna. One of the interesting results was that the abundance of fleshy-fruited alien species in the natural savanna was positively correlated with the number of individuals of those species (irrespective of their traits) planted in the military base, emphasizing the importance of propagule pressure as a driver of invasions. The invasions are proceeding slowly and episodically, but some of the invading species can transform this savanna by disrupting seed-dispersal mutualisms. Also, once dispersed, some of the alien species can rapidly overtop dominant native trees, causing ecosystem-level impacts. One of the invasive species in this area is the Peruvian pepper tree *Schinus molle*. Once established in these savannas, this alien tree rapidly overtops the dominant native *Acacia tortilis* trees. The ability of *S. molle* to compete for light with the native trees was examined. Applying canopy symmetry as an index of ability to compete for light showed that *S. molle* consistently out-competed the dominant native tree species. Its superiority in competition for light appears to be a crucial attribute that shapes its impact in this savanna ecosystem.

Invasive grasses – impacts examined

Grasses are among the most damaging of invasive plants in many parts of the world, and their effects have been well studied. Although many grasses have invaded South Africa, little is known of their ecology and impacts. Studies on two important invasive grasses were undertaken by C·I·B researchers. When the distribution of *Pennisetum setaceum* (fountain grass) was plotted along national roads, it was associated with river crossings more frequently than would be expected and could invade roadside cuttings and natural drainage lines. *Pennisetum setaceum* tended to invade near-natural habitats with high levels of disturbance (e.g. rivers that intersect with roads; heavily grazed vegetation), and invasion of arid and fire-free Karoo ecosystems by this grass could introduce fire. An experiment was conducted to estimate the potential impact of fires on Karoo vegetation by undertaking prescribed fires with added grass fuels. Two levels of fuels were added: low (2 tonnes.ha^{-1}) and high (5 tonnes.ha^{-1}). Ten experimental burns were effected, resulting in fire intensities ranging from 2800 to 26 000 kW.m^{-1} – higher than the mean fire intensities recorded in savanna ecosystems in the Kruger National Park. Such fire intensities could have severe impacts in Karoo ecosystems. Adding fire to similar ecosystems in North America, due to invasion by alien *Bromus* species, has had devastating impacts.

Another widespread invasive grass is the riparian species *Arundo donax* (Spanish reed). Community composition, biomass and fuel loads, and nutrient cycling in stands of Spanish reed and stands of the indigenous reed *Phragmites australis* were investigated. Invasions by Spanish reed increased biomass by 450 %, but fire behaviour models suggested that stands of *Phragmites* would burn at higher intensities (~ 12 000 kW.m^{-1}) than would *Arundo* stands (~ 100 kW.m^{-1}) because of a higher proportion of dead, dry material in the former. Shortcomings in the fire behaviour model precluded the reliable simulation of extreme fire behaviour in stands of *Arundo* under severe fire-weather conditions, but fire intensities under such conditions would probably be much higher in *Arundo* than in *Phragmites* stands.

Impact of Argentine ants on native ants

C·I·B-funded research produced the first formally quantified evidence of the impact of the Argentine ant on native ants in South Africa. Comparisons between invaded and non-invaded areas in three nature reserves in the Western Cape, revealed that the Argentine ant reduced local ant species richness by more than 50 % and significantly reduced beta diversity. Most native ant species were more abundant at non-invaded than at invaded sites. These findings were consistent with those from studies elsewhere in the world. Native ant species diversity and composition was severely reduced in all three reserves due to the Argentine ant invasion, resulting in homogenisation of native ant communities.

Honeybee invasion dynamics

Two contiguous honeybee subspecies exist in South Africa: *Apis mellifera capensis* (Cape honeybee) and *A. m. scutellata* (Africanized honeybee). Populations of the two subspecies are separated by a stable hybrid zone which is interesting and important because the Cape honeybee can be a lethal social parasite of the other subspecies. In collaboration with other scientists, C·I·B researchers have been investigating why the two subspecies have not increased their range in South Africa. Several aspects of the biology of the bees have been studied, including whether the Africanized honeybee has a mating advantage. An experiment to study the flight time of drones generated ambiguous results, with some data suggesting no separation in flying time between males of the two subspecies, while other data suggested that *A. m. capensis* flies earlier. Should this be the case then assortative mating would result in asymmetrical gene flow. A second experiment focused on suppression of drone production. In the Americas, the presence of *A. m. scutellata* drones in a colony was shown to suppress drone production in host colonies. No such affect has been found in natal African colonies. The prediction is that *A. m. scutellata* drones have a higher propensity to drift and when in host *A. m. capensis* colonies, suppress the production of *A.m. capensis* drones and consequently *A. m. scutellata* drone numbers increase in the population, again resulting in asymmetrical gene flow. However, results indicate that the level of drone production is variable within colonies with no correlation with the number of adult drones present in that colony.

Another aspect of bee research under the C·I·B banner has been the work on the invasion of African colonies by *A. m. capensis* workers. The aim was to determine whether a 'window of opportunity' exists for Cape workers to invade host colonies. Various aspects of the swarming process were examined. Host colonies were found to be highly susceptible to invasion when queenless, but the greatest opportunity for invasion was in the period immediately before colony fission (when the queen is still present). Preliminary results from studies on brood pheromones, an important factor regulating worker reproduction, indicated that Cape workers reproduce quicker and produce more eggs when exposed to African brood pheromones, compared with either *A. m. capensis* brood pheromones or no brood pheromones. Pheromones produced by African larvae therefore do not simply inhibit Cape worker reproductive development but accelerate the commencement of egg laying by these workers. These data are surprising and more in depth investigations are necessary. Finally, the quantity and contribution of the major mandibular gland components of all workers were analysed. Mandibular gland secretions of the parasitic population were significantly different from that of native *A. m. capensis* populations for all age cohorts when aged in a constant environment. The results suggest that the mandibular gland profiles of parasitic workers have diverged from the majority of the native worker population. However, continued overlap in individual worker secretions from both populations suggest that these two populations are not distinct as has been suggested by earlier literature. Any knowledge gained on the host colony's environment and its predisposition to parasitism is essential to conserving the honeybee diversity of southern Africa. A practical approach to curbing the spread in commercial stocks will ultimately protect the wild populations from take-over, maintaining the subspecies integrity, as well as the pollination services of bees in the wild.

Range expansion of arid-adapted native carnivores – mechanisms and impacts on biodiversity

Human activities are leading to range changes in many native species, including substantial increases in the ranges of species that can capitalise on human-modified habitats. Studying such range expansions and their impacts is justified because they shed light on processes that are important for invasions of alien species. To this end, a study was initiated to examine the impacts of the range expansion of small native carnivores *Suricata suricatta* (meerkat) and *Otocyon megalotis* (bat-eared fox) on biodiversity in

arid areas of the Eastern Cape. One finding was that meerkats cooperate in vigilance with yellow mongoose in the 'invaded' range. This behaviour, previously undescribed between two species of carnivores, probably contributes to the capacity of the former species to expand its range in this area. Both meerkats and bat-eared foxes change the diversity on ancient termitaria.

d. Roadsides as reserves and bridgeheads

Roads as corridors for plant invasion

Human-inhabited areas are often sources from which invasive species spread. Road verges in particular have been suggested as corridors for the rapid dispersal of invaders. This idea was tested in the Nama-Karoo. It was hypothesized that: (i) houses and urban centres are propagule sources from which problem plants disperse; and (ii) that road verges function as corridors for the dispersal of problem plant species. Presence and cover of problem plants were sampled in 206, 20 m plots per road at 5 km intervals for four roads, nested within three localities/urban centres, i.e. Beaufort West, Prieska and Middelburg. Houses and other buildings were mapped in 5 km radius arcs from the samples.

Forty-three problem plant species (including 13 plant families, and 26 alien species) were recorded, typically at low frequencies (only four species had > 25 % occupancy) and with low local species richness (one to three species on average per plot). *Hyparrhenia hirta* (common thatching grass) and *Tragus berteronianus* (small carrot-seed grass) were the dominant road-verge problem plant species. Problem-plant communities were significantly different at the three localities, with differences largely attributable to the variation in annual precipitation, elevation, bare soil and indigenous plant cover on the road verges.

Within localities, cover and community structure were the best predictors of problem plant richness, and differed between localities as well as between roads within localities. Road surface type (tarred or gravelled) played a role in determining the species richness and cover of problem plants. Contrary to expectations, distance from urban centre was not significantly related to any problem plant variables. Rather, the strongest pattern to emerge was the significant positive relationship between local housing density and problem plant species richness per plot. Both problem plant species richness and cover were significantly positively related to distance from the road edge. Despite the fairly low richness and cover of problem plants in this arid part of South African, problem plant species richness is significantly related to human disturbance and activity patterns, for which housing density proved an appropriate surrogate. No evidence emerged for verges acting as corridors for the dispersal of these species, but the verges certainly provide suitable habitat for problem plants.

e. Spatial concordance in diversity and its temporal change

In the face of escalating change across South African ecosystems, it is crucial to have well-studied reference sites, situated along appropriate gradients in order to detect changes in ecosystem composition and functioning. Substantial effort has been invested in setting up two transects for this purpose.

Climate modelling has suggested that the Cape Floristic Region, especially in the north, is highly sensitive to climate change and that major changes are likely in the next few decades. Because there is little monitoring of diversity in this area, ant assemblage structure is being investigated in the main vegetation types in the Greater Cederberg Biodiversity Corridor. The work is seeking to explain how the ant assemblages differ in structure between the main vegetation types, how restricted ants – and in particular the major myrmecochores – are to the major vegetation types, and which environmental variables might

underlie differences in the ant assemblages and in the specificity of species to particular areas. Sampling is done annually across an altitudinal gradient ranging from sea level (Lambert's Bay) to c. 2 000 m elevation (Sneeukop, Cederberg) and down again to 500 m (Wupperthal). Pitfall traps are used to sample ants at 17 altitudinal bands, stretching over three vegetation types (Strandveld, Mountain Fynbos and Succulent Karoo). Initial results show that temperature explains much of the variation in species density and abundance along the transect, and that this factor, together with area and several vegetation variables, contributes significantly to the separation of the assemblages in the major vegetation types and biomes. These results suggest that there are likely to be substantial and complex changes to ant assemblages as climates change in the northern Cape Floristic Region. Ongoing monitoring of this transect will reveal the nature and pace of the change as it unfolds.

Another transect was set up in Drakensberg-Maloti to investigate spatial variation in invertebrate diversity and its temporal change along an altitudinal gradient. This gradient spans a distance of c.150 km from Ixopo in KwaZulu-Natal (900 m elevation) to the top of Sani Pass in Lesotho (3 000 m). Eight sampling stations at 300 m vertical increments have been established and are monitored biannually.

Highlights of short-term work

f. Large scale patterns in biodiversity

Role of ecotones in ecology, evolution and conservation

Much debate in the ecological literature has centred on whether ecotones, transitional regions between biomes or other spatial entities, are hotspots for speciation and biodiversity and therefore should be given priority in conservation planning, or whether they hold marginal populations that depend on other parts of the range for their maintenance and therefore do not deserve conservation priority. Recent advances in the understanding of the role of ecotones in ecology, evolution, and conservation were reviewed in a paper published in the *Israel Journal of Ecology and Evolution*. This work formed the foundation for analyses that examined the relationship between species richness and range size rarity at the quarter-degree grid cell resolution and the distance to boundaries between adjacent plant-based ecoregions across South Africa. Results suggest that the number of range-restricted species of birds and frogs decreases with increasing distance to boundary regions between ecoregions. Consequently, in addition to being species rich, transitional areas also harbour many rare species and should be considered important areas for biodiversity conservation.

Protected areas and conservation conflicts – changing patterns

The C·I·B and its collaborators also investigated the distribution of birds, frogs and humans across South Africa, with special emphasis on examining the efficacy of reserves in protecting diversity. One study investigated how the magnitude of conservation conflicts arising from positive relationships between human population size and species richness is altered during a period of marked human population growth. Species richness of frogs and birds was calculated from atlas distribution maps, and human population was measured in 1996 and 2001 (from SA census data), all at a quarter-degree resolution. Relationships between human population size in, and its change during, these two periods and environmental energy availability were explored. The nature of relationships between species richness and human population size in both time periods, and its change during them was examined. The nature of the relationships between human population size, and its change, and the proportion of protected land was also investigated. Change in human population size between 1996 and 2001 exhibited marked spatial variation, with large increases and decreases, but was poorly correlated with environmental energy availability. The nature of the relationship between human population size and environmental

energy availability did not, however, exhibit statistically significant differences regardless of whether the former was measured in 1996 or 2001. Similarly, relationships between species richness and human population size did not exhibit significant differences between the two periods. The strengths of the species–human relationships were markedly reduced when energy availability was taken into account. Change in human population size was poorly correlated with species richness. The proportion of protected land was negatively, albeit rather weakly, correlated with human population size in 1996 and 2001, and with its change between these two periods. Thus, positive species–human relationships arise largely, but not entirely, because both species richness and human population size exhibit similar responses to environmental energy availability. During a period of rapid human population growth, and marked changes in the spatial variation in human population size, positive correlations remained between human population size and both anuran and avian species richness. The slope of these correlations did not, however, alter, and the most species-rich areas are not those with the largest increases in human population. Despite marked population growth, the magnitude of conservation conflicts arising from positive species–human relationships thus appears to have remained largely unchanged.

Protected areas are generally regarded as essential for countering these conflicts and for the long-term maintenance of biodiversity. Evidence for their effectiveness in this regard is, however, somewhat equivocal. To examine this question, the relationship between the proportion of protected land and species richness in a region, both with and without taking spatial variation in environmental energy availability into account was documented. For South African birds, it was found that total and threatened species richness show modest increases with the proportion of protected land. While the protected area network should be expanded, it is essential that conservation efforts also focus on maintaining biodiversity in the wider unprotected landscape that supports high species richness.

g. Interactions between indigenous and invasive species on the Southern Ocean Islands

The beneficial acclimation hypothesis

A project was undertaken to identify differences in responses of indigenous and invasive species to short-term changes in their environment and to more longer-term population fluctuations. The first step in this work necessitated a careful re-examination of the concept of acclimation in the broader ambit of phenotypic plasticity. Several of the major hypotheses concerning acclimation were distinguished in an explicit, graphic fashion, which revealed that metabolic cold adaptation is a form of beneficial acclimation. These hypotheses were then tested using mites from marine and terrestrial systems in the Southern Ocean. The beneficial acclimation hypothesis (BAH) is controversial. While physiological work all but assumes that the BAH is true, recent studies have shown that support for the BAH is typically wanting. The latter have been criticized for assessing the benefits of developmental plasticity rather than acclimation. We therefore examined the BAH for five congeneric species of ameronothroid oribatid mites that occupy marine to terrestrial habitats. We did so by assessing responses of maximum speed, optimum temperature, and performance breadth, measured from 10°C to 35°C, to four treatment temperatures (0, 5, 10, and 15°C). It was shown that the BAH and its alternatives often make similar empirical predictions. Weak beneficial acclimation is characteristic of one of the more marine species. In the other two upper-shore and marine species, evidence exists for deleterious acclimation and the colder-is-better hypothesis. In the two fully terrestrial species, there is no plasticity. Lack of plasticity is beneficial when cue reliability is low or costs of plasticity are high, and the former seems plausible in terrestrial habitats. However, weak plasticity in the upper shore/marine species and the absence of plasticity in the terrestrial species might also be a consequence of phylogenetic constraint.

These responses were not consistent for different traits among the same species. The predictions of the beneficial acclimation hypothesis and its alternatives were also examined by comparing the phenotypic plasticity of thermal tolerances (supercooling point (SCP), lower lethal temperature (LLT), upper lethal temperature (ULT)), following acclimation at either 0, 5, 10 or 15 1C, for seven days, of the same five, closely-related ameronothroid mite species. All of the species showed some evidence of pre-freeze mortality (SCPs -9 to -23°C; LLTs -3 to -15°C), though methodological effects might have contributed to the difference between the SCPs and LLTs, and the species are therefore considered moderately chill tolerant. ULTs varied between 36°C and 41°C. Acclimation effects on SCP and LLT were typically stronger in the marine than in the terrestrial species, in keeping with the prediction of strong acclimation responses in species from predictably variable environments, but weaker responses in species from unpredictable environments. The converse was found for ULT. Thus, acclimation responses vary among traits in the same species. Moreover, they suggest that there is merit in assessing the predictability of changes in high and low environmental temperatures separately.

These approaches were then applied to indigenous and introduced springtail species from the same region, in conjunction with a large-scale experimental field trial. The physiological responses differed substantially between indigenous and invasive species, though this work is ongoing. In the field trial, we investigated the species- and community-level responses of microarthropods inhabiting a keystone plant species, on sub-Antarctic Marion Island, to experimental reduction in precipitation, warming and shading. These climate manipulations were chosen based on observed climate trends and predicted indirect climate change impacts on this system. The dry-warm and shade inducing treatments that were imposed effected significant species- and community-level responses after a single year. Although the strongest community-level trends included a dramatic decline in springtail abundance and total biomass under the dry-warm and shade treatments, species responses were generally individualistic, that is, springtails responded differently to mites, and particular mite and springtail species responded differently to each other. Our results therefore provide additional support for the dynamic rather than static model for community responses to climate change, in the first such experiment in the sub-Antarctic. They also show that an ongoing decline in precipitation and increase in temperature is likely to have dramatic direct and indirect effects on this microarthropod community. Moreover, they indicate that while at a broad scale it may be possible to make generalizations regarding species responses to climate change, these generalizations are unlikely to translate into predictable effects at the community level.

This work was supplemented by additional investigations of the micro-arthropods of little investigated Prince Edward Island (PEI). Microarthropod community structure differed significantly between PEI and nearby Marion Island, with only two invasive alien species found on PEI compared with six at Marion Island. Furthermore, species richness, abundance and community structure differed significantly between habitat types on both islands. This study emphasized the importance of quarantine measures when visiting PEI to maintain its status as one of the more pristine islands in the sub-Antarctic region.

h. Determinants of invasions and scenarios of change

It is widely accepted that global climate change will cause an escalating in problems associated with biological invasions. The mechanisms through which changes to invasions dynamics are most likely to occur are, however, poorly understood. C·I·B researchers and their colleagues compiled a review entitled '*Will climate change promote plant invasions?*' for a new textbook entitled *Biological Invasions* to be published by Springer in 2007. The chapter outlined what is known about how various facets of global change (including climate change, elevated CO_2, nitrogen deposition and changes in land use) act individually and in concert to affect key processes that drive plant invasions. Certain changes, such as

elevated carbon dioxide levels, changed rainfall and temperature regimes and increased fire frequency have clear and dramatic effects on invasions. Given the multiple linkages and complex feedback and feed-forward loops that are implicated, our understanding about how these factors interact is rudimentary. Rather than seeking exact predictions, we need to use what understanding we have to build scenarios to guide adaptive management strategies.

i. Impacts of invasion

Distribution of the common myna in South Africa in relation to areas of human habitation and conservation areas

The common myna *Acridotheres tristis* is an Asian starling that has become established in many parts of the world outside of its native range due to accidental or deliberate introductions by humans. The South African population of this species originated from captive birds that escaped in Durban in 1902. A century later, this species has become abundant across much of the country and poses a serious threat to biodiversity. Preliminary observations suggested that the common myna's distribution is closely tied to that of humans, but empirical evidence for this hypothesis is lacking. The relationships between myna distribution in South Africa, human population size, and land-transformation values at a quarter degree resolution were investigated. Mynas were found more frequently than expected by chance in areas with greater human population numbers and land transformation values. Moreover, the myna's distribution is not closely tied to protected areas.

j. Ecosystem services and alien invasions

Information on the potential effects of invasive alien plant species on the delivery of ecosystem services is needed to justify the substantial costs associated with managing invasions. A team of researchers from the CSIR and the C·I·B used data on the current and potential future distribution of 56 invasive alien plant species to estimate their impact on four ecosystem services (surface water runoff, groundwater recharge, livestock production and biodiversity) in the five major terrestrial biomes of South Africa. The analysis was based on available mapped data on alien plant distribution, land transformation, hydrology and water resources, protected areas, vegetation types, and the potential for livestock production.

The estimated reductions in surface water runoff as a result of current infestations of invasive alien plants were > 3 000 million m^3 (about 7 % of the national total), most of which is from the fynbos and grassland biomes; the potential reductions would be more than eight times greater (~ 25 000 million m^3) if invasive alien plants were to occupy the full extent of their potential range. Most of this additional impact would be felt in the relatively un-invaded grassland biome. Impacts on groundwater recharge would be less severe, potentially amounting to approximately 1.5 % of the estimated maximum reductions in surface water runoff.

Reductions in the potential to support grazing livestock as a result of current levels of infestation by alien plants amounted to just over 1 % of the potential number of livestock that could be supported. However, if infestations are allowed to reach their maximum possible extent, these impacts could increase to 71 % of the grazing potential.

Current estimates of a biodiversity impact range from 89 % to 71 % for the five biomes analysed, when the additional impacts of invasive alien plants are not considered. These indicate a loss of biodiversity of between 11 and 29 %. Under a scenario where invasive alien plants are allowed to reach their full

potential, these values decline dramatically, to approximately 30 % for the savanna, fynbos and grassland biomes, but to even lower values (13 and 4 %) for the two Karoo biomes, suggesting significant potential losses of biodiversity of > 90 % in places. These results suggest that, while the current impacts of invasive alien plants are still relatively low (except those on surface water runoff), future impacts could be very high and expensive management operations are justified.

k. Additional new research fields

Molecular ecology as a potent tool in invasion ecology

Molecular techniques have emerged as extremely valuable tools for identifying cryptic or genetically complex organisms and for reconstructing colonization history in invasion ecology. Considerable work was done at the C·I·B in this field during 2006.

The remarkable ability of Argentine ants to form large super colonies in their adventive ranges is thought to be due to the loss of genetic variation during the founding event and to genetic drift in small founding populations, resulting in the loss of inter-colony aggression. A study was done to describe the spatial distribution of genetic variation in the Argentine ant across its South African range using both mitochondrial sequence as well as nuclear microsatellite data from six loci. For the mitochondrial DNA study, the protein coding cytochrome oxidase subunit I (COI) gene was sequenced for 87 specimens taken from 30 localities across South Africa. Results revealed five distinct haplotypes, but most South African specimens (93 %) belonged to a single mitochondrial haplotype. These results (and other work on microsatellites) suggest that most Argentine ants in South Africa form a single large super colony.

Molecular techniques were used to compare the phylogeography of introduced and indigenous species on Marion Island. Mitochondrial COI genes were sequenced for two indigenous mites (Arachnida; Acari) and two indigenous springtail species (Hexapoda; Collembola). Genetic structure across Marion Island was evident for all four species, with localities on western and eastern sides of the island being significantly differentiated from the remainder of the populations, suggesting that climate and topography are important in shaping the population structure. Most Marion Island introductions took place relatively recently, in the late 19th and 20th centuries, allowing little time for population divergence. One would expect less population structuring in such recently introduced than in indigenous taxa; To test this prediction, a wide range of species introduced to Marion Island was studied. Although it was expected that haplotype diversity for introduced species would be low, the findings were more dramatic than anticipated. For most species, only a single mitochondrial DNA haplotype was found, suggesting that only a few individuals colonized the island. If the introduction of only a small number of individuals has led to the establishment of large populations of these species (abundances may be as high as several thousand individuals per square metre), propagule pressure is unlikely to have been a significant factor in their establishment. In consequence, few hurdles to the introduction and establishment of small species such as these probably exist, as has been suggested previously both for this region and elsewhere. Therefore, not only could further introductions from continental areas readily take place, but inter-island transfers are likely.

DNA barcoding is a useful tool for assigning individuals to species and for discovering new species. A DNA-barcoding approach was used successfully to identify the haplotype of the house mouse (*Mus musculus*) on Marion Island. Results showed that that the house mouse on Marion Island is *Mus musculus domesticus,* closely related to haplotypes from Denmark, Sweden, Finland and northern Germany. Interestingly, although the Marion Island haplotypes have a Scandinavian origin, they are very

similar to haplotypes derived from house mice sampled in the Madeiran Archipelago, adding credence to the notion that northern Europeans visited these islands long before Portuguese settlers arrived.

Another study addressed the colonization history of the pygmy shrew *Sorex minutus* in the British Isles. The study used four nuclear loci (microsatellite loci L9, 14, 62 and 69) and a portion (1110 bp) of the maternally-inherited mitochondrial cytochrome b gene (cyt b). Results showed that colonization of Ireland by pygmy shrew was most probably human-mediated, whereas the colonization of Britain occurred naturally when Britain was connected to continental Europe through an ancient land bridge.

Evolutionary physiology

Substantial research in the field of evolutionary physiology was also undertaken (much of it funded by other organizations). The most notable contributions were a demonstration of the way in which molecular mechanisms and ecological realities can be linked and a demonstration of mass and temperature independence of metabolic rates. In the latter work, mass-specific metabolic rates of 173 animal species under various conditions of prolonged food deprivation (aestivation, hibernation, sit-and-wait existence) and/or living at temperatures near the freezing point of water were analysed. These minimum life-supporting metabolic rates are independent of body mass over a nearly 80-million-fold body mass range and independent of temperature over a range of −1·7 to 30°C, with a mean value of 0·1 W kg^{-1} and 95 % CI from 0·02 to 0·67 W kg^{-1}. Additionally, 66 measurements of anoxic metabolic rates in 32 species capable of surviving at least 1 h of anoxia were analysed. While similarly mass-independent, anoxic metabolic rates are significantly more widely scattered (1200-fold 95 % CI); they are on average one order of magnitude lower than during normoxia and depend on temperature with Q10 = 2·8. Energy losses at the time of 50 % mortality during anoxia are 30 to 300 times smaller than the energy losses tolerated by normoxic organisms in the various energy-saving regimes studied. These principal differences form the basis for proposing two alternative strategies by which organisms survive environmental stress: the regime of abandoned metabolic control (‘slow death’), when, as in anoxic obligate aerobes, measured rates of energy dissipation can predominantly reflect chaotic processes of tissue degradation rather than meaningful biochemical reactions; and the regime of minimum metabolic control, when biochemical order is sustained at the expense of ordered metabolic reactions. Death or survival in the regime of abandoned metabolic control is dictated by the amount of accumulated biochemical damage and not by the available energy resources, as it is in the regime of minimum metabolic control.

Other work also included the conclusion of studies of Antarctic arthropods at Cape Hallett in the Ross Sea region. The distribution and abundance of free-living arthropods from soil and under stones were surveyed at the Cape Hallett ice-free area (ASPA No. 106), North Victoria Land, Antarctica. A total of 327 samples from 67 plots yielded 11 species of arthropods comprised of three Collembola: *Cryptopygus cisantarcticus*, *Friesea grisea* and *Isotoma klovstadi* and eight mites: *Coccorhagidia gressitt*, *Eupodes wisei*, *Maudheimia petronia*, *Nanorchestes* sp., *Stereotydeus belli*, *S. punctatus*, *Tydeus setsukoae* and *T. wadei*. Arthropods were absent from areas occupied by the large Adelie penguin colony. There was some distinction among arthropod communities of different habitats, with water and a lichen species (indicative of scree slope habitats) ranking as significant community predictors alongside spatial variables in a Canonical Correspondence Analysis. Recent changes to the management plan for ASPA No. 106 may need to be revisited as the recommended campsite is close to the area of greatest arthropod diversity.

The role of reproductive biology in plant invasions

The role of reproductive traits in the naturalization of South African Iridaceae in other regions was investigated. Naturalized and non-naturalized congeners were selected from a list of species that are widely used in horticulture and therefore have had the opportunity to invade elsewhere. Strong evidence was found that species that have become naturalized elsewhere have a significantly higher probability of being capable of autonomous self-fertilization, as predicted by Baker's Rule, and to have lower levels of pollen-limitation of seed set in their native range. In addition, greenhouse experiments revealed that species that had become naturalized elsewhere have faster germination rates. This highlights the importance of reproductive traits for plant invasions. A parallel study of all South African Iridaceae showed that species that have become naturalized elsewhere have a significant tendency to be taller and to come from lower altitudes, suggesting that vegetative traits may also play a role in the invasion process.

2. EDUCATION AND TRAINING

A. Objectives

The C·I·B plans to educate students and provide them with career path opportunities from the undergraduate to the post-doctoral level and beyond.

B. Progress

The C·I·B supported 51 students in 2006, and 20 of these students graduated (seven 3rd years, eight 4th year/Hons., and five masters students). It also saw five post-doctoral associates move on, typically to employment in South Africa or abroad. Of the 51 students supported, 35 are women and 23 are from the designated groups, indicating that in the former case the equity targets were exceeded whilst in the latter they were not quite met. Amongst the 11 post-doctoral associates, only three are women and none are from the designated groups. The difficulty of attracting post-doctoral associates from the designated groups remains a significant issue faced not only by the C·I·B, but by the biology research environment in general. No shortage of applicants from elsewhere in Africa and from India exists, but the quality of the applicants, in the large majority of cases, is not yet at a standard that is expected at this level. Having said that, some of the current post-doctoral associates have also not turned out to be as successful as their CVs suggested they would be. The selection of post-doctoral associates remains something of an art, especially the selection of associates who considerably improve the research output of a laboratory, who can work independently, and who are keen to work under the circumstances offered to them by the institutions in question. The latter certainly needs more attention than it has perhaps had, but this is a general issue for Tertiary Institutions to take up with the appropriate funding agencies and government departments, and not one about which the C·I·B can do very much.

The C·I·B's Open Bursary programme has demonstrated its value. In 2006, bursars included Ms. Lukeshni Chetty (doctoral student, University of the Free State, who won best presentation award at the 6th Plant Breeding Symposium in March 2006 for her presentation entitled 'The impact of pollen movement on the identity preservation of maize') and Mr. Phemelo Mogodi (masters student, University of the. North West), and new bursaries were awarded to Ms. Kanyisa Nyafu (masters student, Nelson Mandela Metropolitan University) and Ms. Kate Lorentz (doctoral student, University of the Witwatersrand). The current bursars and their supervisors indicated the value that the C·I·B had added to their general research experience. This was especially true of the science publishing workshop held by the C·I·B, and the establishment of the Environmental Research Group on GMOs co-led by several

researchers including Prof. Melodie McGeoch, a C·I·B core team member, and Prof. Chris Viljoen (supervisor of Ms. Chetty).

In keeping with its overall policy of rewarding excellence, the C·I·B once again handed over two awards of R 20 000 to the top students at its annual research meeting. Moreover, because the adjudicators (Prof. T.M. Blackburn, Prof. P. Pyšek, Prof. T.J. Stohlgren) were so impressed by the quality of the work, a third prize, of R 15 000, was also awarded. These awards, for best presentations, went to Dr. Mark van Kleunen (post-doctoral associate), Ms. Benis Egoh (doctoral student) and Ms. Michelle Greve (masters student). On conclusion of the C·I·B annual research meeting, the adjudicators held a special session with the students and post-doctoral associates, providing them with advice on their science, insights into what they considered strong, informative and attractive poster presentations, and on the importance of science communication generally.

The science publishing workshop (Publishing in the 21st Century: A Guide for the Rejected and Perplexed), run by Dave Richardson, Steven Chown and Liz Ferguson (Blackwell Publishing, Oxford, UK) was open to a select group of students. Owing to the hands-on nature of the workshop it was restricted to core team members, post-doctoral associates, Open Programme bursars and their supervisors, and a small number of C·I·B students. The workshop was rated as a highly successful and extremely enlightening two days.

Biodiversity Conservation Academy, January 2006

The first Biodiversity and Conservation Academy, a joint venture between the DST-NRF Centres of Excellence in Invasion Biology (C·I·B) and Birds as Keys to Biodiversity Conservation at the Percy FitzPatrick Institute, was held at the Potberg Environmental Education Centre at De Hoop Nature Reserve from 16 to 20 January 2006.The Academy was attended by 15 students selected through a competitive application process open to students from all South African universities. The students came from six higher education institutions (University of Pretoria, Walter Sisulu University, University of the Witwatersrand, University of KwaZulu-Natal, University of Cape Town and Stellenbosch University) and ranged from third year to honours level. They joined eight academic and support-staff of the two CoEs, including the directors, Profs. Steven Chown and Morné du Plessis.

Seven of the students were from the designated groups. The five-day programme of the Academy immersed students in an intensive series of theoretical, practical and philosophical discussion and field-work sessions on biodiversity conservation. The aim was to improve student appreciation for the complexity of biodiversity, sharpen their understanding of the skills required for its assessment, and broaden their knowledge of the theory and practice of conservation in a South African context.

No formal lectures were given. Instead, after a brief introduction to a topic, Academy staff led an informal discussion, guiding the discussion with questions, and actively encouraging questions and answers from all participating students. Students were frequently split into three groups to work on specific problems, questions and fieldwork activities. They subsequently convened again for a general report-back and further discussion. Students were also given a number of pertinent readings to help guide their thinking. Evenings were spent relaxing and chatting around a circular campfire seating area.

The Academy was jointly funded by the Department of Science and Technology, the C·I·B and DST-NRF Centre of Excellence in Birds as Keys to Biodiversity Conservation at the Percy FitzPatrick Institute.

Following the Academy, and based on the enthusiastic responses of students to the course evaluation, a report was submitted to the DST.

Figure 4. Participants in the first Biodiversity Conservation Academy held at Potberg Environmental Education Centre in January 2006

3. INFORMATION BROKERAGE

A. Objectives

The objectives are to ensure access to scientific information by peers and students, enhance data availability to all scientists and to ensure long-term continued access, to facilitate communication amongst partners in the field, and to develop an outreach programme demonstrating the significance of biodiversity, and the threats posed to it by invasive species, to all sectors of society.

B. Progress

Scientific communication with peers

The C·I·B has further improved its science communication with peers, increasing overall conference attendance and contributing a wide range of papers to the peer-reviewed literature. Six invited/keynote addresses were presented at international meetings and four at local meetings. Twenty presentations were made at conferences (eight international) and ten posters were presented. Forty-three peer-reviewed papers were published in the primary literature in a wide range of journals, including leading disciplinary journals such as *Trends in Ecology and Evolution*, *American Naturalist*, J*ournal of Applied Ecology* and *Ecology*. In addition, two book chapters, five contributions to conference proceedings, and two CIB Occasional Papers were published.

Scientific communication to students

In addition to its Annual Research Meeting, to which students contributed posters, discussion, and a lively atmosphere during talks presented by core team members, the C·I·B also involved a select group of students in the science publishing workshop it held (details below), and in an international workshop

concerning terrestrial biodiversity in the Antarctic, run on behalf of the Scientific Committee on Antarctic Research. These workshops were, by their very nature, not open to all students, but nonetheless, a select group of students and post-doctoral associates were afforded the opportunity to participate.

Discussions with students at the Annual Research Meeting also led to the election of a new student and post-doctoral representative (Ms. Dian Spear), and an agreement that a list-server would be established to improve communication among the students. Ms. Spear was also added to the general C·I·B distribution list, with the understanding that confidential matters would not be sent on to her. Likewise, Ms. Spear was welcomed by the Board as an observing student representative, again with the understanding that the student representative would not be in attendance during confidential items, and would have observer status only.

The document management system used by the C·I·B continues to be used by students and core team members collaborating on various research aspects. Likewise, several lectures were presented by C·I·B core staff and post-doctoral associates in addition to their normal lecturing duties (in the case of core staff), which highlighted the significance of invasion biology.

Communication with partners

The home-page of the C·I·B continues to function well and its hit rate is increasing slowly. The page has proved to be of considerable use in keeping core team members and partners informed about the work of the C·I·B, as well as the various procedures required to apply for support. The ongoing supply of news via the 'nuggets' continues to constitute a major component of communication with partners.

In addition to the nuggets, the C·I·B also instituted the publication of more formal research papers that are typically either in a form more useable for practical application than for primary publication, or that require urgent publication to address key domestic issues. The CIB Occasional Paper series has proven valuable thus far, with many partners and others indicating the value of these works. The two papers published to date are: *Towards Best Practice in Management of Road, Power Line and Rail Reserves* and *Ecological Risk Assessment of Genetically Modified Organisms in South Africa: An Assessment of the Current Policy Framework*.

Following a request by its core team members for advice on getting published in the modern literature, the C·I·B ran a workshop entitled 'Publishing in the 21st Century: A Guide for the Rejected and Perplexed'. Two experienced journal Editors from the C·I·B, and Liz Ferguson (Blackwell Publishing, UK) presented talks and interactive sessions on a range of topics from preparing manuscripts, to the submissions process (from author and editor perspectives) to the economics of publishing, and finally to the more difficult aspects such as writing scientific and trade (popular) books. Assessments by participants (from the C·I·B and elsewhere) indicated that the workshop was highly successful and achieved its aims.

Figure 5. Dave Richardson, Elizabeth Ferguson and Steven Chown, presenters of the C·I·B science publishing workshop 'Publishing in the 21st Century: A Guide for the Rejected and Perplexed' held in September 2006

Communication with the public

a. Iimbovane outreach project

2006 started with a number of events and activities including and a teacher training workshop, hosted on the 27th and 28th of January at Stellenbosch University. This was an intensive interactive workshop where teachers from the ten schools participating in Iimbovane worked through the implementation of the project in their schools. Teachers were given background lectures on biodiversity, ant biology and the scientific method, and were introduced to the methods applied in the Iimbovane project through field and laboratory practicals. The workshop also included practicals on data handling and the interpretation and presentation of results.

Iimbovane also used the evening of 27 January 2006 as an opportunity to publicly launch the project. The launch was attended by potential funders, local conservation groups, and the media.

During the remainder of January and February the two transects selected for the project were finalised (identified in November 2005). Both transects run east-west in the Western Cape Province (WCP). One transect runs from Beaufort West to Worcester, following the N1 national road. The second transect runs from Oudtshoorn via Wilderness to Table Mountain National Park, following the N2 national road (Table 1).

Table 1. Names and town locations of sites used in the Iimbovane project

School/Disturbed Site	Control Site
Cape Academy for Maths, Science and Technology Tokai, Cape Town	Table Mountain National Park (Cape Peninsula)
Emil Weder Sekondêr, Genadendal	Moravian Mission Land, Genadendal
Fezekile High School, Oudtshoorn	Grootkop Nature Reserve, Oudtshoorn
Groendal Sekondêr, Franschhoek	Mont Rochelle Nature Reserve, Franschhoek
Ikamvalethu Secondary School, Langa, Cape Town	Tygerberg Nature Reserve, Cape Town
Luhlaza High School, Khayelitsha, Cape Town	Wolfgat Nature Reserve, Cape Town
Manzomthombo Secondary School, Mfuleni, Cape Town	Helderberg Nature Reserve, Somerset West
Riviersonderend Hoërskool, Riviersonderend	Riviersonderend Municipal Land, Riviersonderend
Sentraal Hoërskool, Beaufort West	Karoo National Park (flat area)
Weltevrede Sekondêr, Wellington	Hawekwas, Wellington
Wilderness (Rondevlei)	Wilderness (Rondevlei)
Argentina Farm, Prince Albert (October sampling only)	Tierberg Private Nature Reserve, Prince Albert
	Bontebok National Park*
	Werner Freshe Nature Reserve, Riversdale*
	Worcester Veld Reserve, Worchester*
	Kapklip Private Nature Reserve, Touws River
	Karoo National Park (Mountain area)

* In December 2006 three schools were added to the Iimbovane project, adding disturbed sites for these three reserves. An additional control site was also added.

The March sampling period provided the first opportunity for the Iimbovane team to interact with the Grade 10 learners in the field. Interactions were successful, with the team being questioned on topics ranging from requirements to study at university to detailed questions on ant biology. The Iimbovane project was also able to take learners from three schools (Genadendal, Riviersonderend and Beaufort West) to their control sites.

In March Ms. Mahood co-presented a plenary talk, which used the Iimbovane project as a working example of an environmental education outreach project, at the South African Environmental Observation Network (SAEON) Summit. This plenary session was followed by a 45 minute presentation by Ms. Mahood about the details of Iimbovane in the workshop session on environmental education. The response to both presentations was overwhelmingly positive, with many delegates later using the project as an example of how to implement outreach projects. A paper based on the presentations is currently under review for a special issue of the *South African Journal of Science*.

In April, Iimbovane submitted its first report to the Darwin Initiative on the progress during the first six months of the project. The independent review of this report was very positive and summarised the first six months by stating that: "*This project is one that should have direct impact on young people involving them in 'real' science and developing a greater understanding of biodiversity and its importance. The continuation of the work through the schools, teachers and the selected sites is well planned. This is a good project.*" From April to June the Iimbovane team spent much time sorting and identifying ants that

were collected during the March 2006 sampling period. In summary, 26 664 ants were caught, belonging to 25 genera and approximately 89 species. The final number of species is still to be confirmed as many ants are currently only assigned to morphospecies. Time was also spent on the development of an ant identification guide and key, and the compilation of ten ant reference collections (showing different sub-families), one for each of the schools. The fast uptake of the project within the WCP has seen the Iimbovane team receiving regular requests from Western Cape Education Department (WCED) to assist with training workshops on biodiversity for teachers. WCED approached Ms. Mahood and Ms. Kruger to assist them in their Provincial Teacher Orientation Session for Life Sciences 2006, which was aimed at assisting senior school teachers to implement the new National Curriculum Statement.

In May and June the Iimbovane team undertook an equipment handover trip, where each of the schools was presented with a Leica EZ4 Microscope, an IBM laptop, their own reference collection and an ant identification guide and key. All the equipment was funded by the Darwin Initiative. The impact of the microscopes was immediately visible in the excitement learners showed when viewing ants from the reference collection under the microscope for the first time. The handover of data from the March 2006 sampling season took place during August. The teachers at many of the Iimbovane Schools had expressed an interest in having Iimbovane give additional lessons for learners on data handling at the same time as the data handover. In light of this, a worksheet on data handling that incorporated data from the schools and their control sites was prepared. These lessons were well received and the learners were able to do most of the calculations required, including some basic biodiversity indices.

The progress and planning workshop for the Iimbovane project partners was held in August at Stellenbosch University. It was attended by Prof. Kevin Gaston, Dr. Brigitte Braschler and Dr. Sue Shaw of the University of Sheffield and Prof. Steven Chown, Ms. Kirsten Mahood, Ms. Natasha Kruger and Ms. Sarah Davies of the C·I·B. This was a successful workshop with much of the science coming from the data being discussed. The electronic ant database being developed for the project by Mr. Vhengani (C·I·B Principal Technical Officer – Database) was demonstrated during the workshop. It was also agreed that an additional sum would be made available to the project to employ additional technicians to assist with the project. The services of a student assistant (third year BSc at Stellenbosch University) were obtained for the project. Ms. Matlakala Mapatha assisted with sorting of pitfall traps and preparations for the October field trip.

The year came to a close with Ms. Mahood presenting a well received paper on the communication aspects of Iimbovane at the African Science Communications Conference. This was followed by a joint presentation given by Ms. Mahood and Ms. Kruger at the Commonwealth Association for Science, Technology and Mathematics Educators Conference held in Cape Town. WCED has been a major partner and influence in Iimbovane's success. Through WCED's support Iimbovane has been implemented in 10 schools with minimal administrative complications. The Iimbovane team has become recognised as experts in the field of communicating biodiversity and ecology issues to learners at the senior level. Iimbovane has established links with BIOTA (http://www.biotaafrica.org), and has identified two BIOTA sampling sites for use in the project. Iimbovane works in four South African National Parks (two parks have two sites). Through this interaction the inclusion of the CoastCare programme has been possible.

The project has maintained a high media profile, disseminating information about the project to a variety of audiences. The January teacher training workshop was promoted through interviews for the Cape to Midnight show in January and an additional radio interview for Radio Sonder Grense. Television footage

of the teachers participating in a field based practical during the January workshop was aired on *Groen*, an environmental programme on Kyk-Net. This insert included interviews with both Ms. Mahood and Ms. Kruger. The Iimbovane project has received publicity in many local community newspapers, mostly featuring Iimbovane team visits to local schools.

b. Media Highlights for 2006

Although the full list of media interactions can be viewed in the media section of the Annual Report, the following items should receive special attention.

Prof. Richardson generated international interest in the C·I·B, being the first ecologist to win the international Hans Sigrist prize, creating a large media stir. Publicity was concentrated in the print and electronic media, with articles appearing in Swiss newspapers and on the University of Bern website. This achievement also received extensive press coverage in several local newspapers, including the Cape Argus, Eikestad Nuus and the Wood and Timber Times. Various Stellenbosch University websites and newsletters gave this award good coverage.

Dr. van Vuuren was appointed as the Chief Shore-based Scientist for the April 2006 Marion Island relief voyage bringing more attention to the C·I·B, especially during the lead up to the voyage. This was the first time in the history of the South African National Antarctic Programme that a woman was appointed to this position. Articles about this achievement appeared in Die Burger, Matieland, District Mail and Kampus Nuus. Dr. van Vuuren was also interviewed for Radio Sonder Grense and briefly for a news insert for the Kfm 94.5 Breakfast Show.

Karen Esler and Sue Milton generated interest with the Roads and Rivers Workshop, which brought disturbance ecology researchers, National Roads Agency managers and interested parties together to discuss the management of road reserves in the context of their role as natural corridors. The workshop led to the first C·I·B Occasional Report being published on the C·I·B website. This issue was also highlighted by articles in Die Burger and on various Stellenbosch University websites and newsletters.

The C·I·B raised its national profile when it received an hour of airtime on the SAfm Cape-to-Midnight programme hosted by John Richards and Lynette Francis, where Steven Chown spent the time in the studio discussing the C·I·B, invasive species in general and the future of invasive species control in the country.

Following the National Climate Change Conference, Steven Chown was interviewed and quoted regarding climate change on Marion Island in an article for the Sunday Times. This newspaper article was followed by an interview with Mike Wills on 567 CapeTalk Radio, which covered the same topic.

Steven Chown was interviewed by the Mail & Guardian regarding the current state of the regulations for Invasive Alien Species that are in the process of being drafted for the National Environmental Management: Biodiversity Act. This discussion brought about an article in the M&G which raised the profile of the issues of concern.

Knowledge Management System

A system of backups for all Core Staff computers has now been implemented at the C·I·B hub, and significant administrative documents are also loaded onto the Stellenbosch University Document management System. This aspect of knowledge management is effectively run by the Principal Technical Officer: Database, Mr. Lufuno Vhengani.

Together with colleagues based at Stellenbosch University Library and at the Stellenbosch University IT Department, Mr. Vhengani also spent the better part of 2006 helping design an Information Retrieval and Submission System (IRSS). Mr. Vhengani was responsible for the development of the use cases and continual verification of their implementation, whilst the system itself was designed by Mr. Wouter Klapwijk. In essence, an open source product, known as DSPACE, which is in use in many University libraries in South Africa, was dissembled and then re-assembled to cater to the C·I·B's requirements. An especially powerful tool for the integrated management of data and metadata was delivered at the end of 2006 by the team, and it will be fully operational in 2007. Among the benefits of the DSPACE system is its open-source software, ability to be integrated with other information management systems, and ease of use.

4. NETWORKING

A. Objectives

The C·I·B will formalize its interactions with local partners and will seek interactions with international partners working in the same broad fields. The partnerships will involve both research partnerships and partnerships based on complementarity of skills and core business directions.

B. Progress

Over the 2006 period, the C·I·B consolidated its relationships with local partners, and focussed on further developing a relationship with one of the most significant programmes in the invasive alien field in South Africa: the Working for Water Programme. Although the networking focus appeared to be exclusively national, the proposal for collaboration made to the Working for Water Programme included several international partners, as well as a range of new national partnerships. Towards the end of 2006, the Working for Water Programme indicated its enthusiasm to collaborate on the two major projects identified in the proposal: *1. Using genetic techniques to improve understanding and management of invasive alien plant species in South Africa; 2. Documenting the effects of invasion, control and rehabilitation in support of the management of biological invasions in South Africa*. A memorandum of understanding between the Working for Water Programme and the C·I·B will be concluded in 2007 to give effect to the proposed collaboration.

Agreements with partner institutions - International

None

Agreements with partner institutions -National

The C·I·B signed memoranda of understanding with the Western Cape Nature Conservation Board (CapeNature), initiating a research collaboration that will lead to joint student training from 2007 onwards. Areas for collaboration on research and student training were identified at a meeting in September.

In 2006 the C·I·B formally concluded its memorandum of understanding with the South African Institute for Aquatic Biodiversity (SAIAB), although the two organisations have been working closely together since the C·I·B was launched. A post-doctoral associate working at SAIAB, Dr. Steven Lowe, is receiving support from the C·I·B.

The C·I·B's Open Bursary Programme was launched in 2006, supporting two post-graduate students at the Universities of the Free State and the North West, further expanding the C·I·B network to these universities.

Academic visitors to CIB

Dr. M. Beekman, School of Biological Sciences, University of Sydney. Collaborator on projects relating to the Cape honeybee invasions and the honeybee hybrid zone and why *A.m. capensis* has not expanded its range (Theresa Wossler).

Prof. B.P. Oldroyd, School of Biological Sciences, University of Sydney. Collaborator on projects relating to the Cape honeybee as a social parasite (Theresa Wossler).

Prof. J. Bengtsson, Department of Entomology, Swedish University of Agricultural Sciences, Uppsala, Sweden. Collaborator on projects concerning effects of fragmentation on soil fauna. (Steven Chown).

Dr. D. Bergstrom, Terrestrial Sciences Division, Australian Government Antarctic Division, Tasmania, Australia. Collaborator on International Polar Year project Aliens in Antarctica (Steven Chown).

Prof. K.J. Gaston, University of Sheffield, UK. Collaborator and PI on Darwin Initiative limbovane grant (Steven Chown).

Prof. H.P. Leinaas, Programme for Experimental, Behavioural and Population Ecology Research, Department of Biology, University of Oslo, Oslo. Norway. Collaborator on projects regarding alien and invasive springtails both in W. Cape and at Marion Island. (Steven Chown).

Prof. R. Raguso, University of South Carolina. Collaborator on invasive species pollinated by long-tongued hawkmoths. (Steve Johnson).

Dr. P. Naskreki, Harvard University / Conservation International, USA, and Dr Dan Otte, Philadelphia Academy of Sciences, USA. Collaborators on projects relating to alien plant invasions and Orthoptera (Michael Samways).

Dr. J. Ott, L.U.P.O., Germany. Collaborator on landscape planning (Michael Samways).

Prof. T. New, La Trobe University, Australia and Dr. S. Spector, American Museum of Natural History. USA. Collaborator on Red Listing processes (Michael Samways).

Dr. V. Kalkman, Leiden Museum, The Netherlands. Collaborator on Red Listing processes (Michael Samways).

Dr. J-C. Vie, IUCN, Gland, Switzerland. Collaborator on Red Listing processes. (Michael Samways).

Prof. J. van den Berg, School of Environmental Sciences and Development, North West University Collaborator on the Ecological Risk of Genetically Modified Organisms in South Africa (McGeoch).

Prof. C. Viljoen, Department of Haematology and Cell Biology, University of the Free State. Collaborator on the Ecological Risk of Genetically Modified Organisms in South Africa (McGeoch).

Dr. C. Swift, Department of Biology, Whittier College, Whittier, CA 90608 USA, Collaborator on project relating to water relations in riparian trees (Karen Esler).

Academic visits to other institutions

Prof. K.J. Gaston, University of Sheffield, UK. Collaborator and PI on Darwin Initiative Iimbovane grant (Steven Chown).

Prof. H.P. Leinaas, Programme for Experimental, Behavioural and Population Ecology Research, Department of Biology, University of Oslo, Oslo. Norway. Collaborator on projects regarding alien and invasive springtails both in the Western Cape and at Marion Island (Steven Chown).

Dr. S. Kark, Dept. of Evolution, Systematics and Ecology, Hebrew University of Jerusalem, Israel. Collaboration on the importance of ecological transition areas for biodiversity conservation (Berndt van Rensburg).

Department of Bioagricultural Sciences and Pest Management, Colorado State University, Fort Collins, CO, USA, September 2006. Invited participant in the inaugural meeting of the Global Invasions Network [http://www.invasionsrcn.org] (Dave Richardson).

Department of Environmental Sciences, Section of Conservation Biology, University of Basel, Switzerland, November 2006. To ascertain the importance of biological invasions relative to other factors threatening native plants in Switzerland (Dave Richardson).

Dr. P. Harrison, Oxford University. Collaboration on supply of ecosystem services and loss due to aliens (Michael Samways).

Dr. J. Gerlach, Cambridge University. Collaboration on threats to tropical islands. (Michael Samways).

Research collaborations

A gender-focused bibliometric analysis of the field of invasion biology, 1990-2005 – Collaborators: Mr F van Niekerk and Ms C. Mouton, Centre for Research on Science and Technology (CREST), Stellenbosch University (Heidi Prozesky).

Apis mellifera capensis honeybees as a continuous threat to *A.m. scutellata* honeybees – Collaborator: Mike Allsopp, Plant Protection Research Institute, Agricultural Research Council (Theresa Wossler).

Alien snails in West Coast National Park - Collaborators: SANParks (Charles Griffiths)

Aliens in Antarctica: International Polar Year project – Collaborators: Dana Bergstrom, Australian Antarctic Division, Ad Huiskes, Netherlands Institute of Ecology, Niek Gremmen, Data-analyse Ecologie, Netherlands and Peter Convey, British Antarctic Survey, UK (Steven Chown).

Assessing and monitoring local scale impacts of *Opuntia stricta* plant species on arthropod assemblages in the Kruger National Park – Collaborator: South African National Parks (Berndt van Rensburg).

Assessing Large-Scale environmental Risks with Tested Methods (ALARM) - Collaborators: European Partnership (Michael Samways).

Best practice for maintenance of road verges for road safety, biodiversity conservation and prevention of the spread of invasive alien plants – Collaborators: National Roads Agency, National Department of Public Works, Conservation Agencies, Private Landowners, Provincial Government (Sue Milton, Karen Esler).

Biodiversity monitoring at long term ecological research and environmental observatory sites – Collaborators: Prof. Avi Perevolotsky, Agricultural Research Organization, Menachem Zalutzki, Director of Open Spaces, Department Ministry of Environmental Protection, Yehosua Shkedy, Chief Scientist, Israel Nature and Parks Authority, Israel Tauber, Land Development Authority, Elli Groner, Department of Desert Ecology, Blaustein Institute for Desert Research, Efrat Sheffer, Ma'arag project and Dr. Richard Dean, Percy Fitzpatrick Institute for African Ornithology, University of Cape Town. (Sue Milton).

Body size variation in insects – Collaborator: Kevin J. Gaston, University of Sheffield, UK (Steven Chown).

BTB/buffalo/helminth interactions in Hluhluwe-iMfolozi Park – Collaborators: Oregon State University, Princeton University, Ezemvelo KZN Wildlife (Michael Somers).

Carnivore Reintroduction Biology in Hluhluwe-iMfolozi Park – Collaborators: Humboldt State University, Smithsonian Institute, University of California - Berkeley, University of Oxford, Joint Nature Conservation Committee, UK, Endangered Wildlife Trust, University of KwaZulu-Natal, South African National Parks, Ezemvelo KZN Wildlife (Michael Somers).

Chromolaena odorata in Hluhluwe-iMfolozi Park – Collaborators: University of Gröningen, Agricultural Research Council, Ezemvelo KZN Wildlife (Michael Somers).

Concepts in invasion ecology – various studies - Collaborators: Institute of Botany, Academy of Sciences of the Czech Republic (Dave Richardson).

Development of ecological networks for sustainable forestry - Collaborators: Mondi (International) and World Business Council for Sustainable Development (Michael Samways).

Diversity and distribution of insect herbivores associated with *Acacia* species in South Africa and Australia – Collaborator: Dr N. Andrew, School of Environmental Sciences and Natural Resource Management, University of New England, Australia (McGeoch).

Diversity and use of gastropod shells by hermit crabs crab *Clibanarius virescens* – Collaborators, Walter Sisulu University (Michael Somers).

Effects of ungulates on spider diversity in Hluhluwe-iMfolozi Park– Collaborators: University of Cape Town, Agricultural Research Council, Ezemvelo KZN Wildlife (Michael Somers).

Establishing a conservation protocol for the indigenous freshwater fish of the Cape Floristic Region (South Africa) - Collaborators: CapeNature and Cape Action Plan for People and the Environment (CAPE) (Charles Griffiths).

Gas exchange patterns in insects – Collaborator: Craig R. White, Centre for Ornithology, University of Birmingham, UK (Steven Chown).

Human impacts in pine forests – a global synthesis – Collaborators: Department of Ecology and Evolutionary Biology, University of California; Department of Botany, University of Wyoming; Warnell School of Forestry and Natural Resources, University of Georgia; Centre d'Ecologie Fonctionnelle et Evolutive, Montpellier, France; USDA Forest Service, Riverside Fire Laboratory, Riverside, California and Forestry and Agricultural Biotechnology Institute, University of Pretoria (Dave Richardson).

Identification of threats to Fynbos. Collaborators: BIOTA/DST (Michael Samways).

Invasive species responses on Marion Island – Collaborator: Hans Petter Leinaas, Programme for Experimental, Behavioural and Population Ecology Research, Department of Biology, University of Oslo, Norway (Steven Chown).

Modelling of alien plant invasions – Collaborators: Laboratoire d'Ecologie Alpine, CNRS, Université Joseph Fourier, Grenoble, France; CSIR, Natural Resources and Environment (Dave Richardson).

Rationalising biodiversity conservation in dynamic ecosystems (RUBICODE). Collaborators: European Partnership (Michael J. Samways).

Relationships between human population densities, species richness and human population growth - Collaborators: University of Sheffield, University of Stellenbosch (Berndt van Rensburg).

Restoration of aquatic biodiversity using dragonflies as indicators. Collaborators: Department of Water Affairs and Forestry, Working for Water Programme (Michael Samways).

Restoration of Seychelles ecosystems. Collaborators: Nature Protection Trust of Seychelles; Cousine Island Trust (Michael Samways).

Restoration of Table Mountain. Collaborators: WWF(SA), South African National Parks, Kirstenbosch Botanical Gardens. (Michael Samways).

Scheduling conservation action in South African Important Bird Areas: combining current and future threats from transformation with biological significance – Collaborators: University of the Witwatersrand (Berndt van Rensburg).

Science policy: Multi-stakeholder involvement in environmental risk assessment for genetically modified organisms in South Africa – Collaborators: Prof. A.R. Kapuscinski, Institute for Social, Economic and Ecological Sustainability, University of Minnesota; Ms D. Genya, Department of Fisheries and Wildlife; South African National Biodiversity Institute (McGeoch).

Scientific Working Group on the Ecological Risk of Genetically Modified Organisms in South Africa – Collaborators: Prof. J. van den Berg, School of Environmental Sciences and Development, North West University; Prof. C. Viljoen, Department of Haematology and Cell Biology, University of the Free State (McGeoch).

Soil fauna responses to fragmentation – Collaborator: Jan Bengtsson, Department of Entomology, Swedish University of Agricultural Sciences, Uppsala, Sweden (Steven Chown).

Spreading Small Carnivores in the Eastern Cape – Collaborators, Walter Sisulu University, University of Fort Hare, University of Stellenbosch, St Andrews University (Michael Somers).

Targets for Ecosystem Repair in Riparian Ecosystems in Fynbos, Grassland and Savanna Biomes – Collaborators: Department of Water Affairs and Forestry, Working for Water, Universities of Cape Town, Stellenbosch, Rhodes and Witwatersrand (Dave Richardson and Karen Esler).

Terrestrial biodiversity in Antarctica – Collaborator: Peter Convey, British Antarctic Survey, UK (Steven Chown).

The role of reproductive biology in plant invasions – Collaborators: Dr Markus Fischer, University of Potsdam, Germany and Dr John Manning, South African National Biodiversity Institute (Steve Johnson).

The value of community-based conservation in a heterogeneous landscape: an avian case study from sand forest in Maputaland, South Africa - Collaborators: University of Pretoria, Ezemvelo KwaZulu-Natal Wildlife (Berndt van Rensburg).

The value of ecological transition areas for biodiversity conservation – Collaborators: The Hebrew University of Jerusalem (Berndt van Rensburg).

Understanding disruptions of plant-animal interactions due to biological invasions – Collaborators: Institut Mediterrani d'Estudis Avançats, Balearic Islands, Spain (Dave Richardson).

Understanding the success of invasive plants: a leaf-carbon strategy approach – Collaborators: Department of Biological Sciences, Macquarie University, NSW, Australia (Dave Richardson).

5. SERVICE RENDERING

A. Objectives

The C·I·B plans to become known, within its first full year of operation, as *the* centre for obtaining reliable, credible scientific information on a wide range of biodiversity and biological invasion issues at a national level, or as the point of contact for reaching those who have much of this information.

B. Progress

The early part of 2006 saw ongoing work by C·I·B members and partners in the development of regulations for Chapter 5 of the National Environmental Management: Biodiversity Act as part of the Task

Team appointed by the National Department of Environmental Affairs and Tourism (DEA&T). Substantial disagreements developed between certain DEA&T officials and the Task Team. In June 2006 a landmark meeting was held to resolve the differences, and a senior official of DEA&T assured the scientists involved that they would continue to be part of the process. Since then, the Task Team has been disbanded, but the regulations process is ongoing. Further developments on this front are expected in 2007.

The C·I·B delivered, on time, the Prince Edward Islands Environmental Management Plan, to the National Department of Environmental Affairs and Tourism (DEA&T) early in 2006. Subsequent discussions with officials at the DEA&T revealed that the EMP was unlikely to be implemented in 2006 or 2007.

A major outcome of the assistance given by the C·I·B to the Global Invasive Species Programme (GISP) for the development of a report on the requirements for invasive species indicators for the GEF 2010 Biodiversity Indicators Partnership project, was the development of such an indicator, published in 2006 by C·I·B researchers in *Conservation Biology*.

In addition to these major service provision activities, core team members have been involved in a wide range of service provision both to the scientific community and to the community at large. These service provision activities have included:

National panels and committees

Advisory Committee to South African Minister of Agriculture and Land Affairs: Genetically Modified Organisms. Member: Melodie McGeoch

BIOTA. South African Liaison Committee member: Karen Esler

CAPE Alien Species Task Team. Member: Dave Richardson

De Wildt Cheetah and Wildlife Trust. Scientific Advisory Board member: Michael Somers

Development of a National Biodiversity Monitoring and Reporting Framework for South Africa, Department of Environmental Affairs and Tourism and SANBI. Consulting participants: Karen Esler and Melodie McGeoch

Development of Criteria for Identifying Threatened or Protected Ecosystems in South Africa, Department of Environmental Affairs and Tourism and SANBI. Consulting participant: Karen Esler

Fynbos Forum. Committee member: Karen Esler

Helderberg Nature Reserve. Advisory Board member: Theresa Wossler

Higher Education Resource Systems (HERS). Advisory Board Member: Karen Esler

IUCN South African Wild Dog Advisory Group. Member: Michael Somers

National Environmental Advisory Forum. Alternate Member representing biosafety: Melodie McGeoch

National Environmental Management: Biodiversity Act, task team for invasive species listing. Coordinator for Vertebrates, excluding fish: Bettine Jansen van Vuuren

National Environmental Management: Biodiversity Act, task team for invasive species listing. Coordinator for risk assessment protocols: Dave Richardson and Steven Chown

National Science and Technology Forum. Member: Berndt J van Rensburg

Paarl Mountain Advisory Board member: Karen Esler

Prince Edward Islands Management Committee. *Ad hoc* member: Steven Chown

SANBI Remuneration Committee. Member: Steven Chown

SANBI Science Programmes Advisory Committee. Chair: Steven Chown

SANCOR. Scientific Steering Committee member: Charles Griffiths

Scientific, Engineering and Technological Societies and Allied Professions Group of South Africa. Member: Berndt J van Rensburg

South African Association of Botanists. Council member and Vice-President: Karen Esler

South African Association of Women in Science and Engineering. Western Cape branch committee member: Karen Esler

South African Data Centre for Oceanography. Board member: Charles Griffiths

South African National Antarctic Programme. Steering Committee Member: Melodie McGeoch

South African National Biodiversity Institute. Board member: Steven Chown

Succulent Karoo Ecosystem Plan (SKEP). Advisory Board member: Karen Esler

Working for Water Programme. Research Advisory Panel member: Brian van Wilgen

Zoological Society of Southern Africa Council Member/Biodiversity portfolio: Berndt J van Rensburg

Zoological Society of Southern Africa. Council member/*Aardvark* portfolio: Bettine Jansen van Vuuren

International panels and committees

Africanness: African Global Change Research Network. Steering Committee Member: Melodie McGeoch

Census of Marine Life: Chair, Africa Regional Implementation Committee: Charles Griffiths

DIVERSITAS. Scientific Committee Member: Melodie McGeoch

Global Invasive Species Programme. Alternate Board member for SANBI: Steven Chown

International Liaison Committee (ILC) for Wildland Fire Management. Member: Brian van Wilgen

Invasive Plant Atlas for New England. Member of Advisory Committee 2002-present: Dave Richardson

IUCN Species Survival Specialist Groups on Invasive Organisms 1996-present, Conifers 1999-present and Southern African Plants 2006-present: Dave Richardson

IUCN-SSC-Invertebrate Conservation Sub-committee. Chair: Michael Samways

IUCN-SSC-Steering Committee. Member: Michael Samways

IUCN-SSC Otter Specialist Group. Member: Michael Somers

IUCN-SSC Pig, Peccary and Hippo Specialist Group. Member: Michael Somers.

IUCN-SSC Re-introduction Specialist Group. Member: Michael Somers

Orthopertists' Society. Board Member: Michael Samways

SCAR Antarctic Treaty System Standing Committee. Chief Officer: Steven Chown

Xerces Society: Counsellor: Michael Samways

Editorial and refereeing activities

a. Editor

African Zoology (joint Editor): Charles Griffiths

Diversity and Distributions (Editor in Chief): Dave Richardson

PLoS One (Academic Editor): Steven Chown

b. Associate Editor

American Naturalist: Steven Chown

Biodiversity and Conservation: Michael Samways

Biological Invasions: Dave Richardson

Conservation Biology: Michael Samways

Functional Ecology: Steven Chown

Journal of Applied Ecology: Sue Milton

Journal of Arid Environments: Sue Milton

Journal of Biogeography: Melodie McGeoch

Journal of Insect Conservation: Michael Samways

Journal of Orthoptera Research: Michael Samways

Marine Biology: Charles Griffiths

South African Journal of Botany (Guest Editor): Karen Esler

c. Editorial Boards

International Journal of Wildland Fire: Brian van Wilgen

African Natural History: Charles Griffiths

Smithiana: Charles Griffiths

Ecologia Mediterranea: Dave Richardson

Environmental Management: Dave Richardson

Odonatologica: Michael Samways

PLoS One: Michael Somers

Antarctic Science: Steven Chown

BMC Ecology: Steven Chown

Diversity and Distributions: Steven Chown

Reviewing

International Journals: Acta Oecologia; African Zoology; Agriculture, Ecosystems and Environment; American Journal of Botany; Austral Ecology; Behavioral Ecology and Sociobiology; Biodiversity and Conservation; Biological Conservation; Biological Invasions; Canadian Journal of Botany; Comparative Biochemistry and Physiology; Conservation Biology; Diversity and Distributions; Ecography; Ecological Applications; Ecological Monographs; Ecology; Ecology Letters; Ecosystems; Environmental Conservation; Forest Ecology and Management; Global Change Biology; Global Ecology and Biogeography; International Journal of Hydrobiology; Journal of Animal Ecology; Journal of Arid Environments; Journal of Biogeography; Journal of Ecology; Journal of Environmental Management; Journal of Experimental Biology; Journal of Insect Conservation; Journal of Insect Physiology; Journal of Thermal Biology; Journal of Vegetation Science; Journal of Zoology; Koedoe; Marine Biology; Molecular Ecology; New Phytologist; Odonatologica; Oecologia; Perspectives in Plant Ecology; Evolution and Systematics; Physiological Entomology; Plant Biology; PLoS Biology; Polar Biology; Preslia; Proceedings of the National Academy of Sciences of the USA; Proceedings of the Royal Society of London B; Restoration Ecology; Science.

National Journals: African Entomology, African Journal of Range and Forage Science, Bothalia, Durban Museum Novitates, South African Journal of Botany, South African Journal of Marine Science, South African Journal of Science, South African Journal of Wildlife Research, Transactions of the Royal Society of South Africa, Water SA.

d. Grant reviews for external bodies

Critical Ecosystem Partnership Fund: Sue Milton

Czech Academy of Sciences: Dave Richardson

Department of Water Affairs and Forestry: Sue Milton

National Science Foundation, USA: Dave Richardson and Steve Johnson

South Africa-Netherlands Research Programme on Alternatives in Development: Karen Esler

The Royal Society: Brian van Wilgen

e. Appointment reviews and committees

SANBI CEO Appointment Committee: Steven Chown

University of Cambridge (post-doc appointment): Dave Richardson

University of Hawaii at Manoa (promotion to professor): Dave Richardson

University of KwaZulu-Natal (professorial appointment): Dave Richardson and Steven Chown

University of Nottingham (professorial appointment): Dave Richardson

f. Conferences and workshops organized

National

South African Marine Science Symposium 2008 to be held in Cape Town. Member of organising committee: Charles Griffiths

International

21st Annual Meeting of the Society for Conservation Biology conference 2007, to be held in Port Elizabeth, 1 - 5 July 2007. Member of Scientific Advisory Committee: Karen Esler

4th International Wildland Fire Conference to be held in Seville, Spain, May 2007, Member of the Organising Committee: Brian van Wilgen

51st International Association for Vegetation Science Symposium to be held in Cape Town in September 2007. Vice-President of organizing committee: Karen Esler

IUCN/SSC Invertebrate Conservation Sub-committee Meeting held in Stellenbosch, October 2006. Organiser and chairperson: Michael Samways

g. Consulting and other services rendered

Granger Bay harbour expansion 2006. Consultant: Charles Griffiths

Hluhluwe-iMfolozi Management Plan for Ezemvelo KZN Wildlife. Advisor on carnivore management: Michael Somers

Koeberg Nuclear Power Station marine environmental surveys for Eskom 2000-2006. Consultant: Charles Griffiths

Kwezi-V3 Construction: gravel mine environmental control and rehabilitation, Merweville. Consultant: Sue Milton

National Ports Authority Port Elizabeth port survey 2006. Consultant: Charles Griffiths

South African Conservation Agencies and Game Industry. Genetics consultant: Bettine Jansen van Vuuren

6. GENDER IMPACT OF RESEARCH

The C·I·B continues to invest in the further development of women in science and science management. Of the 28 core team and core staff members of the Centre, 13 are women, as are 38 of the 62 post-doctoral associates and students supported in 2006. All of the Masters students who graduated in 2006 are women, and four of these graduated with distinction. One has already gone on to enter the labour force (Jeanne Gouws is employed by CapeNature) and the other four are currently seeking employment or study opportunities.

C·I·B core team members continue to make large impacts and serve as role models in science management. Karen Esler served as Vice-President for the South African Association of Botanists in 2006, retained her position as a Board member of the Succulent Karoo Ecosystem Programme, and continued to contribute to the S.A. Association of Women in Science and Engineering. Melodie McGeoch continued to serve on the Genetically Modified Organisms Advisory Committee to the Minister of Agriculture and Land Affairs, the National Environmental Advisory Forum (alternate member), the South African National Antarctic Programme Steering Committee, the African Global Change Research Network Steering Committee, and the Scientific Committee of DIVERSITAS.

The gender impacts of the research of the C·I·B cannot yet be quantified in any objective fashion. Heidi Prozesky's role in the C·I·B continues to grow, and her bibliometric assessments of productivity in the South African invasion biology field are well within what has been found generally: a paucity of prominent women in the past, and a slow growth in recent prominence. At a foundation level, the Iimbovane programme's enthusiastic adoption by the Western Cape Education Department and the partner schools has meant broad access by young women to an improved perspective on the importance, career benefits, and fun of biodiversity science.

HUMAN RESOURCES

1. Core Team Members

Name	Citizenship	Institution	Gender	Race	% time spent working in CoE
Prof. Steven Chown	South Africa	SU	M	W	100
Prof. Dave Richardson	South Africa	SU	M	W	100
Prof. Chris Chimimba	South Africa	UP	M	B	5
Dr. Savel Daniels	South Africa	SU	M	B	5
Prof. Karen Esler	South Africa	SU	F	W	20
Prof. Charles Griffiths	South Africa	UCT	M	W	10
Prof. Steven Johnson	South Africa	UKZN	M	W	10
Prof. Melodie McGeoch	South Africa	SU	F	W	10
Prof. Sue Milton	South Africa	SU/UCT*	F	W	5

Name	Citizenship	Institution	Gender	Race	% time spent working in CoE
Dr. Heidi Prozesky	South Africa	SU	F	W	5
Dr. Victor Rambau	South Africa	SU	M	B	5
Prof. Michael Samways	South Africa	SU	M	W	15
Dr. Michael Somers	South Africa	WSU/UP**	M	W	15
Prof. Albert van Jaarsveld	South Africa	SU	M	W	10
Dr. Berndt van Rensburg	South Africa	UP	M	W	20
Dr. Bettine van Vuuren	South Africa	SU	F	W	10
Dr. Brian van Wilgen	South Africa	CSIR	M	W	5
Dr. Theresa Wossler	South Africa	SU	F	W	5

* Prof. Milton holds a joint appointment at Stellenbosch University and University of Cape Town

** Dr. Somers was employed at Walter Sisulu University until the end of March and moved to University of Pretoria in April 2006

2. Post-doctoral associates

Name	Citizenship	Institution	Gender	Race	% time spent working in CoE
Dr. Antoinette Botes	South Africa	SU	F	W	30
Dr. Brigitte Braschler	Switzerland	U. Sheffield	F	W	100
Dr. Susana Clusella Trullas	Spain	SU	F	W	100
Dr. Jesse Kalwij	Netherlands	SU	M	W	100
Dr. Steven Lowe	United Kingdom	RU	M	W	100
Dr. Sonja Matthee	South Africa	SU	F	W	60
Dr. Şerban Procheş	Romania	SU	M	W	100
Dr. John Terblanche	South Africa	SU	M	W	100
Dr. Mark van Kleunen	Netherlands	UKZN	M	W	100
Dr. Ruan Veldtman	South Africa	SU	M	W	85
Dr. Bruno Walther	Germany	SU	M	W	100
Dr. John Wilson	United Kingdom	SU	M	W	100

3. Students

Title	Name	Surname	Citizenship	Institution	Gender	Race	Level	Status
Ms.	Anneke	Cilliers	South Africa	SU	F	W	3rd. yr.	Completed
Ms.	Thulisile	Jaca	South Africa	WSU	F	B	3rd. yr.	Failed*
Ms.	Lize	Joubert	South Africa	SU	F	W	3rd. yr.	Completed
Ms.	Lethuxolo	Khuluse	South Africa	WSU	F	B	3rd. yr.	Completed
Ms.	Oesimo	Matetela	South Africa	WSU	F	B	3rd. yr.	Completed
Ms.	Edith-Maria	Mertz	South Africa	UP	F	W	3rd. yr.	Completed
Mr.	MacDonald	Mokhatla	South Africa	UP	M	B	3rd. yr.	Completed
Ms.	Phumlani	Mpinda	South Africa	WSU	F	B	3rd. yr.	Failed*
Ms.	Marlene	Neethling	South Africa	SU	F	W	3rd. yr.	Completed

Title	Name	Surname	Citizenship	Institution	Gender	Race	Level	Status
Ms.	Anele	Ngcebetsha	South Africa	WSU	F	B	3rd. yr.	Failed*
Ms.	René	Wolmarans	South Africa	UP	F	W	Hons./4th yr.	Completed
Ms.	Nozuko	Booi	South Africa	SU	F	B	Hons./4th yr.	Completed
Ms.	Tanya	Haupt	South Africa	UCT	F	B	Hons./4th yr.	Completed
Mr.	Stephan	Herb	South Africa	SU	M	W	Hons./4th yr.	Continuing
Ms.	Lizelle	Odendaal	South Africa	UCT	F	B	Hons./4th yr.	Completed
Mr.	Derick	Peacock	South Africa	UP	M	W	Hons./4th yr.	Completed
Ms.	Mariette	Pretorius	South Africa	SU	F	W	Hons./4th yr.	Completed
Mr.	Bradley	Reynolds	South Africa	UP	M	W	Hons./4th yr.	Completed
Ms.	Natalie	Theron	South Africa	SU	F	W	Hons./4th yr.	Completed
Mr.	Bernard	Coetzee	South Africa	UP	M	W	M.Sc.	Continuing
Ms.	Lihle	Dumalisile	South Africa	UP	F	B	M.Sc.	Continuing
Ms.	Jeanne	Gouws	South Africa	SU	F	W	M.Sc.	Completed**
Ms.	Michelle	Greve	South Africa	SU	F	W	M.Sc.	Completed**
Ms.	Gené	Guthrie	South Africa	UWC	F	W	M.Sc.	Completed
Mr.	Kyle	Harris	South Africa	UP	M	W	M.Sc.	Continuing
Ms.	Sanet	Hugo	South Africa	UP	F	W	M.Sc.	Continuing
Ms.	Ulrike	Irlich	South Africa	SU	F	W	M.Sc.	Completed**
Ms.	Keafon	Jumbam	South Africa	SU	F	B	M.Sc.	Continuing
Ms.	Jennifer	Lee	United Kingdom	SU	F	W	M.Sc.	Continuing
Ms.	Ndivhuwo	Luruli (Netshilaphala)	South Africa	SU	F	B	M.Sc.	Completed**
Ms.	Nomvuyiso	Matokazi	South Africa	UP	F	B	M.Sc.	Continuing
Ms.	Mandisa	Mgobozi	South Africa	UP	F	B	M.Sc.	Continuing
Mr.	Phemelo	Mogodi	South Africa	UNW	M	B	M.Sc.	Continuing
Ms.	Natasha	Mothapo	South Africa	SU	F	B	M.Sc.	Continuing
Ms.	Sarah	Muhl	South Africa	SU	F	W	M.Sc.	Continuing
Ms.	Ethel	Phiri	South Africa	SU	F	B	M.Sc.	Continuing
Ms.	Charlene	Scheepers (Janion)	South Africa	SU	F	W	M.Sc.	Continuing
Mr.	Colin	Schoeman	South Africa	SU	M	W	M.Sc.	Continuing
Ms.	Shelley	Vosse	South Africa	SU	F	W	M.Sc.	Continuing
Mr.	Emile	Bredenhand	South Africa	SU	M	W	Ph.D.	Continuing
Ms.	Lukeshni	Chetty	South Africa	UFS	F	B	Ph.D.	Continuing
Ms.	Benis	Egoh	South Africa	SU	F	B	Ph.D.	Continuing
Mr.	Llewellyn	Foxcroft	South Africa	UCT	M	W	Ph.D.	Continuing
Mr.	Thomas	Lado	Sudan	SU	M	B	Ph.D.	Continuing
Mr.	Rembuluwani	Magoba	South Africa	SU	M	B	Ph.D.	Continuing
Ms.	Elrike	Marais	South Africa	SU	F	W	Ph.D.	Continuing
Mr.	Sean	Marr	South Africa	UCT	M	W	Ph.D.	Continuing
Mr.	Donald	Midoko Iponga	Gabon	SU	M	B	Ph.D.	Continuing
Mr.	Sebataolo	Rahlao	Lesotho	SU	M	B	Ph.D.	Continuing
Mr.	James	Rodger	South Africa	UKZN	M	W	Ph.D.	Continuing
Ms.	Dian	Spear	United Kingdom	SU	F	W	Ph.D.	Continuing

* C·I·B support of this student was discontinued at mid-year due to inadequate performance

** Degree awarded *cum laude*

4. Collaborators (loosely involved with CoE)

See networking

5. Administrative Staff

Name	Position	Based at	Gender	Race
Ms. Sarah Davies	Research Manager	SU	F	W
Ms. Kirsten Mahood	Principal Technical Officer: Outreach	SU	F	W
Mr. Lufuno Vhengani	Principal Technical Officer: Database	SU	M	B
Ms. Suzaan Kritzinger-Klopper	Senior Technical Officer	SU	F	W
Ms. Erika Nortje	Technical Officer	SU	F	W
Ms. Linda Rambau	Administrative Officer	SU	F	B
Ms. Anel Garthwaite	Director's Personal Assistant	SU	F	W
Ms. Natasha Kruger	Outreach Officer/Dept. Science Liaison Officer	SU	F	B
Ms. Leonie Joubert	Contract Administrative Officer (science writer)	SU	F	W
Ms. Matlakala Mapatha	Temporary Administrative Officer (limbovane)	SU	F	B

6. Resources in the market place

Name	Level at which supported	Supervisor	Organisation
Ms. Jeanne Gouws	M.Sc.	Prof. S.L. Chown	CapeNature Scientific Services
Ms. Mandisa Mgobozi	M.Sc.	Dr. M.J. Somers	Ezemvelo KwaZulu-Natal Wildlife
Ms. Ndivhuwo Luruli	M.Sc.	Prof. M.A. McGeoch	National Research Foundation
Dr. Antoinette Botes	Post-doctoral associate	Prof. S.L. Chown	CapeNature Scientific Services
Dr. Emilie Gray	Post-doctoral associate.	Prof. S.L. Chown	University of Cape Town (part-time)
Dr. Sonja Matthee	Post-doctoral associate.	Prof. M.A. McGeoch	Stellenbosch University, Dept. Entomology
Dr. Krystal Tolley	Post-doctoral associate	Prof. S.L. Chown	South African National Biodiversity Institute
Dr. Ruan Veldtman	Post-doctoral associate.	Prof. S.L. Chown	South African National Biodiversity Institute
Dr. Bruno Walther	Post-doctoral associate.	Prof. A.S. van Jaarsveld	DIVERSITAS

OUTPUTS

Books and chapters in books

Chown, S.L., Greenslade, P. and Marshall, D.J. 2006. Terrestrial invertebrates of Heard Island. In: *Heard Island: Southern Ocean Sentinel*. K. Green and E.J. Woehler (eds.) Surrey and Beatty, Chipping Norton, pp. 91-104.

Richardson, D.M., Henderson, L. and Ivey, P. 2006. Taking control of biological invasions. In Willis, C.K. (ed.), *Conserving South Africa's plants*. *A South African Response to the Global Strategy for Plant Conservation,* SANBI Biodiversity Series 1, South African Biodiversity Institute, Pretoria, pp. 42-46.

Articles in peer reviewed journals

Note: All C·I·B team member names are highlighted regardless of whether they all addressed / acknowledged C·I·B for that publication

Alston K.P. and **Richardson D.M.** 2006. The roles of habitat features, disturbance, and distance from putative source populations in structuring alien plant invasions at the urban/wildland interface on the Cape Peninsula, South Africa. *Biological Conservation* **132**, 183-198.

Baret, S., Rouget, M., **Richardson, D.M.**, Lavergne, C., **Egoh, B.**, Dupont, J. and Strasberg, D. 2006. Current distribution and potential extent of the most invasive alien plant species on La Réunion (Indian Ocean, Mascarene Islands). *Austral Ecology* **31**, 747-758.

Bernhardt, E., Bunn, S.E., Hart, D.D., Malmqvist, B., Muotka, T., Naiman, R.J., Pringle, C, Reuss, M. and **van Wilgen, B.W.** 2006. The challenge of ecologically sustainable water management. *Water Policy* **8**, 475-479.

Bohensky, E.L., Reyers, B. and **van Jaarsveld, A.S.** 2006. Future Ecosystem Services in a Southern African River Basin: a scenario planning approach to uncertainty. *Conservation Biology* **20**, 1051–1061.

Botes, A., **McGeoch, M.A.**, Robertson, H.G., van Niekerk, A., Davids, H.P. and **Chown, S.L.** 2006. Ants, altitude and change in the northern Cape Floristic Region. *Journal of Biogeography* **33**, 71-90.

Buckley, Y.M., Anderson, S., Catterall, C.P., Corlett, R.T., Engel, T., Gosper, C.R., Nathan, R., **Richardson, D.M.**, Setter, M., Spiegel, O., Vivian-Smith, G., Voigt, F.A., Weir, J.E.S. and Westcott, D.A. 2006. Management of plant invasions mediated by frugivore interactions. *Journal of Applied Ecology* **43**, 848-857.

Chown, S.L. and Storey, K.B. 2006. Linking molecular physiology to ecological realities. *Physiological and Biochemical Zoology* **79**, 314-323.

Chown, S.L., Marais, E., Picker, M.D. and **Terblanche, J.S.** 2006. Gas exchange characteristics, metabolic rate and water loss of the Heelwalker, *Karoophasma biedouwensis* (Mantophasmatodea: Austrophasmatidae). *Journal of Insect Physiology* **52**, 442-449.

Deere, J.A. and **Chown, S.L.** 2006. Testing the beneficial acclimation hypothesis and its alternatives for locomotor performance. *American Naturalis*t **168**, 630-644.

Deere, J.A., Sinclair, B.J., Marshall, D.J. and **Chown, S.L.** 2006. Phenotypic plasticity of thermal tolerances in five oribatid mite species from sub-Antarctic Marion Island. *Journal of Insect Physiology* **52**, 693-700.

Do Linh San, E. and **Somers M.J.** 2006. Mongooses on the move: an apparent case of interspecific cooperative vigilance between carnivores. *South African Journal of Wildlife Research.* **36**, 201-203.

Esler, K.J., Shackleton, L. & Chinsamy-Turan, A. 2006. SAWISE and HERS-SA: Raising the profile of women in science. *South African Journal of Science* **102**, 275-276.

Evans, K.L., Rodrigues, A.S.L., **Chown, S.L.** and Gaston, K.J. 2006. Protected areas and regional avian species richness in South Africa. *Biology Letters* ***2***, 184-188.

Evans, K.L., **van Rensburg, B.J**., Gaston, K.J. and **Chown, S.L.** 2006. People, species richness and human population growth. *Global Ecology and Biogeography* **15**, 625-636.

Govender, N., Trollope, W. S. W. and **van Wilgen, B.W.** 2006. The effect of fire season, fire frequency, rainfall and management on fire intensity in savanna vegetation in South Africa. *Journal of Applied Ecology* **43**, 748–758.

Graf, J.A., Gusset, M., Reid, C, Janse van Rensburg, S., Slotow, R. and **Somers, M.J.** 2006. Evolutionary ecology meets wildlife management: artificial group augmentation in the re-introduction of endangered African wild dogs (*Lycaon pictus*). *Animal Conservation* **9**, 398-403.

Greve, M. and **Chown, S.L.** 2006. Endemicity biases nestedness metrics: a demonstration, explanation and solution. *Ecography* **29**, 347-356.

Grobler, G.C., Janse van Rensburg, L., Bastos, A.D.S., **Chimimba, C.T.** and **Chown, S.L.** 2006. Molecular and morphometric assessment of *Ectemnorhinus* weevil species (Coleoptera, Curculionidae, Brachycerinae) from the sub-Antarctic Prince Edward Islands. *Journal of Zoological Systematics and Evolutionary Research* **44**, 200-211.

Gusset, M., Slotow, R. and **Somers, M.J**. 2006. Divided we fail: the importance of social integration for the re-introduction of endangered African wild dogs (*Lycaon pictus*). *Journal of Zoology, London.* **270**, 502-511.

Hammond, W. and **Griffiths, C.L.** 2006. Biogeographical patterns in the fauna associated with southern African mussel beds. *African Zoology* **41**, 123–130.

Hobbs, R.J. Arico, S., Aronson, J, Baron, J.S., Bridgewater, P., Cramer, V.A., Epstein, P.R., Ewel, J.J., Klink, C.A., Lugo, A.E., Norton, D., Ojima, D., **Richardson, D.M.**, Sanderson, E.W., Valladares, F., Vilà, M., Zamora, R. and Zobel, M. 2006. Novel ecosystems: theoretical and management aspects of the new ecological world order. *Global Ecology and Biogeography* **15**, 1-7.

Hugo, E.A., **Chown, S.L.** and **McGeoch, M.A.** 2006. The microarthropods of Prince Edward Island: A quantitative assessment. *Polar Biology* **30**, 109-119.

Hui, C., **McGeoch, M.A.** and Warren, M. 2006. A spatially explicit approach to estimating species occupancy and spatial correlation. *Journal of Animal Ecology* **75**, 140–147.

Kark, S. and **van Rensburg, B.J.** 2006. Ecotones: Marginal or central areas of transition? *Israel Journal of Ecology and Evolution* **52**, 29-53.

Krahulec, F., Lepš, J. and **Richardson, D.M.** 2006. Marcel Rejmánek at 60 – the man and his work. *Preslia* **78**, 361-374.

Makarieva, A.M., Gorshkov, V.G., Li, B.-L. and **Chown, S.L.** 2006. Size- and temperature-independence of minimum life-supporting metabolic rates. *Functional Ecology* **20**, 83-96.

McGeoch, M.A., **Chown, S.L.** and **Kalwij, J.M.** 2006. A global indicator for biological invasion. *Conservation Biology* **20**, 1635-1646.

McGeoch, M.A., le Roux, P.C., Hugo, E.A. and **Chown, S.L.** 2006. Species and community responses to short-term climate manipulation: microarthropods in the sub-Antarctic. *Austral Ecology* **31**, 719-731.

Pyšek, P. and **Richardson, D.M.** 2006. The biogeography of naturalization in alien plants. *Journal of Biogeography* **33**, 2040–2050.

Pyšek, P., **Richardson, D.M.** and Jarošík, V. 2006. Who cites who in the invasion zoo: insights from an analysis of the most highly cited papers in invasion ecology. *Preslia* **78**, 437-468.

Richardson, D.M. 2006. Pinus: a model group for unlocking the secrets of alien plant invasions? *Preslia* **78**, 375-388.

Richardson, D.M. and Pyšek P. 2006. Plant invasions: merging the concepts of species invasiveness and community invasibility. *Progress in Physical Geography* **30**, 409–431.

Sinclair, B.J. and **Chown, S.L.** 2006. Caterpillars benefit from thermal ecosystem engineering by Wandering Albatrosses on sub-Antarctic Marion Island. *Biology Letters* **2**, 51-54.

Sinclair, B.J., Scott, M.B., Klok, C.J., **Terblanche, J.S.**, Marshall, D.J., Reyers, B. and **Chown, S.L.** 2006. Determinants of terrestrial arthropod community composition at Cape Hallett, Antarctica. *Antarctic Science* **18**, 303-312.

Sinclair, B.J., Terblanche, J.S., Scott, M.B., Blatch, G.L., Klok, C.J. and **Chown, S.L.** 2006. Environmental physiology of three species of Collembola at Cape Hallett, North Victoria Land, Antarctica. *Journal of Insect Physiology* **52**, 29-50.

Terblanche, J.S. and **Chown, S.L.** The relative contributions of developmental plasticity and adult acclimation to physiological variation in the tsetse fly, *Glossina pallidipes* (Diptera, Glossinidae). *Journal of Experimental Biology* **209**, 1064-1073.

Terblanche, J.S., Klok, C.J., Krafsur, E.S. and **Chown, S.L.** 2006. Phenotypic plasticity and geographic variation in thermal tolerance and water loss of the tsetse fly *Glossina pallidipes* (Diptera: Glossinidae): Implications for distribution modelling. *American Journal of Tropical Medicine and Hygiene* **74**, 786-794.

Thuiller, W., **Richardson, D.M.**, Rouget, M., **Procheş, S.** and **Wilson, J.R.U.** 2006. Interactions between environment, species traits, and human uses describe patterns of plant invasions. *Ecology* **87**, 1755-1769.

Traveset, A. and **Richardson, D.M.** 2006. Biological invasions as disruptors of plant reproductive mutualisms. *Trends in Ecology and Evolution* **21**, 208-216.

Van Eeden, D.G., **van Rensburg, B.J.**, De Wijn, M. and Bothma, J. du P. 2006. The value of community-based conservation in a heterogeneous landscape: an avian case study from sand forest in Maputaland, South Africa. *South African Journal of Wildlife Research* **36**, 153-157.

Van Wyk, E., Breen, C.M., Rogers, K.H., Sherwill, T., Roux, D.J. and **van Wilgen, B.W.** 2006. The Ecological Reserve: Towards a common understanding for river management in South Africa. *Water SA* **32**, 403 - 409.

Warren, M., **McGeoch, M.A.**, Nicolson, S.W. and **Chown, S.L.** 2006. Body size patterns in *Drosophila* inhabiting a mesocosm: interactive effects of spatial variation in temperature and abundance. *Oecologia* **149**, 245-255.

Worland, M.R., Leinaas, H.P. and **Chown, S.L.** 2006. Supercooling point frequency distributions in Collembola are affected by moulting. *Functional Ecology* **20**, 323-329.

Published conference proceedings

Neethling, K, **Esler, K.J.** and Midgley, G.F. 2006. The effect of soil and climate on the growth and survival of A. saligna and A. Cyclops seedlings on a mountain gradient in Villiersdorp, South Africa. In: Abstracts: South African Association of Botanists – Annual meeting 2006. *South African Journal of Botany* **72**, 313-347.

Richardson, D.M. 2006. Riparian vegetation – degraded, invaded, transformed. Towards a conceptual framework for management. In: Preston, C., Watts, J.H. and Crossman, N.D. (eds.), 15th Australian Weeds Conference. Papers and Proceedings. Managing Weeds in a Changing Climate, pp. 6-10. Weed Management Society of South Australia Inc., Adelaide.

Richardson, D.M., Rouget, M., Le Maitre, D.C., Mgidi, T.M. and Nel, J.L. 2006. Setting priorities for invasive plant management in South Africa. In: Brunel, S. (ed.), Invasive plants in Mediterranean type ecosystems of the world. Proceedings, pp. 29-37. Environmental Encounters Series No, 59, Council of Europe Publishing, Strasbourg.

Van Wilgen, B.W., Le Maitre, D.C., Reyers, B., Schonegevel, L. and **Richardson, D.M.** 2006. A preliminary assessment of the impacts of invasive alien plants on ecosystem services in South Africa. In: Preston, C., Watts, J.H. and Crossman, N.D. (eds), 15th Australian Weeds Conference. Papers and Proceedings. Managing Weeds in a Changing Climate, pp. 819-822. Weed Management Society of South Australia Inc., Adelaide.

Vosse, S., **Esler, K.J.**, Holmes, P.M. and Richardson, D.M. 2006. Natural rehabilitation potential of riparian zones after alien clearing in the Fynbos Biome – Phase 1: a reference study of indigenous seed banks. Abstracts: South African Association of Botanists – Annual meeting 2006. *South African Journal of Botany* **72**, 313-347.

Products / Artifacts / Patents

Chown, S.L., **Davies, S.J.** and **Joubert, L.S.** 2006. *Prince Edward Islands Environmental Management Plan Version 0.1*. Prepared under contract to the Directorate Antarctica and Islands, Department of Environmental Affairs and Tourism, South Africa, 176 pp.

Esler, K.J. and **Milton, S.J.** 2006. Towards Best Practice in Management of Road, Power Line and Rail Reserves. *C•I•B Occasional Paper Series No. 1*, 22 pp.

Forsyth, G.G., **van Wilgen, B.W.**, Scholes, R.J., Levendal, M.R., Bosch, J.M., Jayiya, T.P. and Le Roux, R. 2006. *Integrated veldfire management in South Africa*: An assessment of the current conditions and future approaches. Report CSIR/NRE/ECO/ER/2006/0064/C, CSIR, Stellenbosch.

McGeoch, M.A. and Rhodes, J.I. 2006. Ecological Risk Assessment of Genetically Modified Organisms in South Africa: An Assessment of the Current Policy Framework. *C•I•B Occasional Paper Series No. 2*, 19 pp.

Van Wilgen, B.W. and V. C. Moran, V.C. 2006. *Integrated management of invasive alien plants in South Africa*: a case for increased expenditure on research into biological methods of control. Report to the Working for Water programme, CSIR, Stellenbosch.

Conferences / meetings attended

Invited, plenary and keynote Presentations

a. International

Chown S.L., **Davies, S.J.** and Joubert, L.S. Conservation and management frameworks: Prince Edward Islands Environmental Management Plan. *International Forum on the Sub-Antarctic, Hobart, Australia, 6-7 July 2006.*

Chown, S.L. Metabolism, life history and ecology. *Gordon Research Conference on the Metabolic Basis of Ecology, Lewiston, U.S.A., July 2006*.

Damonse, B.A., **Mahood, K.** and Mokoena, S. Extra-curricular high school science education programmes and monitoring: Using research for delivery. *South African Environmental Observation Network Summit, Pretoria, Gauteng. March 2006.*

Richardson, D.M. Lessons for invasion ecology from the study of conifer invasions. *Plenary keynote address at Annual Symposium of the Hans Sigrist Foundation: "Biological Invasions", December 2006, University of Bern, Switzerland.*

Richardson, D.M. Riparian vegetation - degraded, invaded, transformed. *Plenary keynote address at 15th Australian Weeds Conference, Adelaide, Australia, September 2006*.

Samways, M.J. Dragonflies as umbrellas for monitoring recovery of freshwater ecosystem health. *Opening address for the 17th International Symposium of Odonatology, Hong Kong, July 2006.*

b. National

Chown, S.L. Summary of outcomes and closing remarks. *Closing plenary speaker at the South African Environmental Observatory Network Summit, Pretoria, March 2006*.

Richardson, D.M. Riparian vegetation - degraded, invaded, transformed. Towards a conceptual framework for management. *Plenary keynote address at the joint congress of the South African Weed Science Society and the Grassland Society of South Africa, Bela Bela, July 2006*.

Van Wilgen, B.W. Fire regimes in the fynbos biome: Is there cause for concern? *Invited speaker and workshop convenor at the annual Fynbos Forum, Goudini Spa, August 2006.*

Van Wilgen, B.W. Invasive alien plants: Are researchers doing enough? *Invited keynote speaker at the 20th National Congress of the Southern African Weed Science Society, Bela Bela, 16-19 July 2006.*

Oral presentations

a. International

Griffiths, C.L. and Robinson T.A.: The *Mytilus galloprovincialis* invasion of South Africa – Threats and opportunities. 14th International Conference on Aquatic Alien Species, Key Biscayne, Florida May 2006.

Gusset, M., Slotow, R. and **Somers, M.J**. Allee effects, co-operative breeding and endangered species recovery: case of the African wild dog (*Lycaon pictus*). *Biology06 Conference, Geneva, Switzerland, February 2006*.

Gusset, M., Slotow, R. and **Somers, M.J.** Predators and people: anthropogenic factors affecting the re-introduction of African wild dogs (*Lycaon pictus*). *Management of Conflicts between Wildlife and Human Resource Use, Leipzig, Germany, January 2006.*

Mahood, K., **Kruger, N.**, **Braschler, B.**, **Chown, S.L.**, and Gaston, K.J. Iimbovane: Putting life into life science. *Commonwealth Association for Science, Technology and Maths Educators Conference, Cape Town, South Africa. December 2006.*

Marr, S.M., Impson N.D. and Swart E. There are no hopeless cases, mitigation the impact of invasive freshwater fishes in the Cape Floristic Region, South Africa. *14th International Conference on Aquatic Alien Species, Key Biscayne, Florida, USA, May 2006.*

Richardson, D.M., **Procheş, S.**, **Wilson, J.R.** & Rejmanek, M. Is there a phylogenetic pattern to the invasibility of plant communities? – theory and the real world. *Conference on Macroecological tools for global change research, Potsdam, Germany, August 2006.*

Sinclair, B.J. and **Chown, S.L.** Physiological constraints on the small-scale distribution of three species of Antarctic Collembola. *Society for Integrative and Comparative Biology, Orlando, Florida, USA, January 2006*.

van Wilgen, B.W., Le Maitre, D.C., Reyers, B., Schonegevel, L., and **Richardson, D.M.** Invasive alien plants and the delivery of ecosystem services in South Africa: A preliminary assessment. *15th Australian Weeds Conference, Adelaide, Australia, September 2006.*

b. National

Esler, K.J. Interrogating gradients from sub-continental to site-specific scales: have southern African studies yielded answers to global change challenges? *32nd Congress of the South African Association of Botanists, Port Elizabeth, South Africa.*

Esler, K.J. and **Milton, S.J.** Managing roads, rivers and powerlines servitudes as biodiversity corridors through the landscape. *Fynbos Forum, Rawsonville, 9-11 August.*

Gusset, M., Slotow, R. and **Somers, M.J.** Individual-based modelling as a tool in re-introduction planning, as illustrated by African wild dogs (*Lycaon pictus*). *Symposium of the Southern Africa Wildlife Management Association, Loskop Dam, September 2006.*

Iponga D.M., **Milton, S.J**. and **Richardson, D.M.** *Schinus molle* (Peruvian pepper tree) ability to compete for light with indigenous savanna trees in South Africa. *20th National Congress: Southern African Weed Science Society, Bela Bela, 16-19 July 2006.*

Iponga, D.M. Invasive potential of the Peruvian pepper tree (*Schinus molle*) in South Africa. *Kimberley Biodiversity Symposium, Rooifontein, 6 September 2006.*

Kruger, N. Ellerman Resource Centre: Communicating science in a balanced way. *African Science Communication Conference, Port Elizabeth, South Africa, December 2006.*

Mahood, K., **Kruger, N.**, **Braschler, B.**, **Chown, S.L.**, and Gaston, K.J. Working with education: The Iimbovane outreach project. *African Science Communication Conference, Port Elizabeth, South Africa, December 2006.*

Muhl, S., **Esler, K.J.** and **Milton, S.J.** Alien Grass invasion of west coast lowland fynbos: influence of soil variable gradients. *Fynbos Forum, Rawsonville, 9-11 August.*

Rahlao, S.J., **Esler, K.J.**, **Milton, S.J.** and Barnard, P. Current and future vulnerability of South African ecosystems to perennial grass invasion under global change scenarios - a case of fountain grass (*Pennisetum setaceum*). *20th National Congress of the Southern African Weed Science Society. Bela Bela, 16 -19 July 2006.*

Rahlao, S.J., **Esler, K.J.**, **Milton, S.J.** and Barnard, P. Current and future vulnerability of South African ecosystems to perennial grass invasion - a case of fountain grass (*Pennisetum setaceum*). *Kimberley Biodiversity Symposium, Rooifontein, 6 September 2006.*

Vosse, S., **Esler, K.J.**, Holmes, P.M and **Richardson, D.M.** Natural rehabilitation potential of riparian zones after alien clearing in the Fynbos Biome – Phase 1: A reference study of indigenous seed banks. *32nd Congress of the South African Association of Botanists, Port Elizabeth, South Africa.*

Vosse, S., **Esler, K.J.**, **Richardson, D.M.**, Holmes, P. The natural rehabilitation potential of riparian areas after alien clearing – a seed bank study in the fynbos biome. *Fynbos Forum, Rawsonville, 9-11 August.*

Poster presentations

a. International

Rambau, R.V., van Sandwyk, J., Maree, S., Taylor, P.J.. Taxonomic revision of *Otomys saundersiae* (Rodentia: Muridae) based on cytogenetics and skull morphometrics. *2nd Congress of the International Cytogenetics and Genome Society, Kent, United Kingdom, June 2006.*

Thuiller, W. and **Richardson, D.M.** Determinants of plant distribution: Evidence from alien invasions - A southern perspective. *Conference on Macroecological tools for global change research, Potsdam, Germany, August 2006.*

b. National

Botes, A., **McGeoch, M.A.**, Robertson, H.G., Van Niekerk, A., Davids, H.P., **Mahood, K.** and **Chown, S.L.** Ants, altitude and change in the northern Cape Floristic Region. *South African Environmental Observation Network Summit, Pretoria, Gauteng. March 2006.*

Braschler, B., **Mahood, K.**, **Chown, S.L.**, **Kruger, N.** and Gaston, K.J. Iimbovane: Exploring South African biodiversity and change. *South African Environmental Observation Network Summit, Pretoria, Gauteng. March 2006.*

Dumalisile, L. Small mammals as affected by *Chromolaena odorata* in Hluhluwe-iMfolozi *Park. Symposium of the Southern Africa Wildlife Management Association, Loskop Dam, September 2006.*

Esler, K.J., **Milton, S.J**. and roads and rivers workshop delegates. Managing roads, rivers and power line servitudes as biodiversity corridors through the landscape. *Fynbos Forum, 9-11 August 2006, Rawsonville.*

Gusset, M., Slotow, R. and **Somers, M.J.** Conflicting human interests over the re-introduction of African wild dogs (*Lycaon pictus*). *4th Kruger National Park Science Networking Meeting. Skukuza, March 2006*.

Mgobozi, M.P. Spiders in an African Savanna as affected by mammal grazing. *Symposium of the Southern Africa Wildlife Management Association, Loskop Dam, September 2006.*

Somers, M.J., Jordaan, T., Do Linh San, E. and Walters, M. Can we separate species and biodiversity focused conservation? The effects of a small carnivore on ant biodiversity. *Symposium of the Southern Africa Wildlife Management Association, Loskop Dam, September 2006.*

Walters, M., **Somers, M.J.**, White, R.M., Nel, J.A.J. and Roberts, P.D. A diverse diet of *Genetta tigrina* as affected by habitat and season. *Symposium of the Southern Africa Wildlife Management Association, Loskop Dam, September 2006.*

Conferences and meetings hosted

a. National

Managing roads and rivers workshop, Darling, 12 June 2006 (Convenors: Karen J. Esler and Sue J Milton).

Scientific Working Group on the Ecological Risk of Genetically Modified Organisms in South Africa, 1st Meeting, Centre for Invasion Biology, University of Stellenbosch, 5-6 December 2006, (Convenor: Melodie McGeoch)

Publishing in the 21st Century: A Guide for the Rejected and Perplexed", Stellenbosch South Africa, September 2006 (Convenor: Steven Chown; presenters: Dave Richardson and Liz Ferguson (Blackwell Publishing)).

b. International

Terrestrial Biodiversity in the Antarctic: Microbial, Macroscopic, Indigenous and Alien, Scientific Committee for Antarctic Research (SCAR) workshop hosted by the Centre for Invasion Biology, Stellenbosch University, South Africa, October 2006 (Convenor: Steven Chown).

Other relevant outputs

Popular articles and talks

a. Articles

Braschler, BM. 2006. Learners explore ant diversity in the Western Cape. News from the Addo Elephant Park, South Africa. May/June 2006

Lickindorf, E. 2006. Caring for the Karoo. *Quest: Magazine of the South African Academy of Science* 2(4):42-43.

Pepler, D. 2006. Klimaat. *Insig*. November 2006.

Pepler, D. 2006. Ons gekneuste planeet. *Insig*. June 2006

Pillay, V. 2006. The Smith memorial lecture. *Rhodos* 18:8.

Samways, M.J. 2006. Recent advances in South African Orthopterology. *Metaleptea*. August 2006.

Samways, M.J. 2006. Astonishing recovery of rare and threatened dragonflies. *Rostrum*. September 2006.

Schmidt, W. and Montgomery, K. 2006. Invading aliens. S*outh African Gardening.* October 2006.

Theron, K. 2006. Boek "vertaal" wetenskap vir Karooboere. *Landbouweekblad*. March 2006.

van Wilgen, B.W. 2006. Invasive alien species – an important aspect of global change. *Science Scope* 1 (2), 8 – 11.

Van Wilgen, B.W. and Holmes, P.M. 2006. Laying waste to aliens? *Quest: Magazine of the South African Academy of Science* 3 (29).

Vosse, S. 2006. Banking on seeds. Can our riverine plant communities fight back after heavy invasion? *Veld and Flora*, December 2006.

b. Talks

Chown, S.L. Biological invasions: A physiological perspective. *Smith Memorial Lecture, South African Institute of Aquatic Biodiversity, Grahamstown, September 2006.*

Chown, S.L. Climate change, invasion and conservation: an Antarctic perspective. *Schonland Memorial Lecture, Rhodes University, Grahamstown, September 2006.*

Esler, K.J. Experiences of an established researcher. *Invited seminar to HERS-SA Academy. UCT Graduate School of Business, Cape Town. September, 2006.*

Esler, K.J. Biodiversity on the farm: Natural Capital. *Invited seminar to Ocean Agri Science Farmers Day, Infruitec, Stellenbosch, March 2006.*

Esler, K.J. Guidelines to farmers facing challenges of climate change. *Invited seminar to "Ons en Ons Veld" Farmers Day, Succulent Karoo Knowledge Centre, Kamieskroon, February 2006.*

Mahood, K. Iimbovane: Exploring South African Biodiversity & Change. *Invited talk for the Rotary Club of Somerset West. July 2006.*

Milton, S.J. Alien invasive plants in fynbos. *Prince Albert Garden Club, November 2006.*

Prozesky, H.E. Do assessment systems discriminate against women scientists? *Invited speaker at SAWISE/HERS-SA Discussion, Kirstenbosch Research Centre, August 2006*.

NRF Service Provision

a. Rating and project proposal reviews

Number of reviews completed: 22 (Steven Chown 2; Karen Esler 2; Charles Griffiths 3; Steve Johnson 1; Melodie McGeoch 1; Sue Milton 5, Dave Richardson 1; Michael Samways 1; Berndt van Rensburg 3; Bettine van Vuuren 2; Theresa Wossler 1).

b. Panel and committee service

Conservation and the Management of Ecosystems and Biodiversity: Dynamics and Management of Terrestrial Systems and Sustainable Inland Resources: Sue Milton and Karen Esler.

DST-NRF SA Research Chairs Initiative: Melodie McGeoch.

South African National Antarctic Programme Steering Committee: Steven Chown.

South African National Committee for SCAR – Chair: Steven Chown.

Media Interactions

a. Newspaper Articles

Anonymous. 2006. Ehrangen und Preise. BernerZeitung. December 2006.

Anonymous. 2006. Denspesialis vereer. Eikestadnuus. June 2006.

Anonymous. 2006. Persoonlik. Die Burger. July 2006.

Anonymous. 2006. Pine tree specialist receives top Swiss science prize. *Wood & Timber Times Southern Africa*. July 2006.

Anonymous. 2006. Protecting our biodiversity. *South African Gardening*. October 2006

Anonymous. 2006. Wetenskap Profiel. Die Burger. June 2006.

Bonthuys, J. 2006. Twee baie skaars naaldekokerspesies op Tafelberg gewaar. Die Burger. June 2006.

Bonthuys, J. 2006. Bewaring: Skoonmaakwerk lei tot biodiversiteitsverliese. Veld langs die pad tel óók. Die Burger. August 2006.

Botha, L. 2006. Vroue staan plek vol in Marion-span. Die Burger. April 2006.

Duvenage, E. 2006. Lekker uitdaging wag op Somerset-Wesser. District Mail. March 2006.

Duvenage, E. 2006. Schools equipped for ant hunt. Paarl Post. July 2006.

Duvenage, E. 2006. Biodiversity. Paarl Post. February 2006.

Duvenage, E. 2006. Jonges het miere. Paarl Post. January 2006.

Environmental Writer. 2006. Marion Island warms to alien species. Sunday Times. April 2006.

Gosling, M. 2006. Fauna return from brink of extinction after alien trees cut down. Cape Times. June 2006.

Harris, K. 2006. New baboon spider found in Kruger National Park. Kruger Park Times. October 2006.

Jordan, B. 2006. The heat is on for SA. Sunday Times. April 2006

Macleod, F. 2006. Aliens invade South Africa. Mail & Guardian. December 2006

Nel, J. 2006. Die Riller van Noord-Kaap se monsterbome. Rapport. October 2006.

Mangxamba. S. 2006. Cape academic wins top Swiss science prize for research. Cape Argus. June 2006.

b. Articles published by Stellenbosch University

Duvenage, E. 2006. C·I·B uses ants to teach biodiversity basics. Stellenbosch University News. January 2006.

Duvenage, E. 2006. Equipment for schools involved with ant project. Matieland. 2006:2

Duvenage, E. 2006. Pine tree specialist receives top Swiss science prize. Stellenbosch University News. June 2006.

Duvenage, E. 2006. Swiss prize for pine specialist. Celsius. July 2006.

Mahood, K. 2006. Centre of Excellence a welcome threat to invasive species. Research @ Stellenbosch. December 2006.

Samways, M.J. 2006. Amazing new dragonfly discoveries in the Western Cape. Faculty of AgriSciences Newsletter. November 2006.

Thormählen, J. 2006. Zen-man van tuin en woestyn. Die Matie. August 2006.

University of Stellenbosch Media Office. 2006. Equipment for schools involved with ant project. Stellenbosch University News. July 2006.

University of Stellenbosch Media Office. 2006. Karen Esler is the first ever woman president of SAAB. Kampusnuus. March 2006.

University of Stellenbosch Media Office. 2006. Pine expert receives Swiss prize. Matieland. 2006:2

University of Stellenbosch Media Office. 2006. Science Publishing in the 21st Century. Stellenbosch University News. June 2006.

University of Stellenbosch Media Office. 2006. Top scientists nominated for prestigious science award, Stellenbosch University News. May 2006.

c. Electronic sources

Anonymous. 2006. Iimbovane Outreach Project: Exploring South African Biodiversity and Change. http://www.darwin.gov.uk/projects/details/14012.html

Anonymous. 2006. South Africa's Universities. http://www.safrica.info/ess_info/sa_glance/education/universities.htm

Botha, T. 2006. Iimbovane Outreach Project. Western Cape Education Department website. http://curriculum.wcape.school.za/site/27/page/view/

Gusset, M., Graf, J. & Somers, M.J. 2006. The re-introduction of endangered wild dogs into Hluhluwe-iMfolozi Park, South Africa: an update on the first 25 years. Re-introduction NEWS 25, 31-33. URL: http://www.iucnsscrsg.org/images/Rnews25.pdf

Jakob, B. 2006. Die Uni Bern in Glanz und Gloria. Das Online-Magazin der Universität Bern. www.uniaktuell.unibe.ch/lenya/uniaktuell/live/koepfekarrieren/2006/hanssigrist.html

Jakob, B. 2006. 100 000 Franken für einen Biologen. Das Online-Magazin der Universität Bern. www.uniaktuell.unibe.ch/lenya/uniaktuell/live/unileben/news/2006/dies.html

Pri'Tal, B. 2006. BRAVO! Student from Dr. Allen Gibbs's lab, Ecology & Evolutionary Biology and Entomology. University of Arizona Undergraduate Biology Research Program Gazette, 17:1. http://ubrp.arizona.edu/gazette/2006/01/a3.html

SAEON electronic newsletter. 2006. Education Outreach. http://www.saeon.ac.za/eNewsletter/jun-2006-issue/education-outreach

SAEON electronic newsletter. 2006. Summary of the Summit. http://www.saeon.ac.za/eNewsletter/jun-2006-issue/summary-of-the-summit-proceedings/

d. Radio and Television

Chown, S.L. Interview on SABC Radio concerning the Centre for Invasion Biology and invasive alien species, SAfm Cape to Midnight, with John Richards and Lynette Francis. November 2006.

Chown, S.L. Interviewed on 567 CapeTalk Radio (Mike Wills morning show) concerning Climate Change on Marion Island. April 2006.

Jansen van Vuuren, B. Interview on Radio Sonder Grense concerning Marion Island. June 2006.

Jansen van Vuuren, B. Interview on Kfm concerning Marion Island. June 2006.

Kruger, N. 2006. Interview by Groen "Bewonder en Bewaar" Kyk-Net television, for a 10 minute insert about the Iimbovane project. May 2006.

Mahood, K. 2006. Interview on Radio Sonder Grense concerning the Iimbovane project. March 2006

Mahood, K. 2006. Interview on SAfm concerning the Iimbovane: Exploring South African Biodiversity and Change Outreach Project. January 2006

Mahood, K. Interview by Groen Bewonder en Bewaar Kyk-Net television, for a 10 minute insert about the limbovane project. Aired May 2006.

Samways, M. 2006. Organized Belgian TV team and interviews on biodiversity conservation in Cape Floristic Region. February 2006.

STAGE PROGRESS

Since the CoE is presently in Stage 3 (2006 to 2008), this section reports progress towards the targets agreed in the C·I·B's 3rd Service Level Agreement.

Timeframes:

- The pending Gate review (Gate 3) shall take place during February or March 2009.
- Two CoE Advisory Board (virtual or real) meetings should take place per annum during this Stage: Typically during March and October of each year.

  Response: Two full board meetings held in 2006

Activities related to the Current Stage:

- The CoE shall provide to the NRF a list of students that are being supported by the Centre by March of each year. Additional students can be appended to this list as and when they arrive. The list should indicate their progress and expected or actual dates of completion.

  Response: Student lists submitted in March, May and August 2006
- The CoE and the NRF will exchange "nuggets" of information for publication on the CoE website at regular intervals. (This means the NRF will be slightly more active in interviewing members of the CoE and packaging information for sharing).

  Response: Nuggets have been submitted.

Financial responsibilities:

- The CoE shall present an audited set of financial statements annually at the February / March Advisory Board meeting reflecting the financial situation of the CoE during the previous financial year.

  Response: Audited statements submitted for 2005 and 2006
- The CoE shall submit monthly cash-flow statements within 15 days of the end of each calendar month, indicating expenditure and commitments.

  Response: Completed for 2006

Reports due in this Stage:

- The CoE shall submit an Annual Progress Report by no later than March each year, including the Stage 3 Gate Review Documentation by no later than March 2009 to be reviewed by the CoE Advisory Board.

  Completed for 2005 and 2006
- The CoE shall submit a Statement of Compliance by no later than March 2009 referring to Stage 3.

Response: Pending

Standard Output Targets per annum in the Current Stage:

- Total number of students supported ≥ ***40*** on average per annum.

  2006: 51 students (excluding post-doctoral associates)
- Woman students ≥ ***50*** % of all students on average per annum.

  2006: 35 women, 16 men students
- Black students ≥ ***50*** % of all students on average per annum.

  2006: 23 black students, 28 white students
- Number of social science students ≥ 1 on average per annum.

  2006: No social science students supported; post-doctoral associate in social science accepted end 2006
- Average duration of submitted Masters degrees (post Honours) ≤ ***2.5*** years at end of stage.

  Average duration is 24 months at this stage
- Average duration of submitted PhD degrees (post Masters) ≤ ***3.5*** years at end of stage.

  n/a
- Average duration of submitted PhD degrees (upgraded from Masters) ≤ ***5*** years at end of stage.

  n/a
- Post-doctoral researcher ≥ ***10*** % of all students at end of stage.

  2006: 11 post-doctoral associates supported (17 % of student/post-doc group)
- Core team members undertaking at least one scientific review per annum on behalf of the NRF = ***100 %***.

  2006: 11 out of 16, but 22 in total and much panel and committee activity
- Number of patents ≥ ***0***

  n/a
- Number of the peer reviewed publications ≥ ***35*** on average per annum.

  2006: 43 peer-reviewed publications, 41 in ISI-accredited journals
- Number of the peer reviewed publications ≥ ***1*** with an impact rating of ≥ ***15*** on average per annum.

  2006: None
- Number of the peer reviewed publications ≥ ***5*** with an impact rating of ≥ ***3.5*** on average per annum.

  2006: 10
- Number of national conference presentations ≥ ***20*** on average per annum.

  2006: 24 (16 oral presentations and 8 posters)
- Number of international conference presentations ≥ ***8*** on average per annum.

  2006: 16 (14 oral presentations and 2 posters)
- Number of joint venture student training initiatives ≥ ***5*** on average per annum.

  2006: 15 students trained in collaboration with CoE in Birds as Keys to Biodiversity (Percy Fitzpatrick Institute, UCT)

- Number of local conferences organized ≥ ***1***

  2006: 4 (3 hosted by the C·I·B)

- Number of international conferences organized ≥ 1 at end of stage 2006:

  2006: 5 (1 hosted by the C·I·B)

Special Output Targets for the Current Stage:

- Fine tuned strategy to increase research and other output from the key performance areas.

  Response: Management of the strategy is on-going

- At least one full CoE team activity per annum.

  Response: Annual Research Meeting held from 15 to 17 November 2006; full team attended with one exception

- The CoE shall report on activities initiated under the auspices of the CoE.

  Response: In progress

- The CoE shall demonstrate a sound working relationship between the CoE host institution and the satellite institutions.

  Response: Relationships established and managed in an on-going manner

- Successful adoption of *Iimbovane* outreach program by schools in the WCED region.

  Response: Successful implementation during 2006 and expansion from 10 to 13 schools at the end of the year

Long Term Outputs:

- Have a defined strategy and report on progress in the development of at least five career academics from designated (formerly disadvantaged) groups. Carried over from SLA 1.

  Response: Three new core team members from designated groups have joined the original core team (one in 2005, two in 2006)

FINANCES

DST / NRF CENTRE OF EXCELLENCE FOR INVASION BIOLOGY

BALANCE SHEET AT 31 DECEMBER 2006

	Notes	2006 R	2005 R
ASSETS			
NON-CURRENT ASSETS		1 201 476.82	996 279.14
Property, plant and equipment	4	1 201 476.82	996 279.14
CURRENT ASSETS		920 720.09	2 120 485.63
Trade receivables		10 213.20	84 253.98
Stellenbosch University	5	910 506.89	2 036 231.65
TOTAL ASSETS		**2 122 196.91**	**3 116 764.77**
EQUITY AND LIABILITIES			
CAPITAL AND RESERVES		2 002 257.09	2 961 593.38
Accumulated funds		2 002 257.09	2 961 593.38
CURRENT LIABILITIES		119 939.82	155 171.39
Trade and other payables	6	119 939.82	155 171.39
TOTAL FUNDS AND LIABILITIES		**2 122 196.91**	**3 116 764.77**

DST / NRF CENTRE OF EXCELLENCE FOR INVASION BIOLOGY

INCOME STATEMENT FOR THE YEAR ENDED 31 DECEMBER 2006

	2006 R	2005 R
INCOME	6 140 860.57	5 184 843.76
Exchange rate gain	1 550.52	71.65
Interest received	126 792.39	172 416.31
NRF grant	4 654 680.00	4 261 455.00
Other income	1 335 928.77	750 900.80
Profit on sale of property, plant and equipment	21 908.89	-
EXPENDITURE	7 100 196.86	4 757 621.46
Operational expenses	5 332 436.10	3 247 093.83
Audit fees - current year	28 500.00	22 000.00
- previous year	-	15 048.00
- previous year underprovision	9 920.00	-
Consumables	27 975.46	19 875.74
Copying and stationery	46 734.56	38 025.08
Depreciation	291 239.05	132 301.90
Exchange rate loss	1 116.39	-
Interest paid	1 980.51	36.28
Insurance	1 800.00	-
Levies	33 507.66	2 584.89
Marketing	2 970.06	2 618.81
Medical expenses	-	506.20
Membership and affiliation fees	38 801.19	1 005.00
Non-capitalised books	-	1 814.80
Small capital works: not capitalised	29 433.98	29 981.85
Postage, telephone and fax	50 043.32	36 354.40
Rent paid for facilities	500.00	2 300.00
Repairs	7 341.37	11 531.63
Software and internet	4 779.00	19 633.28
Sundry expenses	519.95	51 634.83
Team member research costs	4 164 184.30	2 551 036.67
Transport and accommodation	543 545.69	276 913.81
Workshop costs and entertainment	47 543.61	31 890.66
Personnel expenses	1 767 760.76	1 510 527.63
Salaries	1 767 760.76	1 510 527.63
NET (LOSS)/SURPLUS FOR THE YEAR	(959 336.29)	427 222.30

DST / NRF CENTRE OF EXCELLENCE FOR INVASION BIOLOGY

STATEMENT OF CHANGES IN EQUITY FOR THE YEAR ENDED 31 DECEMBER 2006

	2006 R	2005 R
ACCUMULATED FUNDS		
At the beginning of the year	2 961 593.38	2 534 371.08
Net (loss)/surplus for the year	(959 336.29)	427 222.30
At the end of the year	2 002 257.09	2 961 593.38

DST / NRF CENTRE OF EXCELLENCE FOR INVASION BIOLOGY

CASH FLOW STATEMENT FOR THE YEAR ENDED 31 DECEMBER 2006

	2006 R	2005 R
CASH FLOW FROM OPERATING ACTIVITIES		
Net (loss)/surplus for the year	(959 336.29)	427 222.30
Adjustment for:		
Interest received	(126 792.39)	(172 416.31)
Interest paid	1 980.51	36.28
Exchange rate gain	(1 550.52)	(71.65)
Depreciation	291 239.05	132 301.90
Profit on sale of property, plant and equipment	(21 908.89)	-
Operating (loss)/profit before working capital adjustments	(816 368.53)	387 072.52
Working capital adjustments	40 359.73	70 389.13
Decrease/(Increase) in trade receivables	74 040.78	(84 253.98)
(Decrease)/Increase in trade and other payables	(33 681.05)	154 643.11
Cash (utilised in)/generated from operations	(776 008.80)	457 461.65
Interest received	126 792.39	172 416.31
Interest paid	(1 980.51)	(36.28)
NET CASH FLOW FROM OPERATING ACTIVITIES	(651 196.92)	629 841.68
CASH FLOW FROM INVESTMENT ACTIVITIES		
Equipment purchased	(558 852.84)	(1 002 900.80)
Equipment sold	84 325.00	-
Increase in amount owed by Stellenbosch University	1 125 724.76	373 059.12
NET CASH FLOW FROM INVESTMENT ACTIVITIES	651 196.92	(629 841.68)
NET INCREASE IN CASH AND CASH EQUIVALENTS	-	-
CASH AND CASH EQUIVALENTS AT THE BEGINNING OF THE YEAR	-	-
CASH AND CASH EQUIVALENTS AT THE END OF THE YEAR	-	-

DST / NRF CENTRE OF EXCELLENCE FOR INVASION BIOLOGY

NOTES TO THE ANNUAL FINANCIAL STATEMENTS FOR THE YEAR ENDED 31 DECEMBER 2006

1. ACCOUNTING POLICY

The financial statements are prepared on the historical cost basis, with the exception of IAS39/AC133 where assets and liabilities are stated at fair value, in accordance with South African Statements of Generally Accepted Accounting Practice. The following are the principal accounting policies of the centre which are consistent in all material respects with those applied in the previous year, except where stated otherwise.

PROPERTY, PLANT AND EQUIPMENT

Property, plant and equipment is stated at historical cost and depreciation is calculated on the straight-line method to write off the cost of the assets to their residual values over their estimated useful lives as follows:

Laboratory equipment at 20% per year on the straight-line method;
Office equipment at 10% per year on the straight-line method;
Computers at 33.3% per year on the straight-line method;
Vehicles at 25% per year on the straight-line method, with a 40% residual value.

IMPAIRMENT OF ASSETS

Property, plant and equipment are reviewed for impairment losses whenever events or changes in circumstances indicate that the carrying amount may not be recoverable. An impairment loss is recognised for the amount by which the carrying amount of the asset exceeds its recoverable amount, that is, the higher of an asset's selling price and value in use. For the purposes of assessing impairment, assets are grouped at the lowest level for which there are separately identifiable cash flows.

FINANCIAL INSTRUMENTS

Financial instruments on the balance sheet include other payables and a loan to Stellenbosch University. These instruments are generally shown at their estimated fair value.

INCOME RECOGNITION

Income consists mainly of a National Research Foundation ("NRF") grant, the contribution from the Vice-Rector: Research to the centre, refunds received for expenditure incurred and income received for work performed on sundry projects.

Income from the NRF and the Vice-Rector: Research is recognised when it is received. Other income is recognised as it accrues.

Interest income is recognised as it accrues (taking into account the effective return on assets), unless collectability is in doubt.

STANDARDS, INTERPRETATIONS AND AMENDMENTS TO PUBLISHED STANDARDS NOT YET EFFECTIVE

Certain new standards, amendments and interpretations to existing standards have been published that are mandatory for the centre's accounting periods beginning on or after 1 January 2006 or later periods but which the centre has not early adopted, as follows:

IFRS 7 (AC 144) introduces new disclosures to improve the information about financial instruments. It requires the disclosure of qualitative and quantitative information about exposure to risk arising from financial instruments, including specified minimum disclosures about credit risk, liquidity risk and market risk, including sensitivity to market risk. It replaces IAS 30 (AC 120), Disclosures in the financial statements of Banks and Similar Financial Institutions, and disclosure requirements in IAS 32 (AC 125), Financial Instruments: Disclosure and Presentation. The amendments to IAS 1 (AC 101) introduces disclosure about the level of an entity's capital and how it manages capital. The centre assessed the impact of IFRS 7 (AC 144) and the amendments to IAS 1 (AC 101) and concluded that the main additional disclosures will be the sensitivity analysis to market risk and the capital disclosures required by amendments of IAS 1 (AC 101). The centre will apply IFRS 7 (AC 144) and the amendment to IAS 1 (AC 101) from annual periods beginning 1 January 2007.

DST / NRF CENTRE OF EXCELLENCE FOR INVASION BIOLOGY

NOTES TO THE ANNUAL FINANCIAL STATEMENTS FOR THE YEAR ENDED 31 DECEMBER 2006 (continued)

1. ACCOUNTING POLICY (continued)

STANDARDS, INTERPRETATIONS AND AMENDMENTS TO PUBLISHED STANDARDS NOT YET EFFECTIVE (continued)

The following standards, interpretations and amendments have been assessed by management and are not yet relevant to the centre's operations. These would not have a material impact if implemented.

- Amendment to IAS 1 (AC), Amendment to IAS 1 Presentation of Financial Statements - Capital Disclosures (effective from 1 January 2007),
- IFRIC 7 (AC 440), Applying the Restatement Approach under IAS 29 (AC 124) Financial reporting in Hyper inflation Economies (effective from 1 March 2006),
- IFRIC 8 (AC 441), Scope of IFRS 2 (effective from 1 May 2006),
- IFRIC 9 (AC 442), Reassessment of embedded derivatives (effective from 1 June 2006),
- IFRIC 10 (AC 443), Interim Financial Reporting and Impairment (effective from 1 November 2006),
- IFRIC 11 (AC 444), IFRS 2 - Group and Treasury Share Transactions (effective from 1 March 2007),
- IFRIC 12 (AC 445), Service Concession Agreements (effective from 1 January 2008),
- IFRS 7 (AC 144), Financial Instruments: Disclosure, and a complementary amendment to IAS 1 (AC 101), Presentation of Financial Statements - Capital Disclosures (effective from 1 January 2007),
- IFRS 8 (AC 445), Operating segments (effective from 1 January 2009),
- AC 503, Accounting for Black Economic Empowerment ("BEE") transactions (effective from 1 May 2006).

CRITICAL ACCOUNTING ESTIMATES AND JUDGEMENTS

Estimates and judgements are continually evaluated and are based on historical experience and other factors, including expectations of future events that are believed to be reasonable under the circumstances.

The centre makes estimates and assumptions concerning the future. The resulting accounting estimates will, by definition, seldom equal the actual results. The estimates and assumptions that have a significant risk of causing a material adjustment to the carrying amount of assets and liabilities within the next financial year are discussed below.

Useful lives of assets

The useful lives of assets is estimated based on past experience and the characteristics of the specific items.

There were no critical judgements in applying the centre's accounting policies.

2. CHANGE IN ACCOUNTING ESTIMATE

During the previous year the centre adjusted the expected life of its assets. Office equipment previously depreciated at a rate of 20% per annum on the straight-line method are now depreciated at a rate of 10% per annum on the straight-line method. Vehicles previously depreciated at a rate of 20% per annum on the straight-line method are now depreciated at a rate of 25% per annum on the straight-line method taking into account a residual value of 40%. The effect of the change in estimate was as follows:

	2006 R	2005 R
Decrease in depreciation		
- Office equipment	-	(22 409.60)
- Vehicles	-	(34 655.51)
	-	(57 065.11)

3. CHANGE IN ACCOUNTING POLICY

During the previous year the centre decided, in accordance with current practice, to no longer capitalise assets with a cost price below R2,000. In order to comply with the requirements of IAS 8, "Accounting Policies, Changes in Accounting Estimates and Errors", a change in accounting policy was applied retrospectively. The effect of the change in account policy was as follows:

	2006 R	2005 R
Decrease in accumulated funds at the beginning of the year	-	19 408.59
Increase in operational expenses for the year	-	25 853.00
Decrease in depreciation for the year	-	(6 444.41)
Effect on net surplus for the year	-	19 408.59
Decrease in additions to assets at the beginning of the year	-	25 853.00
Decrease in accumulated depreciation at the beginning of the year	-	(6 444.41)
	-	19 408.59

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NOTES TO THE ANNUAL FINANCIAL STATEMENTS FOR THE YEAR ENDED 31 DECEMBER 2006 (continued)

	2006	2005
	R	R
4. PROPERTY, PLANT AND EQUIPMENT		
Carrying amount at the beginning of the year	996 279.14	125 680.24
Cost	1 131 319.74	128 418.94
Accumulated depreciation	(135 040.60)	(2 738.70)
Additions during the year	558 852.84	1 002 900.80
Disposals	(62 416.11)	-
Cost	(120 858.78)	-
Accumulated depreciation	58 442.67	-
Depreciation for the year	(291 239.05)	(132 301.90)
Carrying amount at the end of the year	1 201 476.82	996 279.14
Cost	1 569 313.80	1 131 319.74
Accumulated depreciation	(367 836.98)	(135 040.60)

5. STELLENBOSCH UNIVERSITY

The loan to Stellenbosch University is not secured and is subject to interest rates linked to prime. The loan has no fixed terms of repayment.

6. TRADE AND OTHER PAYABLES

Leave pay accrual	90 364.75	43 212.55
Other creditors	1 075.07	89 958.84
Provision for audit fees	28 500.00	22 000.00
	119 939.82	155 171.39

DST / NRF CENTRE OF EXCELLENCE FOR INVASION BIOLOGY

NOTES TO THE ANNUAL FINANCIAL STATEMENTS FOR THE YEAR ENDED 31 DECEMBER 2006 (continued)

7. FINANCIAL INSTRUMENTS

Credit risk

Financial assets which potentially subject the centre to concentrations of credit risk consist principally of receivables and a loan to Stellenbosch University. Receivables are presented net of the provision made for impairments of these receivables. Management believes the centre has no significant concentration of credit risk. The carrying amounts of financial assets included in the balance sheet represent the centre's exposure to credit risk in relation to these assets.

Fair values

On 31 December 2006 and 2005 the carrying amounts of the financial instruments shown in the financial statements, approximates their fair values.

Interest rate risk

The centre is exposed to interest rate risk due to loans made at variable rates.

	Interest rate at year-end	Interest-bearing R	Interest free R	Total R
31 December 2006				
Financial assets				
Receivables	-	-	10 213.20	10 213.20
Stellenbosch University	6,9 %	910 506.89	-	910 506.89
		910 506.89	10 213.20	920 720.09
Financial liabilities				
Trade and other payables	-	-	(119 939.82)	(119 939.82)
Net financial assets/(liabilities)		910 506.89	(109 726.62)	800 780.27
31 December 2005				
Financial assets		2 036 231.65	84 253.98	2 120 485.63
Financial liabilities		-	(155 171.39)	(155 171.39)
Net financial assets/(liabilities)		2 036 231.65	(70 917.41)	1 965 314.24

CONCLUSIONS

The C·I·B has continued to grow and develop, often in unexpected new directions. The latter are important to follow: a strategy is only as useful as the tactics it allows one to deploy. Challenges remain, of which an increase in research output in several key areas and the attraction of students and post-doctoral associates from the designated groups are most significant. Revisions to the Core Team Membership model may well be required, but to some extent these will depend on flexibility of the funding model. Nonetheless, the C·I·B continues to deliver excellent returns on the investments made by its funders.