

PAPER ABSTRACTS

AZEF 2010

25 years of arid zone research in southern Africa: Past achievements and future challenges

M. Timm Hoffman, Plant Conservation Unit, Botany Department, University of Cape Town, Private Bag X3, Rondebosch, 7701

This keynote address explores the main research achievements that have been made in southern Africa's arid zone over the last 25 years. It highlights the critical role that major initiatives such as the Karoo Biome Project (KBP), the Succulent Karoo Ecosystem Programme (SKEP) and Biodiversity Transect Analysis in Africa (BIOTA) have made to research in the region while acknowledging the on-going contributions of state and parastatal institutions in promoting an awareness of conservation and sustainable land use practices in the region. While there has been a long history of agricultural research in arid and semi-arid southern Africa the launch of the co-operative Karoo Biome Project in 1985 fostered an integrated ecological understanding of the arid zone. Although it was a relatively short-lived programme it created considerable momentum and produced several key publications which remain reference works today. While SKEP and BIOTA differed in their geographical and thematic focus, both of these programmes have contributed substantially to our understanding of the region. They have also fostered a new generation of ecologists and conservation activists who work 'on the ground' on a range of sustainable land use issues. Research activities have also broadened over the last 25 years to include a wide range of disciplines besides ecology such as, economics, social science and anthropology. Key challenges for research in the arid zone include the development and maintenance of long-term research and monitoring initiatives in the face of changing land use practices and a changing climate. Most importantly, however, is the role that new and emerging institutions will play in leading the research community over the next 25 years.

Adapting livestock farming under changing climatic conditions – reconsidering 'new' approaches.

Archer, E.R.M., CSIR, Johannesburg

Scientists in southern Africa and elsewhere focusing on climate change and agriculture, are increasingly indicating how livestock, as a highly climate sensitive sector, may be affected by climate change. The Fourth Assessment Report (AR4) of the IPCC observes that 'Projected increased temperature, combined with reduced precipitation in some regions (e.g., Southern Africa) would lead to increased loss of domestic herbivores during extreme events in drought-prone areas.' (Easterling *et al* 2007: 287). Enabling adaptation in the livestock sector should thus be a significant focus of country response to climate change, particularly in countries where the livestock sector is a critical component of the formal and informal economy. Although innovations are often a primary component of livestock adaptation plans under design, it is increasingly recognized that longstanding approaches to the management of livestock may well have valuable lessons for future adaptation. Such approaches include reintroduction of genetically diverse and resilient breeds, as well as longstanding approaches to managing livestock disease.

Session 1: Research Trends

Urban research in the arid zone: moving forward on an arid zone research strategy

Keywords: urban ecology, research

Dr P.M. Anderson (Researcher, African Centre for Cities, University of Cape Town)

Consideration of the proposed Arid Zone research strategy shows a failure to engage in the urban research gap. Urban growth rates for Africa are 4%, the fastest in the world, and nearly twice the global average. Massive urban growth, combined with depopulation of the rural areas has significant implications for ecological functioning. Excluding the urban in setting an arid zone research strategy is a gross oversight. There is an apparent trend in arid zone research to focus on agricultural landscapes, the

very scope and scale of which are set by demand from urban centres. In addition to this extended footprint where the urban impacts on the ecology of the rural landscape, urban centres grapple with their own ecology-related issues. Expanding neighbourhoods infringing on sensitive ecological areas, increased water demand, and disrupted ecosystem services are some of the ecological issues relevant to the urban environment. The arid zone is particularly sensitive to human use, with limited water availability and long ecological recovery times. This paper asserts the need for the inclusion of urban related research in the arid zone research strategy. Until this research strategy considers the urban environment it will fall short of its mission to attain sustainable conservation and livelihood outcomes. While an urban research agenda would be readily included in the identified research areas (socio-political, change, socio-economic and trans-disciplinary issues) a case is made for urban ecology in the arid zone as a stand-alone research area. How an urban component in the research strategy might be taken forward to promote knowledge, debate and participation in conservation and livelihood activities, as well as engage with and promote good governance and policy development is discussed.

Recent Trends in Direction and Impact of Arid Zone Research In South Africa

Simon Todd, Timm Hoffman, UCT

Using a controlled keyword list to return research articles relating specifically to arid zone ecology in South Africa since 1990, we use Journal Citation Reports and Journal Impact Factors to establish which authors and papers have had the greatest apparent influence on recent South African arid zone ecology. We also analyse the data set to establish past trends and emerging directions in arid zone research and consider the implications of these results for the future of arid zone research in South Africa. Finally, we examine the extent to which arid zone research in South Africa is insular and whether or not the research we are conducting has an international audience.

Session 2: Livestock Impacts:

Herding: can this dying art be kept alive?

Clement Cupido¹, Igshaan Samuels¹, Melvin Swarts¹ and Doreen Atkinson²

¹ ARC – Animal Production Institute: Rangeland & Nutrition Unit, University of the W/ Cape, P/Bag X17, Bellville 7535

² New Frontiers in Poverty Reduction and Sustainable Development, University of the Free State, Bloemfontein, 9301

Before colonisation Nama-herders practiced transhumance over large areas in Namaqualand. With colonisation and the subsequent introduction of Apartheid legislation, the grazing land of these indigenous tribes shrunk and became limited to so-called 'Coloured' reserves. Private white-owned farms were fenced off and a camp system was introduced under the Fencing Act (Act 17 of 1912) and the subsequent Drought Investigation Commission of 1923. This marked the beginning of rotational grazing systems and a decline of herding as a career in the arid zone.

The survival of herding is under threat as the younger generation are reluctant to consider herding as an occupation on the commons. This has far reaching implications for effective grazing management which rely heavily on mobility through the herding of animals. Results from semi-structured interviews with livestock owners indicated that herders leave this career due to the difficult working conditions and the attractiveness of village life as oppose to living alone at a stockpost. Owners acknowledge that the main benefits of employing herders include early detection of illness, stock theft that is almost nullified, and the loss of livestock to predators is significantly reduced. In studies on private farms and municipal commonages stock theft and predation are considered to be the biggest obstacles for farmers.

In South Africa it is generally accepted that rotational grazing using multi-camps is the best grazing management system for livestock. This system is imposed upon emerging farmers on LRAD farms where camps are fence off and leased to individuals or groups of farmers. Studies on LRAD farms have indicated that the use of fences to manage livestock is ineffective due to a lack of infrastructural support from government. Keeping in mind the target of 30% of agricultural land to be distributed to previously disadvantaged citizens under the Land Reform Programme by 2014, we suggest a paradigm shift in managing these livestock farms. This paper argues for the reintroduction of herding on LRAD farms and other municipal commonages in the arid zone. We

suggest that it would be more economically viable for government to invest in promoting and subsidising herding rather than fencing.

Grazing distribution and pressure in relation to vegetation in a semi-arid communal rangeland in Namaqualand

*Igshaan Samuels^{1,2}, Nicky Allsopp^{2,3} & Timm Hoffman¹

¹ Plant Conservation Unit, University of Cape Town, Private Bag, Rondebosch 7701, South Africa

² ARC – Animal Production Institute: Rangeland & Nutrition Unit, University of the W/ Cape, P/Bag X17, Bellville 7535

³ South African Environmental Observation Network, Private Bag X7, Claremont 7735, South Africa

In extensive livestock farming systems, the distribution of grazing pressure is a key factor that determines condition of rangelands. When too many animals are concentrated in one area over long periods, grazing may result in vegetation transformation or degradation. In this study, we assessed how grazing pressure is distributed between 1999 and 2006 across six vegetation types that occur within a 192 000 ha of communal land in Namaqualand.

We calculated the monthly stocking rates at a specific stockpost by dividing the daily grazing area with modelled monthly number of livestock in a herd. Annual stocking rates were determined by the number of months a stockpost was occupied. We created raster images of grazing densities for every herd and overlaid them top of each other to construct a map for the entire communal area. Grazing density information was extracted for six vegetation types found in the area.

Grazing distribution is more evenly spread during winter when animals are less dependent on artificial water sources. During summer, animals are concentrated around human settlements. Grazing pressure was unevenly spread across vegetation types and within vegetation types over time. Renosterveld and Fynbos vegetation types were under stocked during winter and 65% and 50% overstocked during summer respectively. Heuweltjieveld, Renosterveld and Fynbos had less than 12% of their areas not grazed by livestock at all during the study period whereas other vegetation types had between 19% and 31% of their areas ungrazed. Drought periods result in all vegetation types being grazed under the recommended stocking rate. Less than 20% of all vegetation types were overstocked during the years following droughts. However, their total areas ungrazed remained constant suggesting that these areas are inaccessible to livestock. These areas could be regarded as refugia for threatened Renosterveld and Fynbos plant species.

Recruitment strategies of palatable and unpalatable seedlings in Succulent Karoo rangelands

Natasha Gabriels¹ and Nicky Allsopp²

¹ARC – Animal Production Institute, c/o BCB Department, University of the Western Cape, Private Bag X17, Bellville, 7535, email: ngabriels@uwc.ac.za, ²SAEON, Private Bag X7, Claremont, 7735

In the Succulent Karoo we do not understand the full impact of livestock grazing on plant community dynamics. Some studies have looked at how livestock affects the canopy and seed production of palatable shrubs. We also have very little knowledge of how livestock affects recruitment and establishment of palatable shrubs, as well as unpalatable shrubs, like *Galenia africana*. Other factors to consider are whether competitive or nurse plant effects occur in the absence, or presence of grazing and whether other microhabitat effects influence seedling recruitment and establishment. In this study, the effects of livestock, as well as microhabitat (nurse plant effects and occurrence on rocky outcrops or sandy soils) were tested on palatable and unpalatable perennial seedling recruitment over three seasons. The study was done in Paulshoek, a communally managed rural settlement in Leliefontein, Namaqualand. This falls within the semi-arid winter rainfall region of South Africa, which is characterised by Succulent Karoo vegetation. Six study sites were chosen in Moedverloor, Paulshoek, to determine natural seedling recruitment of palatable and unpalatable perennial plants in the area. Three study sites were on rocky substrates and three on sandy substrates. For each of the six study sites, the area on both sides of a fence, with livestock being excluded on the one side, was studied. Natural seedling recruitment was determined along 100 m x 1 m belt transects. Only seedlings, which were considered less than one year old, were counted. These were no taller than 100 mm, had few side branches and were not very woody. The nearest adult neighbour to seedlings was identified and distance from the seedling was measured from the base of the seedling's stem to the base of the adult neighbour's stem, up to a maximum distance of 1m. The seedlings and adult neighbours counted were mainly *Cheiridopsis denticulata*, *Ruschia robusta*, *Hirpicium alienatum* and *Galenia africana*.

Impacts of grazing on vegetation cover and composition around livestock watering points in the Succulent Karoo, South Africa

*Igshaan Samuels^{1,2}, Nicky Allsopp^{2,3} & Timm Hoffman¹

¹ Plant Conservation Unit, University of Cape Town, Private Bag, Rondebosch 7701, South Africa

² ARC – Animal Production Institute: Rangeland & Nutrition Unit, University of the W/ Cape, P/Bag X17, Bellville 7535

³ South African Environmental Observation Network, Private Bag X7, Claremont 7735, South Africa

In communal farming systems, natural rangeland is the most important source of food for livestock. When communal rangelands are overstocked, forage becomes limited and often over-utilised. Heavy grazing is considered to be amongst the main threats to floral diversity of the Succulent Karoo. The impacts of livestock along a grazing gradient result in a disturbance gradient known as a piosphere. Piospheres are most notable in arid and semi-arid areas since animals are dependent on water for drinking, which ultimately restricts their movement to areas further away from watering points. Piospheres may have distinct zones based on responses to grazing intensity. The first zone - called the sacrifice zone experience the most disturbances. In this study we asked: (1) What impact does livestock have on vegetation cover around watering points in Namaqualand? (2) What impact does livestock have on vegetation composition along grazing gradients? (3) Does vegetation type and grazing intensity affect the sizes of the sacrifice zones?

A line intercept method was used to determine the impact of livestock on vegetation canopy cover and composition along a directional axis and extended in four directions from the watering point. Along the transect we measured bare soil, plant litter, rock and canopy cover of various plant functional groups. Vegetation was divided into dwarf succulent and non-succulent shrubs (<25cm), forbs, trees, perennial grasses, leaf- & stem succulents and non-succulent shrubs.

Areas around watering points with the highest livestock densities had a significantly ($p < 0.05$) lower vegetation cover than areas adjacent to watering points visited by fewer animals. There was a significant difference ($p < 0.05$) in vegetation cover along grazing gradients in Renosterveld, Blomveld, Heuweltjieveld and Klipkoppe Shrubland vegetation types. Grazing resulted in a reduction of the palatable plant cover and increased the canopy cover of unpalatable and poisonous plants closer to the watering points. The sizes of sacrifice zones varied between vegetation types and animal densities. Renosterveld did not have a distinctive sacrifice zone.

KEYNOTE SPEAKERS:

A perspective on ecological, economic and social trends in the Eastern Nama-karoo: 30 years in the veld.\

Tony Palmer, ARC, Grahamstown

In the eastern Nama-karoo biome we are currently witnessing the unique juxtaposition of two major land-use types, namely domestic livestock and wildlife production. This paper will explore trends in resource condition in the eastern Nama-karoo using data from a variety of sources, and discuss these trends in relation to these two major activities. I will explore economic, production, biodiversity, social and landuse outcomes. The change in landuse, from a predominantly domestic livestock economy, based on fibre and meat, to an ecotourism and wildlife system, has taken place over a relatively short period. During the 1970s and 80s there was a predominance of livestock farming, underpinned by a strong government intervention programme. This intervention, in the form of subsidies for farm infrastructure (fences, water points, erosion works), as well as transport and animal feed, enabled and encouraged farmers to stay on the land, especially during times of drought. These subsidies also included the tax benefits associated with the farming enterprise, as well as assistance with alien plant and vermin (jackal and lynx) control. Government also provided input to local infrastructure development – roads, telephone, electricity and water supply. These inputs provided benefits in the form of easier access to markets, lower vehicle maintenance costs, more efficient power and communication. The advantages of these benefits are still being experienced by these regions.

With the cessation of some of these direct interventions since 1994, the region has experienced a shift in the nature of funding. Government has freed up investment opportunities for companies and moved away from intervention directed at the individual farmer. This has encouraged large overseas investors, who now feel more secure about investing in South Africa. For example, a company can be established with the confidence that it can currently receive and remove funds with relative ease. Using a

case study approach, this paper will explore the approach of four large-scale overseas investments in eco-tourism in the Eastern Cape. Although predominantly based in the thicket biome, all contain large areas of the Nama-karoo.

Karoo Tourism: What are the trends, and what are their implications for future development?

Doreen Atkinson and Ton Hens, University of the Free State

One of the burgeoning economic sectors in the Karoo is tourism. There are several niche tourism markets taking shape, including ecotourism, heritage tourism, agri-tourism and small-town tourism. This paper presents the results of a recent survey of Karoo tourists. In particular, it suggests that the Karoo is becoming a destination in its own right. This, in turn, will have management consequences, as each of the four Karoo provinces is currently planning and managing tourism in its own way, with little overall co-ordination. If tourism is not managed in a coherent fashion, the negative consequences may crowd out the positive impacts. The presentation will include a potential Karoo Tourism Framework, which would be able to overcome the negative externalities and promote sustainable tourism and wealth creation in the Karoo.

Session 3: Socio-Economic development:

Tarring the Road to Mecca: Dilemmas of infrastructural development for tourism in a small Karoo town

Mark Ingle (UFS) cdsfreestate@intekom.co.za

Nieu-Bethesda in the Eastern Cape Karoo is famous for its Owl House, its Kitching Fossil Centre, and for its having provided the setting for Athol Fugard's celebrated play *The Road to Mecca*. The idyllic pastoral ambience of this South African 'Shangri-la' is often attributed to its relative inaccessibility, being connected, as it is, with the outside world only by fairly hazardous gravel roads. Nieu-Bethesda has seen a huge increase in tourist visitation in recent years and property prices have sky-rocketed. Many investors have bought into the town precisely because it is so 'olde-world' – so undeveloped.

Construction work has already begun on tarring one of the gravel roads that links Nieu-Bethesda with Graaff-Reinet. On the face of it this should be a positive development for the town but there is a body of opinion that is strongly opposed to the road, for a variety of reasons. This poses a conundrum which goes to the heart of many developmental projects viz. how to 'develop' a town without in the process negating precisely those assets which make it what it is – in other words 'killing the goose that lays the golden eggs'.

This paper proposes empirically to articulate the Nieu-Bethesda community's sentiments (expectations, ambivalences, anxieties and ambitions) arising out of what the new road will mean for the town, and to explore the potential dangers of a form of development that, although well-intentioned, might ultimately serve to subtract value from a local economy, or to change the town beyond recognition. Apart from new qualitative research the paper will also be informed by an already existing scoping study of civil society in the town, an unpublished business survey done in 2008, a focus group session that accompanied the business survey, and relevant published literature.

Towards a collaborative craft marketing system in the Karoo: A new approach for remote areas

Anita Harmse, Doreen Atkinson & Mark Ingle

A key challenge for remote arid areas is to promote entrepreneurship. Craft production in South Africa's Karoo is fairly extensive, and includes products made of wool, mohair, leather, wire, glass and beads. In the past, the issue of crafts was largely addressed as a problem of production, with inadequate attention paid to marketing. In addition, the vast Karoo region was bedeviled by strong political boundaries which prevented the four Karoo provinces working together. A study of 120 crafters was undertaken during early 2009 by the Centre for Development Support, University of the Free State. The paper will report on the problems identified by crafters, particularly their difficulties in accessing markets. The research assisted the Karoo Development Foundation to create a new marketing network, known as "True Karoo Crafts". This approach emphasized the creation of a common brand and logo, a data-base of crafters, a catalogue of crafts, and a website whereby such crafts can be

marketed from a central location. In addition, the "True Karoo" crafts brand enables the establishment of craft stalls along the main highways traversing the Karoo. This system enables crafters to access many new markets, at very low cost. Early evidence suggests that the new "True Karoo" brand, and the new marketing opportunities, are inspiring crafters to increase production.

Prince Albert, a fourth economic bubble or sustainable development?

Dr Daan Toerien, UFS

Prince Albert has since its foundation experienced three economic bubbles: gold, ostrich feathers and wool. After the wool bubble resided in the 1970s the town regressed for a period. However, the economic progress over the past decade begs the question whether it is experiencing a fourth bubble or perhaps sustainable economic development? To answer this question it has been necessary to analyse the enterprise structure of the town and to compare this with other South African towns in order to detect similarities and differences. Prince Albert is part of a cluster of towns generally considered to be 'artist towns' and exhibits evidence of 'special entrepreneurship'. Its enterprise assemblage differs in many respects from those of the "Median Church Town" and the "Median Great Karoo Town" but is very similar to that of the "Median Artist Town".

To understand the factors responsible for the shift in the nature of Prince Albert's enterprise structure extensive interviews were held with residents, business people, holiday home owners, visitors and entrepreneurs. These helped to unravel the historical and current 'scenes' of Prince Albert. For a long time Prince Albert was a typical 'church town', very dependent on agriculture. During apartheid the forced removal of many members of the coloured community changed the nature of the community. There were the privileged and the disadvantaged, each with a different sense of Prince Albert as a workplace and a neighbourhood. This resulted in the development of a 'PDI scene' of which unemployment, liquor, drug and child abuse form part. In the meantime the growth of the tourism industry in South Africa and the presence of the Swartberg Pass helped to draw visitors to the town, many of whom were impressed by the beautiful setting, its heritage of quaint cottages and houses, and friendly people. This contributed to the rise of additional 'scenes': the 'tourism scene', the 'gentrification scene' and an 'entrepreneurial scene'.

There is clearly a need to improve the lot of the PDI community and the local authority has focused on this. However, care has to be exercised that the above process does not jeopardise the future of the other 'scenes'. This will require strong and wise leadership, something that has historically been somewhat lacking. If this challenge can be overcome, Prince Albert might indeed have a sustainable future. If not, it might be experiencing a fourth economic bubble.

Finally, the combination of ecological techniques to determine similarities and differences of enterprise assemblages of Prince Albert and other towns and socio-economic interviews of Prince Albert stakeholders helped to provide a deeper understanding of the strengths and weaknesses of the town. This might be helpful in unravelling the challenges of other South African towns.

Using insects to evaluate the biogeographic status of isolated dune patches in southern Namibia

Schalk vdM Louw, Department of Zoology & Entomology and Centre for Plant Health Management, University of the Free State, P. O. Box 339, Bloemfontein
Riana G Scholtz, Scarab Environmental & Geological Enterprises, PO Box 1316, Swakopmund, Namibia
John Irish, P.O. Box 30061, Windhoek, Namibia

A comparative study of the psammophilous insects on isolated inter-Kalahari-Namib dune patches in southern Namibia was conducted with the objective of developing a biogeographical interpretation of the origin, dispersal and survival of this fauna in these areas. By determining whether incidence is related to primary dune fauna presence (*i.e.* survival) on the dune patches, or secondary colonization (*i.e.* immigration), reconstruction of the pattern and process of dune fauna vagility scenarios can take place. Since psammophilous insects can be applied as sand dispersal indicators, the hypothesis under investigation was whether the dune patches are barchan dunes that got detached from the modern-day Kalahari dune sea, or relicts of a larger palaeo-Kalahari sand mass

Twenty-one sites were chosen to represent observed isolated dune lines or isolated dune clusters in southern Namibia, whilst five control sites in the main Kalahari were selected to roughly correspond with the latitudinal setting of the study sites. A total of 184

species (8 orders; 52 families) of arthropods were recorded. Of these 15 psammophilous insect species were selected to be used in the analyses. These, in turn, consisted of 10 species of darkling beetles (Tenebrionidae), 3 species of fishmoths (Lepismatidae) and 2 species of dune crickets (Schizodactylidae). By employing tenets of Historical and Ecological Biogeography, augmented by principles of Island Biogeography, species richness and diversity indices of these psammophiles were analyzed for correlation between control sites and study sites by, firstly, comparing sites along dune lines and within dune clusters and, secondly, according to increasing distance from the main Kalahari dune sea.

Even though a strong overall correlation exists between the psammophile diversity of the main Kalahari and the isolated areas, it was concluded that the isolated dunes are most probably remnants of a larger semi-arid to arid palaeo-Kalahari sand mass that existed during or shortly after Gondwana break up. Substratum interconnectivity during glacial maxima presumably facilitated later immigrations of Kalahari psammophiles into flatter areas in close proximity. In this regard the Orange River environment played a major role, serving both as refuge for species survival and centre of dispersal from which the Namib ultra-psammophiles and the Kalahari psammophiles speciated.

Session 4: Botany:

Insights into the spatial and temporal patterns of biodiversity over nearly a decade of BIOTA research in semi-arid southern Africa

Schmiedel, U.¹, Jürgens, N.¹, Hoffman, M.T.², Dengler, J. ¹, Haarmeyer, D.¹, Luther-Mosebach, J.¹, Mucbe, G.¹

¹ Biocentre Klein Flottbek and Botanical Garden, University of Hamburg, Germany, email: Uschmiedel@botanik.uni-hamburg.de

² Plant Conservation Unit, University of Cape Town, email: Timm.Hoffman@uct.ac.za

The interdisciplinary biodiversity monitoring project BIOTA Southern Africa (www.biota-africa.org) was launched in 2001. In order to initiate long-term biodiversity monitoring that provides baseline information on changes in southern African ecosystems due to climate change and land use, BIOTA Southern Africa established standardised monitoring sites of 1 km² in size. Thirty seven of these "Biodiversity Observatories" were set up along a north-south transect between the Cape of Good Hope and the Kavango Region in northern Namibia that describe a major climatic gradient, covering six biomes in the western parts of southern Africa. We annually monitored plant species composition and several animal groups in a standardised way. To understand the observed dynamics in biodiversity and their interdependence with land use and climate, an interdisciplinary team of BIOTA researchers studied the socio-ecological systems of communities living around the Observatories.

The talk will provide a brief outline of the research aims, design, and structure of the project and will give an overview of some of the major findings of the botanical research focussing on patterns of phyto-diversity along the entire transect. For this purpose we analysed plant family richness, species richness, as well as z-values on different spatial scales in order to provide baseline data for biodiversity assessment in the region and an understanding of the influence of potential drivers on various dimensions of biodiversity. Secondly, by focussing on the arid and semi-arid parts of the transect, we present time-series data of the BIOTA Observatories to analyse whether a change in plant species richness has occurred during the project period. We analyse differences in land use practices and their impacts on vegetation, and suggest how the BIOTA results could feed into policy.

The talk will thus give insight into the findings of the BIOTA research programme that are published in the book "Biodiversity in Southern Africa".

Understanding the occurrence of *Elytropappus Rhinocerotis*

T Vermeulen, WP de Clercq, FE Ellis, E Hoffmann, N Jovanovic
Dept Soil Sciences, University of Stellenbosch

The renosterveld of the Western Cape region is often seen as a natural occurring veld type that will very easily re-establish itself wherever land is left unattended. In this study it was firstly noted that where wheatlands of the Berg River catchment is left bare for a number of years, the renosterbos as a pioneer is slow in its regrowth response and when it does, certain patches in the landscape are preferred. This study therefore firstly focussed on the soil restrictions that widely determine the positions in the Berg River landscape where the renosterbos will re-establish itself. Secondly we needed to know whether some of the soil restrictions encountered could be alleviated and was possibly due to cultivation of this land. Through aerial observation it was found that a general patchiness does exist in the naturally occurring renosterveld of the Voëlvele area and hill tops of the region and was

described by others as the true nature of this veld type. Closer investigation of the soils in the Voëlmei reserve however showed that soil type played a major role in the patchiness found here. When the regrowth of the renosterbos in previous agricultural land was investigated, we again found that soil type played the major role in the patchiness that occurred. The most commonly found soil restriction was soil density of the lower soil horizons. Any soil form that prevented the renosterbos to access the perched water table, to about a 15m depth, could not support the renosterbos. It is however our belief that soils could be prepared for the regrowth of renosterbos and through this action, the renosterbos could also be used to alleviate the salinity problems found in this region. This research also confirmed that the renosterbos through its deep rootedness, is crucial in the conservation of other species found in the renosterveld resulting from its ability to keep the water table down and with that the salts that is so often a problem in this area.

***Ruschia* subgenus *Tumidula* in the arid areas of southern Africa: change and stasis in names**

P.M. Burgoyne, SANBI, Pretoria

This group shrubby of *Ruschias* form a large part of the community structure in arid areas of southern Africa and many are classified as data deficient (taxonomically and through lack of information on species).

Haworth first described this group as a subsection of *Mesembryanthemum* in 1821. Schwantes, in 1930, first divided *Ruschia* into subgenera and sections, many taken from Haworth and Salm-Dyck, but lacking descriptions, however, types were cited. Dehn expanded the study of the group study in 1993. To date no the genus *Ruschia* is in dire need of revision and this study will assist in this.

Characters that define the group are discussed together with distribution patterns and red-list status of members found in the arid zone. Some taxonomic problems are also explained.

A comparison of the thermal sensitivity of lichens determined under laboratory and natural conditions

Prof C. F Musil, Prof L. Raitt and Dr L. Zedda, KW Maphangwa, SANBI, Kirstenbosch

The thermal sensitivity of lichens was assessed under both laboratory and field conditions as potential indicators of climate warming. In the laboratory studies, 9 different lichens species collected from sites of different aridity and mean annual temperature were allowed to acclimatize in a growth chamber for 8 days. The acclimated lichens were hydrated with a fine mist spray and then exposed in forced draft ovens for 2 hour intervals to 7 different temperatures ranging from 24°C to 48°C. The following day, the heat treated lichens were rehydrated and their photosynthetic quantum yields and respiration rates determined with a fluorometer and infrared gas analyzer. In the field studies, thalli of 6 different lichen species growing at a hot arid and a warm coastal site were hydrated with a fine mist spray and their photosynthetic quantum yields at a steady state measured monthly at hourly intervals between 09h00 and 16h00 with a fluorometer. Fluorescence measurements were matched with simultaneously recorded ground surface air temperatures. Exposure temperatures at which photosynthetic quantum yields and respiration rate exhibited statistically significant declines from ambient were designated as effective temperatures. Regression functions quantified the relationships between laboratory and field exposure temperatures and measured respiration rates and photosynthetic quantum yields. These computed the temperatures at which the respiration rates and photosynthetic quantum yields attained zero and designated lethal temperatures. There was a general trend of declining effective and lethal photosynthetic temperatures for lichens with decreasing site aridity and mean annual temperature. Annually averaged effective temperatures limiting for lichen photosynthesis under field condition were up to 20°C lower than those determined under laboratory conditions. The exceptionally low temperatures limiting lichen photosynthetic quantum yield under natural conditions suggest that even small increases in temperature especially during early morning periods of peak photosynthetic activity during wintertime could negatively affect the carbon balance of lichens already living close to the edge of their physiological abilities.

Session 5: Speed Presentations:

Wednesday 6th October

Keynote Presentations:

Erosion processes in marginal Karoo environments; recent trends.

Peter Holmes, University of the Free State

A recent trend in geomorphological research in southern Africa has been the focus on the question of denudation versus degradation in southern Africa. The recent South African Association of Geomorphologists biennial conference in Grahamstown saw much debate on this issue.

In particular, the foothill areas of the Sneeuberg Range have been a focus of recent research into the accumulation of sediment in farm dams. This work will be mentioned in this paper. However, the focus of the paper is recent work undertaken on wind erosion in another marginal dryland environment, namely the west-central Free State. This summer rainfall area is bisected north-south by the 500 mm isohyet. Although marginal for dryland agriculture, it is an important grain producing area. It is particularly vulnerable to wind erosion from August to October when winds, associated with steep pressure gradients linked to the passage of cold fronts, are at their strongest. The situation is exacerbated by gusty conditions associated with the first thunderstorms of the summer. Ploughed fields, prepared for spring planting, are exposed to the wind.

On Western Free State agricultural land, wind, rather than moisture, exercises the predominant control on sediment mobility. Topsoil is quickly desiccated by the wind, negating the influence of recent rain, and encouraging sediment mobility. In spite of greater aerodynamic roughness, and conservative management practices, ploughed fields are vulnerable to wind erosion, particularly under mechanized agriculture. Short periods with intense gustiness appear particularly to favour sediment mobility. Although lands are ploughed to minimise wind erosion, variability in wind direction is such that this cannot guarantee that intensive wind erosion will not take place. Climate change is an important future consideration. The region is adjacent to the Kalahari, where recent research has demonstrated that reactivation of dunes is likely to occur within decades. Should the Karoo margins suffer increased sediment mobility on a similar scale, the consequences for commercial agriculture may prove to be far-reaching.

Water in arid areas

Prof Maitland Seaman, Centre for Environmental Management, University of the Free State

Water is like money; its only important if you don't have it. That's the arid zone. With lots of water, there's no arid zone.

In the classic north-south comparison of haves and have nots, the north also has water and the south doesn't. Of course there are exceptions like Brazil, but generally the dry parts are in the south - think of Australia, southern Africa and southern South America. Yet these areas are exciting, with their stark beauty and the challenges facing their ecosystems and ultimately their human communities.

In the arid zones, drought is a risk that is largely only predictable in its variability and not in its certainty. Survival strategies are dependent on the ability, maybe genius, in handling temporal and spatial variability, connectivity and isolation (refuge).

The presentation will attempt to illustrate the environmental context of the arid zone, the general problems faced by natural communities, the human threats to those communities and the positive signs that ultimately make us happy that all is not lost. Appropriate examples will be given.

Session 6: Water Related Issues:

VALLEY FLOOR CHANGES ALONG THE BAVIAANSKLOOF RIVER, EASTERN CAPE PROVINCE, SOUTH AFRICA: TESTING CONFINEMENT

Lindie Smith-Adao^{1,2}, Kate Rowntree² and Jeanne Nel¹

¹CSIR, Natural Resources and the Environment, PO Box 320, Stellenbosch 7599, South Africa

²Rhodes University, Geography Department, PO Box 94, Grahamstown, 6140, South Africa

Dryland environments (i.e. which cover approximately 68% of the global land area) describe the world's hyper-arid, arid, semi-arid and dry-subhumid regions. These regions are seldom seen as priorities for research because of their harsh climates, widespread distribution and limited resources and are therefore poorly understood. Local knowledge of physical processes operating in South African dryland fluvial systems is fragmentary and matches these global trends. River function and structure are strongly linked to the catchment of which they are a part of. Catchment controls (e.g. geology and soils, climate, land cover, etc.) and site or channel controls (e.g. the flow regime, sediment characteristics, vegetation cover, etc.) are important in controlling channel morphology. The former determine the runoff and sediment regime of the river while the latter control the stability of the channel. Catchment factors control the rates of hill slope erosion and the potential for sediment storage at different points in the system. Channel factors determine sediment entrainment and transport which is directly related to stream power, the product of discharge and channel gradient. Together these two sets of control mechanisms determine geomorphic form and process within a spatial and temporal context. The study in the semi-arid Baviaanskloof River catchment aims to improve knowledge on valley floor (i.e. river, riparian zone, floodplain, etc.) functioning and processes operating in geomorphological zones in a dryland environment. Fieldwork commenced systematically down the valley in selected study reaches during a winter sampling programme, 2009 and 2010. Data collected across the valley floor included surveys of cross-sections, vegetation distribution, surface sediment size and groundwater levels. The methods and procedures that were used to collate the data are briefly described, together with preliminary results.

Key words: Semi-arid, Baviaanskloof River catchment, valley floor changes, vegetation and sediment distribution patterns.

A CONCEPTUAL MODEL FOR PREDICTING THE MINIMUM WATER REQUIREMENTS FOR SHALLOW-ROOTED PLANTS IN THE RIPARIAN ZONE: A CASE STUDY OF THE MOKOLO RIVER

Marthie Kemp¹, Leon van Rensburg² and Frank Sokolic¹

1. Centre for Environmental Management, University of the Free State

2. Department of Soil, Crop and Climate Sciences, University of the Free State

Riparian zones are the interface between terrestrial and aquatic ecosystems. It is a life zone along the thousands of kilometers of streams and rivers in arid areas especially. Most of the tributaries and main channels in the arid zone are non-perennial and even more sensitive than perennial systems to changing environments as a result of catchment management and climate change.

In this paper, a conceptual model is proposed in which the main processes that play a role in the characterization of the riparian zone are explained. It is important to note that the riparian zone is a process-driven ecosystem, with drivers such as geomorphology and hydrology, and that there are various links between these drivers and their responders. The understanding of this multi-dimensional system is further complicated by complex phytosociological relationships. One of the main research questions that has been derived from our conceptual model is: "*How much water does the riparian zone need to stay alive?*"

Based on the model and in order to answer this question, we propose a preliminary methodology to estimate the minimum water requirement for shallow-rooted plants in the riparian zone. In April 2010 this methodology was tested on the Mokolo River in the Limpopo Province, South Africa and the results will be presented.

Keywords: Riparian vegetation, shallow roots, non-perennial, minimum water requirements

Session 7: Zoology:

Changes in bird functional diversity along an aridity gradient in different habitats – is there much functional space to move?

Colleen Seymour, Rob Simmons, Jasper Slingsby, Grant Joseph

In the past, ecological studies tended to focus on numbers of species, their diversity or evenness, as a measure of diversity. More recently, there has been a move towards considering the functional diversity of these communities to try to understand how changes in species assemblages might affect ecosystem functioning. Global climate change models predict an overall decline in rainfall in southwestern Africa, so changes in functional diversity with aridity might indicate how we can expect systems to change with warming. We surveyed bird assemblages in three habitat types (riverine, thicket and open savanna) along an aridity gradient in Namibia, to ascertain if these communities exhibited functional redundancy or not. Communities with high numbers of species but low functional diversity are considered to have high “functional redundancy”, whilst those that lose functional diversity rapidly with species loss have low functional redundancy. We examine if, and how, functional diversity changes along an aridity gradient, and within habitats, and we explore what the consequences of these changes might be in the face of climate change.

HOME RANGE SIZE AND HABITAT SELECTION OF ELEPHANTS, *LOXODONTA AFRICANA*, ON SANBONA WILDLIFE RESERVE

Ryno Erasmus, EWT, Loxton

No information is available on elephant ecology in the Little Karoo. This study looks at two aspects of their ecology namely home range size and habitat selection. Several studies showed that the home range size and habitat preferences of elephants vary from area to area and between seasons. The home range size and seasonal variation calculations thereof for the elephant herd on Sanbona Wildlife Reserve were based on 525 sightings from 2003 to 2006. All the maps and statistics were obtained by using ARCVIEW 3.2. It was found that the elephants utilised a total area of 18,813ha (49% of the area available to them) with their home range (95% utilisation distribution) being 2636ha. Significant differences in the size and shape of their home ranges between summer and winter months were observed. The same sightings over the same time period were used to calculate the habitat preferences. Of the 8 habitat types that occur in their home range Grassy Fynbos was preferred during the summer months while the River drainage was preferred during the winter months. Within their core habitat (50% utilisation distribution) the River Drainage was preferred during the summer and winter months. River Drainage and Succulent Karoo Gannaveld were utilised the same as the expected rate in their summer home range while the other habitat types were avoided. Arid Mosaic Succulent Karoo and Succulent Karoo Gannaveld were utilised the same as the expected rate in their summer core area while the other habitat types were avoided. During the winter months Arid Mosaic Succulent Karoo was utilised the same as the expected rate for the winter home range and the other habitat types were avoided. Within the winter core area Succulent Karoo Gannaveld, Arid Mosaic Renosterveld and Succulent Karoo Quartz Gannaveld were utilised the same as the expected rate while the other habitat types were avoided.

Using insects to evaluate the biogeographic status of isolated dune patches in southern Namibia

Schalk vdM Louw, Department of Zoology & Entomology and Centre for Plant Health Management, University of the Free State, P. O. Box 339, Bloemfontein
Riana G Scholtz, Scarab Environmental & Geological Enterprises, PO Box 1316, Swakopmund, Namibia
John Irish, P.O. Box 30061, Windhoek, Namibia

A comparative study of the psammophilous insects on isolated inter-Kalahari-Namib dune patches in southern Namibia was conducted with the objective of developing a biogeographical interpretation of the origin, dispersal and survival of this fauna in these areas. By determining whether incidence is related to primary dune fauna presence (*i.e.* survival) on the dune patches, or secondary colonization (*i.e.* immigration), reconstruction of the pattern and process of dune fauna vagility scenarios can take place. Since

psammophilous insects can be applied as sand dispersal indicators, the hypothesis under investigation was whether the dune patches are barchan dunes that got detached from the modern-day Kalahari dune sea, or relicts of a larger palaeo-Kalahari sand mass

Twenty-one sites were chosen to represent observed isolated dune lines or isolated dune clusters in southern Namibia, whilst five control sites in the main Kalahari were selected to roughly correspond with the latitudinal setting of the study sites. A total of 184 species (8 orders; 52 families) of arthropods were recorded. Of these 15 psammophilous insect species were selected to be used in the analyses. These, in turn, consisted of 10 species of darkling beetles (Tenebrionidae), 3 species of fishmoths (Lepismatidae) and 2 species of dune crickets (Schizodactylidae). By employing tenets of Historical and Ecological Biogeography, augmented by principles of Island Biogeography, species richness and diversity indices of these psammophiles were analyzed for correlation between control sites and study sites by, firstly, comparing sites along dune lines and within dune clusters and, secondly, according to increasing distance from the main Kalahari dune sea.

Even though a strong overall correlation exists between the psammophile diversity of the main Kalahari and the isolated areas, it was concluded that the isolated dunes are most probably remnants of a larger semi-arid to arid palaeo-Kalahari sand mass that existed during or shortly after Gondwana break up. Substratum interconnectivity during glacial maxima presumably facilitated later immigrations of Kalahari psammophiles into flatter areas in close proximity. In this regard the Orange River environment played a major role, serving both as refuge for species survival and centre of dispersal from which the Namib ultra-psammophiles and the Kalahari psammophiles speciated.

Digging deep for the dirt on the porcupine

Christy Bragg, Justin O'Riain, Simon Todd, UCT

For decades, people have had a negative perception of the Cape Porcupine, *Hystrix africaeaustralis*, due to the destructive influence of these prickly rodents on farms and in gardens. However our research, conducted over the last 5 years, show that this geophyte-foraging, disturbance-driving mammal has a positive value in ecosystems, through the effects of its widespread digging and foraging activities, and through its disturbance impacts on the community composition of highly threatened Renosterveld patches. Permanent plots, 3-year porcupine exclosure experiments and soil nutrient analyses in Nieuwoudtville Renosterveld demonstrate myriad porcupine impacts on biodiversity and soil properties. However there is a need to find ways to ameliorate the damage caused by porcupines and endear them to farmers. The effects of various taste and smell repellents were tested on porcupines in Nieuwoudtville and the results demonstrate porcupines are hardy, tough rodents, and difficult to repel. There is thus a need to raise awareness of the role the porcupine plays, not only as a key herbivore but also as an engineer at an ecosystem-wide level, and therefore conservationists need to rethink the value of the porcupine and encourage positive perceptions at the local and national level. Furthermore there is a need for finding innovative out-the-box solutions to problem animal issues.

Session 8: Engaging and interacting:

Scientist–community interactions – opportunities for mutual benefits and lessons learnt for the future

Reginald Christiaan,

The interdisciplinary biodiversity research project BIOTA Southern Africa aimed to collaborate closely with the local land user communities in the vicinity of their main research sites, in order to share local knowledge and research findings. Both, researchers and the landuser communities benefitted from this collaboration. The BIOTA para-ecologists played a critical role in the development and maintenance of this collaboration.

The talk, held from the perspective of a BIOTA para-ecologist, will explain the role that the para-ecologists play in the communities – even after the BIOTA project ended. They provide valuable input in the field of awareness raising among schoolchildren, they help with the rangeland management and support the community as well as individuals with the skills that they gained during their employment as para-ecologists such as computer skills, facilitation skills and knowledge about wild plants and animals in the veld.

Engaging stakeholders in global change risk and vulnerability planning: a case study of the Kruger to Canyons Biosphere Region

Claire Davis, Nikki Stevens, Emma Archer, Lee-Ann Sinden and Caesar Nkambule

Understanding climatic changes and their possible impacts on society is essential in critical sectors in South Africa in order to improve strategic adaptation responses. The study presented here, based in the Kruger to Canyons Biosphere Region, aims to investigate and communicate the latest climate change projections, impacts and research to key stakeholders, thereby strengthening the science-practice dialogue in the region. The paper presents results from the 3 stage stakeholder engagement procedure (mapping, questionnaire, and workshops), which outline the key stakeholders identified in the region, their information usage and needs, and their principal climate change concerns and the adaptation strategies that are currently possible to undertake. Challenges to adaptation measures raised by the stakeholders are also reviewed. Climatic extremes, *ecosystem impacts and the increased prevalence of diseases were highlighted as priority areas for adaptation. All participants agreed that targeting funding as well as capacity, training and awareness is required and that* proper policy planning at the national, provincial and local levels could improve adaptive capacity.

Technical and institutional factors influencing smallholder farmers choice in which market channel to supply to produce to: a case study at Letaba District in Limpopo

Miss Reneilwe Maenetja, UFS

In sub-Saharan African countries, the government previously used to play a crucial role in assisting farmers with marketing of agricultural produce. During the 1980s and 1990s, the majority of these countries liberalized their economies, in an effort to create open market-led exchanges, aimed at boosting economic growth. Whereas some countries have removed government controls, some countries still assist farmers in marketing through the use of Marketing Boards. South Africa, amongst other countries, has reduced government control in agricultural markets.

When the Marketing Boards withdrew from the markets, private traders moved in to fill the vacuum created by the withdrawal of the Marketing Boards. These private traders had to choose from whom to purchase agricultural produce. Given the small marketed surplus from smallholder farmers and their locations which were often far away from production centres, traders obviously preferred produce from commercial farmers. Faced with emaciated markets, some smallholder farmers, especially those located in the remote rural areas, could not trade their produce.

The situation has forced some smallholder farmers to resort to other available alternative market channels. In addition, these farmers face a number of institutional and technical factors in produce marketing, which put their market survival at venture.

This presentation has attempted to identify factors that deflate smallholder farmers in the Letaba district in Limpopo Province from the effective use of output markets. By identifying technical and institutional factors, there may be policies and programs developed to assist farmers in marketing their produce therefore improve their livelihood.

Challenges with valuing ecosystem services in arid environment

Patrick J. O'Farrell, Willem J. De Lange, David C. Le Maitre, Belinda Reyers, James N. Bignaut, Sue J. Milton, Doreen Atkinson, Benis Egoh, Ashton Maherry, Christine Colvin and Richard M. Cowling

We undertook an assessment and valuation of three key ecosystem service, grazing, tourism and water supply in the Succulent Karoo biome. We were looking for ways and values that could be used to promote conservation in this region through the adoption of sustainable land-use practices which have human welfare benefits. Our study adopted a variety of methods in valuing these services in developing ranges of values for these services. At the biome level, total annual values ranged from \$ 19 – 114 million for grazing, \$ 2 – \$ 20 million for tourism, and \$ 300 – 3120 million for water. These values are generally low compared with values derived for other biomes and regions and do not adequately reflect known dependence and the importance of ecosystem services to the residents of this biome. The ecosystems here provide small but critical benefits enabling communities to sustain themselves and small changes in service levels can have major welfare effects. Highlighting these sensitivities will require finding more appropriate ways to link ecological and social factors.