PLANT CONSERVATION UNIT

SELF REVIEW PORTFOLIO

FIVE YEAR RESEARCH REVIEW

2005-2010

UNIVERSITY OF

CAPE TOWN

E OF CONTENTS

1. INTRODUCTION

1.1 Background to the review 3

1.2 Historical overview of the PCU 3

1.3 Vision and mission of the PCU 4

1.4 Personnel 5

1.5 Governance 8

1.6 Infrastructure and facilities 8

2. RESEARCH

2.1 Research programmes 9

2.1.1 Land use and sustainable development 10

2.1.2 Applied palaeoecology & ecosystem change 11

2.1.3 Environmental history 13

2.1.4 Disturbance and restoration ecology 14

2.1.5 Plant use 14

2.1.6 Invasive plant ecology 15

2.1.6 Biodiversity research and conservation planning 15

2.2 Future research directions within the PCU 15

2.3 Research output 16

2.4 Research partners 20

2.5 Research and service to society 21

2.5.1 The scientific community 21

2.5.2 Industry and government 22

2.5.3 Civil society 23

3. DEVELOPING CAPACITY IN PLANT CONSERVATION RESEARCH

3.1 Undergraduate and postgraduate teaching 24

3.2 Research culture, mentorship and support 24

4. FUNDING

4.1 For the period 2005-2010 25

APPENDIX 1. Publications of the students and staff of the Plant Conservation Unit for the period 2005-2010. 28

INTRODUCTION

1.1 Background to the review

This review process is a way for the University of Cape Town to evaluate the quality of the research activities undertaken by its research groupings such as the Plant Conservation Unit. It enables the university to assess the extent to which it is promoting research-oriented scholarship and teaching, building research capacity and producing research of an international standard. It further assesses the extent to which research influences the teaching and learning activities of the university.

This is the fourth time since 1992 that the Plant Conservation Unit (PCU) has been reviewed and covers the six-year period 2005-2010. As part of the process, the PCU is required to submit a self-review portfolio (SRP) which is evaluated by a panel of senior academics and UCT research administrators. Two external reviewers together with the Deputy Vice-Chancellor (Research and Innovation), the Dean of the Faculty of Science and the Head of the Botany Department and UCT administrative staff from the University Research Committee (URC) make up the panel. The review panel will evaluate the SRP on 8 August 2011 when it will listen to a presentation by the Director of the PCU. The panel will then draft a summary of its findings within four weeks. The DVC will then submit a report to the Dean of the Faculty of Science before it is tabled before the URC who will then advise the Director of the PCU of the outcome of the review. A summary of the results will be included in the Annual Research Report to UCT's Senate and Council.

Information derived from the Plant Conservation Units Annual reviews (see http://www.pcu.uct.ac.za) has been used in preparing this SRP. These Annual Reviews together with the website provide considerable additional information about the PCU.

1.2 Historical overview of the PCU

Leslie Hill endowed a Chair of Plant Conservation to the University of Cape Town in mid-1991 and the position was filled by Richard Cowling in March 1992. To provide impetus and a corporate identity to the Chair of Plant Conservation, Richard created the Institute for Plant Conservation in July 1993 and served as its Director until his departure from the University at the end of May 2000. The IPC's Deputy Director, David Richardson, served as the Acting Director of the Institute until the appointment of Timm Hoffman to the Leslie Hill Chair of Plant Conservation on 1 April 2001. Dave Richardson resigned from the University at the end of 2004 and his position was filled by Lindsey Gillson in April 2006.

The name of the PCU has changed twice since its inception as the Institute for Plant Conservation in 1993. In 2002 it was changed to the Leslie Hill Institute for Plant Conservation and to the Plant Conservation Unit in 2006. This last decision was taken in response to a recommendation by the University Research Committee that in terms of the nomenclatural criteria for institutions, centres and units the grouping should more

appropriately be called a 'Unit' because of our focussed research mandate and small complement of full time academic staff.

1.3 Vision and mission of the PCU

The terms of the endowment require that the Chair of Plant Conservation "…devote particular attention to the conservation of the flora elements in the Cape Province with particular emphasis placed on the Western, South Western and Southern Cape and the Karoo regions." To give effect to these requirements the vision and mission statements of the PCU as stipulated in the Unit's Strategic Plan for the period 2006-2011 are as follows:

The Vision for the Plant Conservation Unit is to be a world-class, African-centred research and post-graduate training institute for plant conservation that improves the conservation status of the flora of the succulent karoo and fynbos biomes of South Africa and thereby contributes to the quality of life of the people living there.

The Mission of the Plant Conservation Unit is to develop human and institutional capacity through the pursuit of scientific knowledge about the biological functioning of and pressures facing the vegetation of the succulent karoo and fynbos biomes of South Africa so that people are able to make sound management decisions for the sustainable use, conservation and restoration of this unique asset.

The University of Cape Town (UCT) functions on the twin principles of excellence and transformation. This is evident in the Research Strategy, which aims to give substance to the vision of UCT as a *research-led* University. The research s**t**rategy is derived from the University's high-level performance objectives, which are as follows:

Objective 1: Internationalising UCT with an Afropolitan Niche
Objective 2: Transformation of UCT towards non-racialism
Objective 3: Working towards a desired size and shape for UCT
Objective 4: A vision for the development of Research at UCT: greater impact, greater engagement
Objective 5: Enhancing the quality and profile of UCTs graduating class
Objective 6: Expanding and Enhancing UCT's contribution to South Africa's development challenges

The PCU contributes to these objectives through our commitment to UCT's policy of equity and redress. We recruit excellent South African students where possible, and preferentially from elsewhere on the African continent where no such candidates apply. Further, our team includes overseas students and research associates, who contribute to internationalising the research environment of the PCU. We aim to produce excellent graduate students, quality publications, and high-level participation in international conferences and research consortia.

For full details of UCT's research strategy see:

https://www.uct.ac.za/usr/researchoffice/info/policies/UCT_Strategic_Plan_2010_2014.DOC

1.4 Personnel

Staff and student complement of the PCU: 2005-2010

The position and period of tenure of PCU staff and students for the period 2005-2010 are shown in Table 1 below. The PCU's permanent staff complement is comprised of two academic staff, one administrative staff member and one research assistant. Following Dave Richardson's resignation from UCT, effective from the 1st January 2005, the PCU comprised of only one academic staff member until April 2006 when Lindsey Gillson was appointed. Mandy Sauls, the PCU Administrator, resigned in June 2009 and was replaced by Anthea Stain in January 2010. Jacobus Claassen was appointed as a permanent staff member in 2009 as a research assistant in the village of Paulshoek, Namaqualand.

Table 1. Personnel complement of the PCU (including permanent staff, contract staff, research associates and students) for the period 2005-2010.

Name	Period	Position/ Research Programme Affiliation
Permanent Staff		
Hoffman T.	April 2001-present	Director
Gillson L.	April 2006-present	Deputy-Director
Sauls M.	Jun 2001-Jul 2009	Administrative Assistant
Stain A.	Jan 2010-present	Administrative Assistant
Claassen JJ	Jan 2009-present	Research Assistant
Contract Staff		
Arthur M.	2006-2009	Land use and sustainable development
Blanchard R.	2009-2010	Environmental history
Botha S.	2007-2009	Restoration ecology
Boyce A.	2005-2007	Land use and sustainable development
Carrick P.	2006-2009	Restoration ecology
Claassen JJ.	2006-2008	Land use and sustainable development
Cloete A.	2003-2008	Land use and sustainable development
Davids L.	2007-2010	Environmental history
Kruger R.	2007-2010	Restoration ecology
Lot J.	2005-2009	Land use and sustainable development
O'Farrell P.	2006	Environmental history
Price P.	2007-2008	Land use and sustainable development
Sauls S.	2004-2005	Environmental history
Todd S.	2005-2008	Land use and sustainable development
Waldeck D.	2005-2007	Land use and sustainable development

Research Associates

Carrick P.	2010-present	Restoration ecology
Desmet P.	2005-2006	Conservation Planning
Holmes P.	2005-2008	Invasive plant ecology
Rohde R.	2001-present	Environmental history

Sabbatical, post-doc and visiting staff

Chisholm R.	2007-2009	Princeton University
Gallo J.	2007	Conservation Planning
Krug R.	2007-2008	Environmental history

PhD students

Anderson P.	2002-2008	Land use and sustainable development
Collville J.F.	2000-2009	Biodiversity research
Dabengwa A.	2011-present	Palaeoecology
Foxcroft L.	2004-2007	Invasive plant ecology
Macpherson J.	2010-present	Palaeoecology
Manuel T.	2000-2006	Conservation planning
Masubelele M.	2009-present	Environmental history
Naidoo M.	2006-2009	Land use and sustainable development
O'Farrell P.	2002-2005	Land use and sustainable development
Puttick J.	2010-present	Environmental history
Samuels I.	2006-present	Land use and sustainable development
Shiponeni N.	2004-2007	Land use and sustainable development
Swart E.	2006-present	Environmental history
Von Hase A.	2006-2009	Conservation planning
Wheat N.	2009-present	Plant use
Worth Z.	2004-2009	Plant use

MSc (Dissertation)

Ballantyne F.	2006-2010	Palaeoecology
Blanchard R.	2006-2008	Invasive plant ecology
Bonora D.	2007-2009	Environmental history
Erasmus E.	2004-2009	Land use and sustainable development
Forbes C.	2011-present	Palaeoecology
Jack S.	2008-present	Environmental history
Kinyanjui R.	2009-present	Palaeoecology
Louw R.	2003-2006	Plant use
Nicolson G.	2008-2010	Biodiversity research
Nongwe N.	2006-2008	Land use and sustainable development
Quick L.	2007-2009	Palaeoecology
Powell R.	2011-present	Environmental history
Wigley B.	2006-2007	Global change

MSc (Course work and mini-dissertation)

De Abreu P	2010-2011	Restoration ecology
Humphrey G	2007-2008	Landscape ecology
Mader A.	2004-2005	Land use and sustainable development
Puttick J.	2007-2008	Environmental history
Marx D	2010-2011	Restoration ecology
Rahlao S.	2004-2005	Environmental history
Wistebaar N.	2007-2008	Land use and sustainable development

BSc (Hons)

Bonora D.	2006	Environmental history
Fordyce N.	2010	Palaeoecology
Gallaher K.	2010	Palaeoecology
Ghaui M	2010	Palaeoecology
Ingram S	2011	Palaeoecology
Jack S.	2006	Environmental history
Kruger L.	2006	Plant use
Madden C.	2008	Land use and sustainable development
Potts A.	2006	Plant use/Systematics
Mendel L.	2009	Palaeoecology
Price L.	2005	Land use and sustainable development
Ragaller S.	2009	Plant use
Soares M.	2007	Land use and sustainable development
Szoke T.	2006	Land use and sustainable development
Thomas A.	2007	Palaeoecology
Zaloumis N.	2009	Restoration ecology

NRF Rating of scientists at the PCU

Only the permanent academic members of staff are rated by the NRF. The definitions for each NRF rating category described below are taken from http://www.nrf.ac.za/evaluation/Content/Facts/Ratings.aspx where further sub-category details can be found.

Timm Hoffman's NRF rating went from a C2 to a C1 rating in August 2008 when he was rated for the second time. This defines him as an "*Established Researcher*" with "*a sustained record of productivity in the field who is recognised by his peers as having produced a body of quality work, the core of which has coherence and attests to ongoing engagement with the field (*and as having) *demonstrated the ability to conceptualise problems and apply research methods to investigating them*."

Lindsey Gillson received the prestigious NRF Presidents Award (P-rating) when she was rated for the first time in 2008. This recognizes Lindsey as someone with the "*…potential of coming a future international leader in her field on the basis of exceptional research performance and output from their doctoral and/or early post-doctoral research careers.*" Only 16 young scientists currently hold this award in South Africa and only three in the Plant Sciences list of researchers.

1.5 Governance

The PCU's Strategic Plan for the period 2007-2011 (see http://www.pcu.uct.ac.za) outlines the governance structures of the Unit as follows:

The PCU is situated in the Department of Botany. The key management components affecting the unit are the Head of the Botany Department (HoD) and the Director of the PCU (Leslie Hill Professor of Plant Conservation). The primary functions of the Director are:

- Provide leadership and support for all programmes carried out by the unit;
- Be responsible to the HoD (Botany) for the implementation of the PCU Strategic Plan;
- Keep the HoD informed on all activities within the PCU especially those that might influence the attainment of its Mission;
- Establish and maintain mutually beneficial relationships with government departments, organisations, institutes and individuals that may affect the PCU;
- Identify and develop sources of funds required for carrying out the PCU's programmes;
- Represent the PCU in the national and international community;
- Ensure that the PCU Strategic Plan is reviewed regularly and amended as changing conditions require.

Job descriptions for other PCU staff are developed internally and performance is evaluated on a regular basis according to University protocols.

The staff of the PCU meet on a regular basis to discuss matters of governance and strategic planning as it affects the unit. The PCU also tables a written report at monthly Botany Department detailing our activities in the following key areas: Staff, students and visitors, Research (Outputs, Activities and Funding), Teaching and Social Responsiveness and Outreach.

1.6 Infrastructure and facilities

The Plant Conservation Unit is situated within the Botany Department in the H.W. Pearson Building on University Avenue (Upper Campus). It occupies 300 m^2 of floor space and is comprised of an entrance foyer, 7 offices, a computer room and a large open plan conference room (with printer, drawing table, conference table, bench space, map cabinet, projection screen and kitchen facilities). In addition, a palaeoecology Lab has recently been completed, that enables extraction of fossil pollen to take place within the PCU. The laboratory is equipped with an HF-safe fume hood, centrifuge and water purifying system, and constitutes a significant enhancement to the PCU's infrastructure and ability to train postgraduate students in laboratory techniques.

The computer room contains five, recently-purchased computers which are linked via UCT's network to a laserjet printer in the conference room as well as to the University's library and internet facilities. A scanner is also available in the computer room. Standard Microsoft Windows software is supported by the University of Cape Town and the PCU has paid for licenses for additional specialist software such as ArcViewGIS, Statistica, PC-ORD, Adobe Photoshop CS4, etc.

The PCU maintains a research house in the village of Paulshoek where Timm Hoffman is a 'registered occupier' in terms of the conditions set out by the Kamiesberg Municipality. The house is used by students when carrying out their field work in and around the village commons.

A loan agreement with the Mazda Wildlife Vehicle Fund has provided PCU staff and students with an excellent means of transport in the field. The 4x4 double cab vehicle is the third we have received since 2000 and provides a secure and safe means of accessing our research sites.

2 RESEARCH

2.1 Research programmes

While there is some overlap with the period from 2001-2004, the PCU's main research programmes and their leader(s) for the period 2005-2010 can be grouped as follows:

- Land use and sustainable development (Timm Hoffman)
- Applied palaeoecology and ecosystem change (Lindsey Gillson)
- Environmental history (Timm Hoffman)
- Disturbance and restoration ecology (Peter Carrick)
- Plant use (Timm Hoffman and David Gammon)
- Invasive plant ecology (Dave Richardson)
- Conservation planning and biodiversity research (Richard Cowling, Timm Hoffman, Lindsey Gillson)

The research activities within each programme are managed on a project-by-project basis according to the university requirements as well as the requirements of individual donors. Although programme leaders are listed separately above, in reality there is considerable shared responsibility and collaborative interaction between Timm Hoffman and Lindsey Gillson in the course of their programme activities and student supervision.

Table 2. Outline of the main research programmes within the Plant Conservation Unit showing the number of postgraduate theses completed and peer-reviewed publications produced within each programme between 2005-2010.

Programme	No. Honours/ MSc/ PhD theses	No. peer-reviewed articles
Land use and sustainable development	4 / 4 / 3	32
Applied palaeoecology and ecosystem change	6 / 2 / 3	21
Environmental history	4 / 5 / 0	14
Disturbance and restoration ecology	1 / 2 / 0	5
Plant use	0 / 1 / 0	1
Invasive plant ecology	0 / 1 / 1	16
Conservation planning and biodiversity research	0 / 1 / 3	4
Total	**15 / 16 / 10**	**93**

2.1.1 Land use and sustainable development

While the biodiversity of the succulent karoo biome has been relatively well-studied, little is known of the impact of different land use practices on the species and ecosystem services of the region. This programme is comprised of several diverse projects concerned with the dynamics and processes characterizing the succulent karoo. Much of the activity is centred on the broader Namaqualand region with a significant focus on the Kamiesberg and the village of Paulshoek where research first began in 1995. Several long-term data sets have been maintained over the period including detailed records of rainfall, plant phenology, livestock and crop production. The site is visited monthly and several people from the village have been employed over this period to maintain the datasets. Numerous Honours, MSc and PhD-level studies have been undertaken in the village. A number of studies have also been started in Paulshoek and have then broadened out to investigate land use and sustainability of relevance to the wider Kamiesberg and Namaqualand region. Because of our long-term involvement in Paulshoek we have developed productive collaborative relationships with colleagues in other departments at UCT including Applied Maths, Chemistry and Anthropology. The development of a livestock production model for the region has been an especially fruitful collaboration with several publications in national and international journals.

A number of international programmes have funded our research activities in Namaqualand including two EU-funded projects (Maposda/WADE) and the very successful BIOTA project which ran for nine years in the region. BIOTA built on our background and expertise in Paulshoek to establish two long-term observatories in the area. Our expertise in Namaqualand also resulted in a Special Issue of the Journal of Arid Environments in 2007 and was determined in part on a collaborative relationship we had established between ourselves and colleagues from the ARC and UWC. It also provided

the platform for the publication of a 3-volume synthesis of BIOTA's long-term programme in the western part of southern Africa.

While there has been considerable focus on Namaqualand we have also worked in parts of the Little Karoo including on a private nature reserve called Sanbona. Our focus in this area has been on land degradation and the impact of indigenous wildlife species, including elephants, on the vegetation of the Little Karoo.

Future directions

All of the large, well-funded programmes in the Namaqualand region (e.g. SKEP, BIOTA) have now either come to an end or have been scaled down. We continue looking for additional funds to support our efforts in Namaqualand and maintain our long-term data sets in Paulshoek through PCU savings and URC/NRF contributions. A number of long-term data sets still need to be analysed and written up and postgraduate theses completed. This has been a productive programme for the PCU and we will keep this disciplinary and geographical focus in the next five years. It is especially useful in our teaching courses to be able to draw on South African studies and 'real world' examples to illustrate issues of sustainability and land degradation. Paulshoek is also an excellent location for post-graduate students to learn about some of the complexities around social-ecological systems and how to investigate some of the problems concerned with resource exploitation, land degradation and poverty.

2.1.2 Applied Palaeoecology and Ecosystem Change

Many ecological processes take place on decadal to centennial time-scales but long-term data are often lacking. Palaeoecological techniques can be used to reconstruct vegetation and environmental change, providing insights into how present day landscapes developed and how they were impacted by climate change and land-use in the past. Using a range of palaeoenvironmental proxies, vegetation change (fossil pollen), fire history (charcoal abundance), climate change (diatoms), nitrogen availability (stable nitrogen isotopes) and herbivory (fungal spores) can be reconstructed, enabling an analysis of the interactions between vegetation and various environmental drivers. These reconstructions have an important role to play in understanding and managing today's landscapes. For example, studying vegetation change during the Mediaeval Warm Period, approximately one thousand years ago, may give clues as to how ecosystems will respond to today's warming climate, with the potential to facilitate accurate modelling and prediction of future ecosystem change. Similarly, knowing the effect of major changes in anthropogenic impact (for example the arrival of pastoralists, the beginning of iron-age technology and the impact of European settlers), can help in establishing baseline conditions and restoration targets. Many landscapes, for example, may have been cleared of trees in the past and are now recovering, whereas others are undergoing unprecedented tree and shrub encroachment; distinguishing these two scenarios is essential in establishing realistic conservation goals. Furthermore, while global environmental drivers like CO_2 enrichment, increasing temperatures and anthropogenic nitrogen deposition can not be controlled at national – local levels, other factors like herbivory and fire can be manipulated. By studying the interaction between vegetation, fire and herbivory in the

past, it may be possible to guide management interventions that will mitigate the effects of global change on biodiversity and ecosystem services. Another important theme in this programme is the detection of threshold behaviour in ecosystems i.e. points of rapid transition between two alternative stable states. By identifying such transitions in the past and understanding what drove them, we may be in a better position to predict dramatic ecosystem reorganisation in the future.

Since 2005, there have been several projects exploring these themes, focussing on savannas initially but broadening to include the Cape Floristic Regions from 2006 onwards. The Kruger Environments Programme comprised a team of palaeoecological researchers (Lindsey Gillson, Anneli Ekblom, Kristina Duffin and Eleanor Breman) working in the Kruger Park, Greater Limpopo Park to the east and at the savanna – grassland ecotone to the west. Anneli Ekblom compared ecosystem dynamics across the Kruger-Limpopo region and found that different vegetation types varied in resilience, depending on the local hydrology and connectivity to major river systems. Kristina Duffin, contributed to papers that explored the role of palaeoecological data in establishing management benchmarks, known as Thresholds of Potential Concern. Eleanor Breman studied ecosystem shifts at the savanna-grassland ecotone, and identified thresholds at which forest fragments disappeared from the landscapes; she found that the resilience of forest patches was greater at higher altitudes. In the Hluhluwe-Imfolozi Game Reserve, KZN, Lindsey Gillson, Kirsten Gallaher, and Nick Fordyce used a range of proxies to reconstruct vegetation change and environmental history.

Malika Virah-Sawmy explored the palaeo-history of littoral forest fragments in Madagascar, and concluded that, contrary to current thinking, the littoral forest had always been fragmented, and that open Uapaca woodland and a heathland matrix were also ancient features of the landscape. Further, she found evidence of fires in Uapaca woodland long before the arrival of humans, suggesting that fire is a natural part of the complex mosaic in which the littoral forest persists.

Fiona Ballantyne conducted her MSc research in the Cederberg Wilderness area, where she studied vegetation changes on an abandoned farmland. She found that land that had once been ploughed supported a much higher grassy component, and that this change appeared to be hysteretic (irreversible).

Future Directions

From 2010 onwards, a major focus of the applied palaeoecology theme is the ACDI funded “Benchmarks for the Future.” project. Palaeoecological research associated with this project includes James MacPherson’s PhD research on the dynamics of the Fynbos-Renosterveld-Succulent Karoo ecotone, Abraham Dabengwa’s PhD project focussing on the eastern part of the aridity gradient, and Cherie Forbes MSc on the history of Renosterveld in the Swartland.

2.1.3 Environmental history

Most of our understanding of environmental change has been developed from relatively short-term studies over a few years or decades. The historical period, which covers the last 350 years, has been relatively poorly studied in South Africa, particularly in terms of the extent, nature and rate of change in the major biomes of the region. This programme, which focuses on the last 100 years uses repeat ground and aerial photography as well archival records and data to understand environmental change in southern Africa. These techniques are usually coupled with intensive ecological studies at a location so as to more accurately interpret the nature and drivers of change. Our research within this programme has covered a wide geographic area including Namibia, Namaqualand and the Northern Cape, Western Cape, Eastern Cape and KwaZulu-Natal. We have established more than 750 repeat photo stations across these areas with well-curated, hard copy and digital archives of these sites. Repeat photography is a relatively young approach to studying change and we have contributed to the development of methodological advances in the discipline through the publication of several book chapters on the theme. A major focus of this programme is the establishment of a digital archive of historical ground photography. Over the last five years we have scanned over 10,000 historical landscape images dating from 1876 to the 1980s. These images are derived from the photographic collections of people such as Pole Evans, Marloth, Levyns, Acocks, Edwards and Moll amongst others.

In addition to our focus on landscape change we have also documented the extent and nature of change in populations of iconic climate change indicator species such as *Aloe dichotoma*, *A. pillansii* and *Widdringtonia cedarbergensis*. Several post graduate students are currently exploring the long-term dynamics of populations of these species over historical time frames. Much of this research addresses climate change issues and we have published a few long-term climate data sets which focus on changes in drought, evaporation and wind over the 20th century. This work has important implications for regional GCM projections and has initiated several collaborative, cross-disciplinary efforts which we hope to pursue in the future.

Future directions

Our research within this programme has been given recent impetus through significant financial support from UCT's ACDI programme. This has enabled us, for the first time, to build a coherent, joint programme linking the Applied Palaecology and Environmental History initiatives. We have assembled a dynamic group of post-graduate students and look forward to the next five years developing some of the key research themes together. We also hope to consolidate our historical photograph database and make it available on the internet for others to use. A number of new slide collections have recently been made available for scanning and funds have been found to include these collections in the expanded data base.

2.1.4 Disturbance and restoration ecology

This programme was conceived and managed primarily by Peter Carrick who established the Namaqualand Restoration Initiative through funding from SKEP, CEPF and the de Beers mining company. The main focus was firstly on developing the intellectual tools for rehabilitating and restoring the degraded mining areas of Namaqualand. A second priority was to establish trained teams of local people who are contracted to the major mining companies in the region to restore disturbed mining areas as part of their commitment to the relevant mining Act. This innovative mix of theory and practice resulted in several publications, two MSc thesis (Lyons and Kruger) and a forthcoming book on 'best practice' for the restoration of previously-mined areas in the region. The NRI has now ended and Peter Carrick has retained his association with UCT through his Honorary Research Associate status. However, he is no longer actively engaged with the day-to-day activities of the PCU.

Included in this programme is our contribution to RENU-KAROO, a restoration initiative led by Sue Milton and Richard Dean from Prince Albert in the southern Karoo. Our contribution has been both financial and academic in that we have supervised a restoration project at the MSc level (Petra de Abreu) in the little Karoo. We have also collaborated with colleagues from the University of KwaZulu-Natal in supervising another MSc student (Dane Marx) with an interest in the restoration of the grassland environments of the Drakensberg communal areas.

2.1.5 Plant use

This programme arose out of an earlier interest to investigate the impact of harvesting on key fynbos and succulent karoo plant species including rooibos tea (*Aspalathus linearis*), buchu (*Agathosma betulina*) and *Aloeferox*. Work on rooibos tea was carried out primarily by Rhoda Louw in collaboration with colleagues from the Environmental Monitoring Group and the Heiveld Co-operative, which is an initiative run by small-scale farmers in the Suid Bokkeveld. The systematists from the Botany department (Alastair Potts) also helped with aspects of this project. The study on buchu was undertaken by Zulaiga Worth with colleagues from UWC (Thembela Kepe) and Amsterdam university (Ton Dietz) with funding from SANPAD. An exploratory study on Aloe ferox was carried out by Catherine Greengrass but not pursued further. All of the industries involved in this work are understandably secretive about their methods, clients and profits. Without a significant investment of time and effort it is difficult to easily find the data necessary for rigorous analysis and publication.

<u>Future directions</u>

This programme has recently received a significant boost through the collaborative work undertaken with David Gammon and Kelly Chibale from UCT's Chemistry department and Leslie Green from Anthropology. One MSc (Amelia Hilgart) and one PhD student (Nicola Wheat) from Chemistry are investigating the chemical constituents of key medicinal plants in the Paulshoek area while an Anthropology PhD student (Joshua

Cohen) is working on the contextual meaning of plant use in Namaqualand. Funding has been provided through the VC's Strategic Fund initiative.

2.1.6 Invasive plant ecology

This programme was run by Dave Richardson during his time at the PCU. The relatively high research output of this programme primarily reflects the work of Llewellyn Foxcroft who graduated with a PhD from UCT in 2007. Since Dave's departure to the Centre for Invasion Biology at Stellenbosch University in 2005 no new projects within this programme have been initiated.

2.1.7 Biodiversity research and conservation planning

Contributions to the programme on biodiversity research is comprised of two main PhD studies led by students (Jonathan Colville and Alan Ellis) with an interest in the biodiversity of plant-insect relationships of the succulent karoo. These projects were initiated in the early 2000s and current PCU staff made little intellectual input. While work on the basic biology of fynbos and succulent karoo plants is to be encouraged this will unlikely be a strong focus of the work of the PCU in the years ahead. There are several excellent research groups working on this theme and we don't feel we can make a significant contribution to the field.

Richard Cowling and his students have led the conservation planning field for more than a decade. Amrei von Hase completed her PhD while under his supervision and is the last of his students to graduate from UCT. Theo Manuel was supervised by Timm Hoffman and might have led more work within this programme if not for his tragic death in 2006. The PCU has funded an annual award in his name which is given out at the Fynbos Forum. Greg Nicolson completed an innovative walk from the Orange River to Cape Town under the supervision of Timm Hoffman. The main idea was to document the extent to which the road reserve of the N7 acted as a repository and conservation corridor for numerous Red listed species of the Cape Floral Region. Although inventive projects like Greg's will be welcome within the PCU's strategic framework, the programme is unlikely, however, to grow significantly in the years ahead.

2.2 Future research directions within the PCU

In the next five years we will consolidate our focus on the impact of climate and land-use on long-term vegetation change. The core of this research theme is already in place, in the form of the ACDI (African Climate and Development Initiative) - funded project entitled "*Benchmarks for the future: Long-term vegetation change along a 1,500 km aridity gradient in South Africa*", which is currently funded until 2013, though we hope to add further postgraduate bursaries as research and funding opportunities emerge.

The main objectives and activities within this programme are:

1. To synthesize the palaeoecological, archaeological and historical literature about the structure, composition and dynamics of pre-colonial, early colonial and 20th century South African environments along an aridity gradient from the savanna biome in the east to the succulent karoo biome in the west.
2. To analyze the patterns and key drivers of change, including climate and land-use impacts, and the relative contributions of each to landscape-level effects.
3. To develop quantitative tools for the analysis of repeat ground and aerial photography.
4. To quantify the extent and nature of vegetation change within and between biomes along an environmental gradient using repeat ground and aerial photography, palaeoecology and long-term ecological monitoring records.
5. To establish a set of well-archived long-term monitoring data (including historical photographs and field-based measurements) to augment the initiatives already underway at the national long-term ecological research facility (SAEON).
6. To examine the implications of the above for South Africa's current conservation, ecosystem management, restoration, climate change, and agricultural policy.

While conducting research around these core objectives, we hope to work towards greater interdisciplinarity by interpreting our research in terms of changing ecosystem services, a concept that will allow us to work with social scientists to interpret the significance of our findings for the conservation and development sectors.

Our future research direction is well-aligned with the South African government's Grand Challenges and specifically their Knowledge Challenge A which is focused on Understanding a Changing Planet. The following Research themes are relevant in this regard: 1.Observation and monitoring, 3.Dynamics of the complex internal earth systems, and 5.Improving model predictions at different scales) B, Reducing the Human Footprint (Research Theme 2: Conserving Biodiversity and Ecosystem Services) and D Innovation for Sustainability (Research Theme 1. Dynamics of transition at different scales - mechanisms of innovation and learning and 5. Social Learning for sustainability, adaptation, innovation).

Our future direction is also in alignment with the current call for innovation for sustainability and with Presidency Outcome 10: Environmental assets and natural resources that are well protected and continually enhanced (http://www.thepresidency.gov.za/dpme/docs/outcome10.pdf).

2.3 Research output

We include in our research output our peer-reviewed papers and book chapters as well as the contributions we have made through special reports and popular articles. Postgraduate training also forms part of the overall research output. In this regard, a reasonable expectation for a research and teaching unit comprised of two permanent

academic staff is in the order of 4-6 high quality, peer-reviewed articles a year (including journal articles, book chapters and conference proceedings) and 2-3 MSc student equivalents graduating each year (where 4 Honours students = 1 MSc, 2 MSc mini-theses = 1 MSc and 1 PhD = 4 MSc graduates). In terms of these criteria, the PCU has produced more than 13 peer-reviewed articles per year and close to 10 MSc equivalents per year since 2005 (i.e. 10 PhD, 11 MSc, 5 mini-MSc and 15 Honours level students). In total this amounts to 93 peer-reviewed articles and 40 graduate students over the period of review; this despite the hiatus created by the departure of David Richardson at the end of 2005. A full list of the unit's publications between the period 2005-2010 is provided in Appendix 1 and is summarised in Table 3 below.

Table 3. Summary of the research outputs of the Plant Conservation Unit for the years 2005-2010.

Category	2005	2006	2007	2008	2009	2010	Total (2005-2010)
Journal articles	8	12	22	14	15	11	81
Edited book/book volume	0	0	0	0	0	2	2
Book chapters	0	2	1	1	0	5	9
Conference proceedings	0	0	0	2	0	0	2
Total peer-reviewed	**8**	**14**	**23**	**17**	**15**	**18**	**94**
Book reviews	2	1	0	0	0	0	2
Professional Reports	4	6	0	1	0	0	11
Popular articles	1	1	7	0	1	0	10
PhD theses	1	1	2	2	3	1	10
MSc theses	0	1	1	3	3	3	11
MSc mini-theses	2	0	0	3	0	0	5
Honours theses	1	5	2	2	2	3	15
Total non-peer-reviewed	**10**	**15**	**12**	**11**	**9**	**7**	**62**
Total scientific output	**18**	**29**	**35**	**28**	**24**	**25**	**158**

The focus over this period has been on the production of good quality, peer-reviewed publications in national and particularly international journals with a high impact factor. A list of the journals in which PCU staff and students have published their research between 2005-2010, with the number of articles published, as well as the impact factor

and accreditation status of each journal, is provided in Table 4. The spread of journal outlets reflects the diverse research interests of the PCU and the range of our activities across rangeland science, landscape ecology, environmental history, palaeoecology and conservation. Research leadership is further demonstrated through the production of Special Issues in peer-reviewed journals. For example, Timm Hoffman co-edited a Special Issue on Namaqualand for the Journal of Arid Environments in 2007. Also in 2007 Lindsey Gillson co-edited a Special Issue on Biodiversity Hotspots Through Time in Philosophical Transactions of the Royal Society (B): Biological Sciences.

Other highlights for the reporting period include the edited BIOTA volume (Jürgens Schmiedel and Hoffman) which brings together the results of nearly a decade of research in the arid western part of southern Africa. Timm Hoffman helped in the development of the overall concept with his German colleagues and also took sole responsibility for the editing of the third volume.

While our non-peer-reviewed contributions (e.g. reports, popular articles) are valued they lie outside of the main research and teaching focus of the PCU. They form part of a consulting and advocacy framework that does not embody the core business of the PCU.

Table 4. A list of the journals and their impact factors in which PCU staff and students published their research between 2005-2010.

JOURNAL	**IMPACT FACTOR**	2005	2006	2007	2008	2009	2010	Total
Africa	0.592				1			1
African Journal of Ecology	0.629		2			1		3
Afr. J. Range & Forage Science	0.353						2	2
African Journal of Zoology	1.108				1			1
Agriculture, Ecosystems & Environ.	3.130			1				1
Arid Land Res & Management	-						1	1
Biodiversity Conservation	2.146			1				1
Biological Conservation	3.498	1			1			2
Conservation Biology	2.146			1				1
Crop Protection	1.517		1					1
Diversity and Distributions	4.224			1				1
Ecological Applications	4.267					1		1
Ecological Modelling	1.769	2						2
Ecological Monographs	5.938					1		1
Ecoscience	1.589	1						1
Ecosystems	3.679					1		1
Environmental Management	2.760				1	1		2
Environmental Science & Policy	2.213		1					1
Evolution	5.429		1					1

Global Change Biology	5.561	1					1	2
Global Ecology and Biogeography	5.193					1		1
Human Ecology	1.923		1					1
Journal of Applied Ecology	4.970		1					1
Journal of Appl.Veg.Science	1.802			1				1
Journal of Arid Environments	1.535			8	1			9
Journal of Biogeography	4.273				1		1	2
Journal of Ecology	5.260		1					1
J.of Plant Diseases and Protection	0.353		1					1
Journal of Zoology	1.787			1				1
Koedoe	0.160					1		1
Landscape Ecology	3.200				1	1	1	3
Nomadic Peoples	-				1			1
Oryx	2.185			1				1
Palaeogeogr. Palaeoclim. Palaeoecol.	2.390						1	1
Phil. Trans.Royal Soc.of London B	2.547			2				2
Plant Ecology	1.880		2					2
Public Understanding of Science	1.981					1		1
Rangelands	1.656				1			1
Science	29.474	1		2				3
Sth .Afr. Geographical Journal	0.207	1				1		2
South African Journal of Botany	1.107			3	2	1	2	8
S. Afr.J. Econ.& Manage.Sci.	0.082			1				1
Sth. Afr. J. Environ. Law & Policy	0.330				1			1
South African Journal of Science	0.670		1			1		2
The Holocene	2.772				1		2	3
Trends in Ecology and Evolution	11.900	1						1
Tropical Grasslands	0.258				1			1
Veg. History & Archaeobotany	1.656					1		1
MEDIAN SCORE & TOTAL	**2.064**	**8**	**12**	**22**	**14**	**15**	**11**	**80**

2.4 Research partners

Research at the PCU draws heavily on an extensive collaborative network at local, national and international levels (Table 5).

Table 5. Main research partners of the PCU between the period 2005-2010.

Level/Institution	Department/Institution	Person(s)
LOCAL		
University of Cape Town	Botany	Jeremy Midgley, William Bond, Mike Cramer, Ed February, Adam West
University of Cape Town	Environmental & Geographical Science	Mike Meadows, Pippin Anderson
University of Cape Town	Chemistry	David Gammon
University of Cape Town	Maths & Applied Maths	David Richardson, Brian Hahn
University of Cape Town	Zoology	Mike Picker
University of Cape Town	Fitzpatrick Institute	Several CB MSc students
University of Cape Town	Geology	John Compton
University of Cape Town	Anthropology	Leslie Green
University of Cape Town	Manuscripts & Archives	Leslie Hart, Paul Weinberg
University of the Western Cape	Programme for Land and Agrarian Studies	Ben Cousins, Rick Rohde, Thembela Kepe
University of Stellenbosch	Botany	Karen Esler
REGIONAL		
Nelson Mandela Metropolitan University	Terrestrial Ecology Research Unit	Richard Cowling
University of KZN	Biology	Dave Ward
Northern Cape Agriculture	Directorate: Nature Conservation	Elsabe Powell
Western Cape Agriculture	Elsenburg	Johan Botha, Nelmarie Saayman
CapeNature	Kamanassie Nature Reserve	Kas Hamman, Elbe Cloete
Garies Municipality	Paulshoek Village	Vonkie Claassen, Johanna Lot
NATIONAL		
Ford Motor Company	Mazda Wildlife Fund	Humphrey le Grice
Agricultural Research Council	Range and Forage Institute	Nicky Allsopp, Igshaan Samuels
Council for Scientific and Industrial Research	Natural Resources section	Brian van Wilgen, Patrick O'Farrell
Sanbona Wildlife Reserve	Research section	Ryno Erasmus
FARM Africa	Kimberly Office	Alistair Bradstock

Department of Water Affairs & Forestry	Working for Water	Christo Marais
South African National Biodiversity Institute	Kirstenbosch Research Centre	John Donaldson, Guy Midgley, Wendy Foden, Mathieu Rouget
South African National Parks	Namaqua National Park, Richtersveld National Park, Kruger National Park	Matthew Norval, Howard Hendricks, Llewellyn Foxcroft, Melodie McGeoch
Department Science & Technology	SAEON	Tim O'Connor, Nicky Allsopp
SRK Consulting	Johannesburg Office	Donald Gibson
INTERNATIONAL		
University of Edinburgh	Centre of African Studies	Rick Rohde
University of Hamburg	Botany	Norbert Juergens, Ute Schmiedel
University of North Wales	Centre for Arid Zone Studies	Gareth Wyn Jones, Einir Young
University of Botswana	Geography	Molele Molele, Raban Chanda
Norwegian University of Life Sciences	Development Studies	Eirin Hongslo, Tor Arve Benjaminsen
University of Uppsala, Sweden	Department of Archaeology and Ancient History	Anneli Ekblöm
University of Amsterdam	Department of Geography	Ton Dietz
University of Oxford	Department of Zoology	Kathy Willis
University of Oxford	Oxford University Centre for the Environment	Richard Ladle
University of York	Environment Department	Rob Marchant
Australian National University	School of Culture, History and Language	Simon Haberle
Kansas State University	Department of Geography	Kendra McLauchlan
Manchester University	School of Environment and Development	Dan Brockington

2.5 Research and service to society

2.5.1 The scientific community

Staff and students of the PCU have contributed extensively to the broader scientific community in the last five years. This takes the form of regular attendance and presentation at conferences, seminars and workshops at both local and international venues. Some of the main local conferences include the Fynbos Forum, Arid Zone Ecology Forum, Savanna Networking Meetings and South African Association of Botanists. Both Lindsey Gillson and Timm Hoffman have been invited keynote speakers at several local and international conferences (see attached CVs) including meetings held

in Germany, Sweden, United Kingdom, U.S.A. Other highlights include the co-organisation of a workshop on Namaqualand held in the region in 2007 which resulted in an edited volume of the Journal of Arid Environments.

Significant contributions have also been made via our involvement in the editorial and peer-reviewed process for national and high-ranking international journals (e.g. Journal of Applied Ecology, Ecological Applications, Journal of Biography, Journal of Vegetation Science). Lindsey Gillson was on the Editorial Board of the journal Landscape Ecology from 2005-2009. Timm Hoffman is on the editorial board of the Pastoralism Journal.

Lindsey Gillson serves on various University Committees, including the Science Faculty Animal Ethics Committee, the Senate Animal Ethics Committee (until 2010), and the Environment and Management Working Group. She is on the Steering Committee for the African Climate and Development Initiative and the Land Cover Change Consortium. She is a member of the Palaeo-neo Ecosystem Network, an international panel hosted in the USA, working at the interface between palaeoecology and ecosystem ecology. Timm Hoffman also serves on several UCT committees including the Institutional Forum and the Science Faculty's Honorary Professor and A/Prof Committee.

Lindsey Gillson and Timm Hoffman have examined nearly 40 MSc and PhD theses over the period of review including PhD theses from Norway and Sweden which required travelling to the host country to examine the student in an oral examination. Timm Hoffman has also served as an external examiner to the Environmental Science Department at Rhodes University and has served on the NRFs Plant Sciences Assessment Panel for the NRF Rating system for 209 and 2011. Both Timm and Lindsey also both regularly review research proposals from local and international funding agencies.

2.5.2 Industry and government

The PCU serves the conservation industry through participation in scientific and civil forums, workshops, committees and direct contact with decision makers at local, provincial and national government levels.

One area where the Institute has made a significant contribution to the conservation industry is via the Leslie Hill Succulent Karoo Trust. This trust is administered by WWF-SA and is dedicated to the development of a network of conservation areas to conserve the diversity of particularly the succulent flora of the region. One of the responsibilities of the person holding the Leslie Hill Chair of Plant Conservation at UCT is to be a Trustee on the LHSKT. This work entails the attendance of Trust meetings (usually three times a year) where strategic decisions are made, together with the leading conservation agencies in the region (e.g. CapeNature, South African National Parks) concerning the identification and possible purchase of key conservation properties. These decisions need to be made in accordance with the best biological information available. The development of an overall strategic plan to guide the LHSKT is one of the tasks of the Leslie Hill Chair of Plant Conservation at UCT. In addition, regional conservation

plans and the review of scoping studies all form part of the work of the Trustee. Visits to assess the value of specific properties also need to be made and attendance at various opening ceremonies, which commemorate and acknowledge the work of the Trust, also form part of the Trustee's duties. The disbursement of significant financial resources to the Trust in 2004 following Mr Hill's death in January 2003 has increased the activities of the LHSKT over the last five years. The focus of the Trust's work remains primarily on the Knersvlakte and the conservation planning studies undertaken by Philip Desmet as part of his PhD thesis still guide the activities of the Trust in this regard.

The PCU is building collaborations with SANParks, specifically Scientific Services, and the Cape Research Centre (CRC). Projects registered with Scientific Services were developed in collaboration with SANParks staff and where possible the results were related to management goals (e.g. see Gillson and Duffin 2007). Melodie McGeoch of CRC is co-supervising a PCU postgraduate project and is involved in the drafting and submission of several major grant proposals including DST Grand Challenge and ACCESS.

2.5.3 Civil Society

Many of our projects bring the PCU into direct contact with civil society. Our work at Paulshoek, for example, includes the employment of a member from the community (Jacobus Claassen) who acts as a research assistant for the land use and sustainable development programme. Through funding from BIOTA and more recently from UCT's medicinal plant programme, a paraecologist from Paulshoek (Mariana Lot) has been employed and is currently supervised by Timm Hoffman. Her role is to assist researchers and post-graduate students who work in the village and surrounding commons and to share with them her knowledge of the area. She has also undertaken a research project of her own which investigates medicinal plant use in the village. During the course of the reporting period community research assistants were also been employed as part of the WADE project and fulfilled a similar role in two additional communities situated along the Buffels River in Namaqualand. The rooibos tea project provided the PCU with the opportunity to contribute to the Heiveld Co-op in the Suid Bokkeveld as well as to the NGO, the Environmental Monitoring Group, which promotes an action research approach to the project. Further involvement with civil society occurred with the SANPAD-funded buchu project where students and staff interacted within several local discussion forums and presented their findings. The PCU is also involved with a local Botany Group serving the interests of the Zandvlei Nature Reserve. Several third year and Honours level projects have been undertaken in and around the reserve.

The PCU has also provided funding to several projects and individuals over the course of the reporting period. These include RENU-KAROO a section-21 company led by Sue Milton and Richard Dean focused on the restoration of degraded Karoo environments of the southern Cape. Funding from the PCU has supported three members of staff from the local Prince Albert community over the period 2007-2011. We have also provided funds for two book projects including a revision of Jack Skead's Historical incidence of Mammals in the Western Cape and Annelise and Jan Vlok's Field guide to the flora of

the Klein Karoo. An amount of R10k has also been provided to a paraecologist (Reginald Christiaan) from the Soebatsfontein community in Namaqualand to enable him to train as an intern with the National Insect Museum in Pretoria.

3 DEVELOPING CAPACITY IN PLANT CONSERVATION RESEARCH

3.1Undergraduate and postgraduate teaching

Lecture loads for Botany Department staff are relatively low and together the two permanent academic staff at the PCU contribute one full teaching load in the Department. Staff and occasionally postgraduate students of the PCU have also taught and lectured on the following courses within UCT's Faculty of Science which includes several courses outside of the Botany Department.

- BIO2000 Applied Ecology
- B2004 Principles of Ecology
- BIO3011 Global Change
- BIO3006 Ecosystem Ecology
- BOT400W: Honours module in Plant Conservation Biology and more recently in Palaeoecology, Landscape Ecology and Environmental History
- EGS3014, Environmental Change: Theory and Practice, (2007 and 2008)
- EGS 4024 / 4027 Honours Climate Variability / Quaternary Palaeoecology
- Zoo 5009W Masters in Conservation Biology
- Stable Isotopes Course, Department of Archaeology.

3.5 Research culture, mentorship and support

1.1 Research culture, mentorship and support

The PCU offers a supportive environment where postgraduates can interact freely and engage in peer learning. We maintain an active and vibrant research culture through two PCU meetings per week, the first is mainly used to catch up on news, and to provide an opportunity for postgraduate students to present their results, practice conference presentations, or discuss the interpretation of data. The second meeting is a journals club, in which all PCU members take turn to present a current relevant paper on the themes of historical ecology, palaeoecology, landscape ecology or conservation. These two formats encourage students to engage actively with the literature, to develop the art of constructive criticism, and to see the wider context and significance of their research, as well as building confidence, encouraging scientific rigour and strengthening presentation skills. We also bring this research culture into our undergraduate teaching and occasionally ask our MSc and PhD students to talk about their research to third year or honours level students.

All Postgraduates sign a Memorandum of Understanding that establishes clearly the responsibilities of supervisors and students. Timm Hoffman and Lindsey Gillson meet

regularly with students and in addition are available for informal meetings on an ad hoc basis. Students are encouraged to regularly produce written work so that writing skills are honed throughout the MSc and PhD process.

We also accompany students into the field where the techniques and practices of the particular task are demonstrated. Where applicable, training in laboratory techniques is provided.

The PCU has a Vula (Sakai) site where relevant papers can be uploaded and discussed via a chatroom. We also have a Twitter account where we post news from various ecological societies, conservation organisations and relevant journals. Informal interactions are facilitated by the availability of our own tearoom and kitchen facilitates, which create a friendly and welcoming environment that encourages discussion. In addition, PCU students are part of the wider Botany Department PG community, through which there are further opportunities to discuss relevant literature, find out about careers in science, and socialise with like-minded people.

Finding adequate financial support for students is an on-going problem. While there appear to be many opportunities for students the bursaries are very competitive. Each application also comes with considerable administrative effort. Fortunately, we have received generous funding in 2010 from UCT's African Climate and Development Initiative (ACDI) which has enabled us to grow the Unit significantly from this time. We hope to build on the successes of our ACDI research and find additional resources for the next five years.

4 FUNDING

4.1 For the period 2005-2010

The Plant Conservation Unit has three investment funds and several project income funds. The investment funds are held in three separate Portfolios (1-3). The main investment fund is the R5 million endowment given to the University of Cape Town by Mr Leslie Hill in 1992 over which the PCU has no involvement or say. This fund is managed by the university's Joint Investment Committee (JIC). The growth and distribution of the Portfolio No. 1 fund is shown below. The value of the capital fund value is no longer made known to the Director. However, disbursements to the PCU from this fund to pay for staff salaries has increased from R394,137 in 2000 to R775,560 in 2010 and R964, 151 in 2011. The relatively large increase in disbursements for 2011 has occurred because of a decision made by the JIC on the cents per unit that are to be paid out against the endowment funds within this particular portfolio.

From 2005 onwards the income from the endowment has been used to pay for the salaries of the Director and the Administrative assistant only. By agreement with the Dean of Science in 2005 (Professor Daya Reddy) and the Head of Botany (Prof Jeremy Midgley) the Deputy Director's salary has been paid from the General Operating Budget (GOB) of

the Faculty since her arrival in April 2006. In exchange, the PCU Director and Deputy Director contribute to the Botany Department through a shared teaching and administrative load. There is now very little gap between the salaries of the Director and the Administrative Assistant and the total amount disbursed to the PCU from the endowment. In fact, for 2011, there is a projected surplus in this total. If there is a continued surplus in the amount disbursed from the endowment to the PCU then further discussion with the HoD and Dean of Science about the use of these funds might be appropriate.

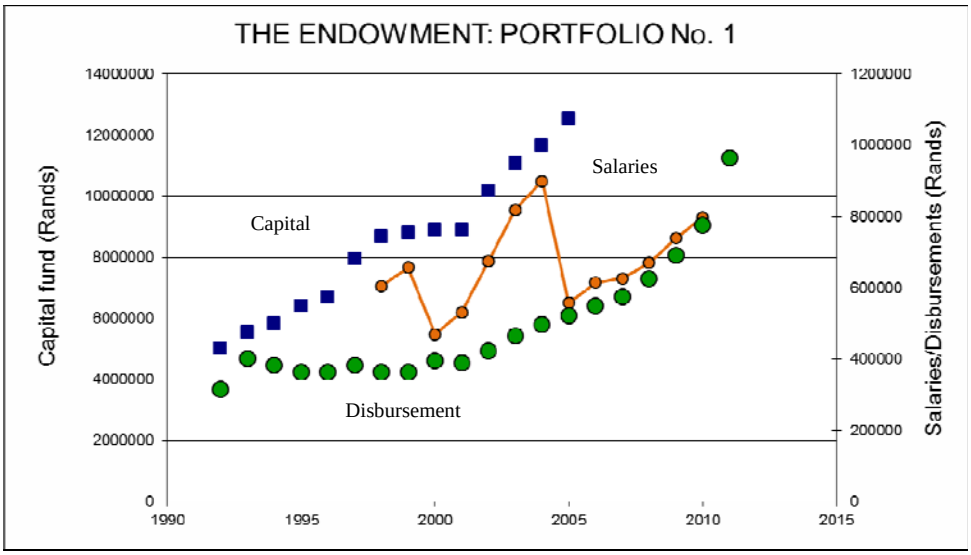

Figure 1. Performance of Portfolio No. 1 since 1992. This reflects the growth and annual disbursements of Mr Leslie Hill's R5 million initial endowment (squares) to UCT for the establishment of a Chair of Plant Conservation as well as the change in the disbursement (circles) and combined salaries of the staff (line) at the Plant Conservation Unit since 1998. A decline in the salary budget in 2000 and 2005 occurred because of staff resignations. From 2006 only the Director and Administrative Officer's salaries have been covered by the disbursements from the endowment and have closely tracked the disbursement amounts.

Two other investment funds (Portfolios No. 2 and No. 3) provide for some of the contract staff, bursary and major capital expenses of the PCU (No. 2) as well as a vehicle replacement fund (No. 3) should we need to replace the Mazda Wildlife Vehicle currently in use. These funds have grown primarily through fees charged to projects using the Mazda Wildlife Vehicle and from consultancies, overhead and salary fees charged to funders for project management. Both of these funds have been used relatively sparing over the reporting period although from 2009 they have been used increasingly for major project and capital expenses such as replacement of computers in the PCU computer lab, bursaries, research assistance, etc. At the end of 2010 the balance in Portfolio No. 2 was R1,216,199 and in Portfolio No. 3 was R499,406.

The bulk of the PCU's income is derived from income funds from project proposals written by permanent and contract staff of the Unit. Most of the contributions are from international sources although the NRF and UCT have made important contributions to some of the programmes over the last five years. A summary of these funds is outlined in Table 6 below.

Table 6. Balance sheet for main income funds at the PCU for the period 2005-2010 and the main research programmes serviced by these funds.

Fund holder	Source	Programme	Income	Expenses	Balance
General	Various	General fund	R1,286,188	R991,960	R294,229
General	Various	Petty cash	R9,359	R2,925	R6,953
General	Various	Scholarships	R486,844	R365,991	R120,853
Hoffman	MAPOSDA	Land use & sustainable dev.	R1,086,420	R952,552	R133,868
Hoffman	WADE	Land use & sustainable dev.	R1,587,894	R1,363,834	R224,060
Hoffman	BIOTA	Environmental history	R1,804,037	R1,810,228	-R6,191
Hoffman	SANPAD	Plant use	R346,663	R231,457	R115,206
Hoffman	WfW	Environmental history	R600,620	R599,464	R1,156
Hoffman	NRF	Rated researcher funding	R79,900	R79,900	0
Hoffman	URC	Environmental history	R161,016	R161,016	0
Hoffman	DS&T	Environmental history	R204,850	R76,177	R128,673
Hoffman	Various	Various	136,348	R63,477	R72,871
Hoffman/ Gillson	ACDI	Environmental history/ Palaeoecology	R556,566	R290,587	R265,979
Gillson	Mellon	Palaeoecology	R290,422	R257,587	R32,931
Gillson	Rufford	Palaeoecology	R69,263	R20,161	R49,102
Gillson	NRF	Palaeoecology	R105,863	R116,949	-R11,086
Gillson	URC	Palaeoecology	R123,007	R61,609	R61,399
Carrick	NRI	Restoration ecology	R3,537,948	R2,219,058	R1,1318,890
Carrick	NRI	Restoration ecology	R 2,117,226	R1,377,020	R740,206
Todd	SKEP	Land use & sustainable dev.	R286,093	R137,887	R148,206
		Total	**R 14,877,047**	**R 11,179,743**	**R3,697,304**

APPENDIX 1. Publications of the staff, research associates and students of the Plant Conservation Unit between 2005-2010. The impact factor (IF) and number of citations (C) as of June 2011 are given after each publication.

Papers in refereed scientific journals

1. Allsopp N, Gaika L, Knight R, Monakisi C and Hoffman MT 2007. The impact of heavy grazing on an ephemeral river system in the succulent karoo, South Africa. *Journal of Arid Environments* 71: 82-96. (IF=1.535; C=2)
2. Anderson PML and Hoffman MT 2007. The impacts of sustained heavy grazing on plant diversity and composition in lowland and upland habitats across the Kamiesberg mountain range in the Succulent Karoo. *Journal of Arid Environments* 70: 686-700. (IF=1.535; C=19)
3. Anderson PML, Hoffman MT and O'Farrell PJ 2010. Above ground perennial plant biomass across an altitudinal and land-use gradient in Namaqualand, South Africa. *South African Journal of Botany* 76: 471-481. (IF=1.107; C=0)
4. Baker LE and Hoffman MT 2006. Managing variability: Herding strategies in communal rangelands of semi-arid Namaqualand, South Africa. *Human Ecology* 34(6): 765-784. (IF=1.923; C=12)
5. Belz RG, Reinhardt CF, Foxcroft LC and Hurle K 2006. Residue allelopathy in *Parthenium hysterophorus* L. – does parthenin play a leading role? *Crop Protection*, 26: 237-245. (IF=1.517; C=27)
6. Blanchard R 2008. Riparian vegetation recovery after invasive alien tree clearance in the Fynbos Biome. South African Journal of Botany 74: 421-431. (IF=1.107; C=9)
7. Bomhard B, Richardson DM, Donaldson JS, Hughes GO, Midgley GF, Raimondo DC, Rebelo AG, Rouget M and 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. (IF= 5.561; C=44)
8. Botha MS, Carrick PJ and Allsopp N 2008. Capturing lessons from land-users to aid the development of ecological restoration guidelines for lowland Namaqualand. *Biological Conservation* 141: 885-895. (IF= 3.498; C=1)
9. Carrick PJ and Kruger R 2007. Restoring degraded landscapes in lowland Namaqualand: Lessons from the mining experience and from regional ecological dynamics. *Journal of Arid Environments* 70: 767–781. (IF=1.535; C=12)
10. Compton JS, Herbert CT, Hoffman MT, Schneider RR and Stuut J-B 2010. A tenfold increase in the Orange River mean Holocene mud flux: implications for soil erosion in South Africa. *The Holocene* 20(1):115-122. (IF=2.772, C=2)
11. Cousins B, Hoffman MT, Allsopp N and Rohde RF 2007. A synthesis of social and biological perspectives on sustainable land use in Namaqualand. *Journal of Arid Environments* 70: 834-846. (IF=1.535; C=7)
12. Duffin K I, Gillson L, and Willis KJ 2008. Testing the sensitivity of charcoal as an indicator of fire events in savanna environments: quantitative predictions of fire proximity, area and intensity. *The Holocene* 18: 279-291. (IF, 2.772; C=18)
13. Duncan JA, Hoffman T, Rohde RF, Powell E and Hendriks HH 2006. Long-term population changes in the Giant Quiver Tree, *Aloe pillansii* in the Richtersveld, South Africa. *Plant Ecology* 185: 73-84. (IF= 1.88; C=0)

14. Ekblom A and Gillson L 2010. Dung fungi as indicators of past herbivore abundance, Kruger and Limpopo National Park. *Palaeogeography, Palaeoclimatology, Palaeoecology* 296, 14-27. (IF= 2.390; C=2)

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