FYNBOS FORUM

Programme

Theme: *A Celebration of our Successes.*

1—3 August 2001
Calitzdorp Spa
Calitzdorp

Organized by the Fynbos Forum Committee.
Funded by the Conservation and Management of Ecosystems and Biodiversity Focus Area of the National Research Foundation

NRF

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COMMITTEE MEMBERS 2000 - 2001

Chairman:	Dr Christo Marais
Vice Chair:	Ms Kristal Maze
Committee:	Mr Mark Botha Dr Charlie Boucher Mr Nicholas Cole Dr Patricia Holmes Dr Dave McDonald Mrs Maryke Middelmann Ms Fatima Parker Dr Annelise Schutte-Vlok Ms Julia Wood
Secretariat:	Ms Wendy Paisley

FYNBOS FORUM MISSION

The Fynbos Forum is an affiliation of researchers, planners, managers, landowners and a range of other stake-holders that meets annually to discuss management issues and research results, and to formulate priorities for future research and conservation management actions required to ensure the conservation and sustainability of Fynbos ecosystems.

In order to achieve this goal, we undertake to assess biological resources, ensure institutional capacity and consider socio-economic issues.

Programme

WEDNESDAY 01 AUGUST 2001

14:00 – 14:30	Registration
14:30	Field Trip
18:00 – 18:10	Welcome – *Christo Marais*
18h10 – 18h30	**Opening Address** Fynbos Parties and Partners: Can we deliver the CAPE's goal - *Trevor Sandwith*
18h30 – 18h40	Briefing session
19:00	Get together and Dinner

THURSDAY 02 AUGUST 2001

7h00 – 8h00	Breakfast
7h45 – 8h15	Late registration

SESSION 1: CELEBRATING SUCCESSES
(Chairperson: Richard Cowling)

8h15 – 8h30	Update from the Table Mountain Fund - *Brett Myrdal*
8h30 – 8h45	Ten glorious years of Protea Atlassing – *Tony Rebelo*
8h45 – 8h50	Poster: Never has so much been achieved by so few with so little – ***Guy Palmer,*** *Helen de Klerk & R de Villiers*
8h50 – 9h05	Dendrochronological research in the Fynbos Biome. How successful have we been? – *Edmund February*
9h05 – 9h20	The journey from benign neglect to a world-class National Park - the trials and tribulations of the conservation on the Cape Peninsula Mountain Chain – *James Jackelman*
9h20 – 9h25	Poster: Cape Flats Flora Core Conservation Sites – *Tania Katzschner*
9h25 – 9h40	Biosphere Reserve : A promise of success - *Ruida Pool*

9h40 – 9h55	Collaborative Conservation Management: Walker Bay Fynbos Conservancy – *Sean Privett*
9h55 – 10h10	Discussion
10h10 – 10h35	**TEA / COFFEE**

SESSION 2: CONSERVATION PLANNING (Chairperson: Kristal Maze)

10h35 – 10h50	The Expert or the Algorithm? – Comparison of Priority Conservation areas identified by park managers and Reserve Selection Software - ***Richard Cowling***, *Bob Pressey, Rebecca Sims-Castley, Ernst Baard, Chris Burgers, Annelise le Roux & Guy Palmer*
10h50 – 11h05	To what extent does the current network of protected areas in the Cape Floristic Region cater for ecological processes? – ***Mathieu Rouget***, *Richard Cowling & David Richardson*
11h05 – 11h20	Identification and prioritization of key Nature Conservation Areas in the City of Cape Town – ***Helen Davies, Dean Ferreira***, *Greg Oelofse & Keith Wiseman*
11h20 – 11h35	Decision-making in the Cape Peninsula National Park. A contextual framework and decision-support tools – *James Jackelman* Internal Operations on Computer
11h35 – 11h50	An action plan for conservation incentives in SA – *Mark Botha*
11h50 – 12h05	Conservation planning challenges: the Cape Lowlands project – *Amrei von Hase*
12h05 – 12h20	Protected Areas – Evaluation techniques for assessing socio-economic values and their impacts for local communities. – ***Goosain Isaacs*** , *Christo Marais, Richard Knight, Irene Hoffmann, David Harpman & Antony Lehman*
12h20 – 12h35	The taming of the GIS – A Tale of Two ITS – ***Richard Knight***, *Lorraine Smit & Barrie Low*
12h35 – 12h50	Discussion
13h00 – 14h00	**LUNCH**

SESSION 3: FYNBOS RESEARCH
(Chairperson - Guy Palmer)

14h00 – 14h15	Mother *PROTEA* swinging her Scepter of Richness in the Fynbos – ***Annelise Schutte-Vlok*** *& Jan Vlok*
14h15 – 14h30	Can pollinator behaviour generate sexual differences between female & male plants in Leucadendron (Proteaceae)? – ***Asa Hemborg*** *and William Bond*
14h30 – 14h45	*Roridula*: still trucking! – *Bruce Anderson*
14h45 – 15h00	The African Restionaceae – an interactive key to the species of African Restionaceae - *H. Peter Linder and* ***Kirsten Freckleton***
15h00 – 15h15	INVITED SPEAKER: Recent advances in the systematics of Hyacinthaceae - *John Manning*
15h15 – 15h30	Effects of landuse on dispersal and germination of *Brunsvigia bosmaniae* (Amaryllidaceae) - *Nathalie Perrot &* ***John Donaldson***
15h30 – 15h45	Will the real Cape Floral Kingdom please stand up: old myths and new perspectives of biodiversity analysis in the Cape flora. - ***Barrie Low****, Richard Knight, & Uschi Pond*
15h45 – 16h00	Phytosociological studies – its role in development - *Kirsten Freckleton & Gavin Hellström*
16h00 – 16h15	30 years of change in the vegetation of the Cape of Good Hope section of the CPNP (1965 - 1995) - *Sean Privett*
16h15 – 16h30	Discussion
16h30 – 17h00	**TEA**
17h05 – 17h55	**ANNUAL GENERAL MEETING**
18h00 – 19h00	**BOPLAAS** **WINE, PORT & GRAPE JUICE TASTING SESSION**
19:00	**SPECIAL DINNER** Dinner Speech: Christo Marais

FRIDAY, 03 AUGUST 2001

07h00 – 08h00 **BREAKFAST**

SESSION 4: POSTER SESSION (8h00 - 8h50)

Rest.

	VENUE 1: CONSERVATION PLANNING (Chairperson - Tony Rebelo)	VENUE 2: AQUATIC SYSTEMS (Chairperson - Julia Wood)
8h00 – 8h05	Eye in the Sky: Monitoring the Hand of Man on the West Coast Lowlands – *Ian Newton*	Freshwater fishes of the Gouritz River System – *Tom J Barry*
8h05 – 8h10	Geology as a surrogate for determining natural vegetation distribution on the West Coast - ***Richard Knight***, *Barrie Low, Grant Benn & Uschi Pond*	The construction of a fish-ladder in the Olifants River, Gouritz River System – ***Tom J Barry*** *& K Coetzee*
8h10 – 8h15	"SaS" – a new management tool and database for species lists from the Cape and Karoo floras – ***Barrie Low***, *Richard Knight & Reuben Roberts*	The effects of *Acacia mearnsii* (black wattle) on Riparian Plant Diversity in the Breede River system – ***Charles Pemberton*** *& Charlie Boucher*
8h15 – 8h20	Analysis of the flora of the Cape Metropolitan Area - ***Barrie Low***, *Richard Knight* & *Uschi Pond*	Synoptic mapping of the water quality in Zandvlei estuary and the accumulation of heavy element pollution in its ecosystems – ***Robert Siebritz,*** *Bongiswa Ndzingani, Joyce Loza, Richard Knight, Hans Aalbers, Lincoln Raitt & Lillburne Cyster*
8h20 – 8h25	A model-based GIS map for the Kouga-Baviaanskloof – ***Doug Euston-Brown***, *Chris Berens, George de Greef & Richard Cowling*	Distribution and abundance of alien vegetation in the Breede River Catchment – assessing the impacts of their removal. ***Joyce Loza*** *& Richard Knight*
8h25 – 8h30	Can all reserves be selected in the same way? The case of the Cape West Coast Biosphere Reserve. ***Iptieshaam Kippie***, *Richard Knight, P Saravanakumar, Barrie Low & Charlie Boucher*	Land-use and amphibian conservation in the Palmiet River Catchment Area, South Africa – *Elaine Thomas, Alan Channing &* ***Richard Knight.***
8h30 – 8h35	Discussion	Rivers running through – ***Barrie Low***, *Uschi Pond, Richard Knight & Ann McGregor*
8h35 – 8h50	Discussion	Discussion

SESSION 5:	**CONSERVATION MANAGEMENT (Chairperson – Mark Botha)**
8h50 – 9h05	INVITED SPEAKER: Bontebok. Icon of West Cape conservation. – *Chris Martens*
9h05 – 9h20	INVITED SPEAKER: Farming with biodiversity - *Neil MacGregor*
9h20 – 9h35	A Case Study: Conservation in the Private Industry – Management approaches of a Private Nature Reserve. – *Jaco Venter*
9h35 – 9h50	Kenilworth Racecourse Conservation Area – Conservation Management issues in a small urban reserve and lessons learnt towards impact assessment. – *Desiree du Preez*
9h50 – 10h05	Discussion
10h05 – 10h30	**TEA**
SESSION 6:	**AQUATIC SYSTEMS: (Chairperson – Claret le Roux)**
10h30 – 10h45	INVITED SPEAKER: Integrating Conservation and Catchment Management with Sustainable Livelihoods: Experiences in the Keurbooms Catchment: - *Pam Booth*
10h45 – 11h00	TMG Aquifer: Brilliant Water Supply Solution OR Conservation Catastrophe of the Millenium – *Wietsche Roets*
11h00 – 11h15	Protecting riverine and wetland buffer zones in the City of Cape Town, Western Cape - ***Julia Wood***, *Cate Brown, Bill Harding, Martin Thompson & Barry Wood*
11h15 – 11h30	Plant water use in the fynbos biome – ***Gcobani Popose*** & *Edmund February*
11h30 – 11h45	Water Resources Planning with Recognition of Alien Vegetation Eradication – Joy *Larsens,* ***Christo Marais*** & *Andre Görgens*
11h45 – 12h00	The riparian vegetation of the Breede River – *Charlie Boucher*
12h00 – 12h15	Alien legume seed banks in the Breede River System – ***Eugene Pienaar*** & *Charlie Boucher*
12h15 – 12h30	Discussion

SESSION 7: POSTER & PAPER SESSION (12h30-13h30)

Restaurant.

VENUE 1: RESTORATION ECOLOGY (Chairperson – Sandra Fowkes)		VENUE 2: SUSTAINABLE USE (Chairperson – Fatima Parker)
12h30 – 12h35	Restoration of Old Lands in the Renosterveld and the Role of Seed Dispersal – ***Ranier Krug*** *& Sue Milton*	Conservation through Utilization – ***Hennie Homan*** *& Paul Slabbert* ULUNTU
12h35 – 12h40	Effects of invasive exotic plants and fire on soil seed banks and regeneration in the Silvermine Nature Reserve, Cape Peninsula, South Africa – ***Charl Cilliers****, Charlie Boucher & Karen Esler*	Inventory of natural resource utilisation and management by the previously disadvantaged Suid-Bokkeveld communities and an assessment of the condition of the environment. – ***Wiesaal Salaam****, Nicky Allsopp & Richard Knight.*
12h40 – 12h45	Dispersal of seeds into old lands in Renosterveld – *Ndafuda Shiponeni*	Safe-guarding the Hermanus botanical wealth. ***Morne Magerman*** *, Richard Knight & Frans Weitz* Link Kogelberg Biosphere?
12h45 – 12h50	Restoring alien-invaded ecosystems – what do the seed banks tell us? – *Patricia Holmes*	Identifying and promoting biodiversity-based business opportunities for the Western Cape – ***Lulama Fanayo*** *,Richard Knight & Sue Milton*
12h50 – 12h55	Mycorrhiza in the Fynbos – ***Heidi Hawkins*** *& Willie Stock*	Optimising the benefits of farmland for conservation and agriculture through conservation farming. – *John Donaldson* GEF Project.
12h55 - 13h00	Rehabilitation methodology in the restoration of strandveld in the Chemfos Mine (W Coast Fossil Park) near Langebaan - *Roy Lubke &* ***Deon van Eeden***	
13h00 – 13h05	Was *Themeda triandra* a dominant grass in the South Coast Renosterveld? – ***Gwen Raitt,*** *Charlie Boucher & Sue Milton*	
13h05 – 13h10	The use of vegetation indicators for the assessment of coastal erosion in Milnerton South Africa – ***Charlene Biggs****, Richard Knight, Lincoln Raitt & Derek Keats*	Who owns Nature? *Maryke Middelmann*
13h10 –13h15	REFYN, restoration of Grassy Fynbos in the Eastern Cape, South Africa – Students, Rhodes – ***Deon van Eeden***	
13h15 – 13h20	Renosterveld: no reason to celebrate – *Chavoux Luyt*	
13h20 – 13h30	Discussion	Discussion
13h30 – 13h35	Closure – *Christo Marais*	

13h35 LUNCH

Paper

+HKN websites

Abstracts

rand Conservation Initiative (talk to Morten)

mapping

think you are managing well
o you think of the current state of the land.

Roridula: still trucking!

Bruce Anderson, Botany, UCT, Private Bag 7701 RONDEBOSCH

Roridula belongs to a paleoendemic family that can be regarded as an evolutionary relict. The single genus and two species predate the explosive radiation of much of the Cape flora. Using floral characteristics and allozyme electrophoresis data, I hypothesise that *Roridula* has changed its breeding system from out-crossing to almost exclusive self-pollination. But self-pollination is thought to be reduce genetic variation of plants and decrease their ability to adapt to local changes. Self-pollination and low seed dispersal may also lead to inbreeding depression. *Roridula* also has a very important mutualistic relationship with an insect that facilitates the absorption of nutrients. But close mutualisms are thought to increase the probability of extinction to the partners involved. With low dispersal capabilities, a reseeding life history, close mutualisms and self-pollination, *Roridula* seems to break all the rules about what should characterise a paleoendemic species. I will discuss why these characteristics have allowed *Roridula* to persist and not perish.

Integrating Conservation and Catchment Management with Sustainable Livelihoods: Experiences in the Keurbooms Catchment

Pam Booth, Working for Water, Tsitsikamma

The marriage of conservation and human development has never been a happy one. Historically the one has usually been accomplished at the expense of the other. Conservation has excluded human development and sometimes compromised it, while human development has often been achieved at the expense of non-renewable natural resources. However, we find ourselves in a unique position in South Africa, where our constitution has been re-written, honouring human dignity and the natural environment. Legislation is being drafted as we speak that will, in the long run, enforce what the constitution suggests and as a result people are for the first time being allowed to think about themselves and their environment in an entirely different manner.

To be free to think of our own development without the yolk of ancient legislation that is compounded by hundreds of years of habit-forming activities and ideas is a liberating experience. One that we should honour by thinking creatively about how we will use the resources available to us in a way that both land and people benefit. In a way that European and American countries can not since they are saddled with ancient ways of being and doing. If we choose to, we can bring human development and conservation together in a mutually benefical manner. For example, we can manage our catchments in a way that water flows more freely while those responsible for freeing the water are educated about its importance, about proper environmental functioning and are taught skills to enable them to live in harmony with the land and provide a sustainable income.

At this point I draw on the experiences we've had in Soetkraal and how – practically – these objectives can be met.

The Riparian Vegetation of the Breede River System

Dr C. Boucher, Botany Department, University of Stellenbosch, Private Bag X1 7602 Matieland.

An assessment of the riparian vegetation of the Breede River System
The riparian vegetation of the Breede River and some of its tributaries as well as a flood-plain known as the Papenkuils Wetland, are described on the basis of a detailed study of seven sites selected in different reaches along the river as part of an Instream Flow Requirement (IFR) assessment for the river. At least two transects were located at each site to cover pool and riffle habitats. Surveyed transects were examined in detail and the lateral zonation patterns are described and related to within year and flood inundation levels.

Some 26 vegetation communities were identified of which selected ones will be described briefly to illustrate the diversity of this vegetation.

The vegetation along the Breede River mainstem and its principle tributary, the Riviersonderend River are both severely degraded from anthropogenic activities. The latter river in particular is reduced to a narrow, deeply incised channel, densely overgrown by exotic species. Activities causing the degradation include excessive water abstraction, summer water releases, channel manipulation, agricultural practices and alien plants. Some suggestions are made to allow the river to reset to a more natural state.

The expert or the algorithm? - Comparison of priority conservation areas identified by park managers and reserve selection software

R.M. Cowling[1], RL Pressey[2], R. Sims-Castley[1], E. Baard[3], C Burgers[3], A Le Roux[3] and G Palmer[3]
[1]TERU, University of Port Elizabeth
[2]New South Wales National Parks and Wildlife Services)
[3]Western Cape Conservation Board

There is some debate in the conservation planning literature regarding the relative merits of expert opinion and systematic approaches in identifying priority sites for conservation action. The systematic approach involves the selection of sites based on consistent and transparent analyses of region-wide data in order to achieve explicit conservation targets. However, a problem with this approach is that potentially important data, for example the unpublished observations of local experts, are not considered. On the other hand, expert opinion may involve biases associated with particular taxa, conservation areas or management issues. To date, no studies have assessed the relative merits of these approaches.

This paper compares priority conservation areas in the Cape Floristic Region identified by a systematic approach with those (a "wishlist") identified by conservation managers (expert opinion) working in the region. We asked two questions: how well does the wishlist achieve conservation targets for biodiversity pattern; and to what extent does the wishlist incorporate priority areas identified on the basis of conservation value (contribution to targets) and vulnerability to threatening processes?

Our results indicate that many wishlist areas are located in low-priority montane areas where the underlying rationale is to consolidate reserve boundaries and incorporate biological processes. However, a large number of wishlist areas were identified in high-priority lowland areas. Here the rationale was to conserve remnant habitat and threatened taxa. Overall, high priority areas identified by the systematic approach were significantly under-represented in the wishlist.

We conclude that there are clear benefits of both approaches. We recommend that expert opinion be best employed against a backdrop of priority areas identified by a systematic approach. This will ensure that trade-offs in terms of target achievement, strategic interventions and management issues – a reality associated with all real-world conservation actions - will be appreciated by local experts and systematic conservation planners alike.

Identification and Prioritisation of Key Nature Conservation Areas in the City of Cape Town

Helen Davies, Dean Ferreira[2], Greg Oelofse & Keith Wiseman
Environmental Management Department, CMC Administration, City of Cape Town
[2]South Apeninsula Administration, City of Cape Town

The City of Cape Town has developed a Draft Integrated Metropolitan Environmental Policy (IMEP) which is currently being reviewed by the various portfolio committees prior to adoption. The IMEP sets a vision and policy principles, for sustainable development and for environmental management. These principles will be given effect through the development of detailed sectoral strategies targeted at specific issues. One of these is the development of a Biodiversity Strategy for the City of Cape Town.

This strategy will create a framework for the protection and enhancement of biodiversity in the City of Cape Town. A core component of this strategy will be the development of a network of effectively managed local government nature reserves for the City of Cape Town. The results of this study, the identification and prioritisation of key nature conservation areas in the City of Cape Town, will form a key input to this nature reserve network.

Optimising the benefits of farmland for conservation and agriculture through conservation farming

John Donaldson Conservation Biology Unit, National Botanical Institute, P / Bag X7, Claremont 7735

Farmland constitutes a large percentage of the land outside reserves and generally contains a large proportion of the country's biodiversity. Agricultural practices, in the form of intensive cultivation as well as grazing, can reduce biodiversity and threaten the important benefits provided by diverse ecosystems. Conservation farming is a loose term for farming practices that seem to provide sustainable economic returns to farmers while minimizing the environmental impacts, including the impact on biodiversity. The biodiversity, ecological, and economic benefits of conservation farming practices are being assessed as part of the GEF-sponsored Conservation Farming Project. This paper gives an update on the results that have been obtained so far, with particular emphasis on the Bokkeveld Plateau near Nieuwoudtville.

Kenilworth Racecourse Conservation Area – Conservation Management issues in a small urban reserve and lessons learnt towards impact assessment

Desiree du Preez , Ecosense, Die Boord
Small urban nature reserves are typically more threatened and require more management than large, ormally rural reserves.

The Kenilworth Racecourse Conservation Area (KRCA) is a good example of such a situation. KRCA is the fourth most important fynbos remnant on the Cape Flats. It is the largest single fynbos site (± 41 ha), contains 13 Red Data Book plant species (12 Cape Flats endemics and 3 KRCA endemics) and 2 endangered frog species.

KRCA part of the Kenilworth Racecourse, which is owned and managed by Gold Circle. The conservation area consists of a portion of the land in the centre of the racecourse, a small piece of land between the racetracks and a small remnant of disturbed fynbos outside the racetrack. The area does not have formal legal conservation status and has the same land use zoning that the currently developed land had. The area is not formally protected for conservation and a proposal for redevelopment of the racecourse could threaten the continued existence of this fynbos remnant or parts thereof.

There are many threats associated with the urban context (i.e. protection alien trees for cultural and aesthetic reasons, predation by pets, vagrants, poaching, potentially polluting developments in the vicinity) that are not conducive to biodiversity conservation. In addition, there are the impacts from racing and racecourse management activities (i.e. structures, parking and eventing activities, horse exercising), edge effects from the racetrack and its management (i.e. encroachment of kikuyu grass, fertiliser leaching, drainage, pest control) and lack of focussed conservation management (i.e. erratic invasive alien plant control, lack of a burning programme).

Lessons to be learnt towards environmental impact scoping and assessment studies are: the boundaries of the (potential) impacts or issues should be scoped and assessed beyo nd the study site; and general ecological principles and practical management issues should be taken into account when deciding on what can be developed and what must be preserved (not just species present); in such sensitive situations the precautionary principle should be followed.

Should such critically important fynbos remnants remain in private ownership or the sole responsibility of private management?

Dendrochronological research in the Fynbos Biome. How successful have we been?

Edmund C. February, Botany, University of Cape Town, Private Bag, 7701 RONDEBOSCH

The very limited time range of the regional rainfall data set (not more than 100 years) means that the long - term variability of water supplies in South Africa is poorly understood. South Africa urgently requires a high - resolution regional data set going back for 300 to 400 years so as to develop hypotheses on future water availability. In the Northern Hemisphere dendrochronology has demonstrated the capacity to produce long rainfall records extending back in time for many thousands of years. Within South Africa Dunwiddie and La Marche (1980) demonstrated the dendrochronological potential of *W. cedarbergensis*. These initially promising results were, however, never fully exploited.

Here, in an effort to better understand the dendrochronological potential of all three South African *Widdringtonia* species growing in the fynbos we not only re-examine *W. cedarbergensis*, but also include W. schwarzii and *W. nodiflora*.

While *W. cedarbergensis* and *W. nodiflora* may cross date the ring width indices of neither species correlates significantly with rainfall. *W. cedarbergensis* may live for many hundreds of years and is restricted to the Cedarberg Mountains while *W. nodiflora* only lives for around 20 and is widespread in the wetter parts of the Western Cape Province. *W. schwarzii*, restricted in distribution to the rugged Kouga mountains of the Eastern Cape Province, does not cross date.

Phytosociological studies - its role in development.

K. J. Freckleton *and G. B. Hellström, Hilland Associates, George*

During the vegetation study of an Environmental Impact Assessment the vegetation was comprehensively sampled. The quadrat data were analysed using TURBOVEG . The vegetation communities present on site were classified and used as an aspect in determining overall environmental sensitivities. "Building pads" were identified in less sensitive areas where after a final development proposal was submitted.

The African Restionaceae – an interactive key to species of African Restionaceae.

H Peter Linder and ***Kirsten Freckleton*** *, Hilland Associates, George*

The interactive key provides a means to identify the 350 African species and subspecies of Restionaceae, using ca. 150 characters. The key is based on INTKEY, developed by Mike Dallwitz in Canberra. The characters are drawn from the vegetative and reproductive parts of the plants. The user can either select characters to use, or allow the programme to suggest which characters are most suitable for separating the species, and for identifying the specimen. In many cases the correct identification can be achieved in under five characters. Almost all characters are illustrated, and allcharacters are explained with detailed notes. For each species a full description is provided, and at least some illustrations. The full set of illustrations include habitat, habit, sheaths, male and female inflorescences, fruit and a distribution map - there are some 2000images on the species. Most of the pictures were taken in the field. Further information is available on the nomenclature of the species,their biology, ecology, distribution, conservation status, and where known, response to fire. It is possible to extract species with various distributional or biological attributes. This is effectively a monograph of the African Restionaceae, but available on CD, and with extensive colour. In addition, being on CD, this allows for easy and efficient searches for species with given attributes.

Can pollinator behaviour generate sexual differences between female and male plants in Leucadendron (Proteaceae)

Asa Hemborg & Prof. William J. Bond , Botany, University of Capec Town

In insect-pollinated unisexual plants, pollinator behaviour plays a crucial role in the communication between sexes. The insects transfer pollen from male to female flowers, acting in response to plant signals and to environmental factors. If this does not happen, the females cannot set seed. In this study, we examine how the behaviour of a pollen beetle (Pria cinerascens Er., Nitidulidae) may influence the evolution of sexual dimorphism in a unisexual plant (Leucadendron xanthoconus, Proteaceae). We studied how adult Pria beetles visisted male and female plants in response to flower number, weather (sunny, dry vs. rainy, overcast) and time of day (morning vs. evening). In L. xanthoconus, males produced ca six times more flower heads than the females. This resulted in male flowers having on average 15 times more beetles than female flowers on sunny and dry days. However, if the weather was colder, i.e. rainy and overcast, the chances of receiving a visit from a Pria beetle increased by 100% for females (1.2 vs. 0.6 Pria per flower head). We found 1.1-1.4 times more Pria on the inflorescences in the evening than in the morning. This was similar for both sexes. It appears from our studies that the beetles visit male and female plants for different reasons. Adult Pria visit male inflorescences for mates, feeding of pollen, and for ovipositing. The developing larva will eat the pollen. This can explain why male plants under all conditions have more beetlesthan females (1.5-2 times more). Female flowers do not offer any food reward in terms of nectar. Instead, pollinators may search for heat, protection and mating opportunities during bad weather and at night. In females, involucral bracts are often also less open than in males and form a cup around the cone. What makes this problem interesting is how fragile it seems to be. How can a pollination system in a dioecious species like this one evolve? Do the beetles go actively to the females or do they have problem finding the males on rainy days? If so, how do they orientate? If Pria actively visit males and females for different reasons, and thus have Pria actively visit males and females for different reasons, an thus have different cues for finding male and female flowers, that may explain why sexual dimorphism in floral characters can be so exaggerated in this species.

The journey from benign neglect to a world-class National Park – the trials and tribulations of the conservation on the Cape Peninsula Mountain Chain

James Jackelman, Manager: Conservation Services Cape Peninsula National Park

Described by renowned botanist, Richard Cowling, as "the jewel in the Cape Floristic Region's crown", this somewhat tarnished but valuable jewel - the Cape Peninsula Mountain chain - has been exploited, abused, eroded, vandalized and despoiled for the last 300 years of colonial settlement and urban development in the Cape Metropolitan Area.
Only 5 years ago, the outlook for the conservation of this area of extraordinary and internationally acclaimed biodiversity was, in the eyes of many conservationists and researchers, somewhat gloomy.

The Persian mathemetician, astronomer and mystic Omar Khayyam however philosophized "*'tis better to light a candle, than curse the darkness*". This presentation highlights the reality that a national park could never have been established on the Cape Peninsula without the extraordinary vision, dedication and commitment of a large number of individuals and organizations, who were the "candle-lighters", and who, collectively and iteratively over the last 70 years, made an enormous contribution to the conservation of this globally unique natural heritage.

This presentation discusses the long challenging road that has been followed in establishing the park, the contributions by many people and organizations towards enabling the establishment of the Cape

Peninsula National Park along this road, the recent progress in proclaiming and managing the park, future initiatives toward consolidating the conservation status of the park and proposed institutional arrangements required to sustain the final extent of the park.

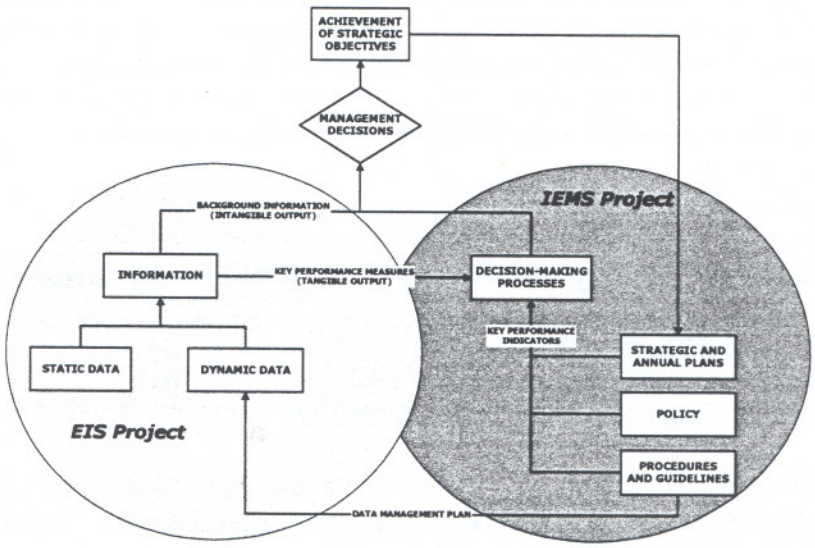
The road is still long and winding, but we can look back with pride!

Decision-making in the Cape Peninsula National Park. A contextual framework and decision-support tools

James Jackelman Manager: Conservation Services, Cape Peninsula National Park

In many (all?) protected areas, management decisions and the implementation of these decisions are often guided by a plethora of complementary and supporting documentation and information. At a broad strategic level there may be a vision, objectives, policies, business plans and a SEA. At the intermediate strategic and planning level there may be strategic plans, development plans, more detailed policies, guidelines, procedures, precinct plans and budgets. At the detailed planning level there may be building plans, detailed budgets, detailed plans, operational programs, detailed policies, pro-forma forms, detailed application forms, key result areas, indicators, EIA's, detailed protocols, data maintenance formats, monitoring programs and detailed procedures. All this is underpinned by dynamic information which may comprise maps, databases, hard copies, legal information, reports, research, monitoring, GIS, images, indigenous knowledge and information held by other agencies. All of this documentation is of varying quality, reliability and levels of maintenance.

Using the broad conceptual model below, the Cape Peninsula National Park have developed a GIS-based Information Management System (EIS project) and an Integrated Environmental Management System (IEMS project) to provide a structured and well maintained decision-support framework in which all of the above are embedded. The IEMS and EIS are made available to all park staff using user-friendly graphic user interfaces and served across a network using data (SQL server, SDE, ArcInfo, DMS) and citrix server technology and regularly maintained using standard data protocols and controlled documentation.
The EIS and IEMS for the Cape Peninsula National Park will be demonstrated.



Will the real Cape Floral Kingdom please stand up: old myths and new perspectives of biodiversity analysis in the Cape flora

A Barrie Low[1], Richard Knight[2] and Uschi Pond[1]
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The Cape Floristic Kingdom has long been renowned for both its high plant species diversity as well as centres of biodiversity. The latter was encapsulated as early as 1941 in Weimarck's landmark paper on the subject. However, both Weimarck and later accounts of biodiversity were based largely on specific mountain-loving (read fynbos) taxonomic groups such as the families Restionaceae, Ericaceae and Proteaceae, and genera Erica, Protea and Aspalathus, as opposed to total floras. Rigid quarter degree squares as opposed to broad natural habitats were also employed, resulting in a number of unrealistic biodiversity boundaries being drawn. We have approached biodiversity within the CFK by examining local **total** floras, testing these against previously defined centres, and using existing site and species information. Although the information available at present is incomplete it nevertheless provides a useful and more accurate means of determining centres. Following MDS and Bray-Curtis similarity analysis, new centres or sub-centres are discussed and include the Saldanha Peninsula, Witteberg and a major review of the southern and eastern parts of the CFK. Putative centres as far afield as the Richtersveld (renosterveld) should also be considered and Weimarck's satellite sub centres such as the Kamiesberg and Hantamsberg re-established. As detailed, habitat-specific data on species distribution on a small (broad habitat) scale is lacking in a number of key mountain and lowland areas, we propose the concept of a Cape Flora Atlas is resurrected, but focuses on site-specific plant collection. This will provide a basis for a more scientific approach to centres of biodiversity in the region, centres which should be incorporated into conservation planning for the CFK.

Recent advances in the systematics of Hyacinthaceae

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One of the characteristics of the Cape Floristic Region is an unusually high proportion of geophytes (over 17 % of all specis). The Hyacinthaceae is one of the three largest families of monocot geophytes in the region. Currently 141 species are recorded from the CFR. Until recently these were distributed between almost 25 genera. Generic limits in the family are notoriously difficult to set but molecular studies are providing valuable new insights. Recent advances in the systematics of the family have reduced the number of genera recognised in the CFR to 15 and further changes are in the offing. These new generic alignments have important consequences for conservation priorities.

Water Resources Planning with Recognition of Alien Vegetation Eradication

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The approach to water resources planning in South Africa has usually been to increase supplies as soon as the demand exceeds the yields of the existing water supply schemes, and has mostly focused on surface water augmentation options such as dams and river diversions. In recent years, the scarcity of surface water resources and an increasing awareness of the importance of setting aside the riverine environmental reserve has lead to a greater emphasis on alternatives to traditional surface water

augmentation options, particularly water demand management. Awareness of the significance of water use by alien invasive plants in certain catchments has also grown. The need to include this as a specific land use with its associated water demand in water resource studies in such catchments has been identified, and a draft methodology for doing so was presented at SANCIAHS 1999.

This paper demonstrates the application of the aforementioned methodology to a case study for the town of George. Currently water supply for the town is obtained from the Garden Route Dam on the Swart River. The catchment of the Swart River contains alien invasive plants, with the level of invasion upstream of the dam estimated to be 48% in 1999. The two adjacent catchments also contain alien invasive plants. The level of infestation in 1999 in the Malgas River was 9% and the Kaaimans River was 60%.

These adjacent rivers are likely to be developed for future water supplies, and sample water resource augmentation options, for example two dams and a river diversion, are put forward and modeled in this paper. An estimate of the riverine environmental reserve was made and included in the modeling exercise. In addition, the clearing of alien vegetation in the three catchments is included as a separate augmentation option. The costs of the sample augmentation options and the clearing options are estimated and compared as unit costs. The sensitivity of the resulting costs to various factors, for example the assumed rate of increase in water demand, the costs of clearing, etc were also tested.

The results show that clearing alien invasive plants results in increased yields of existing and future sample augmentation schemes. This delays the date at which augmentation is required by a significant number of years. Clearing schemes were seen to have competitive unit costs compared with traditional augmentation options such as dams. The Unit Reference Values of the sample augmentation options reduced by 20 to 40% when the upstream catchments were cleared, which provides a significant return on investment.

Who owns Nature?

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Since early explorers first reached the shores of South Africa, plants and specimens have been collected of our indigenous flora. These have been developed, hybridised and manipulated first by the Europeans. Since then huge high value floriculture industries based on our genetic material have been established around the world.

The ownership and potential monatory value is subject to two international conventions:
the Rio Convention on Biodiversity, and
the World Trade Organisation.

Two benefit sharing models will be discussed on how we can get something back for what rightfully belongs to all South Africans.

A proposal on the way forward will be tabled.

Update from the Table Mountain Fund.

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This slide presentation will provide snapshot examples from the experience of the first three years of the management of the Table Mountain Fund, featuring project development on the Cape Flats with partners such as BOTSOC, the City of Cape Town, NBI, RDP fora etc., as well as work in the Baviaanskloof Eastern Cape, support for alien control projects such as the Redhill Fynbos Restoration Project, UkuVuka and PROTEA Hangklip etc.
The purpose of the Table Mountain Fund is to provide a sustainable source of seed funding for biodiversity conservation in the Cape Fynbos Region. The underlying approach is to demonstrate that biodiversity conservation is a necessity not a luxury and that in order for it to be recognised as such, it must practically deliver jobs, social development, be accessible to SA's and be managed by people drawn from all sectors of SA society.

The intention is to both report on progress to date and to solicit ideas on the role of the TMF in the future.

Effects of landuse on dispersal and germination of *Brunsvigia bosmaniae* (Amaryllidaceae)

*Nathalie Perrot & **John Donaldson** , Conservation Biology Unit, National Botanical Institute, P/Bag X7, Claremont 7735*

Large populations of *Brunsvigia bosmaniae (*Amaryllidaceae) grow on the Bokkeveld Plateau, near Nieuwoudtville, which has been transformed by wheat cultivation and stockfarming. The populations are disjunct and it is not clear whether the distribution is purely a result of past or current landuse, differences in soils, or a combination of environmental factors. We tested the effects of landuse and soils on dispersal and seed germination. We first recorded the plant distribution in and around Nieuwoudtville, with information on soil type and landuse history. We then recorded the direction and distance of dispersal, the density of plants, flowerheads, and seeds in different patches, levels of seed germination and seed predation in different habitats, and effects of water stress on seed germination. The results revealed the presence of specific wind corridors, which restricted dispersal to specific parts of the landscape, and a high correlation between the distance covered and the presence of obstacles (shrubs, fences). Furthermore, initial results indicate that seed predation and water stress could influence successful germination and establishment. The results suggest that landuse may initially alter the distribution of plants but the patterns are then reinforced by natural processes affecting dispersal and recruitment.

Biosphere Reserves : A Promise of Success

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UNESCO's MAB Program involves a combination of natural and social sciences. Biosphere Reserves offer an alternative to classic protected areas. They are special places for people and nature and have evolved an interdisciplinary approach in order to attain sustainable development and biodiversity conservation.

In the Cape Floristic Kingdom Biosphere Reserves are ideally situated to demonstrate the implementation of the C.A.P.E. The Biosphere Reserve concept addresses all the C.A.P.E. objectives.

This paper will address the alignment of Biosphere Reserves with modern conservation views. It will also discuss issues in relation to successful biosphere reserve management with some examples taken from the Kogelberg Biosphere Reserve.

Plant water use in the fynbos biome.

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The primary vegetation type of the Cedarberg Mountains in the Western Cape Province is dry mountain fynbos. Growing in this fire prone vegetation type is one tree species, *Widdringtonia cedarbergensis.* The arborescent *Protea nitida* also grows in the Cedarberg mountains. Below 1000 metres *P. nitida* is the dominant arborescent species and above 1000 m *W. cedarbergensis* is dominant. We use both Hydrogen isotope analysis and xylem pressure potentials as tools to gain a better understanding of whether or not there is any niche separation in water use of these two species. Xylem pressure potentials suggest that neither species is water stressed in February, the hottest and driest time of the year. By using hydrogen isotope analysis of the water extracted from twigs of both species compared with ground water, rain water and stream water we hope to determine the source of the water used by these species along an altitudinal gradient. The primary objective is to determine whether or not plant water use plays any role in the altitudinal location of these species in the Cedarberg Mountains.

The Walker Bay Fynbos Conservancy- an example of collaborative conservation management from the Agulhas Plain.

Sean Privett , Grootbos Private Nature Reserve, GANSBAAI

The Agulhas Plain provides conservation authorities and decision makers with a microcosm of the challenges facing biodiversity conservation in the Cape, especially its lowland regions. It is biologically diverse, severely fragmented, heavily infested with invasive alien vegetation and almost entirely privately owned. Ideally all untransformed land on the Plain, irrespective of size of remnant, should enjoy some form of conservation action. However, funds for the purchase of land and conservation management are very limited and need to be strategically spent. Creative thinking and planning is required to ensure that the management and expansion of the conservation network on the Agulhas

Plain can occur. The Walker Bay Fynbos Conservancy provides an example of how the development of partnerships between state institutions, the private sector and non-government organisations can result in successful, cost-effective biodiversity conservation.

Thirty years of change in the fynbos vegetation of the Cape of Good Hope Nature Reserve, 1965-1995.

Sean Privett1 and Richard Cowling2 ,1 Grootbos Private Nature Reserve, Gansbaai
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This study used permanently marked 50 m^2 sites, surveyed at a 30-year interval, to provide a descriptive account of the temporal change in the fynbos vegetation of the Cape of Good Hope Nature Reserve. Management records were used to examine the role of post-fire age, fire frequency and intensity, as well as biotic interactions (competition from overstorey proteoids and alien plants) in influencing vegetation composition over this time period. The mean similarity in species composition of sites between surveys was 62%, indicating an average of nearly 40% turnover in species over the 30-year period. The main causes of this change included differences resulting from stages in the post-fire succession as well as the impact of differential fire regimes (especially frequency effects). Competition from serotinous Proteaceae, which proved highly mobile after fire, as well as invasive Australian acacias also impacted on the composition of the vegetation over time. The study demonstrated that fynbos communities are temporally dynamic and that the changes over time in species composition are caused by a variety of processes.

Ten Glorious Years of Atlassing

Tony Rebelo
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The Protea Atlas Project ran for almost 10 years from August 1991 to March 2001. During that time some 244 000 records of 521 species, subspecies and hybrids were sent in from over 58 000 localities by 478 atlassers and atlassing teams. Eight new species were discovered, and data collected on an additional three probable species not yet described. Significant range extensions were found for almost two-thirds of species. Four species could not be located and are presumed to be extinct. *Leucadendron salignum* is the most common species - present in 38% of sites, with *Protea repens* (25%) second - *Hakea sericea* is the ninth-most common species, being present in 9% of all sites. Some 251 hybrids or crosses were recorded. The richest sites for proteas are around Babylonstoring and Houwhoek, with 20-22 species. The richest eighth-degree square (12km X 12km) is 3319CDC Villiersdorp, with 75 species, followed by 3419AAD Kleinmond with 70 species. In 1991 the richest known square at this scale was 3419AAD Houwhoek, which now has 68 recorded species. Patterns at other scales are being investigated.

Despite all this information, there is no sign from the rate of discovery of new records at an eighth-degree square scale that we have comprehensively atlassed the Cape Flora - one in 12 Sight Record Sheets (or record localities) is still yielding new localities at this scale. The discovery of a new species in the final weeks of the project highlights this deficiency.

More information can be found on the web page www.nbi.ac.za/protea, including lists for nature reserves and data that require herbarium records and checking. The next stages are the updating the Red Data Listing for proteas, the production of the "Protea Atlas", and data analysis.

TMG Aquifer: Brilliant Water Supply: Solution OR Conservation Catastrophe of the Millenium

Wietsche Roets , Western Cape Nature Conservation Board, STELLENBOSCH

In an arid country, such as South Africa, with a rapid human population growth, a low mean annual rainfall and a spatially uneven distribution of water, water supply is a critical consideration for sustainability. As elsewhere in the world, South Africa relies heavily on surface water such as rivers for economic development.

During the recent IAH (International Association of Hydro-geologists) conference in Cape Town in December 2000, it was advocated that the Table Mountain Group, stretching from Elands Bay to Port Elizabeth, can deliver large amounts of water should this aquifer be tapped into. However, abstraction from this aquifer could have far-reaching negative effects on the Cape Floral Kingdom (CFK), particularly in the light of where surface water originates from.

The winter and summer base flows in rivers have always been attributed to groundwater discharge and seepage from sponges and seeps. On the other hand, flood-events in rivers were traditionally interpreted as run-off during rainfall events. Recent research has shown that floods in rivers bear the radioactive fingerprinting of groundwater suggesting that most surface water thus originates from groundwater sources i.e. all base flows and as much as 90% of flood events.

What are the potential impacts of TMG groundwater use on the CFK?:
Headwater (mountain) streams that are near pristine and the last outposts for most of the endemic and indigenous freshwater fish and invertebrate species may be affected.
Sensitive habitats and biota associated with perched aquifers, fountains and sponges (seeps) may become degraded due to desiccation.
Many endemic, indigenous and even endangered plants and animals associated with these habitats might be severely affected.
The unknown impact of Global Climate Change on the recharge of this aquifer.

As the provincial nature conservation agency of the Western Cape we need to clearly understand the potential impacts of groundwater use on the biophysical environment.

To what extent does the current network of protected areas in the Cape Floristic Region cater for ecological processes?

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Conservation planning has largely focussed on the representation of biodiversity patterns in protected areas. The need to consider the ecological and evolutionary processes that maintain and generate biodiversity has been recently realized, but little attention has been given to developing methods to apply such considerations in practice. Here, we present an approach for identifying spatial features as surrogates for ecological and evolutionary processes in order to design conservation networks that cater for the persistence of biodiversity. We recognized six majors spatial surrogates of processes

necessary for maintaining biodiversity in the Cape Floristic Region, South Africa. These were defined as: edaphic interfaces, upland-lowland interfaces, sand dune corridors, riverine corridors, upland-lowland gradients and phytogeographic gradients. Such spatial components act as surrogates for ecological diversification of plant lineages, migration and exchange between inland and coastal biota, faunal seasonal migration, and resilience to climate change. We then assessed the extent to which the current network of protected areas in the Cape Floristic Region caters for these ecological and evolutionary processes.

The current network of protected areas performs relatively poorly for most of the processes identified. However, due to the strong reservation bias towards high altitude or unfertile areas, protected areas capture phytogeographic and upland-lowland gradients along mountains. Such spatially-explicit approach allows for the formulation and quantification of explicit long-term persistence goals, and provide, in some cases, options for selecting from alternative reserve systems.

Key words: **biodiversity persistence, ecological and evolutionary processes, gap analysis, representation, reserve network.**

Fynbos parties and partners: Can we deliver the CAPE's goal?

T.S. Sandwith (Co-ordinator: Cape Action Plan for the Environment), WWF South Africa, NEWLANDS

Following the development of the Cape Action Plan for the Environment, which represents a strategic programme for the Cape Floral Kingdom and the adjacent marine environments, the question must be asked "What are the prospects for effective implementation?". It is in the nature of strategy development that the stakeholders will mask their differences and rise to the challenge of jointly formulating a lofty vision. This is particularly true when there is independent facilitation. It is after the party, in the bright glare of expectations, that the real work has to be done. This is when the old rivalries emerge, the need for control and influence surfaces, fighting for the scraps commences and the spectre of disappointment is raised. But this is the nature of CAPE; the engagement of people and institutions in a fragmented setting guided by a clear vision of what can be achieved. The challenge now is to reach agreement, forge the partnerships and scale up the activities in a strategic way. This paper will outline this process and issue a challenge to the Fynbos Forum to champion the implementation of CAPE.

Mother *Protea* Swinging her Scepter of Richness in the Fynbos

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The effect of short fire cycles on the density of sprouting shrubs and biodiversity is illustrated and discussed. Sprouting shrubs are highly competitive and aggressive and tend to displace non-sprouting shrubs when fynbos is burnt at short fire cycles. This leads to a decrease in species richness. The role of Proteoid shrubs in restraining the competitive ability of sprouting shrubs and maintaining a high biodiversity of plant species is discussed.

The relevance of continuing *Protea* monitoring on reserves is often questioned by Fynbos Reserve Managers. The importance of monitoring post-fire *Protea* regeneration as a part of Fynbos management is re-emphasised.

A Case Study: Conservation in the Private Industry – Management approaches of a Private Nature Reserve.

Jaco Venter, Reins Nature Reserve, ALBERTINIA

Rein's Coastal Nature Reserve (RNR) is a private nature reserve, some 60km west of Mosselbay and about 50km east of Stillbay . It covers an area of about 2400ha, with a 7,5km coastline. The natural vegetation of RNR consists mainly of Lowland Fynbos. Several unique plant communities occur within the Albertinia Lowland Fynbos and each of these communities harbors some plant species restricted to them (some of the plant species occur on RNR and nowhere else in the world). These unique plant species and plant communities support animal and bird species, which are unique to the Fynbos vegetation.

Rein's Nature Reserve is thus a private reserve, which has an irreplaceable role to play in the conservation of the plant and animal species of the Fynbos biome, especially in the Albertinia area.

Various management approaches have been applied to Rein's Nature Reserve since the establishment in 1994. The paper reviews those management approaches (past, present and proposed) with regards to the following broad categories: Ecological (conservation management), Economic (financial feasibility) and Educational (public involvement). As management is a dynamic entity, it tries to explain the need and expectations of management in a changing environment.

The paper focuses further on the fact that private nature reserves do not carry any legal status, and currently government endorses no incentives for landowners. As a final thought, the paper tries to link the central theme of "*A celebration to our successes*" to private nature reserves, and especially to the case study – Rein's Coastal Nature Reserve.

Conservation planning challenges: the Cape Lowlands project

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The Cape Lowlands Project was initiated last year to generate a fine-scale conservation plan for the remaining areas of Coastal Renosterveld and Sand-Plain Fynbos vegetation in the CFR. These habitats remain present only as patches within highly fragmented landscapes in the Overberg and Swartland that have been largely transformed by the plough. CAPE identified these lowland remnants as entirely irreplaceable in terms of widely accepted conservation goals and highlighted the urgency for more in-depth research and planning.

In order to direct effective conservation action and inform land-use decision-making, a clear idea is needed of the priorities for conserving biodiversity in these threatened habitats. The approach of the Cape Lowlands Project is using remote sensing and GIS techniques in combination with ground-based surveys to map and quantify biodiversity patterns in the lowlands. Priority areas will then be identified according to systematic conservation protocols (Pressey *et.al*).

This paper presents a brief overview of the Cape Lowlands Project, summarises progress to date and discusses some of the practical and methodological challenges encountered sofar in more detail.

Protecting Riverine & Wetland Buffer Zones in the City of Cape Town, Western Cape

Julia Wood*, *Cate Brown***, *Bill Harding***, *Martin Thompson** & *Barry Wood**
** City of Cape Town*
*** Southern Waters (Ecological Research and Consulting cc)*

The importance of ecological buffer zones along river systems and around vleis in the urban area of Cape Town have largely been ignored by most conservationists and ecologists. Ecologists have rather followed the lead of the Engineers and attached themselves to the 1 in 50 year floodline (and more recently to the 1 in 100 year floodline), advocating no development within this line. Ecologically speaking this line has very little meaning. In addition, preventing development within this line has very little legislating backing it. In some places development has gone ahead indiscriminately and / or infilling into the floodline has been allowed. Recent work by the City of Cape Town is striving to change this.

POSTER

ABSTRACTS

The construction of a fish-ladder in the Olifants River, Gouritz River System

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Many South African rivers are fragmented by obstructions such as dams, weirs and low-water bridges and the over-extraction of water. Obstacles such as these often prevent the natural migration of fishes and other migratory species and in so doing may negatively influence their breeding success or survival rates.

To faciltate fish migration a fish-ladder has been constructed on an existing man-made barrier in the Olifants River, east of Outdsthoorn. No other fish-ladders exist in the Southern Cape or Little Karoo areas so it is not possible to draw from experience with any locally tested designs. The design should thus be seen as a pioneering case to be tested, evaluated and modified for wider application in the region, and possibly elsewhere.

Freshwater fishes of the Gouritz River System

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The freshwater fish fauna of the Western Cape is equally unique and interesting when compared with the well-known fynbos and succulent karoo flora of the region. An astonishing thirteen of the eighteen species found in the river systems of the Western Cape occur nowhere else in the world. The river habitats in wihch these fish occur are highly sensitive. Alarmingly nine species are threatened with extinction due to human impacts. Damming, canalisation, water abstraction, alien plant infestations and the introduction of alien fishes such as bass, trout and carp have severe detrimental effects on indigenous fish and their habitats.

The Gouritz River system harbours six of the eighteen indigenous freshwater fish species of the Western Cape and a perturbing nine introduced species. Urgent action is called for, to save our precious fish fauna.

The use of vegetation indicators for the assessment of coastal erosion in Milnerton South Africa

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Coastal erosion is a serious problem along many parts of the South African coasts and is the result of disruptions in the sediment transport and its redistribution both along the coast and across the coastal region. Past expansion of the Table Bay harbour has cut-off the supply of sand initiating a cutback of the coast of some 35m along the Milnerton beaches. Currently the coastline is thought to be stable although intended future expansion of the Table Bay Harbour could initiate the erosion processes again. By using vegetation assessments we are hoping to map the movement of sand and produce a technique for detecting changes in patterns of coastal erosion. Using the shrub species *Passerina ericoides* (Thymelaeaceae) that is long-lived and occupies the mobile dunes of this area we hope to

develop a natural monitor for coastal erosion. By comparing the amount of above root biomass with the amount of exposed root biomass we can determine whether sand is being eroded or accumulated in the immediate vicinity of the mature plant. By examining the spatial patterns of these processes, we can speculate on the overall pattern of sand movement. If the patterns are purely random and no bias to either sand-eroded nor sand-covered plants the area is likely to be stable with respect to coastline. By using a GPS we plotted the exact position of all *P. ericoides* plants in the dune field and through spatial modeling we developed continuous surface maps of sand movement to test this hypotheses. These surface maps were examined using various spatial and trend analyses to determine the significance and directional predictability of these patterns.

Effects of invasive exotic plants and fire on soil seed banks and regeneration in the Silvermine Nature Reserve, Cape Peninsula, South Africa

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Extensive fires during January 2000 on the Southern Cape Peninsula highlighted the relative lack of knowledge concerning the impacts of fire, woody exotic plants and current exotic management practices on soil seed banks and regeneration.

This study examines exotic and indigenous soil seed banks and regeneration in different post-fire environments. The post wild fire effects of standing exotic plants and stacks of mechanically cleared plant material are investigated. These are compared to burnt fynbos and the burnt cleared areas which surround wild fire burnt stacks. The effects of stacking and control burning of exotic slash under cool weather conditions are also studied.

Differences in soil seed banks and regeneration occurred in the various post-fire environments studied. Seed banks and regeneration are linked to pre-fire vegetation characteristics, fire intensity and in particular, to the management of exotic plants. High volumes of (standing or stacked) woody exotic plant biomass impact negatively upon post wild fire seed banks. Post wild fire heat damage, associated with high woody exotic biomass, affects seeds to a depth of at least 15 cm. In contrast, control burning of stacks results in the large scale localised germination of exotic seeds. Persistent indigenous seed banks are found in the burnt cleared areas surrounding stacks of exotic slash burnt in wild fires.

Keywords: Fynbos Biome, woody invasive exotics, management, regeneration, soil seed banks.

A model based vegetation map for the Kouga-Baviaanskloof area using geographical information systems.

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A vegetation map of the Kouga-Baviaanskloof area was required to display the complexity of vegetation, within the constraints of limited time and budget. Thus, a model, developed from previous research done on vegetation distribution and dynamics in the study area, was used to generate the map. The model used altitude, slope, geography and geology as explanatory variables and vegetation type as the

response variable. By using a digital terrain model and geology, over 200 000 pixels (178m X 148m) generated the predictive layer on a geographical information system. The model was found to be only 48 % accurate by matching 1688 true vegetation data points with the predicted map. Vegetation types most susceptible to change were least accurately predicted (e.g. Transitional Shrublands, 31 % accurate), compared to more stable vegetation types (e.g. Alpine Fynbos, 88 % accurate). However, the model was successful in that it made few grossly incorrect predictions, resulting in a reasonable depiction of vegetation distribution in the study area.

The map was useful for displaying the complexity of vegetation distribution in the study area, and for identifying areas and/or vegetation types that are prone to change. However, the map's low level of accuracy renders it useless for any further analyses. Ground based field-mapping remains the best method of generating accurate and detailed vegetation maps, especially in places where vegetation distribution is complex and dynamic in mountainous terrain.

Identifying and promoting biodiversity-based business opportunities for the *Western Cape*

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Biodiversity-based business in the Western Cape is regarded as one of the missed opportunities, since it has an exceptional species richness that has not been fully analyzed with respect to the potential opportunities for the economic development of the province. Certain industries such as ecotourism, medicinal use, craft use and flower picking are easily identified with biodiversity. Other uses of biodiversity such as education, promotional decoration (e.g. dried flower heads of *Brunsvigia* in farm stalls), providing material for publications (books, magazines and Internet sites) and the film industry (documentaries and scenic backdrops) have less explicitly defined benefits.

Mycorrhiza in the Fynbos

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Arbuscular mycorrhizal colonization improves or even determines plant, including Fynbos plants, establishment and survival due to improved P acquisition. However, the role of mycorrhiza in nitrogen (N) nutrition, particularly organic N, in this N-limited vegetation has not been considered. Extraradical hyphae of mycorrhiza may bridge the rhizosphere and transport organic N present in the bulk soil to the roots. Determining the importance of organic N in N cycling within the Fynbos would provide new insight into nutrient acquisition in this nutrient-limited habitat and may have implications for management. Fynbos species diversity is particularly endangered by invasion of alien plants, especially in mountainous areas and increased nutrient inputs from alien plants may result in shifts in mycorrhizal communities. Using ^{15}N signals (1) the extent of organic N use by the Fynbos (ericoid, proteoid and various arbuscular mycorrhizal plants) was determined in invaded and non-invaded sites, (2) fungal distribution patterns were determined in dependence of edaphic organic N and taxonomic position (3) ericoid plants were tested for fungal extracellular enzymes.

Restoring alien-invaded ecosystems – what do the seed banks tell us?

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In fire-prone Fynbos vegetation, about half the species regenerate from soil-stored seed banks. Non-soil storage species regenerate from canopy-stored seeds or by sprouting from storage organs. Although Fynbos seed longevity has not been studied extensively, life-history patterns suggest that many, especially shorter-lived, species have persistent seed banks.

Soil-stored seed banks were sampled under dense alien stands of recent (one fire-cycle) and older (three fire-cycles) origin in Mountain Fynbos. Seed banks in recent alien stands were smaller, but similar in composition to those in uninvaded Fynbos, whereas those in older alien stands were depauperate, with a higher proportion of short-lived species. Nevertheless, even in long-invaded stands, the relict seed banks had potential to regenerate a structurally-representative Fynbos community. In field trials, recruitment was much lower than predicted from the seed bank data, indicating that germination was not optimized, possibly as relict seeds were too deeply buried.

Data on the depth distribution of seed banks in Sand Plain and Mountain Fynbos indicated that seeds were distributed throughout the sampled profile (0-9cm). Seed banks decreased following alien invasion, and this decrease generally was largest for surface (0-3cm) seed banks. There were three major differences between the seed banks of Sand Plain and Mountain Fynbos: seed banks of longer-lived (>4 years) species were much smaller, seed density was less affected by depth, and seed persistence was lower (especially of perennial species) in Sand Plain compared to Mountain Fynbos. The management implications of these findings are discussed.

Conservation Through Utilization

Hennie Homann and Paul Slabbert,ULUNTU ENVIRONMENTS cc. CAPE TOWN

MISSION: CONSERVATION THROUGH UTILIZATION

Uluntu means communities or peoples environment i.e. we strive to improve our natural and cultural environment we live in.

We work with the human and natural elements to fulfill a vision of harmony and prosperity.

Target market: Conservation Agencies, Private Nature Reserves & Landowners, National Parks and Unproductive Conservation Areas.

Our expertise within our mission

1. CONSERVATION

- Planning / research and monitoring – Forest, Fynbos & Mountain catchment expertise
- Environmental & Heritage Impact Assessments – ECO – Table Mountain, 4 x 4 route developments
- Restoration / Rehabilitation of degraded areas – Swartberg Pass, Deutsche Schule Kapstadt, CPNP
- Fire Management – Forestry & Fynbos, Urban fringe protection, Private Firefighting Service
- Alien Vegetation Management – Specialist Contractor, Cape Peninsula National Park, Municipalities, Large Landowners, High Altitude expertise

2. UTILIZATION

- Ecotourism planning & development
- Trail Development – Planning, Construction and Maintenance – Swartberg, Table Mountain, Hex River and Langeberg Mountains
- Hiking trails, Footpaths, Mountain biking, Horse riding and 4 x 4 trails
- Organic Architecture – Hiking trail hut construction – Gouekrans, Suurpootjie and Holsloot
- Environmental Education, Interpretation and Heritage Conservation

- Unproductive infrastructure in conservation areas
- Environmental Event Organizing & Control – Barolong and Balele Conservancy
- Local community capacity building – Entrepreneurs, private contractors and spin-offs

CONCLUSION:

For generations to come we need to conserve our natural and cultural environments. To conserve our pristine conservation areas, either private or state owned land we need money. National and international funding is not the only solution, we need to generate money from these environments. We believe that by developing it on the commercial front is not the only answer, environmentally sensible and viable ecotourism development, where the local community can benefit, should form the backbone of income. To utilize with a proper planning and research approach, we can conserve our environment at an appropriate level.

Protected Areas - Evaluation techniques for assessing socio-economic values and their impacts for local communities

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Conservation has undergone a paradigm shift from a focus based solely on biological aspects, to one that includes conservation within social and economic frameworks. Economic assessments of protected areas can fall into two categories of benefit to national and local interests. Specifically these may be direct, where the protected area is a resource that is utilized by the public through activities ranging from tourism and recreation to trophy hunting, or indirect where the system is managed such that the risks of environmental degradation are reduced and subsistence rural economics are maintained through the sustainable use of the environment. In the former case the benefits are direct economic whereas in the latter a situation arises where without some form of protection a situation will worsen and will have increasing economic implementations.

It can therefore be seen that both existing and potential future protected areas should be assessed from economic as well as biological criteria. An economic analysis of protected areas should identify various opportunities for generating capital, which can be used to subsidize the running costs for park maintenance and/or direct economic benefits to local communities. Valuations of resources will be discussed and these are derived through Stated Preference and revealed Preference Techniques. Stated Preference Techniques obtains information directly from individuals through surveys rather than examining observed behaviour patterns of individuals, and includes Contingent Valuation Method - CVA (surveys how much an individual is willing to pay for a resource of a specified quality and quantity) and Conjoint Analysis - CA (based on individuals being asked to rank from within a combination of choices). Revealed Preference Techniques is based on analyzing observed behaviour patterns. These methods include the Travel Cost Method - TCM approach (based on the willingness of users to pay for travel), Hedonistic Pricing Method - HPM (based on the principle that people will put value on a resource because they put value on the characteristics that the resource represents) and an important technique referred to as Averting Behaviour (based on people's willingness to avoid being exposed to certain dangers).

Can all reserves be selected in the same way? : The case of the Cape West Coast Biosphere Reserve.

Iptieshaam Kippie[1], Richard Knight[1], P Saravanakumar[1], Barrie Low[2] and Charlie Boucher

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The biosphere concept aims to conserve biological diversity, promoting economic development and maintaining associated cultural values by having a holistic management approach. The Cape West Coast Biosphere Reserve, situated on the west coast of South Africa is one such reserve. Although the CWCBR has been promulgated, there is debate about the methodologies used to define boundaries of its core, buffer and transition areas, the areas on which biosphere philosophy is based. Existing reserves and unconserved state land were used as core areas and land ownership rather than ecological status informed the definition of these zones. Other commonly used methods for identifying reserve areas in South Africa include iterative selective, scoring techniques and hotspot analysis. These methods, although standard for traditional reserves, are not necessarily appropriate for biosphere reserve selection as these reserves are based on different principles. Although the Cape Action Plan for the Environment (CAPE) recognizes the previously biased nature by which South Africa's reserves were selected and seeked to address biological criteria rather than patterns of species occurrence it did not specially address the nature of a biosphere reserve. This paper aims at analyzing current methodologies used and developing a new or combined approach to redefine the zones and expanding the current boundaries to the CWCBR. Central to this approach is the complementarity of existing frameworks, including the CAPE Project but permitting specific identification of zoning criteria through objective approaches.

Cape Flats Flora Core Conservation Sites : Whats being done.

Tania Katzschner, CMC, Cape Town

Since 1998 the Botanical Society of South Africa and the City of Cape Town have been involved in a number of projects to draw attention to Cape Town's unique lowland plant communities, the threats to their survival and the opportunities they provide.

The city has developed a strong relationship with the Botanical Society of SA regarding conservation of rare vegetation remnants in the City of Cape Town. This has been a most successful and productive partnership in improving status and management of these unique but vulnerable areas.

A brief background of the core flora sites study will be given (which has been presented at the previous Fynbos Forum) and then the presenter will present the work of the working group and some of the outcomes and achievements to date. The presenter will also talk about some hurdles and current and future challenges. The aim is to present, share and celebrate some of the successes of the project.

The Taming of the GIS – A Tale of Two ITs

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The use of Geographical Information Systems for environmental planning and management has often been characterized by a spatial planners euphoria meeting with a field manager's scepticism and a systems administrator's worst nightmare. Are the investments made in collecting, checking, curating and delivering information for a GIS balanced with their use for efficient decision making? The reality is that GIS has yet to convince office and field staff of its benefits, with the life of a normal GIS package being either gathering dust on the bookshelf, hogging your hard disk and devouring your PCs memory, or forever being loved, cherished and obeyed by a few IT geeks. In contrast to GIS technology most people have a serious failure in their sense of humour each time they lose their email address lists or the web goes down. Why is the one technology not readily acceptable and the other technology indispensable? The desktop GIS-equipped PC suffers from a number of problems for its widespread acceptance, which includes being expensive to purchase, resource intensive on the machine and slow to learn by the user with the information accessed being rarely up to date. Have any GIS-equipped offices not undergone the ritual of hunting for the lost dongle or become raiders of the latest ARC coverages? In reality GIS has not become integrated into the fabric and texture of everyday office life, let alone stooped so low as to be useful to learners doing their school projects. To reverse such negative perceptions do we enlist the services of a spin doctor or throw our lot in a spider's web of technology? This latter option is one selected within our Centre of Excellence program for developing broadband applications over the Internet, by developing the GIS with the smiling face. In this paper we discuss what options are available for turning your gorilla in the Mecer into a GIS genie using a "normal" web-enable computer. Advantages of this route are the development of more user-friendly interfaces, pre-programmed functions that can be accessed by a single click of a mouse and centralized management of the most up to date information and terabytes of imagery. No more blank coverages because projections do not match, no more crashed Windows as the GIS steals the last crumbs of RAM, no more deleting of files in haste to feed the GIS gorilla its daily dose of data to repent in leisure because the deleted files had not feed the GIS gorilla its daily dose of data to repent in leisure because the deleted files had not clones in the dozens of back-up disks kept in the bottom left drawer. The dawn of a new era has emerged where centralized servers deliver GIS information in small easily accessed bytes of information and we reveal all by using the Cape Metropolitan Council's Environmental Significance Mapping as an example.

Restoration of Old Lands in the Renosterveld and the Role of Seed Dispersal

Poster: Rainer M. Krug, Sue J. Milton, Univ Stellenbosch

Restoration is an increasingly important issue, especially in agricultural landscapes which are extremely fragmented and threatened. One of these examples is the Renosterveld, on which this project will focus. It is obvious, that two factors play an important role in restoring natural vegetation on old lands: the availability of seeds on the old lands (therefore the seed dispersal abilities and vectors of plants) and the chances of germination / establishment. Nevertheless, it is not obvious which factor is the limiting one on old lands in the Renosterveld, but observations point towards a seed limited system. This project will focus on addressing this question by using field experiments (see also poster of Ndafuda Shiponeni)

and spatio-temporal modelling. This poster will outline the project, present the hypothesis and will put a suggested process chart of processes in the Renosterveld up to discussion.

"SaS" – a new management tool and database for species lists from the Cape and Karoo floras

A Barrie Low[1], Richard Knight[2] and Reuben Roberts[1]

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Numerous floristic and related studies require the management and manipulation of large species databases. Species records are invariably contained in a plethora of dissimilar lists which are difficult to manage and update. A site and species database management system termed "SaS" was developed which had the following objectives:

- To provide a centralised database for **all** plant species lists within these two regions
- To manage and amend large numbers of species lists as well as adding new lists when required
- To provide an electronic and hardcopy reporting facility
- To link with an analytical tool to determine local and sub-regional flora similarities and therefore centres of biodiversity within and between these regions

Presently the database contains species inputs from some 550 sites between the Sperrgebiet (Namibia) and the Zuurberg (Eastern Cape), with approx. 9 000 species and over 80 000 entries. SaS is able to update new species as this information becomes available, and new lists can be added when required. A reporting facility enables generating of both hard as well as electronic (EXCEL) copy for single or multiple sites. Site and species tables are generated in EXCEL and taken into PRIMER or CANOCA where similarity and other analyses such as multi-dimensional scaling and Bray-Curtis are easily undertaken. The database provides a solution to the management and manipulation of numerous species lists and compliments current databases such as PRECIS which focus on general as opposed to site specific species distributions, and the Western Cape Nature Conservation Board's State of Biodiversity database.

Analysis of the flora of the Cape Metropolitan Area

Barrie Low[1], Richard Knight[2] and Uschi Pond[1]

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An analysis of species lists from 223 sites in the CMA revealed over 3 100 species in the 2 473 km2 comprising the area, a third of the Cape Floral Kingdom total, but in only 2.7% of the latter's area. Species numbers were far higher on the Peninsula (2 489) than the CMA lowlands (1 938 species) (5.3/km2 and 1.0/km2 respectively). High species richness was attributed to habitat diversity, particular in topography on the Peninsula, and local variation in climate. Species rarity was high (170 Red Data species (0.36/km2) versus 130 (0.06/km2 respectively). Likewise endemism was higher on the Peninsula (114 or 0.24/km2) than the CMA lowlands (17 or 0.01/km2). MDS analysis of the 223 sites showed distinct sub-regional floras for the Peninsula and Hottentots Holland Mountain Fynbos areas; Cape Flats Shale; Peninsula lowlands; Darling Hills; Tygerberg; combined acid and calcareous coastal sands; the Bottelary Hills, Peninsula, West Coast shale, and Schapenburg. 14 distinct floristic sub-

regions were recognised, underlying the role played by local environmental gradients. The Cape Flats and West Coast dune floras

Rivers running through

A Barrie Low[1], Uschi Pond[1], Richard Knight[2] and Ann McGregor[1]
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A preliminary analysis of the flora and vegetation of selected rivers along a north (Oorlogskloof) to south (Palmiet) gradient in the western arm of the Cape Folded Belt is presented. The aim of the exercise was to answer the following:

- Do rivers possess their own distinctive floras?
- Are rivers *de facto* centres of biodiversity and reservoirs of endemic and other key species?
- Does plant community composition vary along this gradient?
- Does variation in river flora and vegetation reflect corresponding terrestrial environmental gradients in this region?

Where possible, the full length of each river was sampled for its flora (all species present along the river) and vegetation (Braun-Blanquet plots). Using multi-dimensional scaling and Bray-Curtis similarity techniques, individual rivers were shown to support distinctive floras – although by and large lacking in endemics - and displayed a gradient from south (wet) to north (dry) as well as west (permanent) to east (seasonal). On a qualitative basis, changes in river floras were assessed against moisture (amount and seasonality of rainfall), cloud cover, pan evaporation and temperature. Plant communities, although displaying similarities where river stretches were similar, tended to show distinct associations, again following the gradient. River floras and river-specific plant communities maybe good indicators of broad terrestrial flora changes and environmental gradients in the region, and this can have a positive bearing on mountain conservation prioritisation and planning.

Distribution and abundance of alien vegetation in the Breede River Catchment

Joyce Loza and Richard Knight
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Alien plants were introduced to South Africa for a number of reasons including, prevention of erosion, for food, for shelter and for post-mining rehabilitation. Invasive plants are a threat to our natural water resources since they tend to use more water than their indigenous counterparts do, greatly increase the problems associated with flooding, and increase fire risks through increased biomass accumulation. All of these considerations impact on the functioning of the riverine ecosystem and negatively impact on water quality. In order to manage this problem the Working for Water project was established with the main purpose of dealing effectively with the problems of invading alien plants through their eradication. The aim of this project is to investigate the potential impacts of the alien plant removal programme in the Breede River catchment. It aims to assess the changes in channel pattern, following infestation of the riparian zone by aliens and the potential areas of risk for invasion. Existing GIS data (including aerial photos and satellite images) of the Breede River catchment will be used to analyse the catchment, its subcatchments and rivers using vegetation indices. The resulting maps together with aerial photos will be used to analyse changes in channel shape. Using results of both the LANDSAT and aerial

photographs, together with slope, elevation, aspect and terrain ruggedness derived from a 60 m digital terrain model we hope to map all areas representing potential risks for future invasion.

Rehabiltiation metholdology in the restoration of strandveld in the Chemfos Mine (W Coast Fossil Park) near Langebaan

Roy Lubke 1 and Deon van Eeden 2

1 Rhodes University, Grahamstown
2 Vula Environmental Services, Vredenburg

Vegetative Rehabilitation (with local indigenous species), rather than revegetation of arid environments in the South-western Cape is not an easy task. The restoration of Strandveld n a variety of sited at the disused phosphate mine, Chemfos, near Langebaan thus required the use of innovative techniques and a re-visit of proven approaches.

Production of low volumes indigenous seed during droughts has resulted in new methods of harvesting and seed preparation for cultivation. In order to ensure adequate germination of the seed, the production of smoke concentrates to apply in aqueous hydro-seeding mixtures with seeds, (thus boasting germination), has been developed, tested in bio assay techniques and applied in field situations.

Production of rooted cuttings of indigenous woody seeded material in large quantities, has taken many hours of development of horticultural techniques.

Planting out of plants and seedling mats in a variety of different localities on the mine site has resulted in the successful establishment of a nucleus of Strandveld vegetation with an evident increase in biodiversity.

Along with the eradication of alien woody invaders by physical, chemical and biological control methods, the Strandveld vegetation is slowly returning to an area once devoid of all local plant cover

The success of the program which has been carried out over the last five years will be assessed in a final vegetation analysis this winter for comparison with the original information recorded in a plant and soil survey in 1995.

Renosterveld: No reasons to celebrate!

E du C Luyt, University of Stellenbosch

In comparison with fynbos, renosterveld has relatively little floral diversity. However, it grows on the most productive soils of the Western Cape and used to be the real habitat of the greater herbivores (and their predators) that once roamed the Western Cape. Because of relentless human pressure (both urban and agricultural) it seems destined to go the same way as 2 of its well-known former inhabitants: the Blue antilope (*Hippotragus leucophaeus*) and the Quagga (*Equus quagga*). Because of the relative small biodiversity of renosterveld, even some conservationists feel that it isn't worthwhile trying to conserve it. I propose that the real riches of renosterveld are found not only in its plantlife, but mostly in the large mammals that need it as their habitat. And once it is gone, it is gone forever. For this reason I'm doing a study on the ecology of larger mammalian herbivores in renosterveld. This should help to give some answers on questions bugging conservationists trying to conserve the larger mammals of the

Western Cape. Questions like: "What is the actual carrying capacity of renosterveld?"; "How important is seasonal migrations for this?"; "What is the relationship between renosterveld and fynbos as primary producers in the food web?" ; "How important is grazing lawns in the fynbos biome for producing patchiness (and increasing biodiversity)?"and " Is it possible to rehabilitate these 'left-over' patches of renosterveld into a natural functioning ecosystem again?". In a world where the "big and furries" capture imaginations, this might be the only realistic approach to convince the public of the importance of conserving renosterveld. Time is running out...

Safeguarding the Hermanus botanical heritage.

Morne Magerman, Richard Knight and Frans Weitz
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The Overberg has been identified by the CAPE project as a totally irreplaceable region for the overall conservation of the Cape Flora. The Overberg stretches from Sir Lowry's Pass in the west to Tradouw Pass in the east and from Villiersdorp in the north to L'Agulhas in the south and includes the coast town of Hermanus. Ecotourism is central to the local economy of Hermanus since it is considered to be one of the best land-based whale-watching destinations in the world. Complementing this is a very high floral richness occurring in the surrounding Klein Rivier Mountains. Surprisingly little botanical research has been done in Hermanus although the area is well collected due to the efforts of the Hermanus Botanical Society. The botanical specimens are housed within the Hermanus Herbarium and at Vogelgat Private Nature Reserve. While the Mountain areas are well conserved through a consolidation of Municipal, Provincial and Private Nature Reserves, together with a conservancy of local landowners, the coastal areas have received rather less protection. Given that the coastal areas are where the greatest threats from development and invasive alien plants occurs it is imperative that these areas receive more attention if the integrity of the local floral biodiversity is to be safeguarded. The incorporation of the coastal "Cliff Paths" within the municipal Fernkloof Nature Reserve is the first step to addressing this issue, but since these habitats are highly fragmented and under seasonally intense human pressure there is an urgency to develop management plans. Although reserve specific management plans exit these need to be integrated into a macro-conservation plan that addresses issues at the landscape level including the maintenance of biological processes such as mutualism, co-existence and competition and accommodates possible effects of global warming and the implications for maintaining speciation processes.

Eye in the Sky: Monitoring the Hand of Man on the West Coast Lowlands of the Western Cape

Ian Newton and R Knight. UWC, CT

West Coast Renosterveld (*sensu* Acocks 1953) occurs on relatively nutrient rich soils derived from rocks of the Malmesbury or Cape Granite suites (Kruger 1979). These.areas form part of the Western Cape's west coast plain. The area is mildly undulating, with occasional koppies. It ranges from an altitude of a little above sea level up to about 400m and receives a rainfall of between 300 and 600mm per annum (Kruger 1979). The high agricultural potential of these soils has resulted in most of the natural vegetation being replaced by crops (mostly wheat). Of the original 6141 km^2, less than 3% remains untransformed, and of this, little more than half is conserved in some way (Low & Rebelo 1996). This impact can be clearly seen from space, where NDVI images, created from the ratio of AVHRR (Advanced Very High Resolution Radiometry) bands one (red) and two (infra-red), show an annual cycle of a rapid increase in the greenness of the agricultural areas, followed by a sudden drop on harvesting, as opposed to a slower cycle with lower extremes for the areas of natural vegetation.

"Never has so much been achieved by so few with so little"

NG Palmer, H De Klerk & R De Villiers
WCNCB, Scientific Services

Over the last few years much progress has been made regarding the "acquisition" of land for conservation. The map depicts the current status as well as areas still requiring attention, as established by C.A.P.E. The dominant means of acquisition are listed along with the area in hectares involved. There are also suggestions on how to assist with this collaborative effort.

The Effect of *Acacia mearnsii* (black wattle) on Riparian Plant Diversity in the Breede River System

Charles Pemberton, Southern Waters Ecological Research and Consulting, Mowbray

Coupled with an increase in streamflow, the "Working for Water" programme may benefit long-term biodiversity conservation via the restoration of indigenous ecosystems. This study aims to quantify the changes in biodiversity under different densities of *Acacia mearnsii* infestations. An area of natural vegetation and of *A. mearnsii* infestation were chosen along each of three rivers in the Breede River System, namely the Wit, Molenaars and Holsloot Rivers. Six transects of 50m in length were established at each site. Density, percentage cover and height were recorded for each species found in samples of one square metre arranged along transects extending from the waters edge. Data are to be analysed, *inter alia,* using the TURBOVEG and DECORANA software programmes.

Alien legume seed banks in the Breede River System

Eugene Pienaar & Charlie Boucher, Botany Department, University of Stellenbosch

The distribution and viability of alien legume seeds through the soil profile along transects at a number of sites in tributaries of the Breede River are examined.

Sampling was undertaken in the Wit, Molenaars and Holsloot Rivers in semi-natural vegetation, in cleared and in standing woody alien infested stands. Soil samples were taken at regular sampling intervals starting at the waters edge and extending up to 4 and ordinations of plant communities undertaken using the software programme.5 m from the water. At each sampling point, soil samples were taken at 0.15 m depth intervals to a depth of 1.0 m or until no further soil could be extracted because of rock. The soil was sieved to extract the seed. This was then germinated to determine viability.

Indications are that viable seed are distributed through the whole soil profile to the depth sampled. Disjunctions in distribution are attributed to events that destroyed parent plants or stimulated large-scale germination (e.g., through fire) or through flood wash removal of seed.

Suggestions are made as to possible management options for riparian situations.

Was *Themeda triandra* a dominant grass in the South Coast Renosterveld

Miss G.R. Raitt[1], Dr C. Boucher[1] and Prof Sue Milton[2]
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This study aims to sample remnant patches of South Coast Renosterveld to determine whether this grass could have been more widespread than it currently is on the basis of differences in management techniques and substrate variation.

Sample plots are located on the Groot Vaders Bosch Farm in grazed vegetation. The Braun-Blanquet phytosociological technique and descending-point samples are used to determine community composition.

Preliminary findings suggest that management techniques determine whether *Themeda triandra* will survive in an area or be replaced by Renosterveld-type shrubs.

Inventory of natural resource utilisation and management by the previously disadvantaged Suidbokkeveld communities and an assessment of the condition of the environment.

Wiesaal Salaam[1], Nicky Allsopp[2] and Richard Knight[1]

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The Suidbokkeveld is an area situated to the south of Nieuwoudtville in the Hantam District of the Northern Cape Province, South Africa. It lies to the north of the Doorn River, south and east of the Oorlogskloof/Kobee River and west of the Stinkfontein Mountains. The communities are mostly landless labourers but a few are landowner households. The area is marginal for most agricultural activities due to the low rainfall and infertile soils. Rooibos tea farming is the main income generating activity. Other land uses in the area include livestock farming, cropping and wild flower picking. However the capacity of the vegetation to carry livestock is low due to the poor nutritional value. The dominant natural vegetation is arid fynbos. The area surrounding the closest town, Nieuwoudtville, is a biodiversity hotspot for geophytes. There are a number of issues plaguing the communities, ranging from environmental to social; which includes insecure land tenure, poverty, land degradation and mismanagement of farms. Monocultural production of rooibos resulted in the loss of biodiversity, and overstocking on some farms has also contributed to the degradation of natural resources. To achieve a holistic picture of the condition of the natural resources, an ecological condition assessment will be carried out. Participatory research will be used to map biophysical resources as a basis for improving livelihoods or planning

Dispersal of seeds into old lands in Renosterveld

Ndafuda Shiponeni, Student, MSc. Conservation Ecology Department, Stellenbosch University

The movement of indigenous plants back into old ploughed lands is one way by which these lands can be restored to their original natural vegetation. The mechanisms by which seeds disperse, the rate at which plants colonise old lands in Renosterveld by seed dispersal is the main focus of this study. The rate at which seeds are dispersed and the distance they are dispersed is known to be dependent upon the dispersal agent. This in turn is a function of seed type or seed morphology. To understand the process of seed dispersal into these old lands, morphology and abundance as found in both natural vegetation and old lands will be compared. The distance which seeds of different morphologies move will be compared. We propose that there is a trade off between seed dormancy and seed morphology. Finally I will compare the seed bank in soils of natural vegetation and in old lands and compare this with vegetation successional patterns.

Synoptic mapping of the water quality in Zandvlei estuary and the accumulation of heavy element pollution in its ecosystems.

Robert Siebritz[2], Bongiswa Ndzingani[1], Joyce Loza[1], Richard Knight[1], Hans Aalbers[1], Lincoln Raitt[1] and Lilburne Cyster[1].

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Zandvlei is an estuary that lies within the greater areas of Cape Town. With the rapid population growth of Cape Town, it will become increasingly difficult to maintain water quality of this estuary. This is particularly important since Zandvlei is the only large estuary that opens into False Bay and is a critical nursery area for marine fish which spend their juvenile phase in the shallow estuary. Zandvlei is also an important recreational water body for yachting, boardsailing and canoeing (which has included hosting international events). The expanding urbanization (including a marina on its eastern side) and industrialized within the catchment of the Zandvlei has prompted the initialization of an Integrated Catchment Management under the auspices of the Cape Metropolitan Council. The estuary itself has been extensively modified including edge stabilization, construction and dredging of a canal system for the marina together with regulation of water levels to reduce the risk of flooding. Water quality has been deteriorating and the increasing presence of water hyacinth, *Echironia*, are suggestive that the estuary is getting reduced inflow of seawater which in turn could be reducing its importance as a fish nursery for False Bay. This effect is compounded by increasing industrialization in the areas north of the vlei which increases the risk of heavy element contamination of the water body. Although long-term fixed point monitoring of water quality has being undertaken by local authorities this does not reveal sources of problems such as pollution inputs. Given the complicated perimeter geometry of Zandvlei with its canal system that includes multiple water cul-de-sacs, together with numerous storm water outflows, it is important to generate a synoptic map of water quality and especially the concentration of heavy elements in the sediments and biological organisms. In order to do this water samples and sediments together with samples of Pond Weed (*Potamogeton pectinatus*) have been taken throughout the vlei and the canal system of the Marina. From these point-sampling stations, maps are generated using spatial interpolations to generate continuous surface models of each variable of water quality for the entire system. Similarly maps of heavy element concentrations such as nickel and cadmium within the water, the substrate and in the *Potamogeton* are compared and sources of pollution identified.

Land-use and amphibian conservation in the Palmiet River Catchment Area, South Africa.

Elaine Thomas[1], Alan Channing[1] and Richard Knight[2],
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Little is known of the ecology of southern African frogs. The Cape Floristic Region has a rich diversity of amphibians (44 species) of which 56% is endemic and a further 2% are near endemics. A quarter of the endemic amphibians of this region is considered threatened. This research project investigates the ecology and conservation status of frog species in the Palmiet River Catchment Area, as well as the effect of different land-use practices on those frog populations. The Palmiet system is biologically important and has been identified as a biological hotspot within the Cape Floristic Region and the Koggelberg Biosphere Reserve, the first of its kind in South Africa, occupies a large portion of the catchment area. The Palmiet River originates in a pristine area in the north, the mid-section of the river flows through the town of Grabouw and areas used intensively for agriculture and forestry. The lower reaches of the river re-enter and flow through a pristine area, the Koggelberg Reserve. Research aimed at understanding the population dynamics and the factors influencing it provides important guidelines for the conservation of those populations. This study compares the species richness, distribution, abundance and breeding cycles of frogs using direct searches and call analysis at fixed study sites along the Palmiet system at 14-day intervals over a period of two years.

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OF

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BAARD	JOHAN	MR	Indigenous Forest Management	D.W.A.F.	P. Bag X12	KNYSNA	6570	baardj@dwaf-wcp.wcape.gov.za	044-382 5466	044-
BARRY	TOM	MR	W Cape Nature Conservation Board		P. Bag X21	OUDTSHOORN	6620		044-213-3367	044-213 3367
BIGGS	CHARLENE	MS	Univ. Western Cape	Botany Dept	Private Bag X17	BELLVILLE	7535	cbiggs@uwc.ac.za	021-959 2075	021-959 2266
BOOTH	PAM	MS	Working for Water		P O Box 112	THE CRAGS	6602	tzwfw@mweb.co.za	044-531 6710/882	044-531 6706
BOOYSEN	DENNIS	MR	Working for Water			GEORGE	6503	dennis.b@mweb.co.za	044-874 2160	
BOTES	ENGELA	MISS	W. Cape Nature Conservation Board		P Bag X100	VLAEBERG	8018		021-483 4842	021-483 3500
BOTHA	MARK	MR	Botanical Society	Cape Cons.Unit	P. Bag X10	CLAREMONT	7735	Capeveg@gem.co.za	021-797 2284	021-761 5983
BOUCHER	CHARLIE	PROF	Univ. of Stellenbosch	Dept. of Botany	P. Bag X1	MATIELAND	7602	Cb@maties.sun.ac.za	021-808 3064.	021-808 3607
BROWN	ANDREW	MR	Ukuvuka: Operation Firestop	Goldfields Educ. Centre	Rhodes Drive	NEWLANDS	7700	andrew@ukuvuka.org.za	021-762-7474	021-762-8337
BRUWER	CHAREL	MR	EnviroAfrica		P O Box 5367	HELDERBERG	7135	charel@enviroafrica.co.za	021-805 0190	021-855 4248
CATTELL	PETER	MR	W. Cape Nature Conservation Board	Goukamma	P O Box 331	KNYSNA	6570	goukamma@mweb.co.za	044-383 0042	044-383 0042
CHARLTON	VAL	MRS	Ukuvuka: Operation Firestop	Goldfields Educ. Centre	Rhodes Drive	NEWLANDS	7700	val@ukuvuka.org.co.za	021-762-7474	021-762-8337
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COWLING	RICHARD	PROF	U Port Elizabeth	TERU: Botany Dept	PO Box 1600	PORT ELIZABETH	6001	Rmc@kingsley.co.za	042-298 0259	042-298 0259
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DE KLERK	HELEN	DR	W. Cape Nature Conservation Board	Scientific Services	P Bag X5014	STELLENBOSCH	7599	hdeklerk@cncjnk.wcape.gov.za	021-889 1560	021-889-1523
DE VILLIERS	BARBARA	MS	Cape Peninsula National Park	Simonstown	P O Box 62	SIMONSTOWN	7995	gavinb@parks-sa.co.za	021-780 9100	021-780 9525
DE WITT	BERNARD	MR	EnviroAfrica		P O Box 5367	HELDERBERG	7135	bernard@enviroafrica.co.za	082- 449 3923	021-855 4248
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DONIAN	IVAN	MR	W. Cape Nature Conservation Board		P. Bag X6546	GEORGE	6530	Regman@mweb.co.za	044-874 2160	044-874 1567
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DU PREEZ	BRAAM	MNR	SAFCOL		P Bag X5024	STELLENBOSCH	7599	Bdupreez@safcol.co.za	021-889 1512	021-889 1055

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FRAZEE	SARAH	MS	Conservation International	Kirstenbosch Gardens	P Bag X7	CLAREMONT	7735	mwfrazee@mweb.co.za	021-761 7424	021-762 6838
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GIBBS	DALTON	MR	City of Cape Town –	Nature & Coastal	P O Box 30223	TOKAI	7966	Rondevlei@sybaweb.co.za	021-762-2404	021-706-2405
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GREEN	JANE	MRS	Rooiberg Conservancy		P O Box 1231	LADISMITH	6655		027 581 2404	028-581 2404
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HARRIS	DANIELLE	MRS	Boskloof Private Nature Reserve		PO Box 44041	SCARBOROUGH	7975		021-780 1361	021-780 1361
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HEMBORG	ASA	DR	Univ of Cape Town	Botany Dept	Private Bag	RONDEBOSCH	7001	ahemborg@botzoo.uct.ac.za	021-650 3772	021-650 4041
HERD	HYLTON	MR	Indigenous Forest Management	D.W.A.F.	P O Box 24	KARATARA	6580	herd@dwaf-wcp.wcape.gov.za	044-356 9021	044-356 9028
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KOK	RYNHARD	MR	Indigenous Forest Management	D.W.A.F.	P Bag X12	KNYSNA	6570	Rynhard@dwaf-wcp.wcape.gov.za	044-382 5466	044-382 5461
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KRUG	CONNIE	MRS	Univ. Of Stellenbosch	Dept. Conservation Ecol.	P. Bag X1	MATIELAND	7602	c.b.krug@gmx.net	021-808 3603	021-808-3603
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LE ROUX	CLARET	MISS	Envir. Impact Management	D.E.C.A.S.	P Bag X9086	CAPE TOWN	8000		021-483 2704	021-483 4372
LEVENDAL	MINNEALISE	MRS	Envir. Impact Management	D.E.C.A.S.	1Dorp Street	CAPE TOWN	8001	milevend@pawc.wcape.gov.za	021-483 3166	021-483 4372
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LOZA	JOYCE	MS	Univ. of the Western Cape	Botany Dept	P Bag X17	BELLVILLE	7535	jloza@uwc.ac.za	021-959 3740	021-959 2266
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MAGERMAN	MORNE	MR	Univ.of the Western Cape	Botany Dept	P Bag X17	BELLVILLE	7535	mmagerman@uwc.ac.za	021-959 2075	021-959 2266
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MARAIS	CHRISTO	DR	Working for Water Programme		P. Bag X4390	CAPE TOWN	8000	Chris@mweb.co.za	021-405-2200	021-425 7880
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MARSHALL	TONY	MR	W. Cape Nature Conservation Board		P. Bag X6546	GEORGE	6530	Kkarea@mweb.co.za	044-874 2160	044-874 1567
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MATHIYANE	KATY	MISS	W. Cape Nature Conservation Board		Private Bag X6546	GEORGE	6530	?	044-874 2160	044-874 1567
MAYOLI	NOLUTHANDO	MISS	Indigenous Forest Management	D.W.A.F.	Private Bag X12	KNYSNA	6570	mayolin@dwaf-wcp.wcape.gov.za	044-382 5466	044-382 5461
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MIDDELMANN	MARYKE	MRS	SAPPEX		P. Bag X12	BOT RIVER	7185	Sappex@hermanus.co.za	028 284 9745	028-284 9777
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MOSSOP	LEIGHAN	MISS	Cape Peninsula National Park		PO Box 62	SIMONSTOWN	7995	gavinb@parks-sa.co.za	021-780 9100	021-780 9525
MTHIYANE	KATY	MISS	W. Cape Nature Conservation Board		P Bag X6546	GEORGE	6530		044-874 2160	044-874 1567
MULLER	SONJA	MEV			Posbus 77	LAINGSBURG	6900			
MYRDAL	BRETT	MR	Table Mountain Fund		P. Bag X2	DIE BOORD	7613	Bmyrdal@wwfsa.org.za	021-762 8525	021-762 1905
NEWMAN	NATALIE	MISS	South Peninsula Administration		P. Bag X5	PLUMSTEAD	7800	Nnewman@spm.org.za	021-710 8018	021-710 8039

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PALMER	GUY	MR	W. Cape Nature Conservation Board		P. Bag X5014	STELLENBOSCH	7599	Palmerg@cncjnk.wcape.gov.za	021-889 1560	021-889 1523
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PARKAR	ZOHRA	MS	Table Mountain Fund		P.Bag X2	DIE BOORD	7613	Zparkar@wwfsa.org.za	021-762 8525	021-762 1905
PARKER	FATIMA	MS	National Botanical Institute	SABONET	P Bag X7	CLAREMONT	7735	Parker@nbict.nbi.ac.za	021-799 8806	021-761 4151
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PIENAAR	BRUCE	MR	Reins Nature Reserve		P O Box 298	ALBERTINIA	6695		028-735 3322	028-735 3324
PIENAAR	EUGENE	MR	Univ. of Stellenbosch	Botany Dept.	Private Bag X12	MATIELAND	7602		021-883 068??	021-808 3607
PIERCE COWLING	SHIRLEY	DR			P O Box 364	ST FRANCIS BAY	6312	Shirleyc@intekom.co.za	042-298 0259	042-298 0259
POND	USCHI	MS	COASTEC		PO Box 370	RONDEBOSCH	7701	Coastec@mweb.co.za	021-685 5445	021-685 5445
POOL	RUIDA	MS	W. Cape Nature Conservation Board		Prvate Bag X5014	STELLENBOSCH	7599	stanr@cncjnk.wcape.gov.za	021-889 1560	021-889 1523
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PRINS	NATALIE	MISS	Envir. Impact Management	D.E.C.A.S.	P Bag X9086	CAPE TOWN	8000	naprins@pawc.wcape.gov.za	021-483 2702	021-483 4372
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REBELO	TONY	DR	National Botanical Institute	Protea Atlas Project	P. Bag X7	CLAREMONT	7735	Rebelo@nbict.nbi.ac.za	021-761 1425	021-797 6903
ROETS	WIETSCHE	MR	W. Cape Nature Conservation Board	Scientific Services	P Bag X5014	STELLENBOSCH	7599	Roetsw@cncjnk.wcape.gov.za	021-889 1560	021-889 1523
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SPENCER	CRAIG	MR	Hangklip Kleinmond Municipality		P. Bag X3	KLEINMOND	6195		028-271 4010	028-271 4100
STEENKAMP	CHARL	MR	Reins Nature Reserve		P O Box 298	ALBERTINIA	6695		028-735 3322	028-735 3324
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VAN ZYL	PETRUS C	MR	SAFCOL		Private Bag X6507	GEORGE	6530	pvanzyl@safcol.co.za	044-850 1154	044-850 1235
VENTER	JACO	MR	Reins Nature Reserve		PO Box 298	ALBERTINIA	6695	Jtventer@yahoo.com	028-735 3322	028-735 3324
VERMEULEN	COBRI	MRS	Indigenous Forest Management	D.W.A.F.	P.Sak X12	KNYSNA	6570	vermeuc@dwaf-wcp.wcape.govt.za	044-382 5466	044-382 5461
VISSER	NELMARIE	MISS	Dept of Agriculture, W Cape		Private Bag X1	ELSENBURG	7607	nelmariev@wcape.agric.za	021-808 5330	021-808 5331
VLOK	JAN	MR	Regalis Environmental Services		PO Box 1512	OUDTSHOORN	6620	Janvlok@mweb.co.za	044-279 1987	044-279 1987
VON HASE	AMREI	MS	Botanical Society	Cape Cons. Unit	P. Bag X10	CLAREMONT	7735	Vonhase@nbict.nbi.ac.za	021-797-2284	021-761 5983
WEST	ANDREW	MR	Hilland Associates		P O Box 590	GEORGE	6530	Hilland@pixie.co.za	044-873 3793	044-873 3793
WITTRIDGE	HAYLEY-MAY	MS	Cape Peninsula National Park		P O Box 62	SIMONSTOWN	7995	ASRSilvermine@parks-sa.co.za	021-789 2455	021-789 2460
WITTRIDGE	OWEN	MR	Cape Peninsula National Park		P O Box 62	SIMONSTOWN	7995	ASRSilvermine@parks-sa.co.za	021-789 2455	021-789 2460
WOOD	JULIA	MS	South Peninsula Administration	City Cape Town	P. Bag X5	PLUMSTEAD	7801	Jwood@spm.org.za	021-710 8049	021-710 8039

SWANEPOEL	KARIN	MS	W. Cape Nature Conservation Board		Private Bag X100	VLAEBERG	8018		021-483 3396	021-483 3500
TOEFY	ZAAHIR	MR	D.E.C.A.S.		P Bag X9086	CAPE TOWN	8000	ztoefy@pawc.wcape.gov.za	021-473 2700	021-483 4372
VAN BOOM	ELDON MORNAY	MR	Envir. Impact Management	D.E.C.A.S.	Private Bag X6546	GEORGE	6530	evboom@pawc.wcape.gov.za	044-874 2160	044-874 2423
VAN DER MERWE	CAREL	MR	Indgenous Forest Management	D.W.A.F.	Private Bag X530	HUMANSDORP	6300	VdMerweC@dwaf-wcp.wcape.gov.za	042-281 1557	042-281 1558
VAN EEDEN	DEON	MR	Vula Environmental Services		P O Box 858	VREDENBURG	7380	Dve@iafrica.com		022-766 11006
VAN WIJK	YVETTE	MRS	Southern Cape Herbarium		P O Box 564	GEORGE	6530	yvwijk@pixie.co.za	044-874 1558	044-874 1558
VAN ZYL	PETRUS C	MR	SAFCOL		Private Bag X6507	GEORGE	6530	pvanzyl@safcol.co.za	044-850 1154	044-850 1235
VENTER	JACO	MR	Reins Nature Reserve		PO Box 298	ALBERTINIA	6695	Jtventer@yahoo.com	028-735 3322	028-735 3324
VERMEULEN	COBRI	MRS	Indigenous Forest Management	D.W.A.F.	P.Sak X12	KNYSNA	6570	vermeuc@dwaf-wcp.wcape.govt.za	044-382 5466	044-382 5461
VISSER	NELMARIE	MISS	Dept of Agriculture, W Cape		Private Bag X1	ELSENBURG	7607	nelmariev@wcape.agric.za	021-808 5330	021-808 5331
VLOK	JAN	MR	Regalis Environmental Services		PO Box 1512	OUDTSHOORN	6620	Janvlok@mweb.co.za	044-279 1987	044-279 1987
VON HASE	AMREI	MS	Botanical Society	Cape Cons. Unit	P. Bag X10	CLAREMONT	7735	Vonhase@nbict.nbi.ac.za	021-797-2284	021-761 5983
WEST	ANDREW	MR	Hilland Associates		P O Box 590	GEORGE	6530	Hilland@pixie.co.za	044-873 3793	044-873 3793
WITTRIDGE	HAYLEY-MAY	MS	Cape Peninsula National Park		P O Box 62	SIMONSTOWN	7995	ASRSilvermine@parks-sa.co.za	021-789 2455	021-789 2460
WITTRIDGE	OWEN	MR	Cape Peninsula National Park		P O Box 62	SIMONSTOWN	7995	ASRSilvermine@parks-sa.co.za	021-789 2455	021-789 2460
WOOD	JULIA	MS	South Peninsula Administration	City Cape Town	P. Bag X5	PLUMSTEAD	7801	Jwood@spm.org.za	021-710 8049	021-710 8039