

Succulent Karoo Ecosystem Programme

A RESEARCH STRATEGY FOR THE SUCCULENT KAROO BIOME

Prepared by Pippin Anderson for SKEP



CRITICAL | **ECOSYSTEM**
PARTNERSHIP FUND

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1 INTRODUCTION

1.1 A biome level research strategy: Geographical and institutional context

The Succulent Karoo Biome has staggering levels of biological diversity. With over 6300 plant species, 250 species of birds, 78 species of mammals, 132 species of reptiles and amphibians. It claims its place amongst the world's biodiversity hotspots with ease. This biodiversity, combined with high levels of endemism (for example 40% of its plant species are endemic), and intense land use pressures, means the biome is also a recognized conservation priority. Extensive mining, sustained heavy grazing, and the ploughing of lands have all taken their toll on this biologically significant environment. The arid nature of the biome means agricultural livelihood options are constrained. The region offers few job opportunities and poverty is prevalent.

The Succulent Karoo Ecosystem Programme (SKEP) was initiated in response to these combined conservation and social challenges, and catalyzed through a generous investment from the Critical Ecosystem Partnership Fund (CEPF). In 2002 the programme was launched as a bi-national initiative that sought to develop conservation as a land-use with the simultaneous aims of addressing livelihood and conservation agendas in the region. As a multi-stakeholder programme based on good science and a participatory approach to the development and implementation of conservation action, the SKEP has been an extremely successful initiative, catalyzing actions that have resulted in the almost doubling of the formal protected area conservation estate and the flow of funding to strategic implementation, livelihoods related and scientific research projects. SKEP is acutely aware of the significance of the role of research in guiding the implementation and monitoring of conservation interventions.

After the first five years, a thorough review of the programme was carried out. One of the issues emerging from this review was that the research carried out under the programme lacked an over-arching vision. Among the various responses to this criticism was the decision to formulate a research strategy for the biome in relation to SKEP. The timing of this research strategy is critical as the programme moves into its second five year phase and simultaneously SANBI is tasked with the development of a national research strategy.

1.2 A biome level research strategy: national context

At the national level the South African National Biodiversity Institute (SANBI) will shortly be embarking on developing a National Research Strategy for Biodiversity to guide research necessary to implement the National Biodiversity Strategic Action Plan (NBSAP). This will be a national process led by SANBI, and likely to be initiated in 2009.

1.3 How do biome level research strategies fit into this plan?

The Fynbos and Grasslands Biome Programmes have both recently developed research strategies under the aegis of the CAPE and Grasslands Programmes, both sister programmes to SKEP. These existing research strategies for the Fynbos and Grasslands Biomes, and now the Succulent Karoo Biome, will inform the development of the National Research Strategy for Biodiversity. These research strategies will feed in on two levels, firstly in terms of informing content and direction, and secondly in terms of lessons learnt in developing the research strategies themselves.

1.4 How did we go about developing our research strategy?

The methods used to develop this research strategy, were also informed by those used in the development of the Fynbos Research Strategy and the Grasslands Research Strategy. Members of both teams involved in the development of these research strategies were interviewed and their advice taken into account. It was decided that a workshop would be run where participants could come together and pool their ideas as to the research needs of the biome, and that these would then be fleshed out in smaller groups. We recognized that a sound strategy needed to emerge from a dialogue between scientists, managers and politicians. A group of researchers (both social and scientific), relevant government officials, conservation practitioners, and people involved in land management were invited to the workshop (Appendices A agenda, B attendees) which was held in Cape Town in late October 2008.

It is important to note at the outset that considerable research has already been done in the region. This is captured in the Succulent Karoo (SKEP) database (1759-2008) compiled

by Margaret Koopman and includes citations of published and unpublished material, in electronic and print format, relevant to the Succulent Karoo Ecosystem (<http://nivenlib.pfp.uct.ac.za/wwwisis/SKEP.01/form.htm>). The database includes the research identified and compiled by both the 'Karoo Bibliography' by Timm Hoffman and the SANBI Land Degradation bibliography. This extensive database stands as testimony to both the research interest and significance of the region, and it is hoped this current research strategy will serve to build on and further this inventoried work in a guided manner.

The call for research needs and gaps was framed in the following way. The joint vision of the Succulent Karoo as a socially and ecologically resilient place in the face proposed climate or economic change can be driven through policy and management. To this end, what understanding or information is still lacking that we need to better inform management and policy? Following the initial brainstorming at the workshop, a smaller team of volunteers undertook a clustering exercise and broad topics were identified. One or two of these were then visited in greater detail by smaller sub-groups, each with multi-disciplinary members. Report backs from these sub-groups were minuted and form the basis of the Research Areas and Priority Topics presented in this document.

A concern was raised at the outset of the workshop that there was a lack of representation from farmers in the biome. This was duly noted and in January 2009 several meetings were held with commercial and communal farmers' unions in the Namaqualand region (Die Tweerivier Klein Boer Vereenegeng, the Rooifontein Klein Boer Vereenegeng, and the Kamiesberg Farmers Association), to ensure that there was some representation by this group in putting together the research strategy. In addition, a separate meeting was held with Prof Richard Cowling who was unable to attend the October workshop. This meeting was particularly informative in terms of contextualizing the need for the research strategy. Following the invitation to the workshop, Prof Timm Hoffman put our request for ideas and input out to a select group of international researchers via e-mail. He was then able to bring these additional views to the workshop.

1.5 Limitations

The development of Research Areas and Priority Research Questions within these, saw overlap in some issues and topics. This was an unavoidable side effect of reducing the research areas identified to digestible sizes, in a system which is highly complex.

The identified research gaps by-and-large reflect the considerable amount of research already carried out in the biome in that they clearly build on, or add on to, a common understanding of what lies before. Identified gaps and issues are therefore either more nuanced questions that have arisen through prior research, new questions emerging as new issues arise, or reflect an understanding that might be local, but should be considered on a more regional scale. It needs to be made explicit that the team putting this research strategy together is deeply conscious of the large amounts of work already carried out in the region. In some instances there may be reference to a research need that has already been covered comprehensively, but that the authors are unaware of. It is proposed that this document be one that is periodically reviewed and kept up to date in light of research carried out. One of the first research suggestions is an extensive inventory of all work carried out in the Succulent Karoo, which would make an excellent sister document to this current one. This task would be readily achieved given available resources in the form of the Succulent Karoo (SKEP) database mentioned previously.

2 IDENTIFIED RESEARCH AREAS

Five broad research areas were identified:

- ecological systems
- socio-political systems
- management in the face of change
- socio-economic systems
- trans-disciplinary issues

2.1 Research Area 1: Ecological Systems

While considerable excellent research has been carried out in the Succulent Karoo, we still do not have a full comprehension of the ecological systems at play in the biome. There is a need to consolidate existing work. There is also significant scope for further inventory and mapping work and ecological research to expand our understanding of the mechanistic functioning of the Succulent Karoo.

Topic	Priority Research Questions
Inventory and Monitoring	<ul style="list-style-type: none"> • Generate a synthesis of previous data and data analysis of all institutional contributions (both social and scientific) regarding patterns, process, drivers, management and alien organisms • Use this synthesis to identify major knowledge gaps and formulate research questions from these gaps • Prioritise research questions through a socio-ecological relevance system (using the Millennium Ecosystem Assessment and goal linkages) • Continue to do fine scale ground-truthing and mapping of vegetation types (for example of Bushman land vegetation types, not just the inselbergs) • Keep up basic inventory work, which is needed before process studies can be done (such as insects and pollination) • Continue to explore the functional ecology of plant and animal species in the Succulent Karoo, focusing particularly on those species identified as important to the agricultural sector (for example the tick species specific to the Kamiesberg)
Process, Drivers and Responses	<ul style="list-style-type: none"> • What makes and keeps the Succulent Karoo the Succulent Karoo? Further develop our understanding of the drivers and processes of the Succulent Karoo • How are species and communities (fauna and flora) responding to climate change? • What role do ecotones play in the Succulent Karoo and its interfaces with other biomes? • Seed bank studies in various Succulent Karoo habitats (links with rehabilitation and restoration and plant community dynamics) • What is the key driver (i.e. climate, soil, historical factors etc) of the high species richness of the Succulent Karoo?
Dynamic Patterns	<ul style="list-style-type: none"> • Identifying the faunal distribution patterns present and how they are being altered by environmental change • How effectively are protected areas conserving biodiversity and ecosystem processes in the Succulent Karoo? • What are the patterns and rates of spatial and temporal turnover of biodiversity (fauna and flora) in the Succulent Karoo? • What is the role of resource pulses in driving Succulent Karoo ecosystems?
Management, including restoration	<ul style="list-style-type: none"> • Further develop and test methods (and examine the associated costs) of restoration of the degraded veld • Understand basic ecosystem functions and processes necessary to inform management and rehabilitation • Continue to develop a mechanistic understanding of the impacts of various land uses on the Succulent

	Karoo ecosystems <ul style="list-style-type: none"> • Explore techniques for the rehabilitation of inland mine dumps (e.g. copper mines)
Aliens (flora and fauna)	<ul style="list-style-type: none"> • What is the status of invasion by alien species in the Succulent Karoo? • Determining the status of the Orange River with regard to the extent of the alien invasion and degree of utilisation (in conjunction with adjacent ecosystems and current land use)

2.2 Research Area 2: Socio-Political Systems

An understanding of land tenure, governance, power relations and institutions is seen as essential to any work aimed at promoting livelihood and conservation, which are in turn critical to the sustainability of the Succulent Karoo. The linkages between people and the environment lie at the heart of this research area and priority research areas range from understanding macro-scale decision making to factors driving community behavior and the methodological considerations in these areas of research.

Topic	Priority Research Questions
Land Tenure	<ul style="list-style-type: none"> • Develop an understanding of the relationship between land reform and conservation in the Succulent Karoo • Land Tenure and associated management costs, including different scenarios for the future, need to be explored. • What are the management costs in decentralising management to communities? • What are the implications of different tenure arrangements for biodiversity • Explore future Scenarios for land tenure in the context of climate change (its implications and impacts) • Develop an understanding of stewardship, protected areas and the regional and national redistribution of land • How can we support and understand conservation of biodiversity and sustainable natural resource management in the context of land reform and stewardship?
Government, Power Relations and Institutions	<ul style="list-style-type: none"> • Who makes the decisions that influence the management of the Succulent Karoo at different scales? • How does Institutional knowledge sharing influence power relations? • Need to develop a viable Action Research Approach to ensure ownership of research results? • What is the governance processes involved in the management of the resource? • What constitutes capable governance and how is it ensured, for example on the communal lands

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| | <ul style="list-style-type: none">• Understanding power relations in terms of whose visions, values and knowledge is driving natural resource management in the Succulent Karoo• Are conservation strategies developed in partnership with local democratic institutions? Are local authorities involved in planning, consultation and implementation of conservation strategies? If not, how can this be improved?• What government policies and local norms restrict or enable sustainable land use practices amongst land users in the Succulent Karoo?• What is the history of the spatial land use arrangements on the commonages of the Succulent Karoo in relation to current arrangements (in light of the suggested collapse of these systems)?• What are the factors contributing to (suggested) attitude changes to the natural environment and land in general (litter, grazing of animals on other's ploughed land etc)? |
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<p>Enabling Frameworks</p>	<ul style="list-style-type: none"> • How to go about develop trans-disciplinary skills • Creating and accessing networks - plus the monitoring of the effectiveness of networks – which are effective and why? • Develop a true understanding what people really want in terms of livelihoods • How can development support for small scale, part-time and semi-commercial livestock producers be increased so as to improve their productivity and income and thereby contribute to poverty reduction? • How can one change agricultural support to one that recognises complex systems? • How to link human well-being, governance processes and sustainability of the resource? • How can existing environmental legislation and agricultural legislation (i.e. CARA) be implemented in a more effective way in order to safeguard the present biodiversity of agricultural landscapes (at threat from ploughing, over-extraction of ground water) and similarly the agricultural resource base that is linked to livelihoods? How to best use these pieces of legislation to a harmonious end? • How does one develop enabling frameworks for sustainable socio-ecological systems? • How can scientists contribute to policy implementation and assessment and local governance of natural resources?
<p>Knowledge Sharing / and the translation of knowledge to policy</p>	<ul style="list-style-type: none"> • From all the past work in the biome, and though SKEP, what are the lessons learnt? • How to extend these findings to the users going forward • Is research being transferred to policy? If so, how is this effectively done? • How to mainstream action research in the Succulent Karoo? • How do we best share knowledge? • How do we ensure that scientific information is interpreted to the managers? • How to implement the relevant research done at the ground level? • How could one create the conditions for free and independent research on issues of conservation and livelihoods in the Succulent Karoo? • How do we ensure historical knowledge around land management and farming strategies is captured and passed on to younger or emerging farmers and land users?

2.3 Research Area 3: Management in the face change

Farming, in particular livestock grazing, is a significant driver in the Succulent Karoo, with conservation, economic and livelihood implications. This research area addresses land management, in particular grazing, and consideration is given to the predictions of future climate change scenarios. A better understanding of the mechanisms, impacts and management responses to drought and climate change are called for.

Topic	Priority Research Questions
Grazing and land management	<ul style="list-style-type: none"> • What are appropriate stocking rates and management systems? • Need to develop an objective method to determine grazing capacity from veld conditions (game, livestock etc.) • Determining vegetation based carrying capacities (taking into account the condition of the veld) • How to practise biodiversity- and economically-sustainable grazing (agriculture)? • Veld assessment – what is the present condition of the veld across the entire biome? • Benefits of game versus livestock farming: Game farming – Appropriate species and associate activities of game farming What is the impact of game on the vegetation? • What are the effects of different breeds of domestic animals on veld condition? • What are the appropriate rest periods for the veld? • What makes livestock production sustainable in the long-term? How do we do it? • Is resource use monitored (at what scales, by whom, and how)? • Can the pre-colonial system of trans-human pastoralism across an expanded commons be recreated via land redistribution and is this an appropriate ecological and economic approach to land use? Is it socially acceptable? • Has the recent initiative to remove feral donkeys from the communal areas in Namaqualand had an effect on the condition of the veld (in the vicinity of Spoegrivier)? • What are the linkages between the failure in municipal support and veld condition on the communal rangelands? • How infrastructure (fences and positioning of water points) affect veld condition?
Drought and Water Management	<ul style="list-style-type: none"> • How do we manage available water to buffer drought conditions? • What are the impacts of increasing fodder artificially instead of reducing livestock numbers?

	<ul style="list-style-type: none"> • Are current levels of groundwater extraction sustainable (cumulatively)? • Expand the understanding of the role of groundwater and groundwater recharge in the Succulent Karoo (i.e. the dynamics of the seasonal well point in the Tweerivier area) • Investigate options for alternative water management • Investigate the use of NDVI for determining thresholds for stock management • Explore the potential for the establishment of a drought-NDVI early warning system • Development strategies and their relationship to scarce and diminishing water supply • How will increased droughts affect the people, plants and animals of the Succulent Karoo (frequency/duration of the drought)? • Expand ecological understanding of how plants and animals are affected by drought. Understand the role of drought and seasonal or climatic variation on plant, in particular those most significant to farmers - for example leaf abscission of <i>Tylecodon paniculatus</i>, the chewing of plant bark during droughts, palatability in relation to seasonality of rainfall) • How best to harvest rainwater (physically, institutionally etc)? • What are the most effective drought management strategies? Developing a detailed understanding of the both the science and local knowledge • How do land-users perceive and respond to drought in the Succulent Karoo (past and present)?
Global Change	<ul style="list-style-type: none"> • How does the interaction between climate change and land use impact ecosystem dynamics? • Identify, understand, and communicate land uses that exacerbate climate change • How do natural climate cycles relate to human-induced climate change in the Succulent Karoo? • Need to develop long-term monitoring techniques – Remote Sensing? • What effect is global change likely to have in the future and how can the differences between modeled futures and the recorded past be reconciled? • How have changes in atmospheric greenhouse gases, climate and land use influenced both natural and agricultural production systems in private and communal areas over the last 100 years? • Developing a more detailed understanding of climate change scenarios e.g. water, social fabric and natural resource management • Understand past land use impacts in creating current ecosystems and their functions • How to mitigate the impacts of climate change on livelihoods and the ecosystem • What is the impact of climate change on ecosystem processes and services? • How will the expansion of communal areas impact the ability of plant species to move in response to

	<p>climate change?</p> <ul style="list-style-type: none"> • How will climate change and associated functional change/species trait change affect livelihoods? • How will global change have an effect at a local site level (not production, descriptions and correlations but ecosystem function)?
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2.4 Research Area 4: Socio-Economic Systems

A sound understanding of the socio-economic context of the Succulent Karoo, at all scales, is necessary for furthering biodiversity conservation and livelihood concerns. The real value of biodiversity, the costs and benefits of conservation, and current and potential future livelihood practices need to be better understood.

Topic	Priority Research Questions
National Socio-economic context	<ul style="list-style-type: none"> • What contribution does the Succulent Karoo region make to the national economy? • What is the existing and potential socio-economic contribution of the Succulent Karoo to the GDP of South Africa? • How do national or global economic changes influence the contribution to the Succulent Karoo and to its environment and people living there? • How does the socio-economic context of the Succulent Karoo affect the people's ability to use protected resources? • Understand the role and impact of biodiversity conservation within an era of rapid socio-economic development • What is the cost to conserve? • To what extent does economic viability impact on the conservation of the resource? • How do recent changes in support to farmers affect their economic status and what are the social implications?

<p>The Value of Biodiversity</p>	<ul style="list-style-type: none"> • What are the socio-economic costs or benefits of biodiversity for local/regional/national contexts? • How do these socio-economic costs/benefits of biodiversity change over time and space? And why? • What are the current and emerging uses of biodiversity? • Determine the value of biodiversity (ecosystem services) • How to ensure the commercial use of indigenous species without adversely affecting nature? • How to tangibly demonstrate to people the benefits of nature/biodiversity/ecosystems?
<p>The Socio-economic Costs/Benefits of Conservation Initiatives</p>	<ul style="list-style-type: none"> • What is the range of conservation initiatives in the Succulent Karoo and how have they changed over time? • What are the socio-economic effects of a range of conservation initiatives on people's livelihoods, property prices, affordable housing, land availability etc... especially those from disadvantaged communities and communal settlements? • How do people perceive the conservation initiatives of the region in terms of social justice, economic opportunity, and sustainability? • What range of incentives exist and which will be effective in encouraging people to support conservation initiatives? • Is there a willingness to pay for conserving the Succulent Karoo?
<p>Livelihood Practices in the Succulent Karoo</p>	<ul style="list-style-type: none"> • What is the current <i>status quo</i> of livelihoods and what are the alternatives or opportunities available to improve the quality of life in the area? • How are livelihoods affected by age/gender/class/education etc? • How do we redress the socio-economic imbalances of the past and can biodiversity play a role e.g. eco-tourism? • Need to understand the alternative economic options for people in the Succulent Karoo that are not land based and at a regional level (for example the generation of veterinarian medicines currently produced in Johannesburg and bought in to the Province at high prices) • What is the commercial potential of some of the indigenous plant species in the biome (Kougoed, Ngoba)? • Explore how best to set up a viable community-lead business based on a commercially viable indigenous plant

2.5 Research Area 5: Trans-disciplinary

The occasional repeated research need presented in more than one Research Area (though obviously nuanced to that Research Area) does point to areas of research that cover all the identified Research Areas. A few key research gaps were identified and deemed trans-disciplinary and of an over-arching nature, common and important to more than one Research Area. These relate to knowledge synthesis and the development of methodologies across different disciplines in the Succulent Karoo.

Topic	Priority Research Questions
Trans-Disciplinary Synthesis	<ul style="list-style-type: none"><li data-bbox="548 537 1780 605">• Explore how best to set up a viable community-lead business based on a commercially viable indigenous Synthesis and sharing of existing knowledge to identify gaps in thematic areas<li data-bbox="548 610 1703 646">• How can science accommodate and value different knowledge forms (Methodologies)?<li data-bbox="548 651 1461 678">• Develop a methodology of Trans-disciplinary research within SKEP

3 THE WAY FORWARD

The purpose of this research strategy is to guide future research efforts in the Succulent Karoo, under the overarching aim of achieving sustainable conservation and livelihood outcomes. This document will be used in a number of ways. It must serve to guide researchers working in the Succulent Karoo to direct their research efforts. Government and private funding agencies should use it to guide their funding of research efforts in the Succulent Karoo to ensure that work funded is relevant and necessary. To this end there has been the suggestion of a ‘market place’ event where funding agencies, implementation projects and conservation organisations and research entities could be brought together and look for common opportunities. In developing plans to draw up a National Research Strategy, the Government will look to this research strategy both to inform its own methodology and as a starting point in terms of content.

One suggested way forward is to use this Research Strategy as a catalyst for a biome level study group. The example of the successful Little Karoo Study Group was cited. This Study Group brings together a number of individuals and organizations doing research in the Little Karoo, allowing for cross-pollination and support through informal partnerships. The Study Group does not have any associated funding, but rather participants are funded through their own respective agencies. The Study Group also has close linkages with land managers and practitioners in the area through the frequent presentation of research findings in a forum set up for this end. This suggested option as a way forward would be meet the final Research Area 5’s aims in fostering trans-disciplinary research and open opportunities to develop trans-disciplinary methodologies. The Arid Zone Environmental Forum (AZEF) would make a natural home, or starting point, for this proposed way forward, and may on some levels already be serving this suggested purpose.

4 ACKNOWLEDGEMENTS

We are grateful to all the participants who gave of their time in attending our workshop and agreed to give feedback on draft documentation. To Richard Cowling for the useful conceptual chat prior to our workshop. Igshaan Samuels kindly served as translator in the meeting with the Tweerivier Klein Boer Vereenegeng. The development of this strategy would not have been possible without the generous funding support received from CEPF.

APPENIX A

AGENDA FOR THE DRAFT RESEARCH STRATEGY FOR THE SUCCULENT KAROO WORKSHOP TO BE HELD ON THURSDAY, 30 OCTOBER 2008 IN THE COLOPHON ROOM, CBC, KIRSTENBOSCH

8:30	Tea and coffee on arrival	
9:00	Welcome, aims and introductions	Dr P Anderson
9:10	Context and background to the research strategy and opportunity for questions	Dr P Anderson
9:20	Bridging the science, policy and management interface	M Driver
9:30	Individual brainstorming exercise:	Dr P Anderson
	<i>What do you feel are the four most pressing research questions in terms of improving our understanding and management of the Succulent Karoo?</i>	
10:25	Instructions for group work sessions	Dr P Anderson
10:30	Tea	
11:00	Group session	All
12:00	Feedback from groups and discussion	Dr P Anderson and M Johnson
12:55	The process forward, thanks and closing	Dr P Anderson
13:00	Lunch	

APPENDIX B

WORKSHOP ATTENDEES

Name	Surname	Organisation
Annelise	le Roux	CapeNature
Annelise	Vlok	CapeNature
Bettina	Koelle	Indigo
Christy	Bragg	UCT
Colleen	Seymour	SANBI and AZEF
Conrad	Geldenhuis	DNC
Lubabalo	Ntsholo	SKEP
Marion	Johnson	SKEP
Melodie	McGeoch	SANParks Cape Research Centre
Moeniba	Isaacs	PLAAS
Nelmarie	Saayman	Western Cape Department of Agriculture
Nicky	Allsopp	SAEON
Pippin	Anderson	SKEP
Patrick	O'Farrell	CSIR
Pete	Carrick	NRI
Poul	Wisborg	at PLAAS
Rhoda	Malgas	University of Stellenbosch
Roberta	Burgess	NC Agriculture
Simon	Todd	Private
Steven	Dauids	CI
Timm	Hoffman	PCU
Ruth-Mary	Fischer	SANParks Cape Research Centre
Charl	du Plessis	Eisenberg