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DST–NRF CENTRE OF EXCELLENCE FOR INVASION BIOLOGY

ANNUAL REPORT 2005



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DST-NRF CENTRE OF EXCELLENCE for Invasion Biology

ANNUAL PROGRESS REPORT

Reporting Period

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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 7 th March 2006, Financials 10 th March 2006

EXECUTIVE SUMMARY

1. Financial Information (Funding of the CoE)

Total NRF funding for 2005	:	R 4 261 455
Funding from Host institution in 2005	:	R 546 000
Funding from other sources for the CoE in 2005	:	R 377 388
Total funding	:	R 5 184 843

2. Summary of progress against 5 KPAs. (Please limit your responses to completed tasks or work in progress and exclude plans for the future.)

(i) Research

Virtually all of the long- and short-term research work has been initiated, and some aspects thereof are well underway. The C-I-B has had a productive year. Twenty-six papers were published in a range of scientific journals including two in *Science* (IF 31.85) and several in leading international disciplinary journals. Core team members presented five international and four national plenary or keynote addresses, made six international and 23 national contributions to conferences, and organized or co-organized three symposia/workshops.

(ii) Education and Training

The C-I-B was challenged to increase student participation in its activities and has risen to that challenge. Over the past year 38 students were supported at a variety of levels (9 3rd year, 10 Hons., 10 M.Sc., 9, Ph.D.). Of these, 19 graduated successfully, whilst the remainder are continuing with their studies. In terms of equity, 22 of the students supported are female and 16 are black, with three of the black students holding foreign citizenship (Lesotho, Sudan, Gabon). Six post-doctoral associates were supported, of which one has gone on to take up the position as head of the Leslie Hill molecular laboratory at SANBI. Several student workshops and training opportunities were provided at the C-I-B hub. The C-I-B has also promoted the participation of HDIs in its programme, making available core team member grants and open bursaries in a bid to improve equity in human resources in the field.

(iii) Information Brokerage

Information brokerage has been effective via publications, scientific talks, media presentations, newspaper articles, popular articles, popular talks, and the now fully-functional C-I-B home page (www.sun.ac.za/cib). Substantial co-funding (R 3 million) was obtained, from the U.K. Darwin Initiative (in collaboration with the University of Sheffield) for the "Iimbovane: Exploring Biodiversity and Change" project. The project is now underway at 10 schools (Grade 10 level) with the support of the Western Cape Education Department and several other partners. A document management system has been set in place at the C-I-B and an Information Retrieval and Submission System is under development.

(iv) Networking

Memoranda of Understanding have been signed with two international (University of Tennessee and University of Sheffield) and three national (Iziko Museums, South African Institute for Aquatic Biodiversity, Savanna Ecosystems Research Unit – SANParks) organizations, and negotiations for several others have been set in motion. A wide range of collaborators from South Africa and from abroad has visited the C-I-B, and core team members have developed a substantial network of research collaborations. These are all expected to bear fruit in the medium to long term. In addition, 12 students within the C-I-B are co-supervised by core team members, so strengthening networking within the C-I-B.

(v) Service rendering

The C-I-B has rapidly become known as a source of credible, reliable scientific information. It is intimately involved in the development of the regulations for the National Environmental Management: Biodiversity Act (Act 10 of 2004), with core team members participating in the Reference Group, Task Team and listing teams. Service provision to government has also taken the form of production of the

Prince Edward Islands Environmental Management Plan. The C-I-B has also rendered services to international organizations such as the Global Invasive Species Programme, and its core team members participate in a wide range of activities in support of the international science and science policy systems.

3. What was the gender impact of your work?

At this stage it is too early to tell what the gender impact of our work is. The C-I-B has certainly made every effort to promote women in science, as is reflected in the core staff and in the students supported. The appointment of Heidi Prozesky as a social scientist within the Centre will further focus attention on work that needs to be done to understand gender issues in invasion, and gender issues in invasion biology. One of the core team members has also been intimately involved in providing opportunities to prospective young women science graduates via the South African Association of Women in Science & Engineering (SAWISE).

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

Managing a core team that comprises largely individuals employed by other institutions will remain one of the most significant challenges to the Centre. It is not possible to make instant calls on core team members' time, and the resulting differences between Centre goals and core team member goals have to be carefully managed.

Service provision to government also remains a key challenge. Whilst the C-I-B is enthusiastic to continue doing so, the pitfalls of inter- and intra-Departmental politics mean that it is not always clear with whom engagement should be sought, and what long-term value such engagement might have.

5. General Comments

The C-I-B wishes to express its appreciation for the vision and foresight shown by the Department of Science and Technology in establishing the Centres of Excellence Programme. In addition, the National Research Foundation has managed the programme in a way that has enabled the C-I-B to grow into a vibrant research centre with very little in the way of interference or constraint. Considerable support from Stellenbosch University and all of our partner organizations is gratefully acknowledged.

2005 ANNUAL REPORT

1. Scientific Research

A. Objectives

The major objective of the research proposed within this Centre of Excellence 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.

B. Progress

Long-term work

A. Listing and mapping of invasive species

Lists of species of plants, invertebrates, and vertebrates that occur in South Africa, and which vary in their status as invasive alien species, were prepared in collaboration with several partners for the Task Team responsible for developing the regulations for the National Environmental Management: Biodiversity Act. The largest contribution from the C-I-B was the listing of vertebrates and the production of 'consensus' maps on the distributions of indigenous mammals that are being extensively moved around by those in the game industry. The C-I-B also produced the primary lists for marine invasive species. Whether these lists and maps will be adopted by the Department of Environmental Affairs and Tourism has yet to be resolved by the Task Team led by Dr. Guy Preston (National Programme Leader, Working for Water).

A collaborative project with the CSIR and the Agricultural Research Council, on the mapping of invasive alien species in South Africa, was established, with the C-I-B providing scientific guidance and student supervision. In addition, mapping of the distributions of the major invasive plant species on Marion Island also commenced with support from the DEAT/USAID Capacity Building Programme for Climate Change Research. The latter work will enable a comprehensive map of the major invasive plant species to be established on a reasonably fine scale grid. Such data have not previously been available for the island and will form the basis for future control and eradication work.

B. Risk Assessment and scenario planning

This area of long-term work was effectively divided into three sections, one on scenario planning, one on risk assessment of invasive species, and a final one on ecological risk assessment for genetically modified organisms.

A scenario planning workshop was held in June 2005, attended by Karen Esler, Erin Bohensky, Dave Richardson, Albert van Jaarsveld, Arthur Chapman (CSIR), Guy Midgley (SANBI), David Le Maitre (CSIR), Wilfred Thuiller (SANBI), and Sarah Davies. This workshop was followed by participation in a national DEAT-led Scenario initiative which formally developed national environmental scenarios for South Africa for the first time. Once available these scenarios made it possible to further pursue the concept of nested scenarios in the SA context. This led to a smaller working group session (Albert van Jaarsveld, Erin Bohensky, Arthur Chapman, Sarah Davies) during which a start was made at formally developing a nested scenario approach. This nested scenario work is presently in progress. A position paper has also been submitted and is in review.

The C-I-B was heavily involved in the development of the Framework for the Assessment and Management of Risk which forms part of Schedule 3 of the Regulations on Alien and Invasive Species of the National Environmental Management: Biodiversity Act (10 of 2004). Work was done with Dr. Guy Preston (National Programme Leader, Working for Water) and many other people to develop the draft framework. The proposed framework for risk assessment is a two-phased process, involving an Initial Species Risk Assessment and (for species where there is still uncertainty as to the level of risk) a full Species Risk Assessment to determine the risk of the species becoming invasive in South Africa. The steps in the process are shown in Fig.1. A large part of the C-I-B's involvement in the development of the framework was to provide a list of questions relating to the potential invasiveness of a species. It was not considered practical to assign a score to a species that would automatically

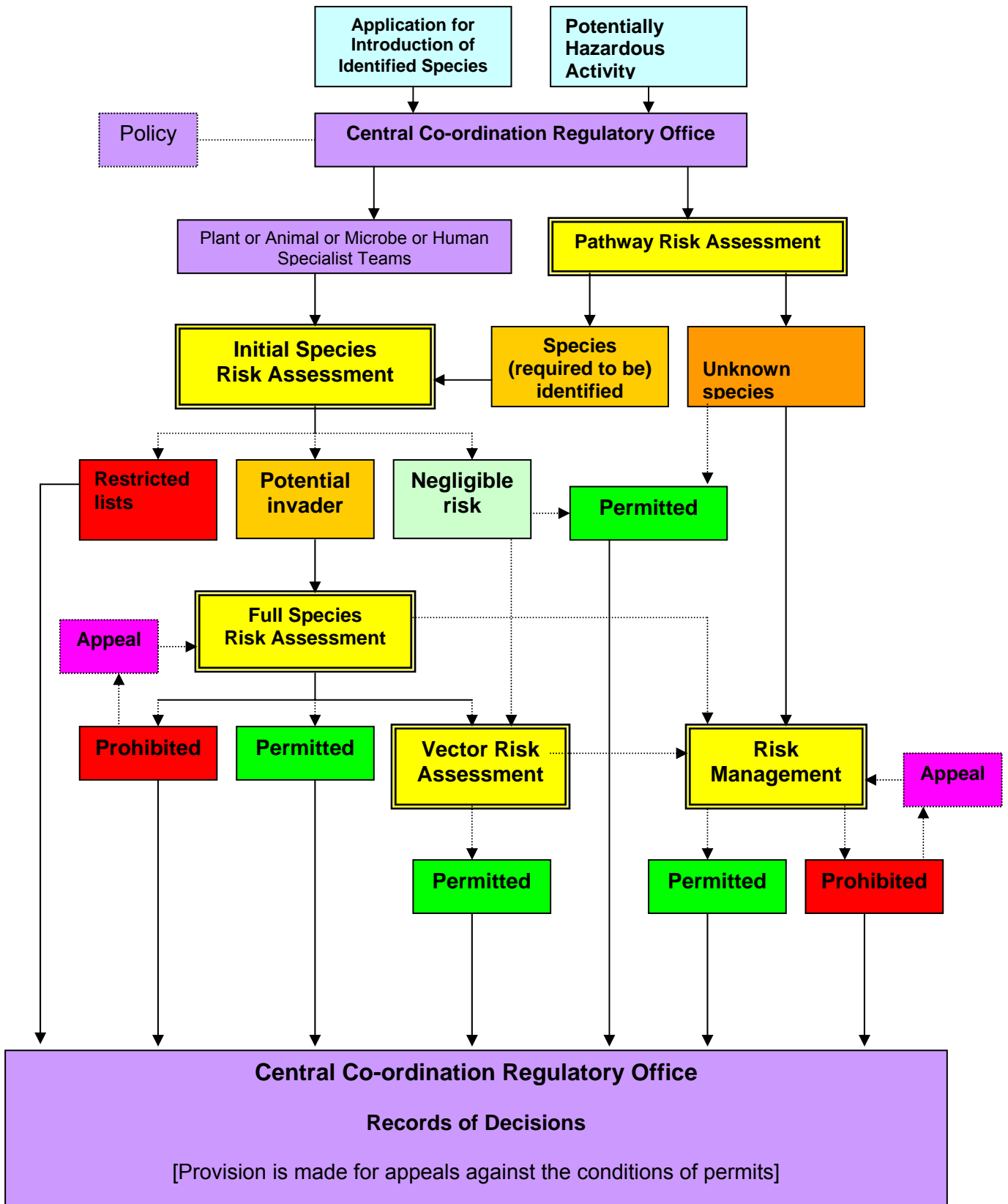
determine whether it should be permitted into the country. The development of the key questions was done by reviewing the literature and risk-assessment protocols in place in other parts of the world. For plants, questions for assessing risk were structured around the following key considerations: (a) the domestication/cultivation/history of introductions and naturalization of the species; (b) the extent to which the species is suited to South African climates; (c) the invasive tendencies of the species elsewhere, and its predisposition to invasiveness; (d) the undesirable traits of the species that may add to its ability to establish and spread in its new environment; (e) plant type, that may add to its ability to establish and spread in its new environment; and (f) reproductive, dispersal, and persistence attributes that may add to its ability to establish and spread in its new environment. For animals, it was decided that assessment of risk of establishment in the wild in South Africa should include detailed questions relating to at least the following factors: (a) the extent to which the species is suited to South African climates; (b) features of the native and adventive range of the species; (c) the history of introduction and invasiveness of the species in other parts of the world; (d) body mass; (e) fecundity; (f) known seasonal movement patterns (sedentary or migratory); (g) features of its diet (generalist or specialized feeder); (h) whether the species is known to be commensal with humans; (i) whether the introduced species are from wild or captive-bred populations; (j) features of environments targeted for introduction; and (k) the taxonomic group to which the species belongs (high-risk groups are defined for at least mammals, birds, reptiles, amphibians, fish, and invertebrates). The above questions were selected because of their value in determining the risk of invasiveness as well the practicality of being able to find information to provide accurate answers. Work on the risk assessment framework identified numerous areas that require further research.

The development of an ecological risk assessment framework for genetically modified organisms has been a priority within the C·I·B. One of the most important of these risks is the development of weediness in genetically modified plants. Although legislation relevant to the assessment and monitoring of environmental risks of transgenics is in place in South Africa, extremely little ecological research has been conducted on transgenics in the country, and no ecological risk assessment (ERA) framework has yet been developed for this purpose. Research elsewhere has shown that these methodologies must be driven by context-specific priorities. The South African context is unique climatically and ecologically, both factors highly relevant to the environmental risks associated with transgenics. Because the research required to support an effective ERA for transgenics is extensive, labour intensive, time-consuming and long-term, it is important to establish those priorities most critical for South Africa. Research should be driven by an inclusive, objective prioritization process, rather than one that is reactionary or merely responsive to industry developments. As one of the countries with the fastest rate of adoption of transgenic biotechnology, South Africa cannot necessarily rely on appropriate or timely research to be conducted elsewhere. Through the involvement of one of our core team members with the National Department of Agriculture (Directorate: Genetic Resources) (NDA), the C·I·B has campaigned for the need for such an ERA for South Africa, and currently assistance is being given to the NDA with the ERA development process.

C. Invasive and remediation effects on biodiversity

Work by individual core team members on this objective has commenced, although to date no long-term work has been established. The former work includes, *inter alia*, investigations of the natural rehabilitation potential of riparian zones after alien clearing in the fynbos biome; mechanisms for Spanish Reed, *Arundo donax*, control for the restoration of biodiversity capital in Cape riparian vegetation; the effects of invasive alien plants on functional and taxonomic insect diversity at Vergelegen Wine Estate; the effects of *Chromolaena odorata* invasion and eradication on invertebrate diversity; the impacts of silver wattle (*Acacia dealbata*) on invertebrate assemblages in the Drakensberg region of South Africa, the local-scale impacts of *Opuntia stricta* on spider and dung beetle assemblages in the Kruger National Park, South Africa. The longer-term work will be discussed with Working for Water in 2006 as part of a Memorandum of Understanding that will be established specifically to address this issue.

Fig. 1 Risk Assessment Framework



D. Roadsides as reserves and bridgeheads

The C-I-B and several of its members have raised concerns both to the National Roads Authority and the Extended Public Works Programme that work programmes, especially in western arid regions, are causing substantial damage to roadside reserves of indigenous vegetation. The clearing practices also seem likely to lead to establishment of invasive alien species. In initial investigations it became clear that roadsides have been little considered in South Africa for their potential role both as reservoirs of biodiversity or as corridors of species invasion. As a consequence, the species present on road verges, their abundance and dynamics and response to road verge condition and context are poorly understood. The objectives in South Africa's National Roads Agency policy include the encouragement of biological diversity within the National Road Reserves by promoting the growth of indigenous, naturally occurring flora, and to form linking corridors for the natural movement and migration of indigenous fauna and flora. Corridors, such as road verges, may however have both positive and negative consequences.

To address these problems a 'roadsides and rivers as corridors' consortium was established within the C-I-B. The consortium will examine the problems in more depth in 2006, but to date two major projects have been set in motion. In the first, the objective is to evaluate the role that road verges may play in the dispersal of invasive alien species. To date one of four proposed regions have been surveyed. This included 4 x 100 km stretches of road radiating out from Beaufort West, three plots of 25 x 2 m surveyed every 5 km. Data collected included, for example, species presence/absence, coverage, distance from road edge, adjacent land-use, verge disturbance status. The road verges in this region are generally species poor. However, 31 problem plants were recorded, including one indigenous and four declared alien invaders. Preliminary results suggest that distance to city and road edge made little difference to problem plant richness or coverage, whereas local disturbance and road-construction material are more important explanatory variables. An additional project examining the distribution of *Pennisetum setaceum* along roadsides and rivers is also underway.



Road verge clearing along the R318 (Montagu direction), showing the considerable change to the vegetation following clearing operations (cleared, image on right). Images: Dr. J. Kalwij.

E. Spatial concordance in diversity and its temporal change

A fourth year of fieldwork was undertaken on the Coast to Karoo, Cederberg transect, with sampling being done in March and October. Material was processed with the assistance of A. Botes, who submitted her Ph.D. in December 2005 on spatial variation in ant and beetle diversity along the transect. J. Gouws continued her work on body size variation of several beetle and ant species along the transect. Two papers were submitted and one was accepted by *J. Biogeogr.* and will be published in 2006.

In terms of ant diversity, the data collected in the first two years of sampling have shown that temperature explains significant proportions of the variation in species density and abundance, and, together with area, and several vegetation variables contributes significantly to the separation of the ant assemblages in the major vegetation types and biomes. Four major myrmecochores have been identified in the area (*Anoplolepis* sp. (c.f. *custodiens*), *Anoplolepis* sp. (c.f. *steinergroeveri*), *Camponotus niveosetosus*, *Tetramorium quadrispinosum*). The abundances of the two *Anoplolepis* species are related to vegetation variables, while the abundance of the other two species show opposite relationships with temperature variables. This suggests that increases in temperature in the region are likely to mean replacement of the former with the latter species. Thus, there are likely to be substantial and complex changes to ant assemblages as climates change in the northern Cape Floristic Region. Moreover, the importance of ants for ecosystem functioning suggests that these responses are not likely to be a response solely to vegetation changes, but might also precipitate vegetation changes. The changes that are predicted to take place in the next 50 years in the CFR could be substantially exacerbated by such synergistic effects, which have major implications for long-term conservation plans. Ongoing monitoring of this transect will reveal the nature and pace of the change as it unfolds.

Analyses of body size of the ground-dwelling carabid beetle *Thermophilum decemguttatum* has revealed a consistent pattern of body size change with gender and altitude. Male beetles are consistently smaller than females, and both show regular declines in size with increasing elevation. These patterns are similar among years (Fig. 2), and suggest that size variation may be maintained by selection. Data for 2005 are currently being analyzed, but provisional assessments thereof suggest that the patterns documented in the first three years are also present in the fourth year (2005).

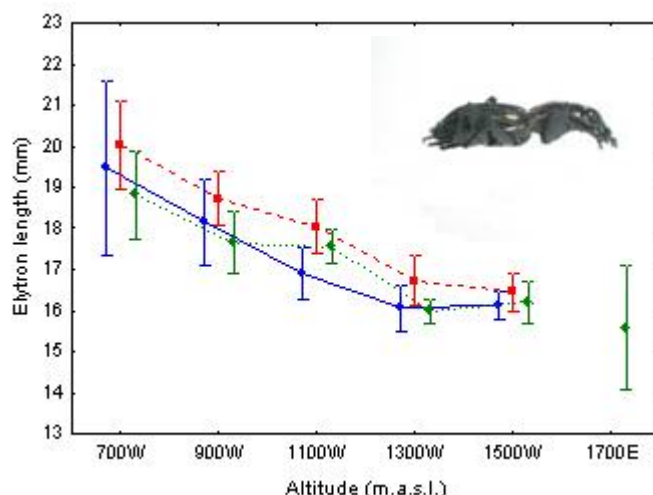


Fig. 2. Altitudinal variation in elytron length (mean \pm S.E.) of female *Thermophilum decemguttatum* from the Cederberg over three years (blue: 2002, red: 2003, green 2004).

A second long-term monitoring gradient was established in the Drakensberg region during August 2005 with the aim of investigating spatial variation in invertebrate diversity and its temporal change. The gradient spans a distance of c. 150 km (as the crow flies) with the Ixopo region in KwaZulu-Natal being the lowest point at 900 m above sea level and a mountain peak at the top of Sani Pass in Lesotho being the highest point at 3000 m. Eight sampling sites at 300 m vertical increments have been identified across this gradient and sampling will take place twice a year (during January and September). Sites were selected to represent undisturbed grassland habitat and an effort was made to select areas with a high probability of remaining undisturbed over the long term. To date, invertebrates have been sampled during September 2005 and January 2006. Specimens have been processed and sorted to order level. This work is being undertaken in collaboration with the University of Pretoria's Department of Zoology and Entomology.

Highlights of short-term work

A. Large scale patterns in biodiversity

South Africa provides an excellent testing ground for exploring the determinants of diversity and invasion patterns at the regional scale. A study undertaken of the correlates of species richness of alien plants at the scale of quarter-degree cells for the whole of South Africa aimed, *inter alia*, to determine whether species richness of indigenous plant species was explained by the same set of factors that explained richness of alien species (all alien plants as well as invasive alien plants in natural and semi-natural ecosystems). Results showed that species richness in all three groups, at the spatial scale under consideration, was explained by the same set of variables – a principal component of climatic factors and topographic roughness were the top-ranking variables for all groups. An implication of the results is that hotspots of indigenous plant species richness in South Africa are clearly also hotspots for invasions, and that ongoing management interventions will be required to reduce and mitigate impacts in these areas. Several other investigations were undertaken to explore interactions between environmental factors and human-activity factors in structuring plant invasions in southern Africa. The interplay of natural features and human-mediated factors in structuring diversity patterns for alien and invasive alien species were found to be different in different groups, with human-activity factors playing a much greater role in explaining species richness for alien species than for the subset of these species that are invasive.

On several Southern Ocean Islands, positive relationships were also found between indigenous and exotic species richness at local scales, although for plants the relationship was partially triangular (Fig. 3). Across the Islands, there was strong positive covariation between indigenous and exotic plant species richness and insect species richness, even taking spatial autocorrelation into account. Thus, species rich sites tend to have the highest number of alien species. This was likely due to species-energy relationships and the effects of propagule pressure, although the two are difficult to distinguish because both exotic and indigenous plant and insect species richness covary with energy availability, as does human visitor frequency. When two islands with almost identical numbers of human visits are contrasted it is clear that energy availability, or perhaps differences in climate-matching, are responsible for differences in the extent of invasion, thus supporting a major role of energy availability.

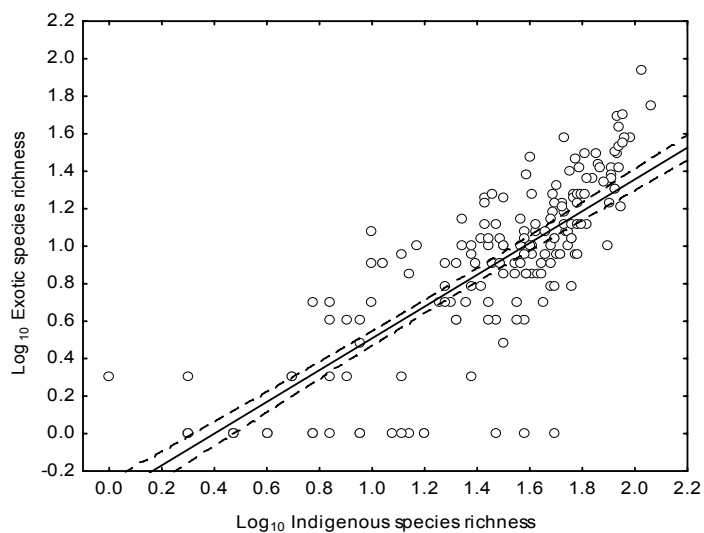


Fig. 3 The relationship between log (n+1) exotic and log (n+1) indigenous species richness across 216 10 x 10 km grid squares for the Falkland Island plants

Invasiveness of a species at a particular locality is clearly influenced by a suite of factors, including biological traits of the species, a range of environmental factors, and a large number of factors relating to human activities that either facilitate or hinder invasions. Considerable progress has been made recently in assessing the importance of these factors individually in different parts of the world. Such

insights offer rather limited potential for explaining invasion patterns or predicting future patterns. To address the issue of interactions between these factors, a unique dataset was assembled for 62 invasive species in South Africa. Detailed data were assembled on biological traits, minimum residence time, and current distribution at the scale of quarter-degree cells. Much of the variation in the current distribution of these species could be explained using a simple model that considers the length of time in the country and the proportion of the country that is potentially invasible (climatically suitable). The significance of biological traits and anthropogenic factors in determining range dynamics was strongly affected by potential range and residence time. Certain types of plants (e.g. nitrogen-fixing species and those suited to arid regions) are more widespread than expected.

A further study showed that across three major continents, including Africa (represented by habitats in the Kruger National Park), the relationship between species richness and the abundance of dominant ants is unimodal. The unimodal pattern is clearly a consequence of stress and the shape of abundance frequency distributions in the ascending part of the curve, and of the constraints of abundance frequency distributions and interspecific competition in the descending part of the curve. Previously it had been thought that only stress and competition were significant in structuring ant assemblages, whereas it is now clear that the form of abundance frequency distributions might constrain the relationship to a unimodal shape.

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

Significant progress was made in this area. A major review of invasions across the Antarctic and Southern Ocean islands was published by *Biological Reviews* early in the year. In it, the authors demonstrated that the extent and impact of invasions across the region have been significant and are likely to increase. The reasons therefore are an almost exponential increase in tourism interest in the region, and especially the Antarctic Peninsula area, and rapidly changing climates, again in the Peninsula area and on many of the sub-Antarctic islands. This paper formed the basis of several policy developments driven partly by the Scientific Committee on Antarctic Research, and raised at the XXVIII Antarctic Treaty Consultative Meeting in Stockholm.

More specific work demonstrated that nestedness metrics can provide insight into biogeographic patterns, and especially the influence of dispersal on these patterns, across the Southern Ocean islands. As might be expected, given their mostly European origins and human transport across the region, assemblages of invasive species show a substantially more nested structure than do those of indigenous species. Additional work on the environmental correlates of alien and indigenous species richness of plants and insects demonstrated that richness in alien and indigenous species is correlated at both fine and coarse spatial scales ('the rich get richer'), and that both energy and propagule pressure are significant correlates of alien species richness across the region. A comparison of Heard and Gough islands, for which complete data on landings since their discovery are available, highlighted the role of energy over propagule pressure.

A detailed study of *Pringleophaga marioni* caterpillars on Marion Island demonstrated, for the first time, that Wandering Albatrosses may act as thermal ecosystem engineers for the species. Caterpillar biomass and survival is much higher in albatross nests, which are several degrees warmer than their surrounding environment (given the warm adults and chicks), and caterpillar feeding rate is also likely to be higher. Thus the albatrosses modify the environment for the caterpillars, so benefiting them. The work showed that the links between caterpillars, introduced predatory feral mice, and other components of the Marion Island ecosystem are more complex than has previously been suggested. Together with additional research done on environmental effects on insect development and survival the work also provided the basis for a review of climate change effects on ecosystem functioning at Marion Island that was presented at the National Climate Change Conference held in Midrand in October 2005.

C. Determinants of invasions and scenarios of change

Several diverse projects are being undertaken under the ambit of determinants of invasion and patterns of change. Some overlap exists with work being undertaken under the large scale patterns in biodiversity theme, but this overlap allows for synergy, with little in the way of duplication.

One of the primary goals of invasion biology is to understand patterns and mechanisms of range expansion. The invasive Australian tree, *Acacia longifolia*, and its introduced biological control agent, *Trichilogaster acaciaelongifoliae*, present an ideal model system for doing so. The success of the pteromalid wasp in controlling *A. longifolia* has never been quantified, and the wasp has also spread beyond what was considered to be its potential range in South Africa. The objectives of this research has thus been to quantify the range structure of the wasp and its primary host plant as a basis for determining the range dynamics of both species, as well as the efficacy of biocontrol. Available data on the distribution of *A. longifolia* in South Africa (SAPIA) was used to stratify the sampling across South Africa into core, edge and climatically unsuitable areas of equal size (i.e. one quarter degree square). Replicates of each these types of sampling areas were sub-sampled at increasingly smaller scales with finer resolution, at each scale recording the occurrence and abundance of both the wasp and host plant. To date, the following QDS cells in the western Cape, Gauteng and Mupumalanga have been completely surveyed and sampled: *core cells*: Elim, Caledon (pilot study), Tulbagh; *edge cells (climatically suitable)*: Porterville, Montagu, Stormsvlei, Kaapsehoop; *edge cells (climatically unsuitable)*: Koo, De Meul, Sokuhlumi, Hendrina. From the data gathered thus far, differences in the occupancy of *A. longifolia* and *T. acaciaelongifoliae* between core and edge QDS cells are already visible and consistent with expectations. A difference in recorded gall abundance between isolated trees and trees with many neighbouring trees is also evident.



Site heavily invaded by *Acacia longifolia* (left), and C·I·B researchers at work assessing spatial patterns in invasion and the presence of control agents (right). Images: Dr. R. Veldtman.

A similar project concerns assessment of the distribution of the Argentine ant (*Linepithema humile*). Although this species is generally known to be widespread in the Western Cape Province (WCP) of South Africa, and present elsewhere in the country, its distribution and prevalence, in both disturbed and undisturbed areas, have never been quantified. Detailed information on the distribution of this species is a necessary first step towards understanding its impact and managing its spread, particularly in protected areas. The C·I·B has been quantifying the distribution of this species at three spatial scales in South Africa, i.e. countrywide distribution (based on museum and literature records, as well as active sampling), within three protected areas in the WCP (Jonkershoek Nature Reserve, Kogelberg Biosphere Reserve, Helderberg Nature Reserve), and the prevalence of the species in urban areas. An additional objective has been to examine ant species composition at bait stations in the presence and absence of the Argentine ant. This will provide information on competitive interactions and species displacement, i.e. the impact of the argentine ant on local fauna. The field work for this project is largely complete. Preliminary findings suggest that the species has a 71% prevalence in households in the WCP, that its distribution in protected areas is limited and largely restricted to disturbed areas with high levels of human activity (picnic areas, offices, campsites, chalets). This confirms current understanding that in the absence of human-assisted jump-dispersal the range expansion of the species is slow, as well as the fact that its prevalence in human-occupied areas is substantially higher than it is in natural areas.

Fine scale work of this nature was augmented by longer-term, broader scale studies. Predicting the probability of successful establishment of plant species by matching climatic variables has considerable potential for incorporation in early warning systems for the management of biological invasions. South Africa was selected as a model source area of invasions worldwide because it is an important exporter of plant species to other parts of the world owing to international demand for indigenous flora from this biodiversity hotspot. Together with partners from SANBI, the C-I-B first mapped the five ecoregions that occur both in South Africa and other parts of the world, but the very coarse definition of the ecoregions led to unreliable results in terms of predicting invisable areas. The bioclimatic features of South Africa's major terrestrial biomes were then determined and the potential distribution of analogous areas throughout the world was projected. This approach is much more powerful, but depends strongly on how particular biomes are defined in donor countries. Finally, bioclimatic niche models for 96 plant taxa (species and subspecies) endemic to South Africa and invasive elsewhere were constructed, and projected globally after successfully evaluating model projections specifically for three well-known invasive species (*Carpobrotus edulis*, *Senecio glastifolius*, *Vellereophyton dealbatum*) in different target areas. Cumulative probabilities of climatic suitability showed that high-risk regions are spatially limited globally, but that these closely match hotspots of plant biodiversity. These probabilities were significantly correlated with the number of recorded invasive species from South Africa in natural areas, emphasizing the pivotal role of climate in defining invasion potential. Accounting for potential transfer vectors (trade and tourism) significantly adds to the explanatory power of climate suitability as an index of invasibility.

In a further collaborative study, the C-I-B and its partners for the first time used spatial predictions of future threats to biodiversity to assess the relative potential impacts of future land use and climate change on the threat status of plant species. It was estimated how many taxa could be affected by future threats that are usually not included in current IUCN Red List assessments. The Red List status including future threats to 227 Proteaceae taxa endemic to the Cape Floristic Region, South Africa was computed and compared with Red List status excluding future threats. Eight different land use and climate change scenarios for the year 2020 were developed, providing a range of best- to worst-case scenarios. Four scenarios included only the effects of future land use change, while the other four also included the impacts of projected anthropogenic climate change (HadCM2 IS92a Gg), using niche-based models. Up to a third of the 227 Proteaceae taxa were uplisted (became more threatened) by up to three threat categories if future threats as predicted for 2020 were included, and the proportion of threatened Proteaceae taxa increased on average by 9% (range 2–16%), depending on the scenario. With increasing severity of the scenarios, the proportion of Critically Endangered taxa increased from about 1% to 7% and almost 2% of the 227 Proteaceae taxa became Extinct because of climate change. Overall, climate change has the most severe effects on the Proteaceae, but land use change also severely affected some taxa. Most of the threatened taxa occur in low-lying coastal areas, but the proportion of threatened taxa changed considerably in inland mountain areas if future threats were included. This approach gives important insights into how, where and when future threats could affect species persistence and can in a sense be seen as a test of the value of planned interventions for conservation.

The C-I-B has also shown that Allee effects seldom pose a constraint on the establishment of populations of invasive plants. Studies were conducted on *Senna didymobotra* (Fabaceae), *Acacia mearnsii* (Fabaceae), *A. dealbata* (Fabaceae), *Lilium formosanum* (Liliaceae) and *Datura stramonium* (Solanaceae). The absence of Allee effects is due either to autonomous selfing or in some cases, e.g. *A. mearnsii*, effective inclusion of the invasive plant within existing plant-pollinator interaction webs.

D. Impacts of invasion

Although the long-term investigations of impacts of alien species and remediation of invaded areas has not yet commenced, several significant advances were made. Headwater rivers are the predominant kind of aquatic ecosystem in South Africa's Cape Floristic Region. Invasion by alien woody taxa (especially *Acacia longifolia* and *Acacia mearnsii*) have altered these rivers in recent decades, replacing indigenous vegetation and altering ecosystem functioning. Aliens have been systematically cleared in watercourses since 1995 as part the Working for Water programme to increase water production and improve water quality. Cleared sites are mostly left to recover to their pre-invasion state without additional intervention. C-I-B researchers compared the vegetation of seven rivers that vary in their extent of invasion and clearing to identify factors limiting recolonization. Dense invasions cleared 3–6 years before the survey differ in vegetation structure and composition from uninvaded or lightly invaded/cleared riparian reaches in the following ways: (1) diminished extent of

indigenous trees in the canopy and increased importance of shrubs or reinvading alien trees, (2) reduced species richness, (3) reduced likelihood of occupancy for more than one-third of common, indigenous species, and (4) reduced incidence of indigenous tree regeneration. Overall, indigenous tree regeneration was very low and not disturbance-triggered, which will likely result in slow recovery if additional interventions are not made. Active revegetation should be focussed on common riparian scrub trees (i.e., *Metrosideros angustifolia*, *Brachylaena neriifolia*, *Brabejum stellatifolium*, and *Erica caffra*). These species tolerate open habitats favored by alien trees, eventually forming the closed canopies required by shade-tolerant species. Accelerating establishment of these small trees is likely critical for shifting cleared riparian corridors from a state that favors alien reinvasion. Effective establishment strategies will need to be developed in the context of hydrologic impairment, since alien-invaded rivers in this region typically have reduced flow.



Most riparian areas in the Fynbos biome are severely invaded (e.g. by Acacia mearnsii, left). Restoration of these ecosystems requires a detailed knowledge of the functioning of non-invaded riparian zones (upper Eerste River, right).

A pilot study examined changes in soil chemistry and microbial population sizes following the extensive wildfires in 2000 on the Cape Peninsula. The effects of standing alien plants and stacks of mechanically-cleared alien plant material on selected post-fire microbial populations and their recovery were investigated. These were compared to burnt fynbos and the burnt cleared areas surrounding wildfire burnt stacks. Microbial population sizes and chemical changes were also monitored in unburnt fynbos and dense unburnt stands of invasive alien plants. Differences in soil chemistry and microbial population sizes occurred in the samples taken from the various post-fire environments while marked seasonal changes were also apparent. Microbial population sizes were linked to pre-fire vegetation characteristics, fire intensity, the management of alien plants, soil chemical changes and seasonal influences. High volumes of woody alien plant biomass impacted on post wildfire microbial population sizes during summer. During winter, however, microbial population sizes were primarily influenced by soil texture and nutrient composition.

Further work is progressing on the effects of Spanish Reed, *Arundo donax*, on communities in areas where it has invaded. Initially, the work has concerned difference in plant and aquatic invertebrate species diversity between invaded and uninvaded areas. Changes in biomass and community structure due to invasion have been estimated, and also expressed in terms of fuel properties and likely changes to fire regimes. Experiments to assess decomposition and growth rates, important features of ecosystem function, have commenced.

Increasing interest in the use of transgenic plantation forestry trees poses a threat. Important plantation species such as pines are already highly invasive in South Africa. Genetic engineering of pines could alter key traits associated with invasiveness. Dave Richardson was asked to address this issue at an international forum on issues in transgenic forestry that was held at Duke University in the USA (see Outputs: Richardson & Petit 2005). There is much interest in the possibility of genetic engineering of sterility to prevent or reduce invasiveness. A major obstacle in this regard is that the Forestry Stewardship Council, whose certification of commercial forests aims to promote sustainable

forest practices, expressly forbids any use of genetically-modified species. This is blocking a potentially valuable avenue of intervention. Much more research is needed in this area.

E. Ecosystem services and alien invasions

A project led by the CSIR, and on which the C-I-B is collaborating, has commenced and will focus on the impacts of invasive alien plants on ecosystem services in each of the South Africa's major terrestrial biomes (karoo, savanna, grassland, fynbos, thicket, forest and freshwater aquatic habitats). The evidence for the magnitude of impact of invasive alien plants is largely anecdotal. The concept of ecosystem services (the benefits that humans derive from ecosystems) can help reduce the vagueness of much impact prediction. Most ecosystems deliver a long list of services, some of which are more amenable to quantification than others. The approach to this problem will be to use existing spatial datasets on the current and potential distribution of invasive alien plants, and on the distribution of untransformed land in the different major biomes to quantify areas at risk. For each biome, the major ecosystem services derived from the use of untransformed land are being identified and quantified. Those alien species that are likely to have the largest impacts on ecosystem services form a major focus, and attempts to quantify the reduction in the level of service associated with invasions are underway. For both ecosystem services and potential impacts, a combination of published studies, expert knowledge, and limited field work, using established networks will be used. The analysis will be explicitly spatial, and will thus map the potential impacts on ecosystem services. The potential for changes in the distribution of invasive alien plants as a result of climate change will also be outlined.

F. Social perceptions of invasion

This sector of the work remains the least well-developed of all, largely owing to the time it has taken to actively engage with researchers working in the field. Heidi Prozesky was appointed a core team member of the C-I-B to take research in this field forward. Together with core team members, especially Karen Esler, ways to collaborate to expand research on the sociological aspects of invasions were investigated and this work is ongoing. One avenue that has emerged involves research by a Ph.D. student on the interaction and relationship of society with invasive species in order to develop a framework for conflict resolution.

H. Additional new research fields

The C-I-B has maintained an active research role in a variety of other fields through the work of its core team members. Perhaps most notable of these for 2005 was ongoing work on biological control via Brian van Wilgen at the CSIR, and the participation of two C-I-B core staff members in assessments (driven by Working for Water) of what is required to improve the pool of scientists working in the field of biocontrol.

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

Over the past year the C-I-B supported 38 students at a variety of levels ranging (9 3rd year, 10 Hons., 10 M.Sc., 9, Ph.D.). Of these, 19 graduated successfully, whilst the remainder are continuing with their studies. In terms of equity, 22 of the students supported are female and 16 are black, with three of the black students holding foreign citizenship (Lesotho, Sudan, Gabon). The C-I-B has therefore met its gender equity target, but still has some way to go before achieving the overall level of equity that was set by the Board. Six post-doctoral associates were supported within the C-I-B. Of these, five are male and one female, and only one was from South Africa. An analysis of gender and racial equity (see Human Resources below) indicated that in general, equity targets are more readily achieved at the junior levels, but as progress is made up the system this becomes less straightforward. By exposing students to research work at 3rd and 4th year level, and via the Biodiversity Academy that is being jointly run with the CoE for Birds as Keys to Biodiversity Indication, it is hoped that an interest that will

last beyond the first lucrative job offer will be engendered. An increase in bursary levels is also being considered and a submission to the NRF has been made in this regard.

Campaigning for equity students and for participants in the C·I·B programme in general was also ongoing and thorough. An advertisement for student and post-doctoral positions was placed in the National Press (Mail and Guardian 2-8 September), and the C·I·B has run constant announcements of student bursary and study opportunities. One of the highlights of these activities was the award to Ms. Lukeshni Chetty, of the University of the Free State of an open Ph.D. bursary award. Ms. Chetty's work concerns identity preservation of maize and soybean in a South African environment, and fits in well with the C·I·B's interest in ecological risks of GMOs. The open bursary system will continue to be used as a vehicle to attract excellent HDI graduates into the field by way of support for them and their research at higher education institutions.

In early 2005, Dr. Lee Belbin (previously Head of the Australian Antarctic Division Data Centre, and now of Blatant Fabrications Ltd.) presented a course on the multivariate statistical package, PATN, which he wrote. The small course, which lasted for a full day, was well attended by C·I·B students and staff, and provided a thorough introduction both to the package and to the assumptions made during multivariate analysis.

Additional, training incentives were provided to two C·I·B supported researchers on the grounds of their contributions to the annual research meeting. The incentives took the form of two R 20 000 travel grants for attendance of a conference or visit to an established research laboratory. They were awarded to Dr. Şerban Procheş for the best post-doctoral presentation and to Ms. Dian Spear for the best poster presentation from a graduate student. A further award was made by the Director to Ms. Mandisa Mgobozi for her outstanding summary presentation of her poster on invasive impacts on insects.



Dr. Şerban Procheş, Ms. Dian Spear and Ms. Mandisa Mgobozi, winners of the C·I·B Research and C·I·B Director's awards at the 2005 Annual Research Meeting of the C·I·B.

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 had an extremely productive year in this arena. Five keynote/plenary addresses were delivered at international meetings and a further four at national conferences. Highlights of these were the Director's presentation to politicians attending the XXVIII meeting of the Antarctic Treaty Consultative Parties, including the King of Sweden, and the Deputy Director's plenary talk on making invasion biology comprehensible to legislators presented to an international scientific audience at the 8th International Conference on Ecology and Management of Alien Plant Invasions. A further five oral and one poster presentations were made at international meetings, and 18 oral and six poster presentations at national meetings.

In the literature, C-I-B researchers contributed to or led 26 primary scientific papers, three book chapters, and one book. Two of the primary research contributions were published in the acclaimed international scientific journal *Science* (Impact Factor 31.85), whilst several were published in leading disciplinary journals in the field.

Scientific communication to students

The C-I-B held one workshop on multivariate analysis to which students were invited. In addition, the annual research meeting, to which all students were invited (3rd year and Hons students found it difficult to attend because of exams), featured student work as an explicit focus. Owing to the fact that most students were in the first year of their work, poster presentations were used as the vehicle for communication between students and core team members. Each student was offered an opportunity to talk about their work for 5 minutes, and thereafter general discussion ensued. This approach offered an informal and relatively non-threatening manner in which student work could be discussed in a public forum. It produced several significant insights for students and was welcomed by the C-I-B technical board members (Drs. Blackburn and Pyšek) who also attended the annual research meeting.

Formal lectures were given to students on aspects of invasion as part of the course-work presented at the various institutions, and Dave Richardson led a one-week module on biological invasions to graduate students in the Conservation Biology Masters Course run by the Fitzpatrick Institute.

The document management system (DMS) established by the C-I-B data manager was used to enable file sharing by several research groups including their students. In particular, the DMS was used to provide broad access by an Argentine ant group to literature, literature sources and data on this species for a review that is being developed. This was also done for a small group collating data on insect body sizes.

One of the C-I-B post-doctoral associates also ran two small workshops on the use of the R statistical 'package' (open source) for C-I-B students and for students of the Fitzpatrick Institute.

Communication with partners

The C-I-B home page is now fully established and provides a major means of communicating with partners. The page provides links to research opportunities, developments within the C-I-B, research news, and general conservation-related news globally. The C-I-B also communicates findings regularly to a wider circle of interested parties via exchanges of information with the National Research Foundation. These 'nuggets' are featured on the C-I-B and NRF home pages and enable a broader audience to make contact with the work done by the C-I-B.

The C-I-B also co-funded a joint focussed symposium on biological invasions and their impacts that was held in conjunction with the Conferences of the Zoological and Entomological Societies in July 2005. This overlap day of the two societies provided a forum for discussing major invasion-related issues and featured Prof. Daniel Simberloff (University of Tennessee) as a plenary speaker. Subsequent keynote addresses covered all aspects of invasion from the science of marine and freshwater invasions to legislative aspects of invasion control. Smaller symposia over the course of the day offered a forum for students and researchers to showcase their work to a broader audience of biologists. The C-I-B was well represented amongst the keynote speakers, researchers and students, and established a prominent display in the meeting venue.

Communication with the public

The major vehicle for communication with the public is an outreach project that has been renamed 'limbovane – Exploring Biodiversity and Change'. limbovane is the isiXhosa word for 'ants'. Successful co-funding (to the value of R 3 million) was obtained from the U.K. Darwin Initiative, with the University of Sheffield (Prof. K.J. Gaston) as the lead partner in the Darwin application. Receipt of the funding meant that more formal approaches could be made to the Western Cape Education Department (WCED). A meeting was held with Mr Tommy Botha (Senior Curriculum Advisor for Life and Agriculture Science), and it was suggested that the C-I-B should submit a detailed proposal to WCED about the limbovane project. The proposal was duly drafted, submitted to WCED, and accepted by the Head of Education for WCED on 25 August 2005. After approval was received, the limbovane team met with the Life Science Curriculum Advisors (CAs) for the seven Education Management and Development Centres (EMDC) in the Western Cape in September. At this meeting the CAs were given more information on how the limbovane project is structured and how it fits into the NCS (National Curriculum Statement – Life Science for Grade 10 learners) and can be included in learner's assessments. The curriculum advisors were impressed with the way the proposal had incorporated many aspects of the NCS and felt that the project could be used in many other subjects, including computer literacy, mathematics, geography and languages (developing writing and oral skills).

At this meeting schools were also nominated to take part in the limbovane project. It was determined that each of the four urban EMDCs would select one school and each of the three rural EMDCs would select two schools to take part in the project, totalling ten schools. The proposed schools were approached and requested by the CAs to take part in the limbovane project. All schools accepted the proposal and put lead teachers' names forward to take part in the project (see Table 1).

Table 1. The list of schools taking part in the limbovane Project.

School	
Rural	Urban
EMDC: South Cape/Karoo	EMDC: South
Fezekile High School	Cape Academy for Science, Mathematics and Technology
Oudtshoorn	Tokai
Sentraal Hoërskool	EMDC: Central
Beaufort Wes	Ikamvalethu Finishing School
	Thornton
EMDC: Winelands/West Coast	EMDC: North
Groendal Sekondêr	Manzomthombo Secondary
Franschhoek	Blackheath
Weltevrede Sekondêr	EMDC: East
Wellington	Luhlaza Secondary
	Khayelitsha
EMDC: Breede River/Overberg	
Emil Weder Sekondêr	
Genadendal	
Riviersonderend Hoërskool	
Riviersonderend	

In October Prof. Kevin Gaston (PI for limbovane), Dr. Sue Shaw (Administrative Officer) and Dr. Brigitte Braschler (post-doc) all from the University of Sheffield visited the C-I-B to discuss the project inputs, outcomes, scientific questions and various administrative and reporting issues. Later that month all participating schools were visited inviting the headmasters and teachers to attend a half-day introductory workshop planned for November. This trip was also used to identify potential school

sampling sites and potential control sites. The headmaster and teacher introductory workshop was held in November and was also attended by the Curriculum Advisors and Mr. Tommy Botha. Teachers were enthusiastic about the project and looked forward to the training workshop planned for January 2006. Initial field sampling was carried out in November. This sampling was used to provide a quick reference as to what ant species could be expected at each of the school and control sites, and a baseline for future monitoring. This sampling also provided initial training for Dr. Braschler and the C-I-B field staff in ant identification. These samples were also used to develop the reference collection for each of the schools as well as the provisional reference collection for the C-I-B during November and December. A website for the limbovane project was also developed (see: www.sun.ac.za/iimbovane) during November.

The limbovane project has proved to be much more successful, at least initially, than had been planned, and has focussed substantial attention on the innovative outreach scheme developed by the C-I-B in collaboration with its major partners. Although it is a long-term investment in science awareness, it is one that the C-I-B is sure will benefit the broader science system in South Africa by encouraging learners to participate in research and by providing an opportunity for skills development in data analysis.

In addition to the limbovane project, a range of other outreach activities were undertaken, including radio interviews, participation in open days at various Universities, and a range of popular talks.



Learners exploring the pitfalls of ant sampling during the initial phases of the limbovane project.

Knowledge Management System

In April 2005 Dr. Lee Belbin (former head of the Australian Antarctic Data Centre) visited the C-I-B to discuss metadata and information submission and retrieval issues with the C-I-B core staff. Dr. Belbin provided much needed assistance in developing an overall perspective of data submission and retrieval requirements, and helped design the basic system that would be required to achieve effective information submission and retrieval. In focussed discussions with the C-I-B data manager he also demonstrated the way in which the system developed by the Australian Antarctic Division works and what its major benefits are relative to those of other systems. In consequence, a solid foundation for further development of a knowledge management system was established.

The first step in the development of a knowledge management system was the adoption of the Stellenbosch University Document Management System (DMS) by the core staff of the C-I-B. All significant documentation (e.g. strategic plans, cash flow statements, asset registers) is available via the DMS, providing an avenue for multiple independent revisions of documents and for assessing user inputs into the C-I-B core documents. The DMS also provides secure document storage.

The data manager also developed a backup system for all core staff of the C-I-B, ensuring that personal computers are backed up at a minimum once weekly, and the backed-up files stored at a separate location. This system was implemented for all staff except the Deputy Director and Director who have their own systems which backup all active files on a daily basis.

Following extended discussions with the Manager: Innovation (Prof. L. Botha) and Information Technology (IT) at Stellenbosch University, a decision was taken to work with SU IT to develop an in-house information retrieval and submission system (IRSS). The development and implementation of the system was not completed in 2005, but it will be online in 2006. Metadata forms adhering to international standards were also developed during this period and will be tested with core team members in 2006. Data submitted at the end of 2005 and at the start of 2006 will be archived using a simple data storage system that cannot be extensively queried, until such time as the IRSS is completed.

Perhaps the most successful knowledge management intervention in 2005 was the development of a user-friendly, fast, and effective home page for the C-I-B and limbovane project. The page has formed a useful tool for communicating recent developments in the Centre to core team members, students and partners. It has therefore become something of a cornerstone of knowledge management in the Centre, and the list of activities on that section of the home page provides a succinct perspective on the development of the C-I-B and its major activities.

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

During 2005 the C-I-B undertook a wide range of networking activities at a variety of levels. These ranged from core team member interactions with South African and visiting academics to formal memoranda of understanding with institutions both in South Africa and abroad.

Agreements with partner institutions

The C-I-B finalised memoranda of understanding with several institutions, in addition to the agreements signed in 2004. These agreements aim to facilitate collaboration between the C-I-B and partner institutions working in the biodiversity field. The institutions complement the strengths of the C-I-B in many areas and provide support for several key performance areas, particularly research and education and training, but also outreach, which is central to the C-I-B strategic vision.

International

- Institute for Biological Invasions, University of Tennessee, U.S.A.
- University of Sheffield, U.K.

National

- South African Institute for Aquatic Biodiversity
- Iziko Museums of Cape Town
- Savanna Ecosystems Research Unit, South African National Parks

Academic visitors to C-I-B

Dr. P. Pyšek, Institute of Botany, Academy of Sciences of the Czech Republic. Collaborator on several projects relating to alien plant invasions (Dave Richardson).

Prof. M. Rejmanek, University of California, Davis, USA. Collaborator on several projects relating to alien plant invasions (Dave Richardson).

Prof. J. Bengtsson, Swedish Agricultural University. Collaborator on fragmentation project to be proposed to SA-Sweden funding collaboration (Steven Chown).

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

Prof. H.P. Leinaas, University of Oslo, Norway. Collaborator on SA-Norway grant and with C·I·B (Steven Chown).

Prof. D. Simberloff, University of Tennessee, U.S.A. MOU being established with C·I·B (Steven Chown).

Prof. F. Jaksic, Center for Advanced Studies in Ecology and Biodiversity, Chile. MOU being established with C·I·B. (Steven Chown).

Dr. N. Andrew, University of New England in Australia, School of Environmental Sciences & Natural Resource Management, October 2005. Collaboration on Australian *Acacia* species that are invasive in South Africa, their biological control agents, and comparative issues in population and community ecology (Melodie McGeoch).

Academic visits to other institutions

“Zentrum für interdisziplinäre Forschung, Bielefeld“, Germany, September 2005. Collaboration on use of gradients to understand global change challenges (Karen Esler).

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

Dr. Peter Convey, British Antarctic Survey, UK. Collaborator on work concerning Antarctic invasions. (Steven Chown).

Research collaborations

Project-based collaborations with external national and international partners were developed further among the C·I·B core team and staff. The following collaborations were active in 2005:

Assessment of the impacts of invading alien plant clearing on the recovery of biodiversity in freshwater systems using river health indicators – Collaborators: Working for Water; Michael Samways (C·I·B).

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; Sue Milton (C·I·B).

Chromolaena odorata in Hluhluwe-iMfolozi Park – Collaborators: University of Groningen, Ezemvelo KwaZulu-Natal Wildlife; Dr. Michael Somers (C·I·B).

Concepts in invasion ecology – Collaborators: Institute of Botany, Academy of Sciences of the Czech Republic; Dave Richardson (C·I·B).

Differential effects of annual and perennial N-fixing alien plants on nitrogen cycles in nutrient-limited systems – Collaborators: Department of Ecology, Evolution and Marine Biology, University of California, Santa Barbara; Dave Richardson (C·I·B).

Disruption of plant-animal interactions due to biological invasions – Collaborators: Institut Mediterrani d'Estudis Avançats, Balearic Islands, Spain; Dave Richardson (C·I·B).

Ecology of 'novel' or 'emerging' ecosystems – Collaborators: School of Environmental Sciences, Murdoch University, Perth, Australia; Dave Richardson (C·I·B).

Ecosystem services - Collaborators: Dr. Belinda Reyers (CSIR); Dr. Matthieu Rouget (South African National Biodiversity Institute); Dr. Tim Lynam (University of Zimbabwe); Prof. Bob Scholes (CSIR); Albert van Jaarsveld (C·I·B).

Effects of recently 'invaded' arid adapted small carnivores on the diversity of invertebrates in the Great Fish River Reserve – Collaborators: Eastern Cape Parks Board, Prof. Peter Lent (University of Fort Hare); Michael Somers (C·I·B).

Evolution of insect body size – Collaborators: Prof. Kevin Gaston (Biodiversity and Macroecology Group, Department of Animal and Plant Sciences, University of Sheffield); Steven Chown (C·I·B).

Guidelines for the Namaqualand Restoration Initiative – Collaborators: Namaqualand Restoration Initiative; Karen Esler (C·I·B).

Human impacts in pine forests – towards a global synthesis – Collaborators: Centre d'Ecologie Fonctionnelle et Evolutive, CNRS, France; Dave Richardson (C·I·B).

Influence of human population dynamics on biodiversity in South Africa – Collaborators: Prof. Kevin Gaston (Biodiversity and Macroecology Group, Department of Animal and Plant Sciences, University of Sheffield); Dr. Karl Evans (Biodiversity and Macroecology Group, Department of Animal and Plant Sciences, University of Sheffield); Berndt Janse van Rensburg (C·I·B); Steven Chown (C·I·B).

International Polar Year proposal for investigating routes for and numbers of invasive species entering Antarctica – Collaborators: Australian Antarctic Division (Dr. Dana Bergstrom); British Antarctic Survey (Dr. Peter Convey); French Polar Institute IPEV (Dr. Yves Frenot); Netherlands Institute for Ecology (Dr. Ad Huiskes); Steven Chown (C·I·B).

Landholder attitudes and behaviour towards the conservation of Renosterveld – Collaborators: Sue Winter (Wine and Biodiversity Initiative); Heidi Prozesky (C·I·B).

Modelling of alien plant invasions – Collaborators: Laboratoire d'Ecologie Alpine, CNRS, Université Joseph Fourier, Grenoble, France; Dave Richardson (C·I·B).

Modelling of potential ranges of invasive plants on Réunion Island – Collaborators: Laboratoire de Biologie Végétale, Université de La Réunion, France; Peuplements Végétaux et Bio agresseurs en Milieu Tropical, CIRAD, La Réunion; Dave Richardson (C·I·B).

Opuntia stricta in Kruger National Park – Collaborators: Llewellyn Foxcroft (Savanna Ecosystems Research Unit, South African National Parks); Berndt Janse van Rensburg (C·I·B).

Perspectives from plant invasions to inform international policy on transgenic forestry – Collaborators: Center on Global Change, Duke University, USA; Dave Richardson (C·I·B).

Reintroduction biology of wild dogs – Collaborators: Dr. Rosie Woodroffe (University California, Davis), Micaela Szykman (Humboldt University), Markus Hofmeyr (South African National Parks), Dr. Rob Slotow (University of KwaZulu-Natal), Dr. Ant Maddock (JNCC, UK), Michael Somers (C·I·B).

Restoration following alien clearing in the Eastern Cape, and contribution to GEF report on costs and benefits of alien vegetation control – Collaborators: Working for Water; Sue Milton (C·I·B).

Restoration of mine dumps and management of invasive alien plants – Collaborators: De Beers, Kimberley; Sue Milton (C·I·B).

Risk of disease invasion - Collaborators: Prof. Lise Korsten (University of Pretoria); Prof. B. Huntley (University of Durham, UK); Dr. Barend Erasmus (University of the Witwatersrand); Albert van Jaarsveld (C·I·B).

Sani Pass long term monitoring project and research on *Acacia dealbata* – Collaborators: Dr. Mark Robertson (Department of Zoology and Entomology, University of Pretoria); Berndt Janse van Rensburg (C·I·B).

Scenario planning for biological invasions - Collaborators: Erin Bohensky (SU); Arthur Chapman (CSIR); Dr. Guy Midgley (South African National Biodiversity Institute); Dr. David Le Maitre (CSIR); Sarah Davies (C·I·B); Karen Esler (C·I·B); Dave Richardson (C·I·B); Albert van Jaarsveld (C·I·B).

Species richness patterns of alien and native plants – Collaborators: Dr. Mathieu Rouget (South African National Biodiversity Institute); Berndt Janse van Rensburg (C·I·B).

Sustainability modelling - Collaborators: CSIR; Albert van Jaarsveld (C-I-B); Karen Esler (C-I-B).

TB/buffalo/helminth interactions – Collaborators: Dr. Anna Jolles (Oregon State University), Dr. Venessa Ezenwa (Princeton University); Ezemvelo KZN Wildlife; Michael Somers (C-I-B).

Women in the field of invasion biology – Collaborators: Prof. Johann Mouton, Derick van Niekerk and Charlene Mouton (Centre for Research on Science and Technology, Stellenbosch University); Heidi Prozesky (C-I-B).

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

Service provision developed at a rapid pace in 2005. Most notable amongst all of the activities was participation in the development of the Regulations for Chapter 5 of the National Environmental Management: Biodiversity Act. At the invitation of Dr. Guy Preston (National Programme Leader, Working for Water), C-I-B core team members participated at several levels, from the Task Team coordinating the regulations, to the listing of species for the regulations. In addition, facilitation of public access to information also formed a major part of the C-I-B's role in the development of the regulations.

Much of the initial part of the work with the National Task team was spent in months of fruitless discussion with several officials of the Department of Environmental Affairs and Tourism, who remain convinced that knowledge of the identity, presence and geographic distribution ranges of every living species in South Africa is either readily available or can be had easily. After convincing all rational parties that an approach based on these assumptions is unworkable, the Task Team pressed on with the development of the regulations. This process took many months and included presentations by C-I-B core team members to interested and affected parties, organizational assistance with national workshop on the regulations, and development of a web site and e-mail discussion system in support of the regulations development process. By the end of 2005 a draft set of regulations had been developed that were due for submission to the Department of Environmental Affairs and Tourism in early 2006.

On the basis of this work alone it was clear that the C-I-B had gained national recognition as one of the places to go to for advice on the biodiversity consequences of biological invasions. This impression was reinforced by wide interest from the public in the work being done by the C-I-B, reflected in numerous requests for information for the press and media.

A further reflection of the good standing in which the C-I-B is held nationally was the award by the Department of Environmental Affairs and Tourism (Directorate: Antarctica and Islands) (DAI) of the contract to revise the management plan for the Prince Edward Islands. In keeping with many changes in legislation since the publication of the first management plan for the islands, a wholly revised Environmental Management Plan (EMP) for the Prince Edward Islands was submitted to DAI at the end of the year. The EMP not only provides the necessary background information for management of the islands, but it is highly explicit about actions, roles and responsibilities. It therefore represents a substantial improvement to the previous management plan. Given the C-I-B's experience with the Southern Ocean Islands, several core team members were also consulted by the WWF and its partners during the development of the plans for a marine protected area around the islands.

The C-I-B also gained something of an international reputation for service provision. The Global Invasive Species Programme (GISP) approached the Centre late in 2005 for assistance with the development of a report on the requirements for invasive species indicators for the GEF 2010 Biodiversity Indicators Partnership project. A major outcome of the work delivered to GISP was

recognition of the fact that indicators for biological invasion remain poorly developed by comparison with indication in other fields. GISP has subsequently been awarded a significant contract to further develop the indicators.

The Scientific Committee for Antarctic Research also entrusted the C·I·B with the running of a small, international workshop on best practise in modern conservation and its relevance to conservation in Antarctica. The workshop resulted in a key working document that will form the basis of a revision of Antarctic conservation best practices.



Ethel Phiri and Leonie Joubert (left) and Asanda Phiri and Sarah Davies (right) discussing riparian and other invaders during the site visit for development of the Prince Edward Islands Environmental Management Plan.

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 Council to South African Minister of Agriculture and Land Affairs: Genetically Modified Organisms: Member (McGeoch)
Alien Invader Task Group for the Kruger National Park (Richardson)
Arid Zone Ecology Forum Committee (Milton)
Board Member, South African National Biodiversity Institute (Chown)
Board South African Data Centre for Oceanography (Griffiths)
CAPE Invasive Alien Species Task Team (Richardson)
Chair of SANBI Board Science Programmes Committee (Chown)
Council Member, Zoological Society of Southern Africa – Biodiversity portfolio (van Rensburg)
Council of South African Association of Botanists (Esler)
Council of the Zoological Society of South Africa (Griffiths)
Fynbos Forum Committee (Esler, Richardson)
HERS Advisory Board Member (Esler)
National Environmental Management: Biodiversity Act (#10 of 2004), Invasive species listing; Coordinator: Vertebrates (excluding fish) (Van Vuuren)
Paarl Mountain Advisory Board (Esler)
Prince Edward Islands Management Committee, *ad hoc* member 2005 (Chown)
Reference Group NEMBA Regulations (van Wilgen)
SAEON Advisory Board (Chair, van Jaarsveld)
Scientific Committee of SCORE (Scientific Committee for Ocean Research) (Griffiths)
South African BIOTA Liaison Committee (Esler)
South African National Antarctic Programme Steering Committee: Member (McGeoch)
South African Women in Science and Engineering (SAWISE), committee and treasurer (Esler)
Succulent Karoo Ecosystem Plan (SKEP) advisory board (Esler)
Succulent Karoo Ecosystem Plan (SKEP) Research Panel (Milton)
Task Team NEMBA Regulations (Chown, Richardson)

International panels and committees

Alternate Board Member to Brian Huntley for the Global Invasive Species Programme (Chown).
IUCN/SSC Board (Samways)
Orthopterists Society Board (Samways)
Societas Internationalis Odonatologica Board (Samways)
Census of Marine Life: Chair, Africa Regional Implementation Committee (Griffiths)
Chair, IUCN/SSC Invertebrate Conservation Sub-Committee (Samways)
Chair, IUCN/SSC Southern African Invertebrates SG (Samways)
Counsellor, Xerces Society (Samways)
DIVERSITAS Scientific Committee, Member (McGeoch)
Global Biodiversity modelling, RIVM, Enkhuizen, The Netherlands, April 2005 (review panel member) (van Jaarsveld)
IUCN SSC Invasive Species Specialist Group (ISSG) (Richardson, van Wilgen)
IUCN Species Survival Specialist Group on Conifers (Richardson)
IUCN-SSC Odonata SG (Samways)
IUCN-SSC Otter Specialist Group (Somers)
IUCN-SSC Pig, Peccary and Hippo Specialist Group (Somers)
IUCN-SSC Re-introduction specialist Group (Somers)
Scientific Committee on Antarctic Research, Chair-elect of Antarctic Treaty Standing Committee (Chown).

Editorial and refereeing activities

Editor

African Zoology (Editor – Griffiths)
Diversity and Distributions (Editor in Chief – Richardson)
Functional Ecology (Executive Editor – Chown)

Associate Editor

American Naturalist (Chown)
Journal of Applied Ecology (Milton)
Journal of Arid Environments (Milton)
Journal of Insect Conservation (Samways)

Editorial Boards

Annals of the South African Museum (Griffiths)
Antarctic Science (Chown)
Biodiversity and Conservation (Samways, van Jaarsveld)
Biological Invasions (Richardson)
BMC Ecology (Chown)
Conservation Biology (Samways)
Diversity and Distributions (Chown)
Ecologia Mediterranea (Richardson)
Global Ecology and Biogeography (Richardson)
Journal of Biogeography (McGeoch)
Odonatologica (Samways)
Journal of Orthoptera Research (Samways)

Reviewing

International Journals: African Journal of Ecology, American Journal of Botany, American Journal of Physiology, Annals of Botany, Austral Ecology, Biodiversity and Conservation, Biology Letters, Conservation Biology, Biological Conservation, Biological Invasions Diversity and Distributions, Ecography, Ecological Applications, Ecological Modelling, Ecology, Ecology Letters, Ecosystems, Environmental Management, Global Change Biology, Global Ecology and Biogeography, Insectes Sociaux, Journal of Applied Ecology, Journal of Arid Environments, Journal of Biogeography, Journal of Ecology, Journal of Environmental Management, Journal of Experimental Biology, Journal of Insect Physiology, Journal of Mammalogy, Naturwissenschaften, New Zealand Journal of Botany, Oecologia, Oikos, Physiological Entomology, Plant Ecology, PNAS, Proceedings of the Royal Society of London B, Restoration Ecology, Science, Trends in Ecology and Evolution, Tropical Zoology. **National Journals:**

African Entomology, Bothalia, Koedoe, South African Journal of Botany, South African Journal of Science, South African Journal of Wildlife Management.

Grant reviews for external bodies

Israel Science Foundation
New Zealand - Royal Society of New Zealand (Marsden Fund).
Sweden – Sweden/South Africa Cooperation Programme.
Swedish University of Agricultural Sciences
U.K. - Natural Environment Research Council.
U.S.A. – National Science Foundation.

Conferences/workshops organized

Organized and chaired IUCN/SSC Invertebrate Conservation Sub-committee, Stellenbosch, November 2005 (Samways).
Organizing Committee for International Association for Vegetation Scientists, 2007 (Esler)
Organizing Committee for International Society for Conservation Biology Meeting, 2007 (Esler)
Part of the organising team (with J Aronson and J Blignaut) for the “Restoring Natural Capital” conference held in St Louis, Missouri, October 2005 (Milton)
Scientific Advisor to 4th symposium of Worldwide Dragonfly Association, Pontevedra, Spain, July 2005 (Samways)
Vth meeting of the Southern African Society for Systematic Biology, January 2005 (Van Vuuren)

Consulting and other services rendered

Genetic consultancy work for South African Conservation Agencies and Game Industry
McGeoch, M.A. 2005. *Why South Africa needs Ecological Risk Assessment for GMO's*. Various stakeholders.
Midgley, G.F., Chapman, R.A., Hewitson, B., Johnston, P., de Wit, M., Ziervogel, G., Mukheibir, P., van Niekerk, L., Tadross, M., van Wilgen, B.W., Kgope, B., Morant, P.D., Theron, A., Scholes, R.J., Forsyth, G.G. (2005) *A Status Quo, Vulnerability and Adaptation Assessment of the Physical and Socio-economic Effects of Climate Change in the Western Cape*. Report to the Western Cape Government, Cape Town, South Africa. CSIR Report ENV-S-C 2005-073
National State of Environment Indicators Review Panel, Department of Environmental Affairs and Tourism and SRK Consulting, 2005.
Review of the Arid Zone Ecology Forum for the National Research foundation
South African State of the Environment Report 2005.

In summary, the C·I·B has become widely known as a centre for obtaining excellent service that is backed by reliable, credible information and data sources.

6. Gender impact of research

Our activities have had gender impacts given that equity has been a strong consideration in the appointment of staff and students. The C·I·B core staff (including contractees) comprises eight females and three males, and more than 50% of the students in the centre are female. It is as yet too early to tell what the gender impact of the C·I·B's research is likely to be. Part of the work of the newly appointed sociologist, Heidi Prozesky, will be to identify significant gender issues in the field of biological invasions that require urgent attention.

One of the core team members, Karen Esler, was involved in organizing a National Women's Day event in August 2005 through her involvement (as treasurer) with the South African Association of Women in Science & Engineering (SAWISE). Over 200 top performing female pupils (standards 9 to matric) from the Western Cape were exposed to a range of up-and-coming professionals and post-graduates at Iziko Museums of Cape Town. Each speaker gave an account of her own experience and passion for her selected discipline, thereby raising the awareness of science careers. Ndivhuwo Luruli (nee Netshilaphala), a post-graduate in Entomology (and the C·I·B) gave a talk describing the reasons for her study choices. Pupils also had the opportunity to visit posters and displays, designed especially for the celebration by graduates and post-graduates students from all of the Western Cape higher education institutions. The departments of Conservation Ecology and Botany and Zoology and the C·I·B were well represented. Spreading the C·I·B vision were students Sara Muhl (M.Sc.

Conservation Ecology) and Shelly Vosse (Hons. Botany & Zoology). The afternoon event focused on female post-graduates, academics and professionals. Dr. Mamphela Ramphele, from the Global Commission on International Migration, Lucienne Abrahams, chair of South African Reference Group on Women (SARG), and Dr. Dahlia Garwe, head of Biotechnology at the Tobacco Board of Zimbabwe gave valuable accounts on their careers and guidance on decision making. A workshop lead by the HERS-SA team focused on micro-political issues that women may face in their workplaces.

HUMAN RESOURCES

Please report on the people who worked within the CoE during the reporting period (or part thereof).

1. Core Team Members

Title	Surname	Citizenship	Institution	Gender	Race	% time spent working in CoE
Prof.	Chown	South Africa	SU	♂	W	80
Prof.	Richardson	South Africa	SU	♂	W	100
Dr.	Daniels	South Africa	SU	♂	B	5
Prof.	Esler	South Africa	SU	♀	W	15
Prof.	Griffiths	South Africa	UCT	♂	W	15
Dr.	Jansen van Vuuren	South Africa	SU	♀	W	10
Prof.	Johnson	South Africa	UKZN	♂	W	10
Prof.	McGeoch	South Africa	SU	♀	W	10
Prof.	Milton	South Africa	SU/UCT	♀	W	10
Ms.	Prozesky	South Africa	SU	♀	W	5
Dr.	Rambau	South Africa	SU	♂	B	5
Prof.	Samways	South Africa	SU	♂	W	10
Dr.	Somers	South Africa	UNITRA	♂	W	10
Prof.	van Jaarsveld	South Africa	SU	♂	W	5
Dr.	van Rensburg	South Africa	UP	♂	W	10
Dr.	van Wilgen	South Africa	CSIR	♂	W	5
Dr.	Wossler	South Africa	SU	♀	W	10

2. Post Docs

Title	Surname	Citizenship	Institution	Gender	Race	% time spent working in CoE
Dr.	Kalwij	Netherlands	SU	♂	W	100
Dr.	Proches	Romania	SU	♂	W	100
Dr.	Tolley	USA	SU	♀	W	41 (resigned May 05)
Dr.	Veldtman	SA	SU	♂	W	100
Dr.	Wilson	UK	SU	♂	W	100
Dr.	Walther	Germany	SU	♂	W	100

3. Students

Title	Surname	Citizenship	Instit.	Gender	Race	Degree	Status
Mr.	Bewana	SA	WSU	♂	B	3rd Year	Completed
Ms.	Booi	SA	SU	♀	B	3rd Year	Completed
Mr.	Maguga	SA	WSU	♂	B	3rd Year	Completed
Ms.	Mahlabegwane	SA	SU	♀	B	3rd Year	Completed
Mr.	Mnganyana	SA	WSU	♂	B	3rd Year	Completed

Title	Surname	Citizenship	Instit.	Gender	Race	Degree	Status
Mr.	Mtimkulu	SA	WSU	♂	B	3rd Year	Completed
Mr.	Ndesi	SA	WSU	♂	B	3rd Year	Completed
Ms.	Siyema	SA	WSU	♀	B	3rd Year	Completed
Ms.	van Wilgen	SA	SU	♀	W	3rd Year	Completed
Mr.	Coetzee	SA	UP	♂	W	Hons/4th yr	Completed
Ms.	du Preez	SA	SU	♀	W	Hons/4th yr	Completed
Ms.	Faber	SA	SU	♀	W	Hons/4th yr	Completed
Ms.	Holm	SA	SU	♀	W	Hons/4th yr	Completed
Ms.	Mothapo	SA	SU	♀	B	Hons/4th yr	Completed
Ms.	Neethling	SA	SU	♀	W	Hons/4th yr	Completed
Ms.	Snyman	SA	SU	♀	W	Hons/4th yr	Completed
Mr.	Snyman	SA	SU	♂	W	Hons/4th yr	Completed
Ms.	van der Merwe	SA	UP	♀	W	Hons/4th yr	Completed
Mr.	van der Westhuizen	SA	UP	♂	W	Hons/4th yr	Completed
Ms.	Dumalisile	SA	WSU	♀	B	M.Sc.	Registered
Ms.	Gouws	SA	SU	♀	W	M.Sc.	Registered
Ms.	Greve	SA	SU	♀	W	M.Sc.	Registered
Ms.	Guthrie	SA	UWC	♀	W	M.Sc.	Registered
Mr.	Harris	SA	UP	♂	W	M.Sc.	Registered
Ms.	Luruli	SA	SU	♀	B	M.Sc.	Registered
Ms.	Mgobozi	SA	WSU	♀	B	M.Sc.	Registered
Ms.	Muhl	SA	SU	♀	W	M.Sc.	Registered
Mr.	Schoeman	SA	SU	♂	W	M.Sc.	Registered
Ms.	Vosse	SA	SU	♀	W	M.Sc.	Registered
Mr.	Bredenhand	SA	SU	♂	W	Ph.D.	Registered
Ms.	Egoh	SA	SU	♀	B	Ph.D.	Registered
Mr.	Foxcroft	SA	UCT	♂	W	Ph.D.	Registered
Mr.	Iponga	Gabon	SU	♂	B	Ph.D.	Registered
Mr.	Lado	Sudan	SU	♂	B	Ph.D.	Registered
Ms.	Marais	SA	SU	♀	W	Ph.D.	Registered
Mr.	Marr	SA	UCT	♂	W	Ph.D.	Registered
Mr.	Rahlao	Lesotho	SU	♂	B	Ph.D.	Registered
Ms.	Spear	UK/Zim.	SU	♀	W	Ph.D.	Registered
Mr.	Otieno	Kenya	SU	♂	B	M.Sc.	Withdrew

4. Collaborators (Loosely involved with CoE)

See networking

5. Administrative Staff

Title	Surname	Position	Based at	Gender	Race
Ms.	Davies	Research Manager	SU	♀	W
Ms.	Mahood	Principal Technical Officer: Outreach	SU	♀	W
Mr.	Vhengani	Principal Technical Officer: Database	SU	♂	B
Ms.	Kritzinger-Klopper	Senior Technical Officer	SU	♀	W
Ms.	Nortje	Technical Officer	SU	♀	W
Ms.	Rambau	Administrative Officer	SU	♀	B
Ms.	Garthwaite	Director's PA	SU	♀	W
Ms.	Kruger	Outreach Officer/Dept.	SU	♀	B
Ms.	Joubert	Contract Administrative Officer	SU	♀	W

OUTPUTS

Books / Chapters in Books

- Hänel, C., Chown, S.L. & Gaston, K.J. 2005. *Gough Island. A Natural History*. African Sun Media, Stellenbosch, 169 pp, ISBN 1-920109-03-X.
- Rejmánek, M., Richardson, D.M., Higgins, S.I., Pitcairn, M.J. & Grotkopp, E. 2005. Ecology of invasive plants – state of the art. In: *Invasive alien species: A new synthesis*. H.A. Mooney, R.N. Mack, J.A. Mc Neely, L. Neville, P.J. Schei & J. Waage, eds. Island Press, Washington, D.C., pp. 104-161.
- Richardson, D.M. & Petit, R. 2005. Pines as invasive aliens: Outlook on transgenic pine plantations in the Southern Hemisphere. In: *Landscapes, genomics and transgenic conifers*. C.G. Williams, ed. Springer, Dordrecht., pp. 169-188.
- Zermoglia, M.F., van Jaarsveld, A.S., Reid, W.V. & Romm, J. 2005. The multiscale approach. In: *Ecosystems and Human Well-being: Multiscale Assessments*. Island Press, Washington, USA. Capistrano, D., Samper, C.S., Lee, M.J. & C. Raudsepp-Hearne, eds. Chapter 4, pp. 61-83.

Articles in peer reviewed journals

- Balmford, A., Bunnell, L., ten Brink, B., Cooper, D., Côté, I.M., Crane, P., Dobson, A., Dudley, N., Dutton, I., Green, R.E., Gregory, R.D., Harrison, J., Kennedy, E.T., Kremen, C., Leader-Williams, N., Lovejoy, T.E., Mace, G., May, R., Mayaux, P., Morling, P., Phillips, J., Redford, K., Ricketts, T.H., Rodriguez, J.P., Sanjayan, M., Schei, P.J., van Jaarsveld, A.S. & Walther, B.A. 2005. The Convention on Biological Diversity's 2010 target. *Science* **307**, 212-213.
- Bomhard, B., Richardson, D.M., Donaldson, J.S., Hughes, G.O., Midgley, G.F., Raimondo, T., Rebelo, A.G., Rouget, M. & Thuiller, W. 2005. Potential impacts of future land use and climate change on the Red List status of the Proteaceae in the Cape Floristic Region, South Africa. *Global Change Biology* **11**, 1452-1468.
- Cassey, P., Blackburn, T.M., Duncan, R.P. & Chown, S.L. 2005. Concerning invasive species: Reply to Brown and Sax. *Austral Ecology* **30**, 475-480.
- Chown, S.L., Hull, B. & K.J. Gaston. 2005. Human impacts, energy availability, and invasion across Southern Ocean Islands. *Global Ecology and Biogeography* **14**, 521-528.
- Cilliers, C.D., Botha, A., Esler, K.J. & Boucher, C. 2005. Effects of alien plant management, fire and soil chemistry on soil microbial populations in the Table Mountain National Park, South Africa. *South African Journal of Botany* **712**, 211-220.
- Dumalisile, L., Somers, M.J. Walters, M & Nel, J.A.J. 2005. Tourists' willingness to pay to view otters along the Wild Coast, South Africa: a potential for increased ecotourism. *The Journal for Transdisciplinary Studies in Southern Africa* **1**, 97-106.
- Frenot, Y., Chown, S.L., Whinam, J., Selkirk, P.M., Convey, P., Skotnici, M. & Bergstrom, D.M. 2005. Biological invasions in the Antarctic: extent, impacts and implications. *Biological Reviews* **80**, 45-72.
- Galatowitsch, S.M. & Richardson, D.M. 2005. Riparian scrub recovery after clearing of invasive alien trees in headwater streams of the Western Cape, South Africa. *Biological Conservation* **122**, 509-521.
- Gaston, K.J. & Chown, S.L. 2005. Neutrality and the niche. *Functional Ecology* **19**, 1-6.
- Greve, M., Gremmen, N.J.M., Gaston, K.J. & Chown, S.L. 2005. Nestedness of Southern Ocean island biotas: Ecological perspectives on a biogeographic conundrum. *Journal of Biogeography* **32**, 155-168.
- Grobler, J.P., Pretorius, D.M., Botha, K., Kotze, A., Hallerman, E.M. & van Vuuren, J.B. 2005. An exploratory analysis of geographic genetic variation in southern African nyala (*Tragelaphus angasii*). *Mammalian Biology* **70**, 291-299.
- Holmes P.M., Richardson D.M., Esler K.J., Witkowski E.T.F. & Fourie S. 2005. A decision-making framework for restoring riparian zones degraded by invasive alien plants in South Africa. *South African Journal of Science* **101**, 553-564.
- Klok, C.J. & Chown, S.L. 2005. Temperature- and body mass-related variation in cyclic gas exchange characteristics and metabolic rate of seven weevil species: broader implications. *Journal of Insect Physiology* **51**, 789-801.

- McGeoch, M.A. & Pringle, K.L. 2005. Science and advocacy: the GM debate in South Africa. *South African Journal of Science* **101**, 7-9.
- Parr, C.L., Sinclair, B.J., Andersen, A.N., Gaston, K.J. & Chown, S.L. 2005. Constraint and competition in assemblages: a cross-continental and modelling approach for ants. *American Naturalist* **165**, 481-494.
- Procheş, S., Wilson, J.R.U. Veldtman, R., Kalwij, J.M., Richardson, D.M. & Chown, S.L. 2005. Landscape corridors: possible dangers? *Science* **310**, 781-782.
- Richardson, D.M., Rouget, M., Ralston, S.J., Cowling, R.M., van Rensburg, B.J. & Thuiller, W. 2005. Species richness of alien plants in South Africa: environmental correlates and the relationship with indigenous plant species richness. *EcoScience* **12**, 391-402.
- Richardson, D.M., 2005. Diversity, distributions and conservation biogeography. *Diversity and distributions* **11**, 1-2.
- Robinson, T., Griffiths, C.L., Tonin, T., Bloomer, P. & Hare, M.P. 2005 Naturalised populations of Pacific oysters *Crassostrea gigas* in South Africa; distribution, abundance and population structure. *Journal of Shellfish Research* **24**, 443-450.
- Robinson, T., Griffiths, C.L. McQuaid, C.D. & Ruis, M. 2005. Marine alien species of South Africa – status and impacts. *African Journal of Marine Science* **27**, 297-306.
- Robinson, T. B., Griffiths, C.L., Tonin, A., Bloomer, P. & Hare, M.P. 2005. Naturalized populations of oysters, *Crassostrea gigas* in South Africa: distribution, abundance and population structure. *Journal of Shellfish Research* **24**, 443–450.
- Sinclair, B.J. & Chown, S.L. 2005. Climatic variability and hemispheric differences in insect cold tolerance: support from Southern Africa. *Functional Ecology* **19**, 214-221.
- Slabber, S. & Chown, S.L. 2005. Differential responses of thermal tolerance to acclimation in the sub-Antarctic rove beetle *Halmaeus atriceps*. *Physiological Entomology* **30**, 195-204.
- Terblanche, J.S.T., Klok, C.J. & Chown, S.L. 2005. Temperature-dependence of metabolic rate in *Glossina morsitans morsitans* (Diptera, Glossinidae) does not vary with gender, age, feeding, pregnancy or acclimation. *Journal of Insect Physiology* **51**, 861-870.
- Terblanche, J.S., Tolley, K.A., Fahlman, A., Myburgh, K.H. & Jackson, S. 2005. The acute hypoxic ventilatory response: Testing the adaptive significance in human populations. *Comparative Biochemistry and Physiology, Part A* **140**, 349– 362.
- Thuiller, W., Richardson, D.M., Pyšek, P., Midgley, G.F., Hughes, G. & Rouget, M. 2005. Niche-based modelling as a tool for predicting the risk of alien plant invasions at a global scale. *Global Change Biology* **11**, 2234-2250.
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- Zapata, F., Gaston, K.J. & Chown, S.L. 2005. The mid-domain effect revisited. *American Naturalist* **166**, E144-E148.

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- McGeoch, M.A. 2005. Insects and bioindication: theory and progress. In: *Proceedings of the Royal Entomological Society International Symposium on Insect Conservation Biology*. Sussex, U.K. 12-14 September, p. 18.
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Peuplements Végétaux et Bioagresseurs en Milieu Tropical, CIRAD, La Réunion. Baret, S., Rouget, M., Nanni, I. & T. Le Bourgeois, eds. P. 28.

Products / Artifacts / Patents

Centre for Invasion Biology. 2005. Biodiversity Indicator Development Plan. Submitted to the Global Invasive Species Programme, December 2005.

Centre for Invasion Biology. 2005. Prince Edward Islands Environmental Management Plan Version 0.1. Submitted to the Department of Environmental Affairs and Tourism, Directorate Antarctica and Islands in draft form, December 2005.

Conferences / meetings attended

Plenary/Keynote Presentations

International

Chown, S.L. Biodiversity: Antarctic moves in life's grand game. *Plenary address on behalf of the Scientific Committee on Antarctic Research, to King Carl XVI Gustav of Sweden and to the delegates at the XXVIII Meeting of the Antarctic Treaty Consultative Parties, Stockholm, Sweden, June 2005.*

Griffiths, C.L. Getting to grips with Africa's unexplored marine biodiversity. *Invited oral address at the Dynamic Planet Conference, Cairns Australia, September 2005*

Richardson, D.M. Human impacts in pine forests – past, present, and future. *Opening keynote address at the 3rd International Conference on Conservation, regeneration, and restoration of Mediterranean pines and their ecosystems (MEDPINE 3), Bari, Italy. September 2005.*

Richardson, D.M. Practical biogeography ... towards making invasion ecology understandable for managers and legislators. Some examples from South Africa. *Invited keynote address at 8th International Conference on Ecology and Management of Alien Plant Invasions (EMAPI8), Katowice, Poland. September 2005.*

Richardson, D.M. Setting priorities for invasive alien plant management in South Africa. *Invited oral address at the International Conference and Workshop on Invasive plants in the mediterranean-type regions of the world, Montpellier, France. May 2005.*

National

Chown, S.L. Biodiversity responses to climate change on Southern Ocean islands. *Invited speaker at the National Climate Change Conference - Climate Action Now, Midrand, October 2005.*

Griffiths C.L. Marine invasive aliens in South Africa – current status and impacts. *Invited keynote address at the Joint conference of the Entomological Society of Southern Africa and the Zoological Society of Southern Africa, Grahamstown, July 2005.*

Richardson, D.M. Towards a risk assessment framework for invasive alien species for South Africa. *Invited keynote address at the Joint conference of the Entomological Society of Southern Africa and the Zoological Society of Southern Africa, Grahamstown, July 2005.*

Van Jaarsveld, A. The State of Global Biodiversity: feedback from the Millennium Ecosystem Assessment. *Plenary address at 32nd Conference of the Zoological Society of Southern Africa, Grahamstown, July 2005.*

Oral presentations

International

McGeoch, M.A., Veldtman, R. & Hui, C. The contribution of spatially explicit analysis to understanding aggregation and density dependence. *Joint Ecological Society of America 90th Annual Meeting and IX International Congress of Ecology, Montreal, Canada, August 2005.*

Richardson, D.M. Determinants of plant distribution: Evidence from alien invasions - A southern perspective. *Invited oral address at the Joint Ecological Society of America 90th Annual Meeting and IX International Congress of Ecology, Montreal, Canada, August 2005.*

Richardson, D.M., Rouget, M., Ralston, S.J., Cowling, R.M., van Rensburg, B.J. & Thuiller, W. Human demographics, biodiversity and future of conservation areas in South Africa. *XIX Annual Meeting of the Society for Conservation Biology, Brasilia, Brazil, July 2005.*

Richardson, D.M., Rouget, M., Ralston, S.J., Cowling, R.M., van Rensburg, B.J. & Thuiller, W. Species richness of alien plants in South Africa: environmental correlates and the relationship with

indigenous plant species richness. *Ecological Society of Australia Annual Meeting, Brisbane, Australia, November 2005.*

Robinson T.B., Griffiths C.L., Govender A. & Branch G.M. Harvesting the alien mussel *Mytilus galloprovincialis* in South Africa. *Fourth International Bioinvasions Conference, New Zealand, September 2005.*

National

Botes, A., McGeoch, M.A., Roberston, H.G. & Chown, S.L. Species richness across an altitudinal gradient: ants and beetles in the Cape Floristic Region. *32nd Conference of the Zoological Society of Southern Africa, Grahamstown, July 2005.*

Chown, S.L. Hemispheric asymmetries in biodiversity – a serious matter for ecology. *32nd Conference of the Zoological Society of Southern Africa, Grahamstown, July 2005.*

Coetzee, B.W.T., Robertson, M.P. & van Rensburg, B.J. Silver wattle (*Acacia dealbata*) alters arthropod assemblages in the Sani Pass region of the Drakensberg. *32nd Conference of the Zoological Society of Southern Africa, Grahamstown, July 2005.*

Deere, J., Marshall, D.J. & Chown, S.L. Testing the beneficial acclimation hypothesis: mite locomotion. *32nd Conference of the Zoological Society of Southern Africa, Grahamstown, July 2005.*

Gouws, E.J., Botes, A. & Chown, S.L. Altitudinal body size gradients in widely distributed carabid and tenebrionid beetles. *32nd Conference of the Zoological Society of Southern Africa, Grahamstown, July 2005.*

Griffiths, C. L. Marine aliens and their management. *Best practices workshop for the development of Biodiversity Act Regulations for alien and invasive species in South Africa. Kirstenbosch, May 2005.*

Gusset, M., Slotow, R. & Somers, M.J. The behaviour-management interface in the re-introduction of African wild dogs (*Lycaon pictus*). *32nd Conference of the Zoological Society of Southern Africa, Grahamstown, July 2005.*

Holmes, P., Esler, K.J., Richardson, D.M. & Fourie, S. Targets for ecosystem repair in fynbos riparian vegetation. *Fynbos Forum, Port Elizabeth, August 2005.*

Irlich, U.M., Davies, R.G., Gaston, K.J. & Chown, S.L. Latitudinal gradient in seabird species richness. *32nd Conference of the Zoological Society of Southern Africa, Grahamstown, July 2005.*

Midoko-Iponga, D., Milton, S. J. and Richardson, D. M. Invasive potential of the Peruvian pepper tree (*Schinus molle*) in South Africa. *Arid Zone Forum, Barrydale, September 2005.*

Muhl, S., Esler, K.J. & Milton, S. Grass invasion in Renosterveld: Influence of adjacent landuse on soil variable gradients. *Fynbos Forum, Port Elizabeth, August 2005.*

Myburgh, M., Daniels, S.R. & Jansen van Vuuren, B. Comparative phylogeography of invasive and endemic springtails on Marion Island. *32nd Conference of the Zoological Society of Southern Africa, Grahamstown, July 2005.*

Neethling, K., Esler, K.J. & Midgley, G. The effect of soil type and climate on the growth and survival of *A. saligna* and *A. cyclops* seedlings on a mountain gradient in Villiersdorp, South Africa. *Fynbos Forum, Port Elizabeth, August 2005.*

Robinson, T.B., Branch, G.M. and Griffiths, C.L. Harvesting of the alien mussel *Mytilus galloprovincialis*: effects on natural populations. *12th South African Marine Science Symposium, Durban, July 2005.*

Szykman, M., Monfort, S., Wildt, D. & Somers, M.J. Conservation endocrinology of African wild dogs. *32nd Conference of the Zoological Society of Southern Africa, Grahamstown, July 2005.*

Tolley, K.A. & Chown, S.L. A plague of reed frogs: do genetic patterns show a recent extra-limital range expansion for *Hyperolius marmoratus*? *32nd Conference of the Zoological Society of Southern Africa, Grahamstown, July 2005.*

Van der Merwe, J., van Rensburg, B.J. & Robertson, M.P. The impact of silver wattle (*Acacia dealbata*) on small mammal assemblages in the Sani Pass region of the Drakensberg. *32nd Conference of the Zoological Society of Southern Africa, Grahamstown, July 2005.*

Poster presentations

International

Myburgh, M., Daniels, S.R. & Jansen van Vuuren, B. Comparative phylogeography of invasive and endemic springtails on Marion Island. *American Genetics Association – Conservation Genetics Conference, California, USA, September 2005.*

National

- Abraham, S. & Somers, M.J. Size variation in three species of aphids on the Sub-Antarctic Marion Island. *32nd Conference of the Zoological Society of Southern Africa, Grahamstown, July 2005.*
- Dumalisile, L., Somers, M.J., Walters, M. & Nel, J.A.J. Tourists' willingness to pay to view otters along the Wild Coast, South Africa: a potential for increased ecotourism. *32nd Conference of the Zoological Society of Southern Africa, Grahamstown, July 2005.*
- Kieck, M.A., Pearson, A., Cook, P., Snyman, D. and Milton, S.J. 2005. poster Post Mining Recovery of Succulent Karoo Strandveld Biodiversity. *Arid Zone Forum, Barrydale, September 2005.*
- Mgobozi, M.P., Somers, M.J. & Walters, M. Diversity and abundance of ground-dwelling spiders in selected habitats in Dwesa Nature Reserve, South Africa. *32nd Conference of the Zoological Society of Southern Africa, Grahamstown, July 2005.*
- Netshilaphala, N.M. & McGeoch, M.A. 2005. Invasive plant species impacts on Marion Island. *32nd Conference of the Zoological Society of Southern Africa, Grahamstown, July 2005.*
- Van der Westhuizen, R. & van Rensburg, B.J. Species richness of alien plants across protected areas in northern KwaZulu-Natal, South Africa: environmental and anthropogenic correlates. *32nd Conference of the Zoological Society of Southern Africa, Grahamstown, July 2005.*

Conferences / meetings hosted

- Antarctic Conservation in the 21st Century. International Workshop on conservation best practise as applied to Antarctica. Stellenbosch, May 2005.
- The Prince Islands Book Workshop. International workshop for the development and revision of a volume on the Prince Edward Islands. Stellenbosch, March 2005.
- Centre for Invasion Biology Core Team Members' Workshop. Stellenbosch, June 2005.
- Centre for Invasion Biology Annual Research Meeting. Stellenbosch, November 2005.

Other relevant outputs

Popular articles and talks

Articles

- Griffiths, C.L. & Griffiths, R.J. 2005. Changing ocean wildlife. *Envirokids* **26** (3), 6-7
- Griffiths, C.L. 2005. Ocean winners and losers. *Envirokids* **26** (3), 8-9.
- Marr, S., Swart, E. & Woodford, D. 2005. On the brink of extinction – can we stop the freshwater fish decline? *African Wildlife* **59** (4), 38-41.
- McGeoch, M.A. 2005. Backing the GMO horse: what are the odds? *Quest: Magazine of the South African Academy of Science* **1** (4), 40-41.
- Sessions, L. A. & Johnson, S. D. 2005. The flower and the fly. *Natural History* **114**, 58-63.

Talks

- Chown, S.L. Biodiversity: Antarctic moves in life's grand game. *C-I-B Popular Lecture Series, Stellenbosch, June 2005.*
- Esler, K.J. Experiences of an established researcher. *Invited talk to Prontac/Predac group, Kleinmond. January 2005.*
- Esler, K.J. Interrogating gradients from sub-continental to site-specific scales: have southern African studies yielded answers to global change challenges? *Invited seminar in Department of Botany & Zoology, University of Cape Town, Cape Town, South Africa. November 2005.*
- Esler, K.J. Roles of a female academic. *Invited talk to Stellenbosch University Women's Forum. July 2005.*
- Esler, K.J. Sun, salsa and scenery: a sabbatical in Mexico. *Invited talk to Paarl Rotary Club. May 2005.*
- Netshilaphala, N. Why I chose Entomology. *Talk presented at South African Women in Science and Engineering (SA-WISE) Symposium: A celebration of Women in Science and Engineering, Iziko Museum, Cape Town. August 2005.*
- Richardson, D.M. Pines – a model group for unlocking the secrets of alien plant invasions. *Professorial inaugural lecture, Stellenbosch University, October 2005.*

NRF Service Provision

Rating and project proposal reviews: 18

Panel and committee service

- Advisory Panel Inland Systems (Milton)
- Advisory Panel meeting for the Biology and Conservation of Inland Species (McGeoch)
- Chair of the South African National Committee for SCAR (Chown)

NRF URDP Niche Area research team for the Natural Resource Ecology, Utilization and Management
WSU research Niche Area (Somers).

Media Interactions

Newspaper Articles

- Bonthuys, J. 2005. Eikestad is nou Blommestad. Die Burger. October 2005.
Bonthuys, J. 2005. Ruspers kry "warmwatersak" op Marion-Eiland. Die Burger. September 2005.
Chown, S.L. 2005. Letter to the SA Gardening Magazine. SA Gardening. December 2005.
Duvenage, E. 2005. Book on Gough Island launched at US. District Post. October 2005.
Duvenage, E. 2005. Chown first South African to lead important Antarctic Treaty committee. South African Wildlife Management Newsletter. October 2005.
Environmental Writer. 2005. Marion Island warms to alien species (quotes by Chown, S.L. from the National Climate Change conference held in Midrand). Cape Argus. October 2005..
Gewin, Virginia. 2005. Eco-defence against invasions (quotes given by Chown, S.L and Richardson, D.M.). PLoS Biology. December 2005.
Joubert, L. 2005. Action needed for invasive wasps. WineLand. April 2005.
Mahood, K. 2005. South African Centre of Excellence a welcome threat to invasive species. Aliens (Invasive Species Specialist Group).
Pepler, D. 2005. Vyandige inval. Insig Magazine. April 2005.
Yeld, J. 2005. Pupil's project puts ants in their pants. Cape Argus. December 2005.

Articles published by Stellenbosch University

- Chown, S.L. 2005. Albatrosses are thermal ecosystem engineers that keep caterpillars warm. Stellenbosch University News. September 2005.
Duvenage, E. 2005. Chown first from SA to lead Antarctic Treaty committee. Kampusnuus. September 2005.
Duvenage, E. 2005. Chown first from SA to lead important Antarctic Treaty committee. Stellenbosch University News. September 2005.
Duvenage, E. 2005. Chown first from SA to lead Antarctic Treaty committee. Kampusnuus. September 2005.
University of Stellenbosch Media Office. 2005. Chown chosen as board member of conservation bodies. Stellenbosch University News. April 2005.
University of Stellenbosch Media Office. 2005. Chown tells Swedish King about Antarctic Biodiversity. Stellenbosch University News. June 2005.
University of Stellenbosch Media Office. 2005. Maties helps with new names for Marion Island map. Stellenbosch University News. June 2005.
University of Stellenbosch Media Office. 2005. Chown sit vele stoele vol. Matieland Magazine. November 2005.
University of Stellenbosch Media Office. 2005. Maties helps with new names on Marion Island. Matieland Magazine. November 2005.
University of Stellenbosch Media Office. 2005. Goud vir Dekaan. Matieland Magazine. November 2005.
University of Stellenbosch Media Office. 2005. Groundbreaking book looks at conserving those little creatures. Kampusnuus. May 2005.

Electronic sources

- Barker, M. 2005. Monitoring ants leads to big changes for South African students. University of Sheffield website. www.sheffield.ac.uk/mediacentre/20052005/12/14 December 2005.
Chown, S.L. 2005. Albatrosses are thermal ecosystem engineers that keep caterpillars warm. Science in Africa. www.scienceinAfrica.co.za/2005/november/albatross.htm November 2005.
Unknown. 2005. 8 June: His Majesty the King visiting the ATCM. Antarctic Conference website. www.sweden.gov.se/sb/d/5430 June 2005.

Radio and Television

- Chown, S.L. 2005. Interview on Radio Sweden concerning Biodiversity and its Conservation in the Antarctic, June 2005.
Chown, S.L. 2005. Interview on SABC Radio Sonder Grense, ID (for teenagers) concerning the Invasive Alien Species, November 2005.

Mahood, K. 2005. CIB and the National Environmental Management: Biodiversity Act. Interview on SABC Radio, SAfm Cape to Midnight, with John Richards. May 2005.

Mahood, K and Kruger, N. 2005. Imbovane project in the Western Cape. Interview and talk show on SABC Radio, SAfm Cape to Midnight, with John Richards and Lynette Francis. November 2005.

All of the episodes of the TV Programme 'Groen' acknowledge the fact that the main host, Dave Pepler, is a member of the Centre for Invasion Biology.

STAGE PROGRESS

This section gives information to the Board that will enable them to decide whether the CoE has made sufficient progress to pass from Stage 2 (Storming) into Stage 3 (Norming).

Timeframes:

- Two CoE Advisory Board (virtual or real) meetings should take place during this Stage: Typically during March and October 2005.
Response: Completed.

Activities related to the Current Stage:

- The CoE should have initiated many, if not most, of its intended research themes / strategies / projects by the end of this stage.
Response: The majority are underway. Long-term impacts work yet to be established.
- The CoE shall provide to the NRF a list of students that are being supported by the Centre by March 2005. Additional students can be appended to this list as and when they arrive.
Response: Completed – provisional list sent in March and final list in July.
- The CoE shall make available to the NRF, on a quarterly basis (March, June, September and December), current “nuggets” of information for publication on the CoE website.
Response: Nuggets sent more frequently than requested.

Financial responsibilities:

- The CoE shall present an audited set of financial statements at the February / March 2005 Advisory Board meeting reflecting the financial situation of the CoE during the previous financial year (inception to December 2004).
Response: Complied.
- The CoE shall submit monthly cash-flow statements within 15 days of the end of each calendar month, indicating expenditure and commitments. done, except for Dec 05, which was submitted on 15 Feb 06 owing to SU financial year end
Response: Complied.

Reports due in this Stage:

- The CoE shall submit an Annual Progress Report including Gate Review Documentation by no later than March 2006 to be reviewed by the CoE Advisory Board.
Response: Complied.
- The CoE shall submit a Statement of Compliance by no later than March 2006 referring to stage 2.
Response: Currently serving.

Standard Output Targets per annum in the Current Stage:

- Total number of students supported ≥ 40 . **19 completed, 2 withdrawn, 19 continuing.**
- Woman students $\geq 50\%$ of all students. **22F:18M.**
- Black students $\geq 50\%$ of all students. **18B:22W.**
- Number of social science students ≥ 1 . **None.**

- Average duration of submitted Master degrees (post Honours) ≤ 2.5 years. **N/a.**
- Average duration of submitted PhD degrees (post Masters) ≤ 3.5 years. **N/a.**
- Average duration of submitted PhD degrees (upgraded from Masters) ≤ 5 years. **N/a.**
- Post-doctoral researcher ≥ 10% of all students. **Yes.**
- Core team members undertaking at least one scientific review per annum on behalf of the NRF = 100%. **Yes.**
- Number of patents ≥ 0. **None.**
- Number of the peer reviewed publications ≥ 20. **30.**
- Number of the peer reviewed publications ≥ 1 with an impact rating of ≥ 15. **2.**
- Number of the peer reviewed publications ≥ 5 with an impact rating of ≥ 3.5. **7.**
- Number of national conference presentations ≥ 30. **27.**
- Number of international conference presentation ≥ 8. **11.**
- Number of joint venture student training initiatives ≥ 5. **12.**
- Number of local conferences organized ≥ 1. **ESSA/ZSSA Day.**
- Number of international conferences organized ≥ 1. **SCAR workshop; PEI book workshop.**

Special Output Targets for the Current Stage:

- Fine tuned strategy to increase research and other output from the key performance areas.
Response: Submitted in 2006 strategic plan.
- At least one full CoE team activity to further encourage team spirit.
Response: Annual Research Meeting.
- The CoE shall begin to report on activities initiated under the auspices of the CoE, as opposed to the outputs inherited by the CoE from previous initiatives.
Response: Complied.
- The CoE shall demonstrate a sound working relationship between the CoE host institution and the satellite institutions.
Response: Overall yes, but room for improvement.
- Increase of core team membership to include at least two members from designated groups (as part of long term output goal of five career academics).
Response: Complied.
- Participation in regulations development for Biodiversity Act.
Response: In many ways, and this is ongoing.

Long Term Outputs:

- Develop at least five career academics from designated (formerly disadvantaged) groups. Carried over from SLA 1.
Response: Several steps have been taken to do so, including appointment to core team and the deployment of assistance and financing.

FINANCES

Please attach audited financial records as described in the MoU (balance sheet, income and expenditure statement, cash flow statement and notes).

A note to the auditors: please confirm in your audit that all expenditure has been recorded by the CoE and that it is in compliance with the financial policies of the host institution and with the MoU between the NRF and the host institution, including all its attachments.

DST / NRF CENTRE OF EXCELLENCE FOR INVASION BIOLOGY

INCOME STATEMENT FOR THE YEAR ENDED 31 DECEMBER 2005

	Notes	2005 R	2004 R
INCOME		5 184 843.76	3 106 293.23
Exchange rate gain		71.65	-
Interest received		172 416.31	27 834.67
NRF grant		4 261 455.00	2 997 000.00
Other income		750 900.80	81 458.56
EXPENDITURE		4 757 621.46	571 922.15
Operational expenses		3 247 093.83	518 449.50
Audit fees - current year		22 000.00	-
- previous year		15 048.00	-
Consumables		19 875.74	6 109.09
Copying and stationery		38 025.08	11 321.96
Depreciation		132 301.90	2 738.70
Entertainment		31 890.66	14 523.50
Interest paid		36.28	-
Levies		2 584.89	-
Marketing		2 618.81	60 871.77
Medical expenses		506.20	-
Membership and affiliation fees		1 005.00	-
Non-capitalised books		1 814.80	589.90
Small capital works: not capitalised		29 981.85	18 117.16
Postage, telephone and fax		36 354.40	5 165.13
Research costs		3 189.66	-
Rent paid for facilities		2 300.00	4 259.45
Repairs		11 531.63	750.00
Software and internet		19 633.28	110.00
Sundry expenses		48 445.17	169.00
Team member research costs		2 551 036.67	319 000.00
Transport and accommodation		276 913.81	74 723.84
Personnel expenses		1 510 527.63	53 472.65
Salaries and wages	5	1 510 527.63	53 472.65
NET SURPLUS FOR THE YEAR		427 222.30	2 534 371.08

DST / NRF CENTRE OF EXCELLENCE FOR INVASION BIOLOGY

BALANCE SHEET AT 31 DECEMBER 2005

	Notes	2005 R	2004 R
ASSETS			
NON-CURRENT ASSETS			
		996 279.14	125 680.24
Property, plant and equipment	2	996 279.14	125 680.24
CURRENT ASSETS			
		2 120 485.63	2 409 290.77
Receivables		84 253.98	-
Stellenbosch University	3	2 036 231.65	2 409 290.77
TOTAL ASSETS		3 116 764.77	2 534 971.01
EQUITY AND LIABILITIES			
CAPITAL AND RESERVES			
		2 961 593.38	2 534 371.08
Accumulated funds		2 961 593.38	2 534 371.08
CURRENT LIABILITIES			
		155 171.39	599.93
Trade and other payables	4	155 171.39	599.93
TOTAL FUNDS AND LIABILITIES		3 116 764.77	2 534 971.01

DST / NRF CENTRE OF EXCELLENCE FOR INVASION BIOLOGY

STATEMENT OF CHANGES IN EQUITY FOR THE YEAR ENDED 31 DECEMBER 2005

	2005	2004
	R	R
ACCUMULATED FUNDS		
At the beginning of the year	2 534 371.08	-
Net surplus for the year	427 222.30	2 534 371.08
At the end of the year	<u>2 961 593.38</u>	<u>2 534 371.08</u>

DST / NRF CENTRE OF EXCELLENCE FOR INVASION BIOLOGY

CASH FLOW STATEMENT FOR THE YEAR ENDED 31 DECEMBER 2005

	2005	2004
	R	R
CASH FLOW FROM OPERATING ACTIVITIES		
Net surplus for the year	427 222.30	2 534 371.08
Adjustment for:		
Interest received	(172 416.31)	(27 834.67)
Interest paid	36.28	-
Exchange rate gain	(71.65)	-
Depreciation	132 301.90	2 738.70
Operating profit before working capital adjustments	<u>387 072.52</u>	<u>2 509 275.11</u>
Working capital adjustments	70 389.13	599.93
Increase in receivables	<u>(84 253.98)</u>	<u>-</u>
Increase in trade and other payables	<u>154 643.11</u>	<u>599.93</u>
Cash generated from operations	457 461.65	2 509 875.04
Interest received	172 416.31	27 834.67
Interest paid	(36.28)	-
NET CASH FLOW FROM OPERATING ACTIVITIES	<u><u>629 841.68</u></u>	<u><u>2 537 709.71</u></u>
CASH FLOW FROM INVESTMENT ACTIVITIES		
Equipment purchased	(1 002 900.80)	(128 418.94)
Increase in amount owed by Stellenbosch University	373 059.12	(2 409 290.77)
NET CASH FLOW FROM INVESTMENT ACTIVITIES	<u><u>(629 841.68)</u></u>	<u><u>(2 537 709.71)</u></u>
NET INCREASE IN CASH AND CASH EQUIVALENTS	-	-
CASH AND CASH EQUIVALENTS AT THE BEGINNING OF THE YEAR	<u>-</u>	<u>-</u>
CASH AND CASH EQUIVALENTS AT THE END OF THE YEAR	<u><u>-</u></u>	<u><u>-</u></u>

DST / NRF CENTRE OF EXCELLENCE FOR INVASION BIOLOGY

NOTES TO THE ANNUAL FINANCIAL STATEMENTS FOR THE YEAR ENDED 31 DECEMBER 2005

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 (2004: 20% per year on the straight-line method);

Office equipment at 10% per year on the straight-line method (2004: 20% per year on the straight-line method);

Computers at 33.3% per year on the straight-line method (2004: 33.3% per year on the straight-line method);

Vehicles at 25% per year on the straight-line method, with a 40% residual value (2004: 20% per year on the straight-line method with no residual value).

During the year, the organisation adjusted the expected life of its assets to reflect more reasonable carrying values of assets in the financial statements. Refer to note 2 for the effect of the change in estimate.

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 NRF grant, the contribution from the Vice-chancellor: 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-chancellor: 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.

COMPARATIVE FIGURES

DST / NRF CENTRE OF EXCELLENCE FOR INVASION BIOLOGY**NOTES TO THE ANNUAL FINANCIAL STATEMENTS FOR THE YEAR ENDED 31 DECEMBER 2005 (continued)****1. ACCOUNTING POLICY (continued)**

STANDARDS, INTERPRETATIONS AND ADJUSTMENTS TO PUBLISHED STANDARDS NOT YET EFFECTIVE

Certain new accounting standards, amendments and IFRIC interpretations have been published that are mandatory for accounting periods beginning on or after 1 January 2006 or later periods but which the centre has not early adopted. Management is of opinion that these changes will not have a material impact on the financial statements of the centre in the following year.

IAS 01 (Amendment) - Presentation of Financial Statements: Capital Disclosures
 IAS 19 (Amendment) - Employee Benefits
 IAS 21 (Amendment) - Net Investment in a Foreign Operation
 IAS 39 (Amendment) - Cash Flow Hedge Accounting of Forecast Intragroup Transactions
 IAS 39 (Amendment) - The Fair Value Option
 IAS 39 and IFRS 4 Amendments - Financial Guarantee Contracts
 IFRIC 4 - Determining whether an Arrangement contains a Lease
 IFRIC 5 - Rights to Interests arising from Decommissioning, Restoration and Environmental Rehabilitation Funds
 IFRIC 6 - Liabilities arising from Participating in a Specific Market — Waste Electrical and Electronic Equipment
 IFRIC 7 - Applying the Restatement Approach under IAS 29 Financial Reporting in Hyperinflationary Economies
 IFRIC 8 - Scope of IFRS 2
 IFRIC 9 - Reassessment of Embedded derivatives
 IFRS 1 (Amendment) - First-time Adoption of International Financial Reporting Standards
 IFRS 6 - Exploration for and Evaluation of Mineral Resources
 IFRS 6 (Amendment) - Exploration for and Evaluation of Mineral Resources
 IFRS 7 - Financial Instruments: Disclosures
 AC 503 – Accounting for Black Economic Empowerment (“BEE”) transactions

2. CHANGE IN ACCOUNTING ESTIMATE

During the 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 is as follows:

	2005	2004
	R	
Increase/(decrease) in depreciation		
- Office equipment	(22 409.60)	129.89
- Vehicles	(34 655.51)	-
	<u>(57 065.11)</u>	<u>129.89</u>

3. CHANGE IN ACCOUNTING POLICY

During the year the centre decided to, 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", an change in accounting policy was applied retrospectively.

The effect of the change in accounting policy is as follows:

2005	2004
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	2005	2004
	R	R
4 EQUIPMENT		
Carrying amount at the beginning of the year	125 680.24	-
Cost	128 418.94	-
Accumulated depreciation	(2 738.70)	-
Additions during the year	1 002 900.80	128 418.94
Depreciation for the year	(132 301.90)	(2 738.70)
Carrying amount at the end 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)

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.

4. TRADE AND OTHER PAYABLES

Leave pay provision	43 212.55	299.98
Other creditors	89 958.84	299.95
Provision for audit fees	22 000.00	-
	<u>155 171.39</u>	<u>599.93</u>

6. PERSONNEL EXPENSES

Salaries	1 510 527.63	53 472.65
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NOTES TO THE ANNUAL FINANCIAL STATEMENTS FOR THE YEAR ENDED 31 DECEMBER 2005 (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 2005 and 2004 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 %	Interest-bearing R	Interest free R	Total R
31 December 2005				
<i>Financial assets</i>				
Receivables		-	84 253.98	84 253.98
Stellenbosch University	5.70	2 036 231.65	-	2 036 231.65
		<u>2 036 231.65</u>	<u>84 253.98</u>	<u>2 120 485.63</u>
<i>Financial liabilities</i>				
Trade and other payables	-	-	(155 171.39)	(155 171.39)
Net financial assets/(liabilities)		<u>2 036 231.65</u>	<u>(70 917.41)</u>	<u>1 965 314.24</u>
31 December 2004				
Financial assets		2 409 290.77	-	2 409 290.77
Financial liabilities		-	(599.93)	(599.93)
Net financial assets/(liabilities)		<u>2 409 290.77</u>	<u>(599.93)</u>	<u>2 408 690.84</u>

CONCLUSION

Although the C·I·B is now fully functional and productive, there is still some way to go before the full portfolio of the Centre is well-balanced and performing at levels that would be considered optimal. Key challenges remain the attraction of HDI students to the Centre, elevation of research output in high quality outlets, and the achievement of a balance between service provision more broadly, and research production and human capacity development.