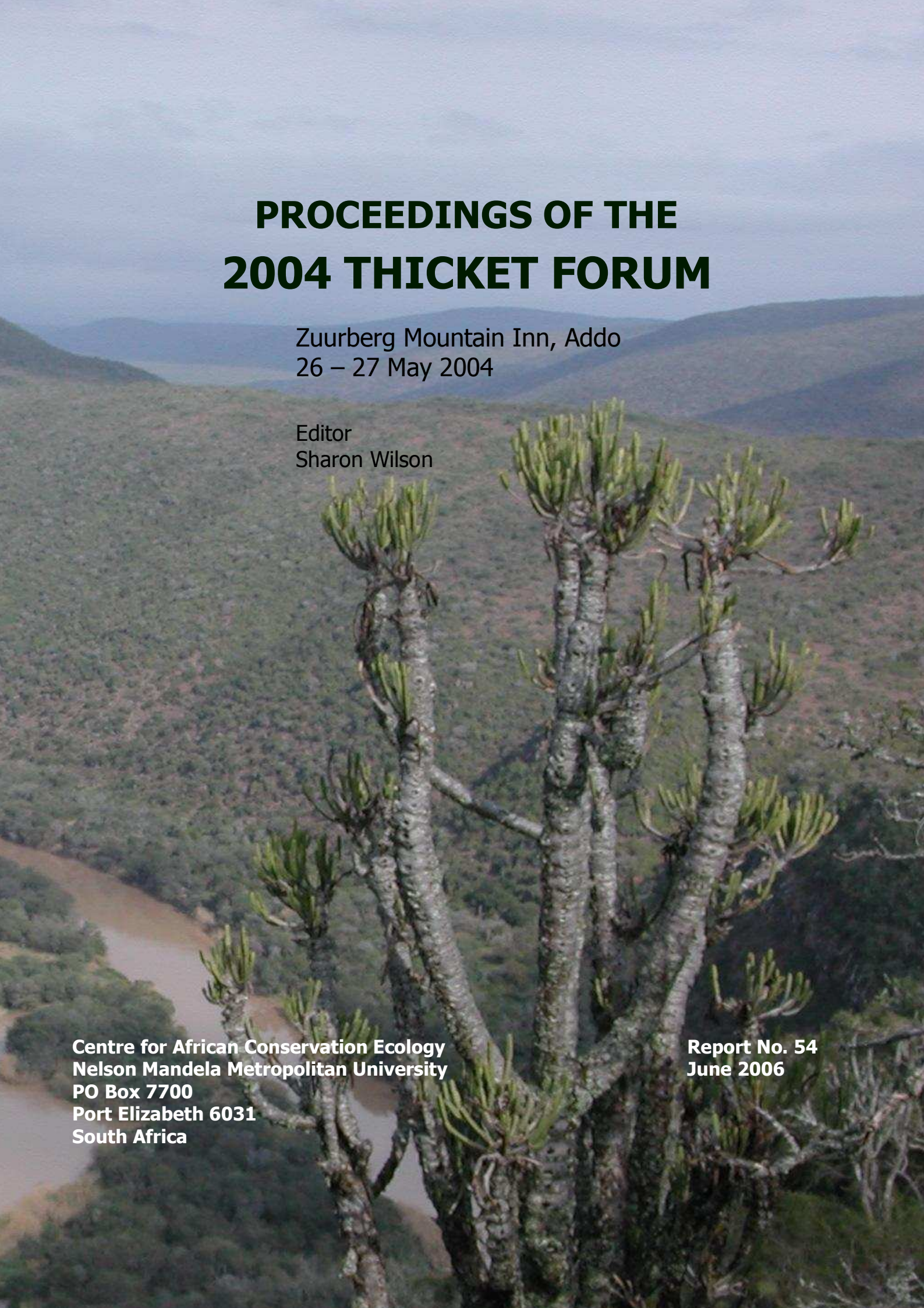
PROCEEDINGS OF THE
2004 THICKET FORUM

Zuurberg Mountain Inn, Addo
26 – 27 May 2004

Editor
Sharon Wilson



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PREFACE

The inaugural forum on natural resource management in the Thicket Biome was organized by the Subtropical Thicket Ecosystem Planning (STEP) Project in response to wide recognition from various stakeholders of the need to align and integrate individuals and institutions conducting research into ecologically, economically and socially sustainable natural resource use within the Thicket Biome. The 61 invited delegates to the forum represented several academic institutions, government and non-government institutions, and included private landowners and reserve managers. Presentations were made by 20 invited speakers, who had been identified as key role players, or as representatives of key organisations, within the Thicket Biome. Speakers were asked to highlight research progress made over the past few years, and to overview current thicket related activities within their respective organisations.

These proceedings are sponsored by the STEP Project and published by the Centre for African Conservation Ecology. They serve as a record of the papers delivered at the forum, and also document the outcomes of a planning workshop held to address the need for, as well as the suggested format and organisational arrangements of future Thicket Forum meetings. It should be noted that none of the contributions have been peer reviewed, and that manuscripts were only copy-edited after receiving them from the authors. Programme abstracts have been included in the proceedings if the speakers did not submit full manuscripts.

The views expressed in these proceedings are those of the authors, and they do not necessarily represent the views of the editor or those of the Centre for African Conservation Ecology.

A number of members of the STEP team contributed to the success of this inaugural Forum, and in particular André Boshoff, Richard Cowling, Andrew Knight and Graham Kerley are thanked for the instrumental roles they played with regard the initiation and planning of this meeting. Furthermore, Mandy Cadman is thanked for facilitating the Forum Planning Workshop and Petro Erasmus for providing organisational assistance at the meeting.

Finally, thanks are extended to the authors who submitted manuscripts for these proceedings, and to all of the invited speakers and forum participants who enthusiastically gave of their time and insights, thereby ensuring the success of this inaugural meeting.

Sharon Wilson
May 2006

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INTRODUCTION TO THE FIRST THICKET FORUM

André Boshoff
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The inaugural meeting of the Thicket Forum, held at the Zuurberg Mountain Inn, Addo District, on 26 and 27 May 2004 represents another important milestone in the evolving story of South Africa's subtropical thicket vegetation. Until the 1990s, subtropical thicket, or valley bushveld as it was commonly known, was not classified as a distinct vegetation type, or biome, and it was placed as a subtype within the Karoo and Karroid Veld Type of Acocks (1975), and in the Savanna Biome by Huntley (1984) and by Rutherford & Westfall (1986).

Subtropical thicket received its first real boost with the holding of the First Valley Bushveld Symposium in Grahamstown in 1990. Here the question was posed "Is subtropical thicket the missing biome of SA?". Interestingly, this symposium focused very much on thicket itself, and no attention was paid to issues relating to thicket and the thousands of people that live in it and depend on it for their livelihoods.

A further boost was provided by the holding of the Second Valley Bushveld Symposium, also in Grahamstown, in 1995. This conference saw the first evidence of attempts to integrate the social, economic and ecological factors that might affect sustainable development in subtropical thicket. This unique vegetation type was finally put on the map, so to speak, when it was accorded the status of a distinct biome in Low & Rebelo's "Vegetation map of South Africa, Lesotho and Swaziland", published in 1996.

In 1997 a group of leading southern African scientists and conservation managers met and agreed that subtropical thicket was in trouble, and that some kind of conservation intervention was urgently required. This led directly to the development and execution of the Global Environment Facility-supported STEP (Subtropical Thicket Ecosystem Planning) project, implemented by the World Bank and managed by the Centre for African Conservation Ecology[1] at the Nelson Mandela Metropolitan University[2]. Briefly, this research and planning project, that commenced in July 2000 and terminated in June 2004, had three major aims:

1) To provide a detailed map and classification of subtropical thicket (see Vlok & Euston-Brown 2002 for project outcomes),
2) To conduct a conservation assessment and compile a spatial plan that identifies priority areas for its conservation (see Cowling *et al*. 2003 for project outcomes), and
3) To provide a framework for its sustainable utilisation (see Knight & Cowling 2003 for project outcomes).

One of the key STEP products is an Implementation Strategy (Knight *et al.* 2003) that was developed in close collaboration with a wide range of stakeholders. One of the priority actions listed in this document is the holding of an annual Thicket Forum that will: "*guide, encourage, align and integrate key research and industry institutions conducting research into ecologically, economically and socially sustainable natural resource use, in consultation with non-academic partners*".

[1] In June 2006, the Terrestrial Ecology Research Unit was renamed to the Centre for African Conservation Ecology.
[2] As of 1 January 2005, the University of Port Elizabeth, Port Elizabeth Technikon and Vista University merged to form the Nelson Mandela Metropolitan University.

With this in mind, it was decided that the aims of the inaugural Thicket Forum should be to:

1) present a series of selected research highlights and activities associated with the Thicket Biome, through a number of invited presentations. Speakers were chosen to broadly represent the wide range of sectors that are involved with thicket in one way or another, for example, academics, conservation planners and managers, agriculturalists, land-use planners and decision-makers, social scientists, land managers and resource economist. The nature and content of the presentations reflected this aim, and to
2) discuss and reach consensus on the future format and content of the Thicket Forum, by way of a dedicated workshop session.

This inaugural Thicket Forum was convened by the STEP project and organised by Dr Sharon Wilson of the Centre for African Conservation Ecology. Our grateful thanks go to Sharon for the superb job that she did in making this first Forum the great success that it was.

This document contains the presentations from the Forum. They will stand as a benchmark of what has been achieved so far, and of greater things to come !

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THICKET RESEARCH: *QUO VADIS*?

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More than eight years has passed since the last Valley Bushveld symposium (Kerley *et al.* 1996). What have we learnt about subtropical thicket since then, and where should we be focusing our research in the future? Below I provide a personal perspective on these two points. I am aware that others may have provided a very different perspective.

What have we learnt?

The Subtropical Thicket Ecosystem Planning (STEP) Project has provided a great impetus for learning more about thicket. We now have an expanded concept of thicket in south-eastern South Africa that encompasses the mosaics that it forms with vegetation associated with other biomes (Vlok & Euston-Brown 2002, Vlok *et al.* 2003). We also have a hierarchical classification of thicket for this region that recognises four major types (Thicket, Valley Thicket, Xeric Thicket and Dune Thicket), subdivided according to biogeographic locality and grain (solid vs mosaic) (Vlok *et al*. 2003). We are beginning to appreciate that thicket is part of a global biome of an ancient, early Tertiary formation that preceded fire-prone savannas, grasslands and sclerophyllous shrublands (Vlok & Euston-Brown 2002, RM Cowling, S Proches and JHJ Vlok unpublished data). Thus, the earlier concept of thicket as a relatively young vegetation type, comprising an admixture of species derived from adjacent biomes (Cowling 1983), appears to be erroneous (but see Hoffman & Cowling 1991). We also now know – as has been hypothesised (Midgley *et al.* 1997) - that at the ecosystem level, thicket functioning is more similar to that of a rainforest than a semi-arid shrubland (Lechmere-Oertel *et al.* 2004a, Mills *et al*. 2005). Much progress has been made in understanding the role of mammalian herbivores, especially megaherbivores, as drivers of ecological patterns and processes in thicket (e.g. Sigwela 1999, Lombard *et al.* 2001, Kerley *et al.* 2002). More light has been shed on the enigma of plant recruitment in thicket: while ramet recruitment predominates in the Xeric and Valley Thicket types (Midgley & Cowling 1993, Sigwela 2004), seedling recruitment may be significant in the Thicket and some Dune Thicket types (Cowling 1997, Cowling *et al.* 1997, Kruger *et al.* 1997, Kamineth *et al.* 2003). We also have a better picture of the extent and impacts of degradation of thicket at the local (Fabricius 1997, Kerley *et al.* 1999, Lechmere-Oertel *et al.* 2004, Sigwela 2004, Lechmere-Oertel *et al.* 2005a,b) and regional scales (Kerley *et al.* 1999, Lloyd *et al.* 2002), and have gained important insights on constraints and opportunities for restoring it, at least to a functional state (Lechmere-Oertel *et al.* 2004, Mills & Cowling 2006, Sigwela 2004). The STEP Project has provided a rigorous and defensible assessment of conservation priorities (Cowling *et al.* 2003) as well as a tractable strategy for implementing these (Knight & Cowling 2003, Knight *et al.* 2003). Finally, some progress has been made with identifying – in addition to fodder for livestock - the services that thicket provides for humans, notably its potential for sustaining rural livelihoods (Cocks & Wiersum 2003), carbon sequestration (Mills *et al*. 2005, Mills & Cowling 2006), ecotourism (Geach 1997, Sims Castley 2002, Turpie 2003), and wildlife ventures (Smith & Wilson 2002, Turpie 2003).

What do we need to know?

However, much research remains to be done if we are to convince stakeholders of the value of using thicket in a sustainable way, both ecologically and economically. Some suggestions are provided below.

- We need to test the notion of thicket as the "mother of all South African vegetation" through comprehensive phylogentic and phylogeographical analyses of its component plant and animal lineages. This will provide a charisma that is currently lacking for this vegetation type.
- We need a better understanding of the biology of keystone plant species, including spekboom (*Portulacaria afra*), wild plum (*Pappea capensis*), boerboon (*Schotia afra*), and aloes.
- More research is required on ecosystem processes, especially with regard to nutrient and carbon dynamics.
- The population and community dynamics of Xeric and Valley Thicket remains an enigma: much more needs to be done. Of great importance is role of fire in maintaining thicket boundaries and the composition of thicket clumps in mosaic formations.
- Given that thicket supports hugely more herbivore biomass than vegetation at equivalent latitudes elsewhere in the world (AV Milewski *pers. comm*.), we need to know why this is so and what are the requirements to maintain this biomass.
- The massive rise in the wildlife industry, often involving extralimital species, challenges us to understand the impacts of these species on biodiversity and ecological processes.
- While there is some appreciation of stocking rates for both domestic and indigenous livestock, a much finer-(farm) scale assessment is required.
- How do we monitor thicket – what are the benchmarks and indicators of change?
- We also need a better understanding of the many services, both direct and indirect, that intact thicket provides for the humans who live in its midst.
- We urgently need an assessment of the likely impact of anthropogenic climate change on thicket vegetation types and keystone species. While some progress has been made (Robertson & Palmer 2002, Rutherford *et al*. 1999, van Jaarsveld *et al.* 1999), more comprehensive studies are required.
- Finally, and most importantly, we require a much better appreciation of the ways in which humans view thicket and the choices they would make regarding its use or abuse. Without these insight we are unlikely to be in a position to mainstream the sustainable use of thicket into sectors traditionally seen as adversaries of conservation, namely agriculture, subsistence use and infrastructure development.

Conclusion

In conclusion, much has been learnt about thicket but much more knowledge is required. In order to harness our limited research capacity and resources, thicket research should be placed within a framework that ensures relevance, defensibility and accountability. In short, we need research for implementation. Hopefully, the Thicket Forum will contribute to identifying such a framework.

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DEGRADATION PATTERNS AND TRENDS IN THE SUCCULENT THICKET

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Abstract
Degradation and transformation in the thicket biome has originated from a number of processes, including excessive herbivory by domestic livestock, land clearing for cultivation, harvesting of woodfuel and medicinal plants, alien plant invasion, mining and urbanization. One of the greatest challenges in preventing further loss and restoring the degraded sites in the thicket is to understand the processes which drive the patterns of change in the ecosystem and to use this knowledge to halt or retard the trend. In this paper we review the literature on the causes of degradation in the thicket, explore the trends within the various degradation processes and offer some ideas on where effort should be focussed to halt the process.

Although the threat from goat farming seems to have abated on freehold rangeland, it continues to remain a serious threat to thicket in the Great Fish, Keiskamma, Buffalo and Kei river valleys. The use of indigenous wood for fuel and dwelling construction is likely to continue at current rates. Efforts to replace these sources with electricity have been accelerated since 1994, but do not appear to take cognisance of the economic conditions of the users and regional population trends. Localized examples of thicket being cleared to make way for urban growth continue to threaten parts of the biome. Integrating the Subtropical Thicket Ecosystem Planning (STEP) Project conservation targets into the regional plans for district municipalities remains a challenge. Clearing of virgin thicket for beef and dairy production in Cacadu and Amatole remain a serious threat, and appears to continue unabated. Efforts to inform the National Department of Agriculture about STEP and its goals should be more actively pursued.

Introduction
Degradation processes in the thicket biome have been the subject of a number of investigations, many of which express concern about the magnitude and direction of transformation in the biome (Everard 1987, Hoffman and Cowling 1990, Kerley *et al.* 1995). Earlier, Acocks (1953) suggested that the structure of the valley bushveld in the Great Fish River basin was a function of being "opened up, overgrazed over large areas, and invaded by the prickly pear". Domestic herbivory is not solely responsible for structural changes in the thicket. Acocks (1953) further suggested that *Euphorbia bothae* was invading the Fish River Scrub, but today it is clear that this species is an integral part of a fully functional Arid Thicket (Vlok & Euston-Brown 2002). In an effort to quantify the nature of degradation by domestic herbivores, Stuart-Hill (1989) provided examples of the species associated with grazing gradients in the Valley Thicket. Certain woody species (e.g. *Lycium oxycarpum* and *Gymnosporia polyacantha*) increased in density with excessive herbivory by domestic goats. Previously Aucamp *et al.* (1980) had shown that *Portulacaria afra* declined under heavy browsing by domestic goats. Resource managers were alarmed by the dramatic fence line contrasts that developed in the succulent thicket after browsing by goats. Despite the concern, commercial ranchers continued to use the thicket for goat production, and it was challenging for researchers to develop guidelines for

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sustainable production levels in mesic and xeric thicket. There continued to be two obvious patterns of vegetation change that required attention. Woody species (e.g. *Acacia karroo*, *L. oxycarpum, Rhus undulata* and *G. polyacantha*) were increasing under conditions of excessive herbivory in the mesic components of the landscape and the region, and in the xeric portions, desirable succulent and woody shrubs were being eliminated. It was clear that different degradation processes were occurring within the thicket, and that the understanding of the contemporary vegetation state required the development of appropriate concepts of expectation or potential for the thicket. Deviations from these defined states could be described as degradation. In the mesic portions of the biome, strong summer seasonality in the rainfall encourages woody shrub production. There is compelling evidence of woody shrub encroachment throughout this and other biomes (Hoffman & O'Connor 1999). Encroachment of less desirable woody species is particularly obvious after disturbance events such as ploughing. Much of the post-disturbance thicket in the eastern portions of the planning domain is dominated by *A. karroo*. Woody encroachment by *A. karroo* is also obvious in thicket that has not been cultivated. Suggested mechanisms for this localized increase in woody shrub biomass in mesic thicket, include i) a reduction of fire frequency (Trollope 1980), ii) the removal of grass biomass by domestic herbivory with the resultant success of woody shrubs (Du Toit 1967), and iii) the C3 shrubs having a competitive advantage over C4 grasses under elevated CO_2 conditions (Bond & Midgley in press). Graziers attempt to control the woody encroachment using a number of approaches including clear felling; burning followed by intensive browsing by goats; and chemical control. However the process continues unabated, with the encroachment of woody species (*A. karroo, R. undulata, Scutia myrtina*) being particularly obvious in post-disturbance situations. In addition to the impact of domestic herbivory, differences in land-use practices were also explored and evaluated (Birch *et al.* 1999). The thicket is unique in that vastly contrasting land-use practices occur adjacent to one another (freehold, state-owned and communal tenure systems). These different treatments allowed researchers to explore the impact of long-term application of disparate land tenure regimes on the thicket. In contrasting the structure and species composition between commercial, communal and conservation land-use, Evans *et al.* (1997) showed dramatic differences between paired samples across these land-use treatments. It is clear that herbivory by different species (domestic and indigenous) and with different levels of resources (poorly resourced communal areas versus subsidised commercial ranches) had dramatic impacts on the structure and composition of thicket. Thicket in communally managed areas was dramatically transformed, with certain species (e.g. *P. afra*) disappearing completely from communally managed areas and other less desirable species (*Pteronia incana*) becoming dominant. Conservation areas had greater structural diversity (Fabricius & Burger 1994) than either the adjacent freehold or communally managed areas. These results are also mirrored in the work of Stuart-Hill (1991), who provided a model for the difference in the impact of elephant (an indigenous herbivore) and domestic goats on the thicket. It was clear that certain species were well adapted to herbivory by elephants but ill-adapted to herbivory by goats. Degradation in the thicket has also been described as a loss of functionality, following the landscape function approach (LFA) of Ludwig *et al.* 1997), who suggest that functionality becomes less efficient as nutrients and water are lost from the landscape.

Methods

In this study, we integrate the results of the earlier research on processes, examine trends in degradation provided by results of the STEP project (Lloyd *et al*. 2002), and provide some guidelines as to where intervention should be planned.

Results

Urbanization and Rural Settlements

Urbanization and rural village construction are the most obvious of these impacts. In these cases, the natural thicket vegetation is totally removed, to make way for dwellings, cultivated land and urban-infrastructures. In some instances, thicket species may have been retained around dwellings, but this is usually confined to the elite coastal settlements and older towns. In general, all thicket adjacent to a dwelling is removed when a new village or settlement is created. This trend is likely to continue but will remain localized (Table 1), and amelioration will require local government to implement planning legislation.

Cultivation

"Of all modern agricultural practices, crop cultivation probably has the greatest impact on the terrestrial biota of a region. Not only is the relatively diverse cover and composition of natural vegetation replaced by one or a few alien species, but soil destruction and water nutrient additions further transform the environment. The total area under cultivation in South Africa in 1988 was around 130 000 km^2 or about 10.6% of the land surface (Anonymous 1994). This is very close to the 12 to 15% estimate of total potential arable land area in South Africa (Schoeman & Scotney 1987). Data from agricultural censuses show that there has been a steady increase in the area cultivated between 1911 and 1965, but that this has levelled off in the last two decades. This suggests that most of the productive lands have already been cultivated. Thus, any agricultural expansion of croplands in the future will encroach increasingly on economically and ecologically marginal environments, where yields are lower and environmental impacts, such as wind and water erosion, probably greater. The implications of these statistics in the light of the region's 3.0% population increase are sobering." (Hoffman 1997). As new rural villages are established on communally owned land in the mesic eastern portions of the thicket biome, cultivation will remain one of the primary impacts on the mesic thicket. Each villager is encouraged to prepare and maintain lands for rainfed agriculture. There are currently no incentives for villagers to preserve thicket and to use it sustainably. On freehold land in the mesic central portions, commercial farmers are continually developing new pastures for dairy and beef production. Examples of large-scale destruction of thicket are evident in the districts of Cacadu and Amatole. This trend is likely to continue in both freehold and communal land. More stringent application of CARA (Act 43 of 1983) is unlikely to occur as government priorities have shifted from supporting commercial farmers to encouraging emerging small-scale farmers.

Mining

Although mining is no longer a threat to the thicket, as much of the exploitable sources of kaolin and limestone have been exhausted, the scars from historical mining operations are obvious throughout Cacadu. Rehabilitation of these to thicket should be encouraged. Borrow pits and quarries for road construction and maintenance will continue to be developed throughout the thicket biome. The control and rehabilitation of these disturbances must be enforced by the Department of Mineral and Energy Affairs and monitored by local authorities in terms of Minerals Act 50 of 1991.

Table 1: Processes that drive degradation within the thicket biome, the areas of greatest importance, primary driving variables and the current trends on communal and freehold land.

Process	Who defined the process	Extent	Primary driving agents	Trends on communal land	Trends on freehold land
Urbanization and Rural Settlements	Lloyd *et al.* 2002	Localized	Human settlement patterns	Tends to be less relevant as urbanization is taking place on the tops of hills	Adjacent to towns and cities the loss of pristine habitat continues to occur
Cultivation	Hoffman 1987, Kakembo 1997, 2004	Extensive	Production of cash crops and cultivated pastures for dairy and beef production	Breaking new land is un-controlled	In intensive dairy and beef production areas (e.g Nhlambe) losses of pristine habitat continue
Mining	Lloyd *et al.* 2002	Localized	Kaolin and limestone mining Rock and stone quarries	Limited to quarries for road construction	Localized on freehold land. Legislation does exist to affect rehabilitation
Fuel-wood and medicinal plant collecting	Cocks & Weirsum 2003, Dold & Cocks 2000.	Extensive in Eastern region	Demand for fuel Poverty	Trends remain un-controlled and a threat to remaining thicket	Localized. Usually beneficial due to bush encroachment
Herbivory by domestic livestock	Stuart-Hill 1989,1991	Extensive	Livestock commodity demand-beef, mutton, wool, goat, hides	Current trends (goat numbers increasing) remain un-controlled and a threat to remaining thicket	Reduced rate with decline in small stock (goat) numbers
Invasive alien species	Lloyd *et al.* 2002, Hoffman & Ashwell 2001	Extensive	Historical. Recent lack of activities by NDA	Usually used for wood fuel and dwelling construction	WfW is making a difference
Encroachment by karroid shrubs	Acocks 1953, Lloyd *et al.* 2002, Hoffman & Cowling 1990	Extensive	Herbivory by domestic stock. Climate change	Trends remain un-controlled and a threat to remaining thicket	Reduced rate with decline in small stock (sheep) numbers
Fire	Vlok & Euston-Brown 2002	Western regions	Wet-dry rainfall cylces	Low grass biomass continues to maintain fire frequency at low levels	With increased grass biomass in conservation areas, fire frequency will increase
Clearing along fence lines	Lloyd *et al.* 2002	Central regions	Access. Security for small stock. Fence subsidies	Not applicable	Reduced. No more fencing subsidies
Fragmentation	Acocks 1953, Vlok & Euston-Brown 2002	Western regions	Herbivory	Not applicable	Trends remain un-controlled and a threat to remaining thicket

Fuel-wood and medicinal plant collecting

Thicket hardwood species make ideal wood-fuel, dwelling and kraal construction material and traditional use material. There are also a large number of taxa used for medicinal purposes (Dold & Cocks 2002). The 2001 Census data (Anon 2004) provides household energy (Table 2) and dwelling construction data (Table 3) for two major rural districts (Cacadu and Amatole) in the thicket biome. The high poverty levels in these districts (Table 4) suggest that alternative commercial energy remains outside the means of at least 218053 households. Estimated fuel wood use per household is 4.2-4.6t y^{-1} (Shackleton *et al.* 2002) for the Kat River Valley.

Table 2: Energy source (for lighting) of households in the large rural district councils of Cacadu and Amatole (Census 2001). About 41% of households (at least 218053) are probably still dependent upon wood fuel for cooking and heating (Source: Stats SA 2004).

	Number of households			
Energy source for lighting	**Cacadu**	**Amatole**	**Total**	**% of Total**
Electricity	73848	232385	306233	58.11
Gas	411	1632	2043	0.4
Paraffin	19807	158437	178244	33.8
Candles	8075	29708	37783	7.2
Solar	202	469	671	0.1
Other	399	1707	2106	0.4
Total	102742	424338	527080	100

In the Great Fish River Valley, Cocks & Wiersum (2003) estimate total wild plant use at 5.6t y^{-1}. Based on the number of households that depend on non-electricity sources for lighting (Table 2), this equates to an estimated annual requirement of $1{,}22 \times 10^6$ tons for the districts of Cacadu and Amatole (total area 8.02 $\times 10^6$ ha) or 0.15t ha^{-1} y^{-1}. Schulze (1997) estimates the primary production of the region at 2-4 t ha^{-1} $season^{-1}$, however with the high co-efficient of variation in annual production (30-40%), this remains extremely variable. Traditional use currently accounts for 3.5-7.5% of total annual production. We believe this figure is likely to grow.

Table 3: Household use of natural products for dwelling construction in the large rural district councils of Cacadu and Amatole (Census 2001). About 27.6% of the households (at least 145826) are probably still dependant upon harvested wood dwelling construction (Source: Stats SA 2004).

	Number of households			
Type of dwelling	**Cacadu**	**Amatole**	**Total**	**% of Total**
Traditional dwelling/hut/structure made of traditional materials	10300	135526	145826	27.6
Other	92439	288812	381251	72.3
Total	102739	424338	527077	100

Table 4: Annual household income for the rural district councils of Cacadu and Amatole (Source: Stats SA 2004).

	Number of households		
Rands per annum	**Cacadu**	**Amatole**	**Total**
<9600	45263	274311	319574
>9600	57470	150027	207497

Domestic herbivory

The region experienced an increase in the goat numbers (Angora and Boer) since the 1960's (Figures 1 and 2) and in many instances, this herbivory has had a dramatic impact on thicket (Figure 3-4). The enforcement of CARA remains the one viable option for preventing further transformation.

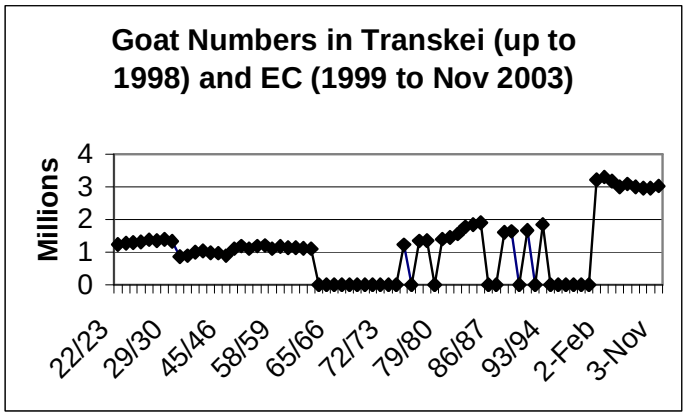

Figure 1: Trends in goat numbers in the former Transkei (up to 1998) and for the whole of the Eastern Cape Province (1999-Nov 2003).

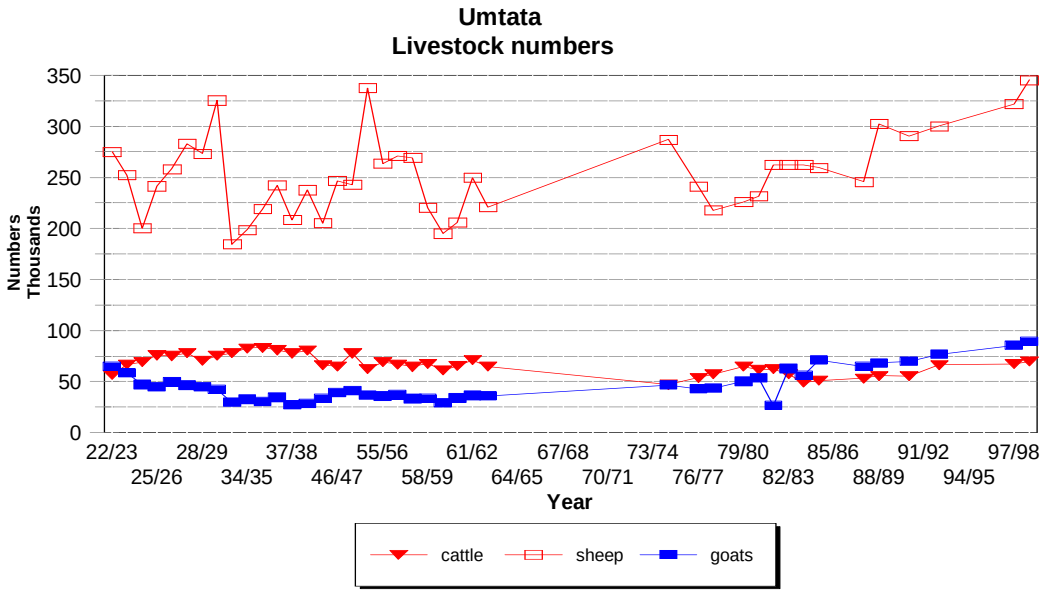

Figure 2: Trends in livestock numbers in the Umtata district, Transkei, from 1922 to 1996. Note the steady increase in goat numbers.

In contrast to earlier suggestions that CARA will be revised, the Act has recently (March 2004) been used to provide exceptional circumstances relief (drought, flood and cold). In the thicket biome, the Amatole District was identified as one in which the subsidy would apply and would cover the costs of transport of fodder to the value of 75%. No other costs, including road toll fees, were subsidized. The subsidy applies to the feeding of a maximum of the first 30 animals of each farmer and animals are expressed in terms of the universally accepted cow units. The subsidies were paid until the monies appropriated for the Scheme were exhausted. The subsidies were

paid directly to the suppliers of fodder and cartage contractors and not to the farmers. Assisting all farmers within the biome to use these subsidies should be encouraged.

The mechanisms driving thicket formation include seed dispersal by birds, small-scale disturbance regime (Vlok & Euston-Brown 2002), zoogenic effects (e.g. harvestor termites, earthworms, mole rats activity), herbivory by mega-herbivores (Stuart-Hill 1991) and vegetation history (Palmer 1990). It is interesting to note that the shrublands of the Great Fish River Valley are often rather depauperate in species, which may be an artefact of heavy grazing by domestic stock after a fire (Vlok & Euston-Brown 2002).

Invasive alien species

Woody alien invasion is a feature of the mesic sections of the biome, where species such as *Acacia mearnsii, Acacia longifolia, Acacia saligna, Lantana camara* and *Psidium guava* colonise disturbed patches in the thicket. In addition, some species escape from plantations and woodlots, and colonise the adjacent thicket. Wherever alien plants comprised a significant portion of the mapping unit (Lloyd *et al.* 2002), the thicket was regarded as degraded. In the coastal dune system, *Acacia cyclops* and *P. guava* remain the most obvious invaders. In the xeric portions of the planning domain, aggressive drought tolerant alien taxa were obvious, including many species of the Cactaceae (*Opuntia* spp) and *Atriplex* spp. The effort by the National Department of Agriculture to control these species has declined in recent years, and we believe that business plans which address the control of the *Opuntia aurantiaca* and *Lantana camara*, two of the thickets worst weeds, should be aggressively stimulated by concerned citizens.

Encroachment by karroid shrubs

Where thicket abuts against the succulent and Nama-karoo biome, karroid shrubs are potential invaders. This is particularly obvious in the communally managed areas of the Buffalo, Keiskamma and Great Fish River basins, where *Pteronia incana* has invaded the inter-clump area. The success of this species is linked to disturbance events on the landscape (e.g. cultivation, extensive abandonment of cultivated lands, zoogenic activity) (Kakembo 2004), changes in nutrient and moisture distribution, and reduced fire frequency, which accompanies a reduction in standing biomass after intensive herbivory. Effort to control the spread of this species into healthy rangeland, include increasing fire frequency and mechanical clearing.

Fire

Much has been written about the role of fire in maintaining grassland and fynbos. However, excessive, injudicious burning results in the edges of thicket being damaged during frequent, hot fires. Fire is particularly damaging to the coastal dune system, and Lloyd *et al.* 2002 regarded obvious fire scars as degraded. Fire is an important disturbance factor in the Sundays Thicket, and is used to maintain species richness of the Mosaic units where the matrix consists of Grassland, Succulent Karoo, Renosterveld or Fynbos species (Vlok & Euston-Brown 2002). Fire poses a threat in the western sections, and once again CARA should be invoked to prevent injudicious use of fire.

Clearing along fence lines

This is the practice of clearing a wide strip along fence lines, which enables farmers to access the fence to effect repairs. These cleared strips have been widely linked to the proliferation of farms using "Holistic Resource Management", which encourages the use of "wagon-wheel" camp layout. Reduction in state subsidy for fencing has reduced the threat.

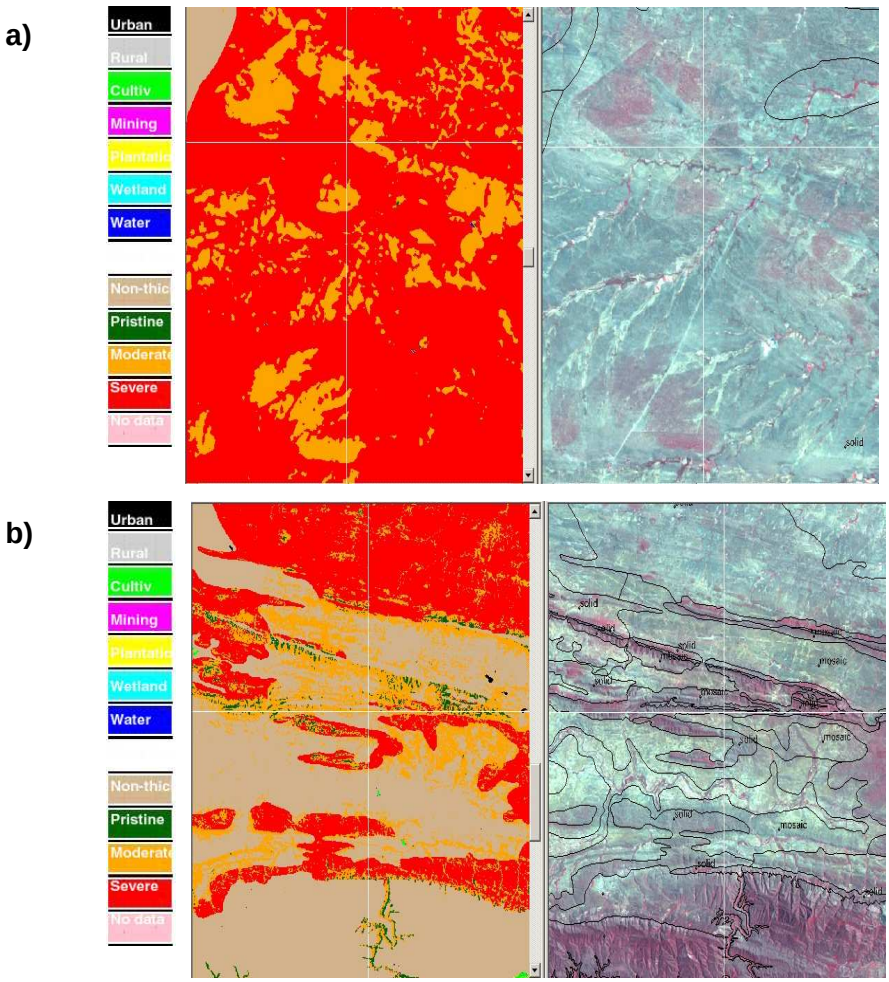

Figure 3: Classified map and Landsat TM image of portions of a) Arid Thicket and b) Groot River Thicket. The thicket of these areas is severely degraded. Transformation of the original thicket patches (dark red), dominated by *Portularacia afra*, has clearly taken place and only remnants remain.

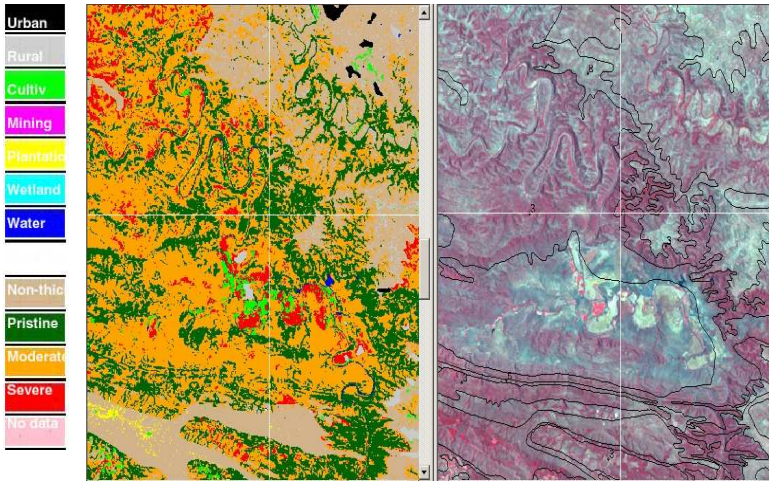

Figure 4: Classified map and Landsat TM image of portion of the Great Fish River Thicket. The thicket of this area is moderately degraded. Transformation of the original thicket for cultivation has occurred adjacent to the river. The pristine thicket is associated with the steeply sloping, largely inaccessible regions.

Fragmentation

Fragmentation threatens the thicket in the Gamtoos River valley. The process had already begun in pre-colonial times, but has been accelerated by fire and grazing regimes applied in recent times landowners (Vlok & Euston-Brown 2002). Nutrient poor geological formations (Uitenhage and Table Mountain group) and relatively high winter rainfall (< 250mm) favour the establishment of Fynbos and Renosterveld, which is fire tolerant. The Albany Thicket appears to be a serial successional stage between Grasslands and Forests. In cool, moist sites, where the substrate is poor in nutrients, it occupies a stage between Sour Grassland (which is often mixed with Grassy Fynbos elements) and Afromontane Forests. In warmer sites, where the substrate has a higher nutrient content (e.g. Nananga & Weltevrede formations) it is an intermediate stage between Coastal Grassland and Coastal Forests. When undisturbed (protected from fire and physical disturbance caused by grazing animals) the few typical Thicket elements in this unit (*e.g. Cussonia spicata* & *Euphorbia triangularis*) are displaced by woody trees, which form a closed canopy (Vlok & Euston-Brown 2002).

Conclusions

The thicket remains under serious threat from a number of sources (Table 5). Recent changes in the political and economic climate of the region have shifted the emphasis away from certain driving processes. There appears to be less of a threat to the thicket from goat production on freehold land, with a concomitant increase in goat numbers on communal rangeland. The control of invasive alien plants that are prevalent in the arid and semi-arid regions has taken a back seat over those likely to influence the supply of water.

Table 5: Proportions (%) of three thicket condition classes and transformed land in the solid thicket types, as a function of the total area of solid thicket (20 730.32 km²).

	% OF TOTAL SOLID THICKET AREA (20730.32km ²)							
VEGETATION TYPE (Vlok & Euston-Brown 2002)	**No ARC data**	**Transformed**	**Water/Sand**	**Non Thicket**	**Thicket (Pristine)**	**Thicket (Moderately degraded)**	**Thicket (Severely degraded)**	**Total**
Thicket, coastal, dune, solid (Dune Thicket)	0.03	0.13	0.17	0.14	0.30	0.56	0.07	1.40
Thicket, mainland, basin, solid (Valley Thicket)	0.00	1.85	0.11	0.62	9.97	17.72	14.01	44.28
Thicket, mainland, inland, solid (Arid Thicket)	0.00	0.22	0.11	0.44	3.02	11.58	23.35	38.73
Thicket, mainland, montane, solid (Thicket)	0.00	0.64	0.11	0.11	5.78	5.87	1.84	14.34
Thicket, mainland, basin 1, solid	0.00	0.00	0.00	0.02	0.53	0.48	0.22	1.25
TOTAL (SOLID THICKET TYPES)	0.03	2.84	0.51	1.32	19.60	36.21	39.49	100.00

In the former Ciskei, tardiness on the part of government in deciding on the distribution of previously commercial farms (so-called “Trust Land”) has precipitated land invasions by adjacent communities. This subtle land invasion is accompanied by poor decisions about rangeland management and access, and results in excessive herbivory, wood harvesting and creation of new cultivated lands. These processes contribute further to the degradation within the thicket.

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MAMMALIAN HERBIVORES AS DRIVERS OF THICKET

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Although the biomes of South Africa are broadly defined as bioclimatic regions (Low & Rebello 1996), it is not often recognized that phenomena other than the "bottom-up" driver of climate also influences the structure of the communities within these biomes. More significantly, understanding how important major ecological processes differ between biomes can provide profound insights into the characteristics of these plant communities and their constituent growth forms, and their major associated faunal communities.

The three major drivers that need to be considered at this scale (although many other factors such as biogeographic history, soil nutrients, etc. also play a role) are rainfall (amount and seasonality), fire and vertebrate herbivory, and their relative importance is summarized in Table 1.

Table 1: The biomes of South Africa and the relative importance of variation in rainfall, fire and herbivory intensity and seasonality in structuring plant communities.

Biome	Rainfall	Fire	Herbivory
Fynbos	High (summer drought)	High (burns in the medium term – 10-30 yrs)	Low (Low palatability)
Forest	High (minimum annual rainfall)	Low (does not normally burn)	Low (Low palatability)
Nama Karoo	High (low summer rainfall, frequent drought)	Low (does not normally burn)	High (High palatability, low production)
Succulent Karoo	High (low winter rainfall, frequent drought)	Low (does not normally burn)	High (Low palatability, low production)
Grassland	High (summer rainfall)	High (burns frequently 1-3 yrs)	Moderate (High palatability, fire effects overrule herbivory)
Savanna	High (summer rainfall)	High (burns frequently to rarely, depending on herbivory and aridity)	Moderate (High palatability, fire effects overrule herbivory)
Thicket	Low (Moderate, largely summer rainfall, plants adapted to survive through drought)	Low (does not normally burn, unless opened up by excessive herbivory)	High (High palatability)

From this it can be seen that subtropical thicket is unique among southern African biomes in terms of the drivers of ecological patterns and process, in that herbivory is probably the most important driver and the other two drivers play a relatively minor role. This is due to the fact that most thicket plants are long-lived and adapted to deal with drought (Hoffman 1989), such that it has been shown that undisturbed thicket maintains its forage production during drought (Stuart-Hill & Aucamp 1993).

Furthermore, fire is extremely rare in intact thicket, owing to the low incidence of lightning as a source of ignition (Manry & Knight 1986) and the low flammability of the largely succulent and evergreen vegetation and the low incidence of grasses (Kerley *et al*. 1995). On the other hand, the fact that thicket vegetation tends to be dense (i.e. has a high biomass), nutritious and evergreen means that herbivores are well supported in terms of forage resources in thicket, and in turn, they can influence the vegetation dynamics, growth form and regeneration process. It is therefore not surprising that thicket landscapes support a high biomass and diversity of browsers (Kerley *et al*. 1995), notable species being elephant *Loxodonta africana*, black rhinoceros *Diceros bicornis* and kudu *Tragelaphus strepsiceros*.

Given the importance of herbivores in thicket as suggested above, it may be appropriate to rephrase the question posed by Hairston *et al*. (1960) to "Why is thicket green?". The short answer is that the interactions between herbivores and plants are not one-sided as animals do not just browse thicket plants, but the plants respond in order to limit browsing, as well as its impacts. This is evidenced by the high incidence of spinescence (physical defence against herbivory) and the ability to coppice (recover from herbivory) among thicket plants (Midgley 1991). This has lead to hypotheses of coevolution between thicket plant species and their associated herbivores (Midgley 1991, Kerley *et al.* 1995, Wilson 2001), which extends beyond the impacts of herbivory to include processes such as seed dispersal (Sigwela 2004).

Mammal herbivores have been shown to consume material from a very broad range of plant species in thicket. The megaherbivore hindgut fermenters appear to feed on the widest range of plants species (Table 2). In contrast, ruminants appear to have a less varied diet, and this presumably reflects the need for ruminants to be more selective feeders in order to obtain the appropriate high quality forage. These findings suggest that the impacts of these two guilds on thicket vegetation will be markedly different, and this warrants further study in the light of the fact that the megaherbivores have been removed from more than 90% of thicket landscapes, with unknown consequences.

Table 2: The number of plant species recorded in the diet of thicket non-ruminant and ruminant browsers.

Digestion style	Herbivore	No. of plant species recorded in the diet	Reference
Hind-gut fermenter	Elephant	146	Paley & Kerley 1998, Davis 2004, Landman in prep
	Black Rhinoceros	120	Landman in prep
Ruminant	Kudu	52	Sigwela 1999
	Eland	27	Schlebusch 2002
	Bushbuck	26	MacLeod 1992

The consequences of herbivory for plants range from minor loss of leaf material to mortality of the plant, and plants exposed to extensive herbivory may undergo a loss of fitness and a decline in abundance. Thus, herbivore feeding preferences may influence the abundance and distribution of plants, as well as the competitive interactions between these plants. This process is made more complex by the observation that different herbivore species have different feeding preferences, thereby impacting on different plant species; as well as different feeding styles and abilities, thereby impacting on different plant parts (Wilson 2001). Furthermore, it can be shown that different browsers prefer to use different habitats within thicket (Henley

2001). Given the complexity of these interactions it is not always possible to separate their consequences. It may however be expected that megaherbivores would have the most significant impacts on the vegetation by virtue of their high biomass and forage requirements and their robust feeding ability – this, together with their other impacts, has lead to the "elephant as a keystone species" hypothesis (Midgley 1991, Kerley *et al*. 1995).

Most studies to date have focussed on the losses of biodiversity attributed to the impacts of herbivores. The earliest such study was by Penzhorn *et al*. (1974) who showed that a loss of plant species and a decline in plant biomass had occurred within less than 20 years in the elephant enclosure of the Addo Elephant National Park (AENP). Subsequent studies have shown a further loss of plant species, particularly amongst the small, largely endemic succulents and geophytes (Moolman & Cowling 1994, Johnson 1998, Lombard *et al.* 2001, Johnson *et al.* 1999). There has also been a change in the structure of the vegetation, with a decline in mean height of about 1 m (Barratt & Hall-Martin 1991) and an increase in the frequency of coppicing (Stuart-Hill 1992) in the presence of elephants.

Elephants have other impacts, most notably in terms of reducing density ("opening up") of the vegetation. Thus, Landman (in prep) has shown that high elephant density leads to an increase in the number and size of paths through thicket, and as these paths grow wider, so the proportion of open habitat increases. Associated with this is a change in microclimates, with air and soil temperatures of such open habitat becoming much more extreme than in intact thicket (Henley 2001). This change in microclimate has varied but as yet unknown implications for processes ranging from soil litter processes (c.f. Lechmere-Oertel 2003) to plant and animal physiology and to seedling germination and survival. A further consequence of this reduced density of the vegetation by elephant is a change in forage availability for black rhinoceros (and probably other browsers). The increase in elephant paths initially facilitates access to forage by black rhinoceros, which feed along the edges of thicket patches, but the subsequent dominance of the landscape by elephant paths leads to a loss of such feeding opportunities (Landman in prep). The focus on elephant management may therefore place black rhinoceros conservation opportunities at risk. These findings clearly illustrate how intricate the animal/plant/animal interactions are in thicket, and strongly highlight the need for further studies on the impacts of other browsing species.

One such area requiring study is that of the actual offtake of forage by herbivores. Currently our understanding of this is limited to a single estimate of daily elephant foraging in the AENP of 40 000 kg/day for a herd of 260 elephant in an area of about 11 000 ha (Paley 1997). The significance of this value is difficult to assess given that we do not know what forage production rates are in these landscapes, nor how the forage production is spatially distributed or utilised by other browsers. The situation is further complicated by Paley's (1997) estimate that elephants wasted an additional 67% (27 000 kg) of their daily forage intake through discarded material – this represents a massive input into the litter pool.

Browsing mammals not only eat plant foliage, but also ingest the fruit of plants, which confers benefits on the plants in terms of dispersing their seeds, thereby providing a mechanism for plants to colonise disturbed areas. Although Cowling (1983) speculated that these thicket plant communities were largely bird dispersed, subsequent data has shown that mammal herbivores disperse a greater range of seeds than either birds or reptiles (tortoises) (Table 3). Within the mammals there is a clear trend of decline in richness of species of seed dispersed with a decline in

body size, again emphasizing the importance of maintaining megaherbivores on the landscape. One of the unexpected consequences of the replacement of indigenous herbivores with domestic herbivores (of which goats are very poor seed dispersers) may be a collapse in the process of mammalian zoochory, with profound consequences for the regeneration dynamics of thicket plants. The information in Table 3 suggests that a significant proportion of thicket plants are not dispersed by birds and tortoises (which may persist when indigenous mammals have been extirpated).

Table 3: Number of plant species dispersed by mammals, birds and reptiles in thicket

Taxon	Number of plants species dispersed	Reference
Birds	14	Bruton 1992
	17	Sigwela 2004
Reptiles (tortoises)	11	Mason 1997
Mammals (all sp)	23	Sigwela 2004
• Elephant	10	
• Black Rhinoceros	16	
• Eland	5	
• Kudu	15	
• Bushbuck	2	
• Grey duiker	1	
• Grysbok	2	

The seeds that browsers disperse generally show increased germination due to the digestion process. Furthermore, these seeds are normally deposited in a nutrient rich patch of faeces (Bruton 1992, Castley 1992), presumably enhancing survival opportunities for the seedlings that germinate from these seeds. Seedlings tend to be relatively rare in thicket (Midgley & Cowling 1993), although Sigwela (2004) has recently recorded appreciable numbers of seedlings in intact thicket. One microhabitat in which seedlings are relatively abundant is that of black rhinoceros latrines (La Cock 1992). Further studies are therefore needed to assess the hypothesis that mammal zoochory is critical for thicket regeneration.

An end product of herbivory is defaecation and this leads to the creation of nutrient rich patches, which also contain large amounts of organic carbon. The megaherbivores and those browsers that create latrines (e.g. black rhinoceros, grysbok) are postulated to have significant impacts on nutrient distribution within thicket landscapes (c.f. La Cock 1992). This hypothesis needs to be assessed in terms of the significance of these nutrient inputs as well as their landscape level impacts. Lechmere-Oertel (2003) has recently shown that thicket transformed by overgrazing is characterised by a loss of nutrients and soil carbon (see also Kerley *et al*. 1999). Indigenous browsers, particularly the megaherbivores, may therefore be able to play an important role in the rehabilitation of degraded thicket through the creation of these nutrient rich patches.

In the last decade there has been a significant research effort aimed at understanding thicket and its dynamics, boosted significantly by the STEP (Subtropical Thicket Ecosystem Planning) and the Albany Centre node of the Conservation Farming projects run by the Centre for African Conservation Ecology. Although we are now starting to develop an understanding of the nature and significance of these interactions, there is much that needs to be learnt. For example, one of the outcomes of the STEP project was a major reassessment of the variety

and complexity of the vegetation types within thicket (Vlok *et al.* 2003), with over 120 types now described compared to Acocks' (1975) four types and Everard's (1987) five types.

Another outcome of this research has been the clear understanding that the mammal communities vary between these vegetation types (e.g. Boshoff *et al*. 2001), as different plant communities offer different habitats and dietary resources to different species. In addition, as suggested above, different mammal species have been shown to vary in their contribution to ecological processes. For example, elephant were implicated as important in 11 broad ecological processes, whereas smaller species such as blue duiker only contributed to five such processes (Boshoff *et al*. 2001). This reinforces the concept that "not all herbivores are equal" and we should take this into account when developing research questions, as well as in how we manage thicket.

Given the variability of vegetation types and the demonstrated importance of mammals in thicket dynamics, it is appropriate to ask how do the mammal-mediated processes vary between thicket types, particularly where thicket forms mosaics with other vegetation types and where other processes such as fire become important? Given the extensive literature on the interactions between fire and grazers these habitats may provide a natural laboratory to study interactions between fire and browsers. There has also been increasingly strong recognition that thicket was occupied by a range of indigenous browsers (e.g. Skead 1987) prior to the introduction of goats, but we have very little detail as to how many there were. We need to know what the "natural" densities of thicket herbivores are, and how have these been altered through management such as bush clearing, overgrazing, fencing, water provision, etc. if we are to be able to manage either indigenous or domestic species at appropriate densities. Critically, we need to understand why the system collapses so rapidly when the indigenous mammal herbivores are replaced by domestic species. This is currently explained in terms of management-specific influences on the distributions and abundances of herbivores, as well as the species-specific nature of the herbivory process (e.g. Wilson 2001). This raises the further question of the impacts of extralimital wildlife introduced into thicket, given that the emerging game farming industry is responsible for the introduction of species that are alien to thicket. The list of introduced aliens is extensive and includes species such as giraffe *Giraffa camelopardalis*, white rhinoceros *Ceratotherium simum* and Himalayan thar *Hemitragus jemlahicus* (Castley *et al*. 2001). These introductions are a consequence of a lack of information as to the long-term consequences of alien herbivores in these landscapes. The observation that introduced nyala *T. angasii* leads to a decline of bushbuck *T. scriptus* (Coates 2003), would however suggest that considerable caution is needed if we are to avoid further degradation of thicket and the thicket fauna.

Thicket vegetation is faced with many new challenges, ranging from global climate change to increased fire frequency. However, it is important not to lose sight of the most important change that thicket has already undergone, the loss of most of the indigenous mammal herbivores over the last 150 years. Traditionally these losses have been described as simple lists of what species have gone, and have not raised any particular conservation concerns as no thicket browsers have gone extinct on a global scale. It can be argued that we now need to recognise that the losses of the mammal-mediated processes may be more important than the extirpation of the species. We therefore need to address the question of whether thicket will change beyond recognition in the absence of mammal herbivores or to put it another way – is thicket still thicket without the indigenous mammalian herbivores?

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WHAT'S DIFFERENT NOW? WORKING WITH POST-2000 LOCAL MUNICIPALITIES TO MANAGE CHANGE

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Abstract
Since the first local government elections of the democratic era were held in November 1995, a great deal has changed in the way local government is structured and operates. These changes are particularly noticeable in the former 'homeland' areas of the Eastern Cape, where the effectiveness of local government had declined drastically during the 1970s and 1980s and where quite radical changes to the previous system were envisaged. But how much of this post-November 1995 change, specifically in the way local government is administered, is really for the better?

This paper presents a short case-study of structural, administrative and personnel changes in local government in one particular magisterial district/municipality, namely Peddie District/Ngqushwa Municipality. Although the changes experienced over the past ten years have been wide-ranging, I argue that, when viewed over a period of the past 150 years, local government in Ngqushwa has only ever enjoyed short periods of institutional stability. In fact, local government in Peddie District has been characterised more by flux and constant, low-level political struggle along three axes. These axes, which I discuss briefly in relation to the present Ngqushwa Municipality and its elected councillors, are (i) a crisis of leadership, (ii) a crisis of administrative capacity and (iii) the near absence of a local revenue base.

The paper concludes with suggestions about how special interest initiatives, such as the proposed Subtropical Thicket Ecosystem Planning (STEP) Forum, might engage with local government in places like Peddie/Ngqushwa Municipality.

Introduction
Since the first local government elections of the democratic era were held in November 1995, a great deal has changed in the way local government is structured and operates. In particular, the role that local government is expected to play in the planning, leading and managing of local development processes has increased steadily. Although many fundamental questions remain, for example, around the role of rural traditional authorities in local government in a democratic state, democratically elected local government structures are now regarded as being the 'developmental' frontline of poverty eradication, job creation and local economic development. Together with provincial and national government, and against considerable odds in most rural areas, local government is tasked with delivering 'a better life for all' to the citizens of South Africa. The main legal and planning instrument provided for under the Municipal Systems Act of 2000, which is at the disposal of local municipalities to deliver development, is the Integrated Development Planning (IDP) process.

In the smaller, more rural municipalities, especially those situated exclusively in the former 'homelands', this developmental mode of government has exposed serious and, I would argue, sustained weaknesses. In this paper, I present a case-study of structural, administrative and personnel change in local government in Peddie District/Ngqushwa Municipality. I begin by setting out a short history of local government in Peddie District/Ngqushwa, in order to place the current situation in context. In the next section, I list and discuss three related challenges experienced

by the local government structures in Peddie/Ngqushwa. I conclude with suggestions about how outside organisations and especially special interest initiatives, such as the proposed Subtropical Thicket Ecosystem Planning (STEP) Forum, might engage with local government in places like Peddie/Ngqushwa municipality in pursuit of their common objectives.

A History of Local Government in Peddie District

As a distinct administrative unit, Peddie had its origins in the period of colonial conquest during the early nineteenth century. A military garrison was established at Fort Peddie after the Sixth Frontier War of 1834-35. On 8 March 1848, Peddie, including the area comprising the Mfengu ('Fingo') Locations which were home to around 10 000 people at that time, was proclaimed a magisterial district and was named the District of Fort Peddie. The same proclamation established the post(s) of Civil Commissioner and Resident Magistrate, although the same person occupied both posts then and at various times thereafter (Donald 1960). The first white settlers began to receive title to land previously held by Xhosa-speakers in 1849, but it was only in 1853, after the Eighth Frontier War, that settlers began to arrive in the area in numbers (Donald 1960). Their numbers were soon augmented by German soldiers who had served the British in the Crimean War and who were settled as peasant farmers in several localities on the border.

In the Mfengu Locations of the 'chequerboard' Peddie District, headmen who reported to the Civil (later Native) Commissioner, were appointed to do the colonial government's bidding in respect of governing local residents. These headmen were however, able to wield considerable authority in village and location politics, to the exasperation of the Native Commissioner (De Wet 1987, Ainslie 1998). Structurally situated between the colonial administration and the rural population, the headmen occupied an 'intercalary' position, and they attempted to exploit the many ambiguities of this position to their own and their supporters full advantage (Hammond-Tooke 1975). The reserve system itself was legally enforced in post-Union, rural South Africa through the passing of the *Natives' Land Act* 27 of 1913. The terms of this Act 'set aside specific tracts of land for the exclusive occupation and ownership of Africans', i.e. Africans were prevented from acquiring land and accumulating capital outside of these small, specified areas.

The *Native Affairs Act* of 1920 provided for the establishment of local councils. These councils were empowered to fulfil a number of administrative tasks and wide-ranging service-related functions in their area of jurisdiction (see Ainslie 1998). The Peddie Local Council was established by Proclamation No.127 of 1927, and was one of nine local councils established in the Ciskeian reserve territories. Since the council relied heavily on local taxes and fees paid by the Africans in their locations for the council's revenue, their capacity to meet their many and varied duties was hamstrung primarily by a lack of finances (Wilson *et al.* 1952). The result was general apathy among rural people regarding the workings of the Local Council and the meetings of the Council were poorly attended. People in Peddie felt that the Council could do nothing for them and that it was powerless to act in their interests against increasingly coercive government laws. Moreover, the lowest tier of local government continued to be the headmen and his subheadmen at village level and many people were apparently unclear what the status and role of the Local Councils actually were (Mager 1999).

The *Native Affairs Act* of 1920 also made provision for the establishment of General Councils, but it was only in 1934 that the Ciskeian General Council – with its nine elected local councils - was established. This so-called 'Bunga' was used by the Native Affairs Department (NAD) to act as an interface between white officialdom and the geographically scattered rural locations of the Ciskei (Mager 1992). Modelled on

the United Transkeian Territories General Council which was established in 1931, it had limited power and even less resources (Switzer 1993).

The *Native Administration Act* No.38 of 1927 provided for the appointment of six Chief Native Commissioners (CNC) who were the regional representatives of the NAD. One of these CNCs had been based in King William's Town since 1923, from where he exercised supervision over all the Native Commissioners, Agricultural and Engineering officials, Tribal Chiefs, headmen, subheadmen and other officers of the NAD in the reserve areas (Rogers 1933). This former Act further stipulated that government-appointed chiefs were, through local headmen, to exercise prescribed powers and functions in their control over the Natives in their areas. For this, they were to be paid allowances authorised by the Minister of Native Affairs (Rogers 1933). They were to report to the Native Commissioner in their district. A full-time minister of Native Affairs was appointed for the first time in 1929, and in the same year a subdepartment of Native Agriculture was established (Switzer 1993).

The influence of successive Native Commissioners in Peddie district increased during the period 1927 to 1951. During this time, one person, representing one department (Native Affairs, later Bantu Affairs), held sway over the lives of several thousand people in the reserve areas of rural Peddie District. This power was, however, still mediated by the intermediate micro-politics carried on by headmen in their respective, increasingly overpopulated and impoverished, locations.

The *Bantu Authorities Act* 68 of 1951, which ushered in the major apartheid-inspired changes in local government, was only applied to the Ciskeian reserves in 1956 (Ainslie 1998). This Act abolished local and district councils and delegated much of the local administrative authority to a system of indirect rule through reconstituted, pseudo-traditional chiefs and headmen. Tribal Authorities, consisting of an ethnically-aligned, tribal chief and his nominated councillors, dealt with local tribal matters by virtue of the powers given to the chief under the Act. The Tribal Authorities answered to the district magistrates who in turn reported to, and attempted to bring some coherence to the activities of, the various departments in the nascent Ciskeian administration.

A central weakness of the Tribal Authorities, among many others, was that they did not explicitly represent any of the major constituencies in the rural villages (Charton and kaTywakadi 1980). Dominated by senior men, their lack of a popular mandate from the village residents whom they supposedly served, mirrored the authoritarian and repressive nature of the Ciskeian government as a whole (Ainslie 1998, Groenewald 1980). Given that under this system many chiefs went on to serve in the Territorial Authority (formerly the General Council or Bunga) of the Ciskei, and thus to act as both policy-makers and local administrators, it was clear that these chiefs could not be accountable to their rural subjects. Opposition to Bantu Authorities mounted steadily. Betterment Planning, which was introduced to rural Peddie in the early 1960s, further alienated the office-bearers of local Tribal Authorities from their subjects. In Peddie, two chiefs were murdered for agreeing to the implementation of agricultural betterment, without first consulting their followers.

The *Promotion of Bantu Self-Government Act* of 1959 and the subsequent elaboration of Bantustan policy saw the transfer of the burden of certain social welfare costs and of unemployment from 'white' urban areas to the homelands – in what Beinart (1994) has called the 'externalization of poverty' to the rural periphery. In terms of the *Bantu Homelands Constitution Act* of 1971, more responsibility for local and 'own affairs' administration was transferred to the Ciskeian Territorial

Authority, which was renamed the Ciskeian Legislative Assembly (Richings 1980). On 1 August 1972, the territory was declared 'self-governing'. By the mid-1970s, stifling traditionalism and the inefficiency of rural local government in the reserve areas of the Ciskei was widespread. This system was to undergo further, debilitating changes. White officials of the South African government were beginning to relinquish their responsibilities, anticipating that the Ciskeian bantustan would be granted independence. This process would see further 'indigenisation' of the civil service. In December 1981, the Ciskei, long regarded as the hotbed of political activism in the country, took its 'independence' from South Africa, with Lennox Sebe and his Ciskei National Independence Party duly installed in power.

Throughout the 1980s, the Tribal Authorities took centre stage in attempting both to shore up political support by dispensing political largesse among disenfranchised, increasingly impoverished and restive rural population and to suppress growing opposition to the bantustan system (Anonymous 1992, Ainslie 1998). In the face of a groundswell of increasingly vehement political opposition against the apartheid state and the ethnic politics of its bantustan puppets during the 1980s, the position of the Tribal Authorities became steadily more untenable.

The Gqozo era (1990-1994) in the former Ciskei was characterised by great uncertainty. As power slipped away from the bantustan regime, the Ciskei government escalated its levels of repression. Rural people responded with widespread resistance, including violence and destruction of state assets in the countryside (Manona 1995). In Peddie, government flagship schemes, such as the Tyefu Irrigation Scheme and other Ulimocor-managed schemes, such as the Pineapple Schemes in Peddie South and the Citrus Schemes along the Keiskamma River, were specific targets for the venting of rural people's frustrations.

During the early 1990s, the ANC-aligned South African National Civic Organisation (SANCO) set about mobilising rural people in Peddie District, in opposition to the hated headman system and Gqozo's ill-fated African Democratic Movement. In some areas, headmen and their supporters were hounded out of their villages and their homes burnt (Manona 1995). These struggles pitted newly formed village-based 'Residents' Associations' against the vestiges of the Ciskeian government patronage networks and virtually paralysed local administration and service delivery throughout the former Ciskei. Local officials, such as agricultural extension officers, who were used to dealing with Tribal Authority structures, suddenly found themselves confronted by angry, SANCO-aligned Resident Associations, fed up with their uniformly top-down intervention programmes in rural villages. But while these Residents' Associations were at least nominally democratically elected, they were non-statutory bodies that had no legal standing. Nor did they have any formal links to tiers or line departments of the bantustan government that was itself in a state of flux. Having swept aside the discredited headman system, the Residents' Associations were poorly placed to take up the role as initiators and managers of development and civic administration at the local level. A few of their most articulate spokespeople were plucked out of rural obscurity and placed on ANC National and Provincial Lists in time for the first democratic elections in April 1994.

The vacuum that constituted local government in the early 1990s was partially filled in November 1995, when the first local government elections of the post-apartheid era were held. The ANC won an overwhelming majority (98%) of the vote in Peddie District. But local government remained seriously fragmented and resistance from deposed headmen remained a problem in several areas. In Peddie District alone, there were three local councils, the Peddie Transitional Representative Council

(TRC), the Peddie Transitional Local Council (TLC) in the town of Peddie and the Hamburg TLC that replaced the Village Board in the seaside resort of Hamburg.

Relations between the three cash-starved councils were fraught, as their respective areas of jurisdiction and functions remained unclear. Ambitious local politicians in the three councils jostled to establish rural power bases for themselves in the rapidly evolving post-apartheid political landscape. But cultivating loyal political support among a sufficient number of rural ANC branches that could fuel ambitions for higher office in emerging District Councils or in provincial and national government, proved very difficult to achieve in the prevailing circumstances. Once elected, especially TRC councillors were not accountable to their wider rural constituencies, and quickly found their cash-strapped TRC inundated with demands from rural people wanting the delivery of services, notably for water and electricity, demands that they were unable to meet.

By June 1999, despite considerable competition between the key political activists (all ANC members) in these three councils, and with fractious inputs from local civil society stakeholders, such as the Peddie Development Forum, a sufficient amount of co-operation was sustained to produce the IDP/LDO document that was required by law. The role of an East London-based NGO, Afesis-Corplan, was critical in assisting Peddie TLC and Hamburg TLC make their contributions to this process, which was later adjudged to be one of the few IDP/LDO documents in the province which had even attempted to include contributions from the rural and urban councils in one municipality.

By late 1999, however, more changes were afoot. The boundaries of Peddie District had been redrawn by the Municipal Demarcation Board to include the towns of Peddie and Hamburg and a total of 112 rural villages, 44 of the latter having previously fallen under the Zwelitsha District of the former Ciskei. The reconstituted and renamed Ngqushwa Municipality now comprised 2 246 km² and had an estimated population of 94 000, 95% of whom lived in the rural areas. The last, crowning achievement of the outgoing TRC was the construction of an attractive new municipal building built adjacent to the town of Peddie.

When the second round of local government elections took place in December 2000, competition for positions on the ANC election list at municipal level was especially fierce. This was because the three councils (Peddie TRC, Peddie TLC and Hamburg TLC) and their respective administrative staff complements had to be integrated into a single local Municipal Council after the 2000 election. Although in terms of Proclamation 20 of 27 September 2001, Ngqushwa Municipality was designated a Category B ('Grade 2 Local authority') municipality with 14 wards, the number of councillors was limited by the number of voters in the municipality and the council was set at 27 members. The previous mayor of Hamburg topped the ANC election list and was duly inaugurated as mayor of the new Ngqushwa Municipality. The post-2000 Integrated Development Planning (IDP) process commenced in earnest in August 2001, while considerable wrangling over posts and positions continued to affect the working of the Municipality and its Council.

This short history of local government in Peddie/Ngqushwa points to a number of challenges that can be tracked over time. They include a sustained absence of democratic local government for rural people. People in rural Peddie simply do not have a history of active, broad-based participation in legitimate and democratic local government. Their experience of local government has been one of authoritarian and coercive government intervention, linked to extreme neglect in the delivery of basic

services. This has resulted in both distrust and low expectations of this system of government, and thus minimal 'buy-in' on the part of rural people.

A significant feature is the longstanding ambiguity inherent in the system of indirect local government, brought about on the one hand by the institutional layering (of modern/'traditional') which sharpened, but did not commence, with the advent of the post-1948 apartheid era. On the other hand, the role of an increasing number of line departments began to impinge on the lives of rural people, with decreasing co-ordination by local government institutions in Peddie. This increased perceptions of favouritism and patronage between villages and locations that both fuelled and fed off bantustan political tensions. A sustained lack of money to implement the work of local government adequately, specifically because the local revenue base was virtually non-existent, was another feature of the system.

We now turn to analyse how the post-1999 Ngqushwa Municipality is coping with these many challenges.

A crisis of leadership

The post-1994 role of traditional leadership in Ngqushwa municipality has been muted, which is fortunate considering the equivocation at the national policy level on how to deal with traditional leadership in local government. Nevertheless, significant intra-party political wrangling continues to characterise the ANC-dominated local council in Ngqushwa. In fact, the Ngqushwa Municipality has spent the past three-and-half years embroiled in controversy. The strategic leadership capabilities of the encumbent mayor, a woman and a teacher who comes from Hamburg, have been widely questioned. A split in the Council is evident, with the majority of councillors opposed to the mayor and intent on securing her resignation through a succession of 'no-confidence' votes in her leadership. This local split was said to be linked to tensions that existed until recently, between the political supporters of the then premier of the Eastern Cape, Makhenkhesi Stofile, and those of Mluleki George, a prominent Member of Parliament who hails from this part of the Eastern Cape. As such, the local problems remain virtually insoluble. The simmering tension that has existed in the Ngqushwa Council since December 1999 has prevented the council from meeting on more than a mere handful of occasions. Even scheduled council meetings, which are publicly advertised in the press, have failed to materialise. This has seriously impeded service delivery and development in the municipality.

The dust has refused to settle over seemingly intractable disputes concerning the division of the spoils between the three former councils in respect of the most sought-after municipal posts. The mayor, formerly mayor of Hamburg, has sought to transfer her loyal administrative staff into the employ of the Ngqushwa Municipality. This has caused considerable tension within the council, as these jobs are rightly considered by local politicians and residents to be a significant part of local government patronage. The post of municipal manager was fiercely contested for a period of 18 months by the former town clerks of Peddie and Hamburg. The contest was finally laid to rest, after arbitration by a labour court and an internal dispute resolution process undertaken by the ANC, but the tensions have not dissipated. The post of Integrated Development Planning/Strategic manager was taken over by a former councillor of the Peddie TLC, while the former administrative officer of the Peddie TRC, after a extended period in 'organogram limbo', was belatedly appointed the municipality's human resources manager. As late as June 2003, the four top municipal officials - who had all taken up a position opposed to the continued tenure of the embattled Ngqushwa mayor - were arrested on charges of corruption that were later dropped because of a lack of evidence.

The gridlock in local government decision-making in Ngqushwa Municipality is dire and although it is widely known and acknowledged, no resolution appears imminent. This is despite intervention by ANC political heavyweights to avert further embarrassment to the party (Daily Dispatch 23 June 2003). In mid-2002, the Eastern Cape Department of Agriculture appointed Co-ordinators of Agriculture (at the level of Deputy Directors), who are responsible for agricultural development in local municipalities. In Ngqushwa Municipality, an area where agricultural development might be expected to enjoy a high priority, the Co-ordinator has been unable to even present his operational plan and budget to the Council for the past two years due to the unworkable state of the current Council. His early intention of instituting a Consultative Forum for Agriculture in the Municipality, in which it was envisaged the ward councillors would play a key role, is no closer to realisation than it was two years ago.

A crisis of administrative capacity

The loss of administrative capacity in local government in places like Peddie District, certainly since the mid-1970s, is well known. Some of this had to do with the loss of skills that occurred when local administrative functions were handed over to the Ciskei bantustan regime. By 1995, local government was in a parlous state. The three post-1995 local government institutions in Peddie District had their work cut out trying to come to terms with some of the administrative challenges they encountered.

However, not nearly enough was done to cover the deficits in local administrative capacity by training local people already in the employ of the local government or in attracting skilled people into this arena. Instead, given the enormous pressures on the post-1995 institutions to 'deliver' to their constituents, they turned, albeit reluctantly, to consultants and established service providers who could meet their deadlines. This is understandable with respect to technical matters, such as the design and installation of engineering works for water reticulation. But where service providers are brought in to ensure that purely administrative processes are followed, it is of greater concern.

More worryingly, national government adopted the approach that where local councils lacked capacity, the meso-level district municipalities (formerly Regional Services Councils) should step in to ensure that development processes occurred smoothly and without significant budget overruns. The proviso was that the district municipalities would have the responsibility of building capacity in the local municipalities until a point was reached where the municipalities could take over more and more municipal functions and responsibilities. For Peddie/Ngqushwa, the relevant meso-level institution is Amatole District Council (ADC), later renamed Amatole District Municipality, which is situated in East London.

The ongoing need for 'service providers' or consultants to do a large share of the actual planning and implementation of development projects on behalf of the local authority remains a challenge. The 2003 IDP Review notes that 13 of the 24 administration/ human resources posts were still vacant. The Municipality finance department had established 12 posts of which seven were vacant. Overall, the Municipality organogram made provision for 59 posts, with only 32 posts filled by early 2004. The IDP Review also notes that 'there is no clear capacity building strategy for the training of municipal staff and councillors' (Ngqushwa IDP Review 2003).

The establishment of PIMMS (Planning and Implementation Management Support System) centres in each of the District Municipalities in late 2000, was an attempt to

fast-track the transfer of skills to local municipalities. If evaluated on the basis of the actual adoption of administrative (especially financial) responsibilities and developmental tasks by local government, then the PIMMS intervention can only be regarded as a moderate success.

The Ngqushwa Municipality IDP Review of 2003 was outsourced to a consulting firm, Complan, which is based in King William's Town. Additional support came from the PIMMS centre at ADM, to ensure ongoing 'co-ordination and alignment' between the Ngqushwa IDP and the IDP of the Amatole District Municipality. In 2003, Spatial Development Frameworks (SDF) were introduced as a requirement of the IDP review process and the Ngqushwa Municipality put out a tender to appoint a service provider to assist with this task. Additionally, ADM identified a number of initiatives that were subsequently grouped as Sector Plans. Co-ordination of these Sector Plans was placed under their internal Spatial Co-ordination Unit and subsequently put out to tender to be conducted by 'service providers' on a District Municipality wide basis, i.e at an arm's length from the local officials, councillors and people on the ground.

The weak local revenue base

The lack of a local revenue base renders local government in rural former bantustan areas financially dependent on other spheres of government. In 2003, the Ngqushwa Municipality had an annual budget of close to R19,2 million, of which only 10,73% was generated locally, through income from rates and services. Fifty-eight % of its total revenue was raised through transfers from national government.

The lack of local income has not prevented the well-publicised practice of handsome salary packages that are paid to senior local government officials from taking root in Ngqushwa since 1999. The combined salary bill of the top five officials in Ngqushwa Municipality for 2003 was advertised as being close to R1,43 million (Daily Dispatch, 31 October 2003).

The upshot of a chronic lack of locally sourced income is what I call 'spectator governance', where local councillors and municipal officials are more focussed on what happens in East London, Bisho and Cape Town, than on their local mandates. The IDP is an example of this. Much energy has been expended on producing and then reviewing the Ngqushwa IDP, and it is clear that special care has been taken to meet the legislative requirements in terms of the *process*es followed in this regard. The actual content of the IDP indicates a lack of administrative planning acumen and reads more like a list of problems and corresponding solutions that, notwithstanding how fervently they are wished for, show little sign of materialising.

Working with local municipalities in the Eastern Cape's former bantustan areas

In conclusion, I list a few lessons that we have learned in working with local municipalities in the former Ciskei. No doubt the list could be greatly expanded, depending on the nature of the working relationship that is envisaged to see an intervention through to successful completion.

Meeting developmental needs in Ngqushwa Municipality remains a top priority. Poverty and unemployment, as well as backlogs in social services, inadequate provision of infrastructure and weak land use management are a source of great concern to local government officials and councillors.

Lesson # 1: *Become fully acquainted with the key development challenges of the municipality that you plan to work in.*

Lesson # 2: *Ensure that your programme has a job creation and a skills training component and that both are in step with current government thinking.*

Despite the many recent changes, local planning and administrative capacity remains low. For this reason, the municipal Integrated Development Plan has become the primary planning instrument for these local municipalities and is followed to the letter. It is particularly important in guiding the drafting of the annual budget. All projects and programmes are tested first for 'IDP compliance' and contestation over which projects are prioritised at ward level is marked.

Lesson # 3: *Plan ahead and ensure that your initiative is included in the IDP document (and subsequent reviews) of the relevant municipality. Be doubly prepared and ensure that your initiative also features in the IDP and Sector Plans developed at the District Municipality level.*

Most local municipalities are technically bankrupt. They are thus unable to financially support your initiative, not even as a way of indicating that they have bought into it. Instead, forming a partnership with local government means that they will (verbally) support your initiative as long as it meets their development agenda.

Lesson #4: *Do not expect to receive any funding directly from local municipalities. Instead spend time and money ensuring that senior officials and councillors are properly schooled in your proposed field of intervention, whatever that might be.*

In terms of public sector financial accountability, increasingly rigorous systems for financial auditing are being put into place. Tender procedures in particular are taken seriously.

Lesson #5: *Notwithstanding your prior and extended contact with them, you will have to bid for any contract work that emerges in your field of interest. Needless to say, there are no guarantees that you or your institution will secure the contract.*

Municipal councils are comprised of councillors who are elected directly and those on a proportional representation (PR) list. In the period between elections, in terms of accountability and interaction with their constituencies, the Ward councillor system currently functions in ways that are similar to the headman system of the past.

Lesson #6: *Plan interventions in such a way that, wherever relevant, they devolve rapidly to the affected Ward Councillor level. However, since local power dynamics are always in play, you should first assess the political standing of the Ward Councillor within the council as a whole, and among his/her constituents.*

The key municipal officials and councillors are in high demand and are constantly rushing from one meeting or workshop to another. Do not expect them to maintain a high level of interest in your intervention, no matter how much they or their rural constituents stand to benefit from it.

Lesson #7: *Be prepared to carry on with your intervention without the active support or participation of the municipality or councillors, but have a plan in place, which allows you to regularly (but briefly) report back to them to ensure that they are kept informed of developments.*

Co-ordination between local municipalities and government line departments, in respect of development delivery, is generally still poor. Spend some time working out where to place most of your effort to maximise impact with officials at this level.

Lesson #8: *Do not take on the thankless task of co-ordinating the interactions between local municipalities and the various government departments operating in the municipal area.*

As local government comes into its own over the next decade, there are increasing pressures being brought to bear from all sides for far greater professionalism, and of enhanced skills levels in particular, among both municipal officials and councillors. The onus is on all of us to raise the bar in our interactions with local government to ensure that these expectations are met.

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THE SIGNIFICANCE OF PLANT DIVERSITY TO RURAL HOUSEHOLDS IN EASTERN CAPE PROVINCE OF SOUTH AFRICA

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Abstract
Increased attention has been given recently to the role of non-timber forest products (NTFPs) in maintaining rural livelihoods and to the spiritual roles of forests and trees for local communities. Few studies have investigated the utilitarian and cultural roles of forests and trees in an integrated manner. Most studies have been focused on indigenous communities with little attention given to the role of biodiversity in local communities living under non-traditional conditions. Furthermore most research has focused on the extraction of resources in tropical rain forests and only recently have attempts been made to determine the contribution of temperate-zone vegetation types. The aim of this paper was to highlight the significance of plant diversity in the livelihoods of rural communities within the Thicket in South Africa. It documents the various uses of NTFP's, the species used, the amounts harvested and their value of nine different use categories. In total 103 plant species were used, but only 17 were recorded by over 10% of the households on a regular basis. The mean gross direct use value for the utilisation of wild plant resources amounts to $159[1] per annum per household. The use of NTFP's is not purely utilitarian. Approximately one-third of the species and just over half of the total use value were for cultural purposes. This illustrates that plant diversity is important in serving the cultural needs of non-traditional local communities. Programmes for biodiversity conservation should heed of its role in traditional cultures.

Introduction
The roles of trees and NTFPs were rarely acknowledged as contributing to rural livelihoods until towards the end of the 20th century. For instance, in 1987 Chambers and Leach (1987) noted a lack of recognition within the scientific literature of trees acting as 'buffers against contingencies', and this article was one of the first to recognise the importance of trees and forest products in rural livelihoods. Since then the contribution of forest products to rural communities has been more clearly recognised and defined. Much attention is now given to the role of NTFPs in maintaining rural livelihoods through household consumption and sale (e.g. Hladik *et al*. 1993, Ruiz-Perez & Arnold 1996, Wollenberg & Ingles 1998).

Increased attention is also being given to the cultural and spiritual roles of forests and trees for rural communities (Posey 1999). Much attention has been focused on the sacred and religious roles of forests as dwelling places for spirits, burial places for ancestors, sites for ritual ceremonies such as initiation rites, or protection of sacred natural features such as springs and caves.

The importance of recognizing the traditional values of indigenous and local communities in forest and biodiversity conservation is now officially recognised, e.g. in the Convention on Biological Diversity. It has been argued that 'p*romoting conservation in the context of local culture would endow protected areas with*

[1] These values have been converted at exchange rate of $1=R8.21, July 2001.

significance that emphasis on biological diversity, landscape, or economies does not' (Infield 2001). This is especially relevant in a continent such as Africa, where people can ill-afford the luxury of a species-focused conservation ethic.

Most statements regarding the cultural significance of forest resources focus on traditional indigenous communities that have a historical continuity with pre-colonial societies. Such historical continuity is characterized by the occupation of ancestral lands, a common ancestry with the original occupants of those lands and a culture that is a manifestation of specific ethnic customs or traditions (Posey 1999). Much less attention has been given to the cultural values of forests for local communities that cannot be considered as indigenous according to such criteria, and whose lifestyles have been affected by modernization. Nonetheless, at present in many tropical countries, notably Africa, rural conditions are changing quickly and the livelihood strategies of local communities are diversifying (Ellis 1998). Little attention has been given to the roles of forests and trees in such non-traditional environments to ascertain whether in such cases forests still are of cultural significance. Such is the aim of this paper. A non-traditional community from South Africa was studied to find out:-

- Which plant species are gathered from the natural vegetation and how much is collected?
- For what utilitarian or cultural purposes are they used?
- What are their comparative values?

Case-study Area

A detailed case study in one village, Woodlands, was carried out to assess the role of the Valley Bushveld vegetation for the black population living in the former Ciskei homeland.

A large proportion of the former Ciskei, particularly along river valleys, is vegetated with Valley Bushveld (Acocks 1988), also known as Valley Thicket (Low & Rebelo 1996). Valley Thicket covers 228,767 km^2 of which approximately half has been altered and only two percent is formally conserved (Low & Rebelo 1996). The distribution of this vegetation type is limited, being found mainly in the Eastern Cape but also extending northwards into KwaZulu-Natal. Valley Bushveld is one of South Africa's richest but most poorly conserved ecological resources in which the high species diversity is recognised internationally as being of global significance and of conservation priority (Lubke *et al.* 1986).

The village is characteristic of a rural settlement in which a large proportion of the community is reliant on cash income from adjacent urban areas rather than on subsistence based economy (Figure 1). The community within the study site is made up of *amaXhosa* and *Mfengu* ethnic groups.

Woodlands village comprises 146 households including 745 people. Fifty seven percent of households are male headed and 42% are female headed. Fifty three percent of the population are adults of whom: 22% are pensioners; 16% are employed in occasional employment; 19% are in fixed employment and 43% are unemployed.

Research Methodology

Within Woodlands a 100% household census was done to document the level of natural resource use within the community. This approach was adopted to ensure that accurate data was collected from each household.

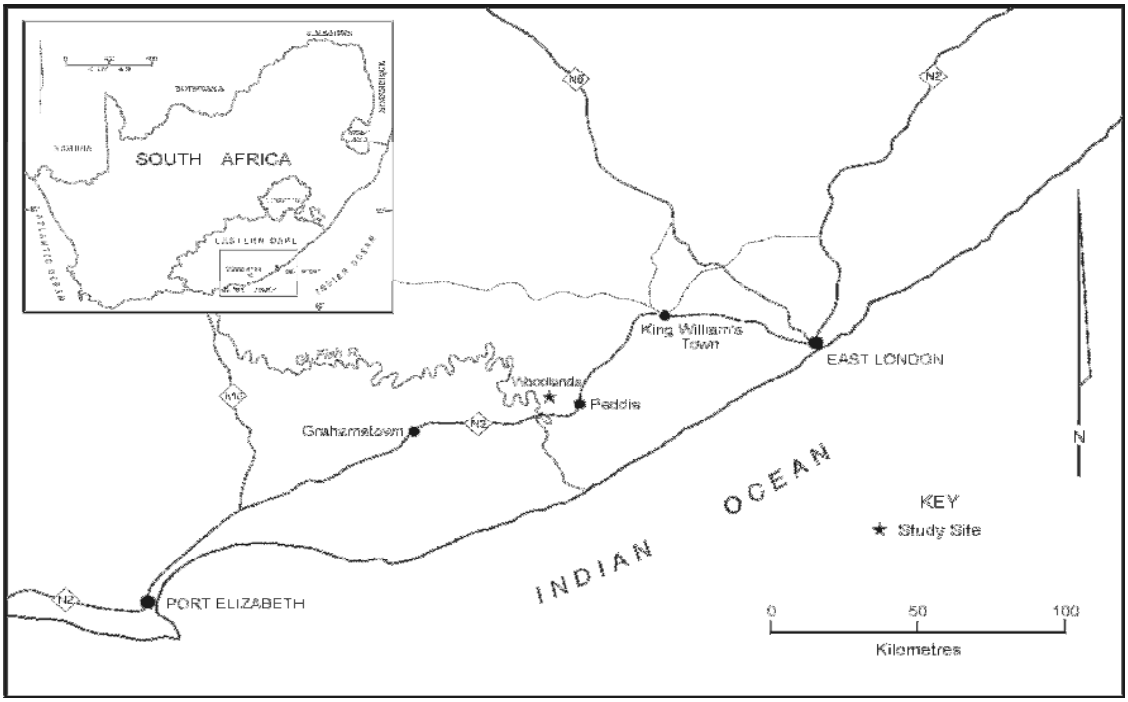

Figure 1: Study site locality: Woodlands.

During the household interviews information was collected on the plant species collected from the natural vegetation and their use. Also the quantities collected and retail prices were recorded. Household informants were asked to indicate the amount of each resource they harvested/utilized. When applicable the dimensions of timber were also recorded, for example, the length and diameter of poles. Information pertaining to the lifespan of the resource was also gathered. Plant material for each product group was then weighed and, where applicable, the average weight for each container type used was recorded to determine the approximate quantity used annually by each household. Care was taken on the side of conservatism in assessing annual consumption; consequently the final values should be viewed as under- rather than over-estimates.

The retail prices of the various resources were recorded from individuals and cross checked at a range of the markets that exist in the area. These markets range in levels of sophistication.

The vernacular names of plants were recorded and six field trips with household members were undertaken to gather both specimens and household knowledge over as diverse a range of species and community members as possible. The specimens have been identified and housed in the Selmar Schonland Herbarium (GRA) in Grahamstown.

Cultural Value of NTFPs

Almost half of all wild plant resources used in Woodlands and one third of the species recorded were for cultural related purposes (Table 1). This demonstrates the very significant role that wild plants play in ensuring the cultural traditions of the people within the study area. The greatest amounts of NTFP material harvested for cultural purposes are used for Kraals (*ubuhlanthi*), woodpiles (*amagoqo*), rituals (*amasiko*) and traditional medicine (*amayeza*) (Table 1).

Table 1: Total amount of wild plants used in Woodlands village.

Category use	Number of households using the item	Mean amount per user household (kgs)
Utilitarian		**2,426**
Fuelwood	N=112	2,121
Fencing	N=77	168
Wild fruits	N=53	52
Medicines	N=49	8
Timber	N=40	45
Wild vegetables	N=36	32
Cultural		**3,258**
Kraal poles	N=111	52
Kraal branch	N=123	913
Rituals	N=109	890
Igoqo	N=54	1,399
Medicines	N=49	4
Total		**5,684**

1. Kraal material

The most common use of wild plant resources in Woodlands was for the construction of kraals. A kraal is normally considered as an enclosure for livestock, but in Woodlands this is not necessarily the case as demonstrated by the fact that 84% (n = 123) of all households own a kraal -though only 19% own livestock. The kraal is foremost an important venue to host traditional rituals and is where family members can communicate directly with the ancestors. Rituals are performed frequently by the homestead. Kraals that also function as livestock enclosures are used daily as livestock are brought in at night.

The mean amount of kraal poles collected per user household amounted to 52 ± 42 (median 40; range 8-231) kg per annum. Between the upright poles thorny branches are packed tightly. The mean amount of branches collected per user household amounted to 913 ± 1,092 (median 496; range 24-5,952) kg per annum. Male members of the household are responsible for the collection of kraal material. Some families collect the kraal material themselves, but others purchase the material from informal sellers. In terms of the mean gross net annual value the use of poles amounted to $2.2 ± 2.0 (median 1.8; range 0.2-9.8) per user household and of the branches to $48 ± 58 (median 27; range 1.3-331) per user household (Table 2).

2. Material for rituals

Seventy four percent (n = 109) of the Woodlands households utilised material for rituals. Rituals are performed only on specific occasions during the year, predominantly in December and June/July. Rituals invariably involve the slaughtering of an animal, either an ox or a goat, for the ancestors. The host family invites extended members of the family, neighbours and friends to attend and large quantities of food and traditional beer are prepared. Preparations for the ritual can take up to four or five days. In order to prepare the food and beer large quantities of fuelwood are required. The mean amount of material utilised amounted to 890 ± 931 (median 744; range 2-6,400) kg per annum per user household. The gross net annual value amounted to $41 ± 355 (median 280; range 1-2,720) per user household (Table 2). If the family has access to a kraal the animal is slaughtered inside the kraal. The first serving of the slaughtered animal is eaten by the male lineage inside the kraal.

Olea europea subsp*. africana* and *Ptaeroxylon obliquum* are culturally significant because these two species are used as plate or platter on which the sacrificed animal carcass is placed in traditional ceremonies. Leafy branches are collected and arranged on the ground as a plate (Dold & Cocks 1999).

3. Igoqo

Thirty-six percent (n = 54) of the Woodlands households utilized wild plant material for maintaining an *igoqo*. An *igoqo* consists of a wood stock kept outside a homestead. The ethnic group of the family largely determines the shape of the *igoqo*. For example, the *Mfengu* women construct their *igogo* by stacking the logs vertically, whereas those of *amaXhosa* women are stacked horizontally. Only specific species and sized stems are collected. These woodpiles are not stacked for fuel purposes but have a high cultural value, particularly for the women of the household as it is considered to be where the female ancestors reside. In the past when home births were frequent stillborn babies would be buried under the *igoqo*. The *igoqo* is also an important venue for women who congregate around it and talk about household matters. The *igoqo* is also considered the place where women urinate after dark in the same way that the kraal is the venue for men. A middle-aged woman described her *igoqo* as providing her with dignity because it signified her status within her community.

Poorer households collect the material required for the *igoqo* on a regular basis. The *igoqo* logs are often collected at the same time as wood is collected for fuelwood purposes. Those households that can afford to hire a donkey cart to transport the wood will do so. The mean amount collected amounted to 1,399 ± 1,287 (median 1,000; range 101-6,000) kg per annum. This is significantly less then the mean amount utilized for fuelwood (2,121 kg per annum) because the material is not replaced as regularly as fuelwood. The gross net annual value amounted to $49 ± 51 (median 28; range 3-263) per user household (Table 2).

4. Traditional medicines

Thirty-three percent (n = 49) of the Woodlands households collected and used wild plants as traditional medicines. This category refers to medicines collected by household members for self-medication purposes or for the treatment of livestock. It does not include medicines purchased or obtained from a traditional healer. The mean amount collected amounted to 12 ± 28 (median 2; range 0.4-148) kg per annum with a gross annual value of $27 ± 28 (median 2; range 0.4-148) per user household (Table 2). The value for medicinal plants is considerably higher then the values for other resources. This is because these plants are also sought for the medicinal plant market that is currently a multi million Rand trade within the country (Cocks & Dold 2000, Mander 1998). Within Woodlands no household members are involved in the medicinal plant trade because the village is situated approximately 90 kms away from the nearest medicinal plant market.

In total 55 species were selected for medicinal purposes; this is the highest number in any resource use category. These traditional medicines are not only involved in the prevention and cure of health problems, but also in the purging and cleansing of the body. Purgatives are administered routinely as a preventive health measure, as it is believed that "contamination" enters from both the physical and the spiritual plane. It is believed that relief is only to be found through purging and cleansing the body (Leclerc-Madlala 1994, Cocks & Møller 2002). The importance of such culturally oriented medicinal uses is demonstrated by the fact that of the three dominant medicinal species (i.e. *Bulbine latifolia, Dioscorea sylvatica* and *Ballota*

africana) two are used for such purposes. *Bulbine latifolia* is used as purgative to cleanse the blood. *Dioscorea sylvatica* is used as a body wash to ward off evil. *Ballota africana* is used to treat coughs and fevers.

Table 2: Total value of wild plants used in Woodlands village.

Category use	**Total direct use value in ZAR***		**Total direct cultural use value**
	Number	Mean	Mean
Kraal poles	N=121	19	19
Kraal branches	N=121	236	236
Ritual material	N=107	323	323
Igoqo	N=57	411	411
Traditional medicines	N=49	226	75
TOTAL		R1 215	R1 064

*ZAR values can be converted to a US$ amount, as reported in the text, using an exchange rate of $1=R8.21, July 2001.

Relative Importance of Utilitarian and Cultural Uses

It is clear that wild plant resources play an important role in Woodlands. Generally speaking, the wild plant resources have either an utilitarian or a cultural role. In many cases the distinction is self-evident. The use of wild plants for fuelwood, fencing, timber and as fruits or vegetables is clearly utilitarian, while the uses of wild plants for ritual purposes and for the construction of the *igoqo* clearly involves their cultural roles. However, this distinction is not always self-evident. For instance, it could be considered that the construction of a kraal is an utilitarian activity. However, it appeared that the ownership of a kraal holds a strong cultural value and is not simply a means of enclosing livestock; the construction of a kraal can foremost be considered as an activity demonstrating one's cultural identity. Traditional medicinal products are not only used for prevention or cure of health problems, but also for the culturally oriented actions of purging and cleansing of the body of evil spirits. A third of medicines are used for such culturally related needs. To summarise, almost half of all wild plant resources used in Woodlands and one third of the species recorded were for cultural related purposes (Table 1 & 2). This demonstrates the very significant role that wild plants play in ensuring the cultural traditions of the people within the study area.

Discussion and Conclusion

This study demonstrates that we have yet to understand fully the complete role and values associated with the diversity of natural vegetation in a given locality and its importance in the cultural fabric of local communities. In the past, most studies on the role of wild plant products focused predominantly on understanding their importance for meeting basic household needs and obtaining additional income. This study reveals that the use of wild plant products is not restricted to such utilitarian use only, but that they also provide an important means for indigenous people to perform and conserve their cultural practices and traditions.

The study also reveals that the distinction between utilitarian and cultural uses of wild plant species is not absolute, but relative. In several cases the utilitarian uses of plant resources are tied up with strong cultural values. Such cultural roles are not restricted to indigenous people living on ancestral lands and following traditions, but may also prevail in non-traditional areas such as Woodlands, which have been affected by major demographic, political and economic changes.

Acknowledgements
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EFFECTS OF TRANSFORMATION ON WOODY PLANT DYNAMICS IN THE SUCCULENT THICKET

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Introduction

Succulent thicket (ST), largely confined to the Eastern Cape, South Africa, is home to a wide range of wildlife and introduced domestic herbivores. Domestic herbivory, especially by goats, has been attributed to vegetation degradation in large areas of this thicket (Hoffman & Everard 1987, Stuart-Hill & Danckwerts 1988, Hoffman & Cowling 1990). This degradation pressure and the recognition that it is irreversible has highlighted the importance of protecting thicket against further transformation (see Everard 1985, Hoffman & Cowling 1990, Kerley *et al.* 1995). This awareness has also stimulated studies of the thicket biodiversity and the processes that sustain this diversity (Vlok & Euston-Brown 2002, Vlok *et al.* 2003).

There is therefore a need to apply conservation friendly management more broadly within thicket than just within traditional protected areas, as protected areas may not be viable in the long term if connectivity is compromised by the biodiversity-unfriendly land uses between the protected areas. Many private properties within ST areas practise either goat or game farming. This study assesses biodiversity indicators in areas that have been historically used for goat farming and compares these indicators to areas that have a long history of mixed (goat-game) farming. The aim of this research was to compare key patterns in above-ground vegetation dynamics that result from long-term exposure to goat browsing to those that have been historically exposed to game browsing. This research tested the hypothesis that mortality of perennial plants is increased and recruitment reduced in transformed thicket.

Methods

Study Area

This study was conducted at eight sites near Port Elizabeth (Figure 1). Each site was characterised by a distinct fence-line contrast, i.e. considerable difference in the above-ground vegetation on either side of the fence. Sites 1-5 were located on moderately steep (10-20^{o}) north-facing foothills of the Groot Winterhoek Mountains (GWH sites). Sites 6 to 8 were in the Kirkwood area (KW sites) and were located on relatively flat slopes. Mean annual rainfall in the study area ranges from 250 to 450 mm and there is a high coefficient of variation (Aucamp & Tainton 1984). The vegetation in the study area comprises Sundays Spekboomveld (Arid Thicket) in GWH sites and Spekboom Thicket (Valley Thicket) in KW sites (Vlok *et al*. 2003), both types being characterised by the dominance of the leaf-succulent *Portulacaria afra* and woody species such as *Euclea undulata* and *Pappea capensis*. *Pappea capensis* is the dominant emergent canopy tree in a mosaic of multi-stem species such as *E. undulata*, *Rhus longispina, Rhus pterota, Putterlickia verrucos, Putterlickia pyracantha* and *P. afra*. Spekboomveld grows under drier conditions (250 - 350 mm.yr^{-1}) than Spekboom Thicket (350 - 450 mm.yr^{-1}) (Lechmere-Oertel 2003, Sigwela 2004).

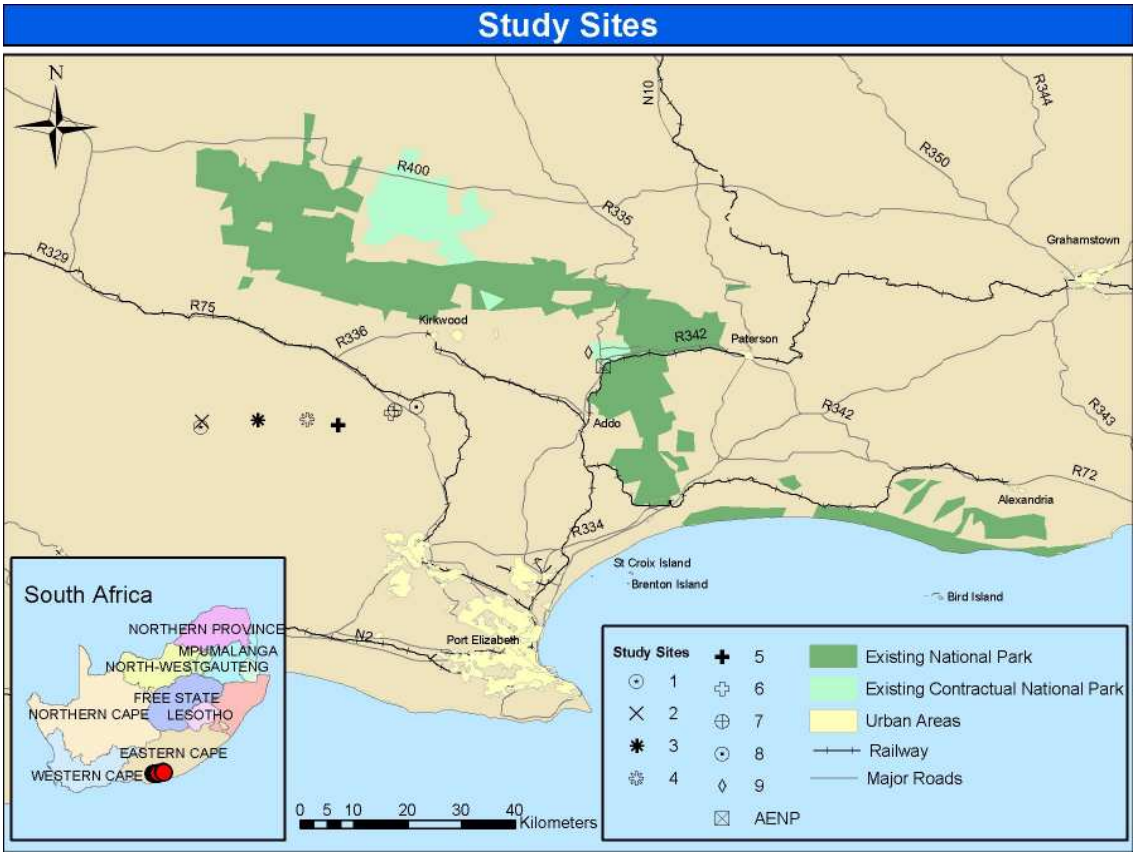

Figure 1: Geographical location of the study sites.

Vegetation Stability

Mortality of *Pappea capensis*

The stability of the canopy tree component of Spekboom Thicket was measured between 1939 and 1990 by locating trees identified from 1939 and 1990 aerial photographs of five GWH sites. Trees observed in the 1990 photographs were identified in the field in 2002, based on their proximity to definite landmarks such as reservoirs and fence intersections, and it was noted whether they were still alive. Mortality of trees in the field was compared between intact and degraded habitats in the five GWH sites by counting the number of dead trees from a random sample of 50 trees per habitat per site.

Seedling frequency

Recruitment of dominant long-lived trees (*P. capensis* and *E. undulata*) was compared between intact and degraded habitats in the four KW sites by counting the number of seedlings (< 30 cm high) in five 10 x 50 m transects per habitat. Care was taken to ensure that recruits were genets and not ramets (Midgely & Cowling 1993). The differences in recruitment and mortality per habitat were tested for significance using paired t-tests (Zar 1999) using STATISTICA 6.1 (Statsoft Inc. 2001).

Results

Mortality of Pappea capensis

The proportion of dead P. capensis trees was significantly higher in degraded (38.8 ± 27.7%) than intact (4.4 ± 5.7%) thicket ($t = -3.85$, $P < 0.02$, $df = 4$). Of the 168 trees from all sites that could be identified on the photograph and ground, 30% had died since 1990, showing that there has been significant mortality in the 12-year period.

Comparing this result to tree mortality before 1990 (Figure 2) showed that there has been 39% mortality since 1939 (Lechmere-Oertel 2003).

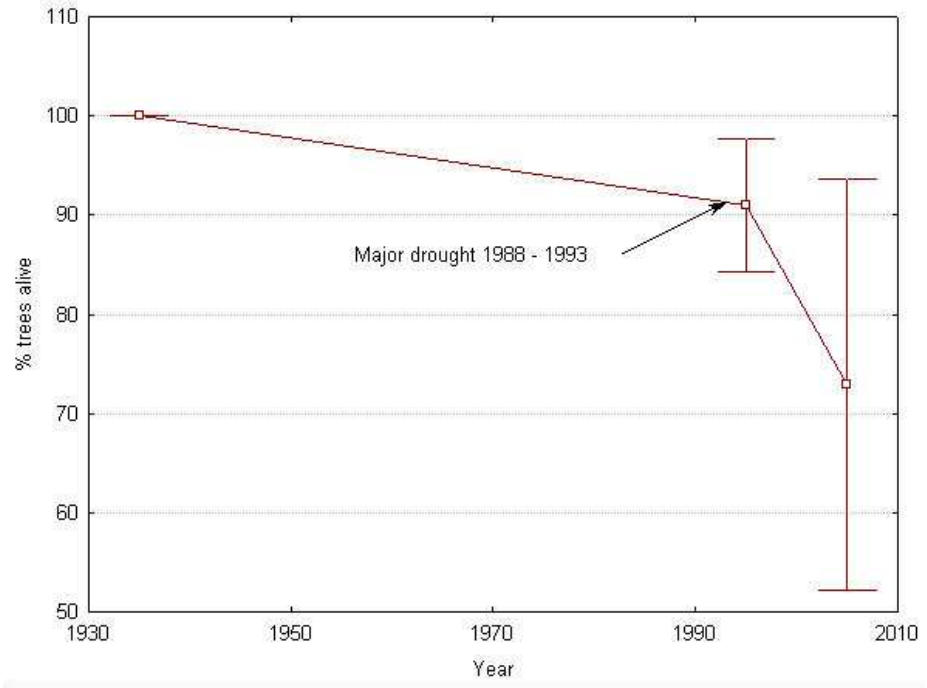

Figure 2: The mean percentage and standard deviation of *Pappea capensis* trees alive over time based on aerial photography and ground-truthing (n = 4 sites).

Seedling abundance

Seedlings of the canopy trees were found in both the degraded and intact habitats (Table 1). The degraded habitats had considerably fewer seedlings of the two main canopy tree species than the intact habitats, although the difference was not significant. All seedlings occurred under canopy environments (Sigwela 2004).

Table 1: The mean (± standard deviation) number of seedlings per hectare of each habitat for the two dominant canopy tree species compared between intact and degraded habitats.

Habitat	***Euclea undulata***	***Pappea capensis***
Intact	300 ± 305	815 ± 946
Degraded	10 ± 11	225 ± 123
Z *(n)*	2.02 (4)*	0.29 (4)

Mann-Whitney U statistic (Z) significance level: * P < 0.05

Discussion

The observed elevated mortality of *P. capensis* trees in degraded thicket compared to intact thicket is an indication that transformed thickets are not stable. Based on Lechmere-Oertel's (2003) data, mortalities between 1990 and 2002 seem to be significantly higher than those between 1939 and 1990. One of the explanations that can be provided is that the increased mortalities have been precipitated by the droughts of 1987-1993. This then suggests that although degraded thickets may seem stable, under particular pressures, they loose their stability. Importantly, intact

thicket is stable. Another explanation of increased mortality of trees in degraded thicket is an accumulation of effects. Lechmere-Oertel (2003) has shown that vegetation transformation introduces changes in environmental conditions of thicket, especially moisture and temperature levels. It is thus possible that the 1987-1993 drought was not the causal factor of the mortality, but that the mortalities may have increased due to the continued exposure to high temperatures and reduced moisture in transformed thicket.

The reduced presence of seedlings in degraded thickets compared to intact thickets suggests that degraded thickets are not a suitable habitat for seedling establishment. This study showed that in these thickets seedlings occur only in association with canopies and that seedlings do not establish in areas that have direct sunlight. These results confirm La Cock's (1992) findings. Reduced seedling establishment in degraded thicket is associated with the reduced availability of canopy, which potentially leads to increased temperature regimes and ultimately reduced moisture availability (due to higher evaporation) (Lechmere-Oertel 2003). It is well known that temperature and moisture levels can have strong effects on recruitment patterns and seedling establishment (Gross & Smith 1991, Nanga & Yadav 1995, Parciak 2002). These parameters may therefore be the fundamental causes of the unsuitability of degraded habitat for seedling establishment.

Recommendations

Though goat farming in thicket areas of the Eastern Cape has been shown to be profitable (Sims-Castley 2002) this study has shown that vegetation that has been extensively utilised for goat herbivory is unstable in the long term. Kerley *et al.* (1995) indicated that although game farming is more ecologically sustainable than goat farming, game farming is not as lucrative as pastoralism. A combination of an eco-tourism approach, trophy hunting, tourism and processed meat production (Kerley *et al.* 1995, Sims-Castley 2002) may however not be profitable to small-scale farmers.

Farming practices that are economically and ecologically sustainable are suggested. A mixed-farming (game and domestic) approach is therefore proposed (*sensu* Furstenburg & Kleynhans 1996). One of the mechanisms of this "conservation farming" approach in goat-browsed areas is the reduction of browsing pressure through destocking and rotational use of paddocks by goats. For appropriate stocking densities to be effectively employed, robust studies on the carrying capacity of the ST are urgently needed.

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AN OVERVIEW OF WILDLIFE-RELATED RESEARCH CONDUCTED AT THE PORT ELIZABETH TECHNIKON [1]

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Abstract
South Africa and the Eastern Cape in particular, is blessed with unique ecosystems and resource biodiversity. Appropriate practices, strategies, tools and policies are required for their sustainable use and conservation and research can play an important role in this regard.

Research at the Port Elizabeth (PE) Technikon[1] into aspects of sustainable utilization and management of biodiversity resources is centred in the niche area titled "Utilisation of wildlife in the Eastern Cape". The diversity of expertise and interests within this niche area allow for research topics ranging from production management, habitat monitoring, strategic management and marketing to those dealing with different forms of utilisation and socio-economic issues, as they apply to the wildlife industry.

Introduction
All wildlife related research currently conducted at the PE Technikon, is centred in the niche area entitled "Utilisation of wildlife in the Eastern Cape". Although this research is part of the current Technikon Development Programme of the National Research Foundation (NRF), it also fits into the NRF's focus area "Conservation and Management of Ecosystems and Biodiversity". One of the objectives of this focus area is "to describe, understand and conserve the biodiversity of resources of South Africa … by developing appropriate practices, strategies, tools and policies for the sustainable use and conservation of South Africa's biological diversity".

The vision of the niche area is to become a centre of excellence for sustainable utilisation and management of biodiversity, and its mission has been formulated as follows: *"Through multi-disciplinary teamwork, create research opportunities, transfer knowledge, and provide training in the fields of sustainable utilization and management of biodiversity resources enabling a range of opportunities to the benefit of all stakeholders, but mainly those in the Eastern Cape."*

The Focus of the Research
Wildlife is an important resource within the Eastern Cape, and its effective and sustainable utilisation can thus directly contribute towards conserving the biodiversity of South Africa's natural resources. Amongst others, this requires developing appropriate technologies and management practices to ensure optimized use, protection, remediation and re-use or resources, while paying due attention to the social and economic implications of such activities.

A broad framework outlining a number of research issues identified within the niche area is summarized in Figure 1. It consists of two interrelated streams: inputs, with a natural science and a social science perspective, and outputs in terms of utilisation and socio-economic issues. These two categories and sub-sections are by no

[1] As of 1 January 2005, the Port Elizabeth Technikon, Vista University and University of Port Elizabeth merged to form the Nelson Mandela Metropolitan University.

means exhaustive or mutually exclusive, but are selected examples of interrelated and interdependent issues.

Disciplines Currently Involved in the Research

As can be seen from Figure 1, the research lends itself to multi-disciplinary and interdisciplinary research. Six disciplines are currently involved: agriculture, marketing, nature conservation, game ranch management, strategic management and tourism. Due to capacity constraints, only selected areas of research are currently focused upon (Figure 1).

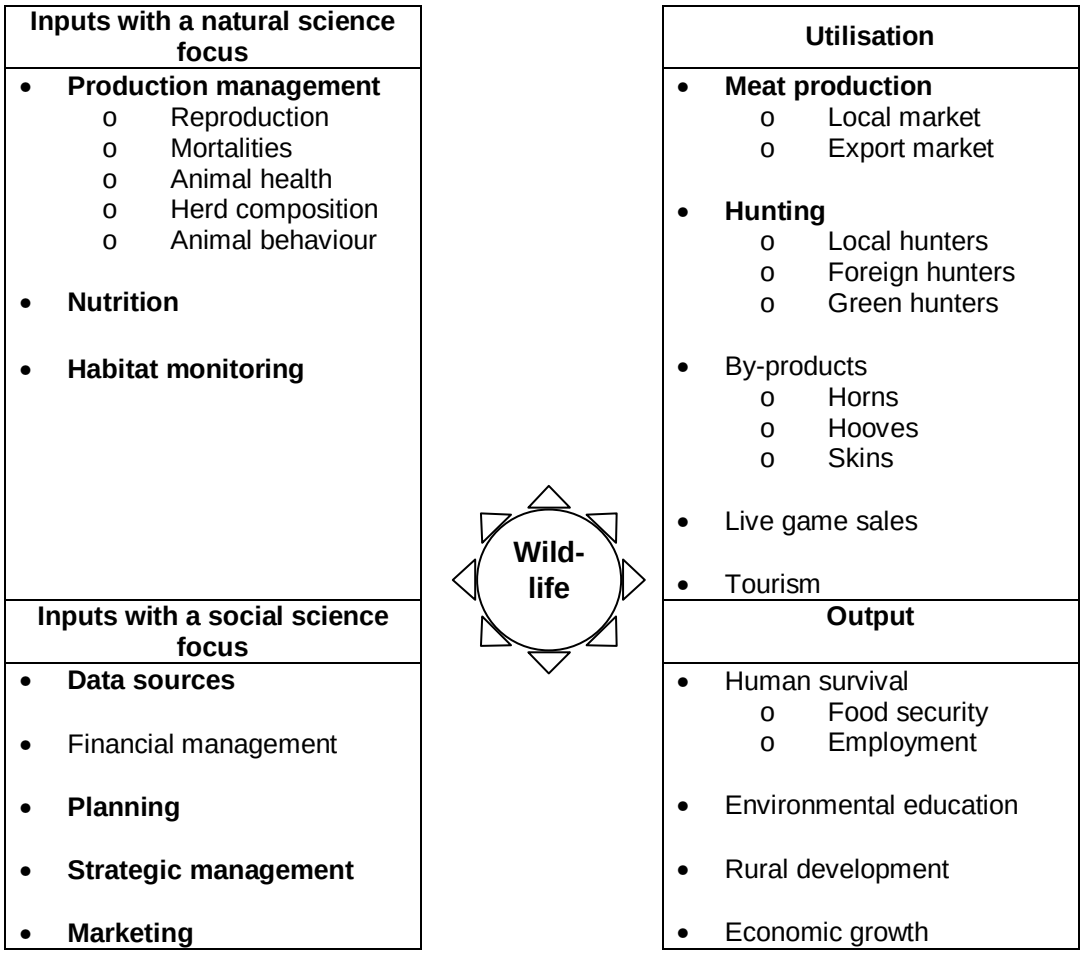

Figure 1: A broad framework outlining a number of research issues within the "Utilisation of Wildlife in the Eastern Cape" niche area, with areas of current research depicted in bold text.

Examples of Research Projects

Various projects have been completed, are underway or are planned. *Examples* of such projects include the following:

- Diet composition and habitat selection of eland in semi-arid shrubland
- Eland browsing of *Grewia occidentalis* in semi-arid shrubland
- Feeding ecology of buffalo
- Population viability of Cape mountain zebra
- Habitat selection of steenbok

- Fire management programmes
- Nyala stocking rates in the Karoo
- Grazing and browsing capacity models as predictors of sustainable stocking rates
- Impact of game (especially the extralimital species) on the threatened "koppies vegetation" in the eastern coastal section of the Gouritz Mega Reserve
- Thresholds of potential concern for ecological sustainability
- Characteristics of the game industry and trends within the industry
- Strategy formulation and implementation within the game industry
- Decision-making and risk discounting within the game industry
- Managerial competencies within the wildlife industry
- Economic aspects of game ranching
- An analysis of the needs and expectations of foreign hunters
- Matching the needs and expectations of local hunters to game ranchers' perceptions thereof
- An analysis of consumers' perceived perceptions of quality of venison
- An investigation of supply of and demand for venison at restaurants in the metropolitan areas of the Eastern Cape
- An investigation into the awareness of consumers and the demand for venison at supermarkets in the Port Elizabeth area
- Marketing strategies associated with niche marketing, focusing particularly on venison
- Job creation resulting from game ranching

Research Expertise within the Current Niche Area
Particular fields of expertise currently exist within the niche area, namely:

- plant/herbivore interactions
- influence of disturbance (herbivory and fire) on plant communities
- the influence of fire on forest communities
- wildlife ecology
- game ranch management, particularly stocking rates
- animal production
- grassland science
- business principles of game management
- nutritional analysis of wildlife meat (including fisheries)
- marketing
- strategic management issues
- consumer behaviour relating to various forms of wildlife utilisation

Dissemination of Research Findings
Research findings are disseminated via various forums, including; academic journals, popular press, and conference papers delivered at international and local conferences, Farmers' Association meetings, and industry magazines. Examples of selected outputs (academic forums) include:

Watson, L.H., Odendaal, H.E., Barry, T.J., & Pietersen, J. 2005. Population viability of Cape mountain zebra in Gamka Mountain Nature Reserve, South Africa: the influence of habitat and fire. *Biological Conservation* 122(2):173-180.

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Summary
The sustainable utilisation of renewable natural resources is normally possible in natural ecosystems when the relevant processes are managed responsibly and prudently. Such controlled utilisation forms the basis of viable wildlife management, including game ranch management. Sound research can help to make it a success.

CHARACTERISTICS OF THE GAME INDUSTRY IN THE EASTERN CAPE: A BRIEF OVERVIEW

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The South African Game and Hunting Industries

It is generally accepted that the South African game industry became established when, for the first time, during 1960, hunters started paying for the opportunity to shoot game (Landbouweekblad 1999). Before 1960 no economic value was attached to game, and family and friends were often invited to ranches for free hunting trips. Hunting was merely considered as a recreational activity to be enjoyed by anyone who had the time and the inclination to hunt.

In the preface to its publication on game-ranch profitability (ABSA 2002), the ABSA group states that there are 5 000 game ranches and more than 4 000 mixed game and stock ranches in South Africa. These cover some 13% of the country's total land area, compared with only 5.8% for national parks. Conroy *et al.* (1997) calculated the total land area used for some form of wildlife utilization in Southern Africa at 1, 003 000, 000 ha, representing 20% of the total land area. At the time of their study, they also estimated the gross annual income of the private game industry to be in the region of R1000 million. Du Plessis, cited in Conroy *et al.* (1997) estimated that during 1995 a total of 120 000 local hunters spent about R850 million on hunting.

A brief overview of the South African game and hunting industries is provided below. Firstly the number and size of exempted game ranches is investigated as an indicator of the level of involvement in the game industry.

Table 1: The number and size of exempted game ranches in South Africa, as on 1 August 2000 (source Eloff 2001).

Province	No. of exempted game farms	% of total number	Total area of exempted game farms (ha)	% of total area	Avg. size of exempted farms (ha)
Free State	180	3,56	147 743	1,43	820,79
Limpopo	2 482	49,04	3 325 652	32,09	1 339,91
North West	340	6,72	364 935	3,52	1 073,34
Mpumalanga	205	4,05	276 016	2,66	1 346,42
Gauteng	72	1,42	82 076	0,79	1 139,94
Natal	90	1,78	16 841	1,63	1 876,01
Eastern Cape	624	12,33	881 633	8,51	1 412,87
Northern Cape	986	19,48	4 852 053	46,82	4 920,95
Western Cape	82	1,62	265 205	2,56	3 234,21
TOTAL	5 061	100	10 364 154	100	2047,85

Although the extent to which game ranching is practiced may differ from province to province, more than 10 million ha are used for this purpose. This indicates that it has grown to such an extent that it has become an important form of income generation from agricultural land. In the Northern Cape and Limpopo Provinces, 46.8% and 32.1% of the land, respectively, is exempted game farms, placing these provinces in leading positions in the game industry. It can also be seen from Table 1 that

exempted game ranches in the Eastern Cape occupy 881 633 ha of land. This represents 8.5% of the available land in the Eastern Cape and makes it the province with the third largest area used for game ranching.

The income generated by the game industry is an indication of the importance of the industry to the economy. An estimation of the income of the game industry is provided in Table 2, where it can be seen that the combined income from trophy and biltong hunting in the year 2000 was R603 million. The importance of hunting as an income generating activity is clearly illustrated, as this was by far the most important income-generating activity, followed by live game sales. The income derived from eco-tourism and venison sales is very low compared to the other income-generating activities in the industry.

Table 2: Estimate of the gross income generated by the game industry in 2000 (Eloff 2001).

Activity	Income generated
Biltong hunters	R 450 million
Trophy hunters	R 153 million
Live game sale	R 180 million
Eco-tourism	R 40 million
Venison sales	R 20 million
TOTAL	R843 million

The hunting statistics relating to foreign hunters are provided in Table 3, which lists the statistics per province for the three leading provinces with regards the numbers of active hunting outfitters, active professional hunters, clients, the total number of animals hunted, the total hunting days, and the average length of the hunts.

Table 3: Hunting statistics for the three leading provinces for the period 1 November 1999 to 31 October 2000 (East Cape Game Management Association 2001).

Province	Eastern Cape	Northern Cape	Limpopo
Active hunting outfitters	91	77	334
Active professional hunters	187	215	463
Clients	1 002	452	941
Total animals	7 915	3 552	4 666
Animals/client	7,90	7,86	4,96
Clients/hunting outfitter	11,01	5,87	2,2
Clients/Professional hunter	5,36	2,1	2,03
Total hunting days	9 223	3 729	9 900
Average length of hunt	9,2	8,25	10,52
Complaints investigated	3	11	67

The Eastern Cape was the leading destination in the country for foreign hunters in terms of the number of animals hunted (Table 3). The statistics provided on the game and hunting industries in South Africa indicates that not only are these industries growing strongly, but also that they have grown to the point where they make a significant contribution to economic activities on farms. The importance of hunting as an income generating activity on ranches and therefore also as a driving force towards sustainable utilization of wildlife resources, is highlighted by the figures quoted above.

The Hunting Industry in the Eastern Cape

The Eastern Cape is the leading destination for foreign hunters visiting South Africa (Table 3), and the foreign hunting industry has become a significant contributor towards the economy of the Eastern Cape, with a direct income in excess of R98 million and an indirect income of more than R39 million during 2002. If the industry maintains its strong growth, it can be expected that its contribution to the economy will increase further.

The numbers of the ten most poplar game species hunted by foreign hunters and the income derived from these species are shown in Table 4, while the ten species that generate the most income from foreign hunters visiting the Eastern Cape are listed in Table 5. Springbok, kudu and blesbok are amongst the most abundant game species found in the Eastern Cape, and these are also important species, with respect to numbers, hunted by foreign hunters (Table 4).

Table 4: The ten most popular species (by numbers) hunted by foreign hunters over the period from 1 November 2001 to 31 October 2002 (Department of Economic Affairs, Environment and Tourism 2002).

Species	Total number	Unit price	Total income	
		US$	US$	SA Rands
Springbok	1 162	200	232 400	1 324 000
Kudu (East Cape)	895	900	805 500	8 055 000
Impala (Southern)	796	300	238 800	2 388 000
Blesbok (Common)	779	350	272 650	2 276 500
Bushbuck (Cape)	624	450	280 800	2 808 000
Warthog	569	300	170 700	1 707 000
Gemsbok	521	900	468 900	4 689 000
Reedbuck (Mountain)	469	300	140 700	1 407 000
Wildebeest (Black)	407	850	345 950	3 459 500
Duiker (Common)	369	200	73 600	736 000

*1US$ = R10

Although foreign hunters in the Eastern Cape hunted more springbok than any other game species during 2001/2002, kudu yielded the highest income (Table 5). It is also significant to note that a number of species that have been re-introduced to game ranches in the Eastern Cape, were amongst the top revenue earners from foreign hunters. It can be concluded that the demand by foreign hunters for hunting a wide variety of game species acts as a driving force to re-introduce new species to game ranches, thereby assisting the conservation of those species.

A summary of the income obtained from different forms of utilization of game in the Eastern Cape is provided in Table 6. Hunting is the most important form of utilization of game in the Eastern Cape (Table 6). Significant numbers of springbok, kudu, mountain reedbuck, blesbok and duiker were cropped annually, but in each case more animals were hunted than cropped. It should also be noted that capturing and live sale of game was not a major form of utilization at the time of the study. It can therefore be concluded that, from an economic perspective, hunting is the main driving force behind the sustainable utilization of game in the Eastern Cape. From the figures quoted and discussions above, it is clear that hunting is not only the most important form of game utilization in the Eastern Cape, but it also generates more

than twice the income that is derived from cropping and more than five times the income derived from live game sales (Table 6). Table 7 provides information on the total economic value of game utilized in the Eastern Cape at the time of the study. A total income in excess of R168 million was derived from game utilization in the Eastern Cape at the time of the study.

Table 5: The ten most popular species (income generated) hunted by foreign hunters over the period from 1 November 2001 to 31 October 2002 (Department of Economic Affairs, Environment and Tourism 2002).

Species	No. hunted	Unit Price	Total Income	
		US$	US$	SA Rands
Kudu (East Cape)	895	900	805 500	8 055 000
Gemsbok	521	900	488 900	4 689 000
Wildebeest (Black)	407	850	345 950	3 459 500
Zebra (Burchells)	281	1 200	337 200	3 372 000
Bushbuck (Cape)	624	450	280 800	2 808 000
Blesbok (Common)	779	350	272 650	2 726 500
Impala (Southern)	796	300	238 800	2 388 000
Eland (Cape)	148	1 600	236 800	2 368 000
Springbok	1 162	200	23 400	2 324 000
Wildebeest (Blue)	246	900	221 400	2 214 000

*1US$ = R10

Table 6: The economic contribution by different forms of utilisation

Form of utilisation	Income (Respondents)	Income (Extrapolate)
Hunting	11 534 729	101 620 962
Cropping	5 007 975	44 120 259
Live sales	2 046 935	18 033 497

The sustainability of game utilisation in the Eastern Cape is investigated in Table 8. It is noted that ranchers seemed to be utilizing game on a sustainable basis. It can be seen from Table 8 that the numbers of game utilized fall within the limits of the reproductive capacity of the species involved (with the exception of springbok). It can therefore be stated that the numbers of all species (with the exception of springbok) would increase if the current rate of utilization were maintained.

Conclusions

From the discussions above it can be concluded that:

1) Hunting is the most important income generating activity from game ranching on privately owned land in the Eastern Cape.
2) Game is currently utilized on a sustainable basis in the Eastern Cape.
3) Game numbers will increase if the current levels of utilization are maintained.
4) Game ranchers make a significant contribution towards conserving wildlife in the Eastern Cape.

5) As long as there is an economic incentive (as provided by hunting) to manage wildlife judiciously and to utilize game on a sustainable basis, game ranchers will continue to contribute towards conserving wildlife.

Table 7: Economic value of game utilisation in the Eastern Cape

Species	Total for Eastern Cape	Economic value per animal	Total economic value
1. Kudu	23 637	2151	50 843 187
2. Springbok	111 658	339	37 852 062
3. Blesbok	15 682	663	10 397 166
4. Mountain Reedbuck	23 214	435	10 098 090
5. Warthog	4 194	876	3 673 944
6. Oryx (Gemsbok)	705	3664	2 583 120
7. Black Wildebeest	1 991	3031	6 034 721
8. Impala	6 960	781	5 435 760
9. Bushbuck	3 868	1358	5 252 744
10. Bontebok	203	4017	815 451
11. Eland	423	7925	3 352 275
12. Blue Wildebeest	502	3775	1 895 050
13. Nyala	291	11667	3 395 097
14. Fallow Deer	6 026	795	4 790 670
15. Lechwe	758	9286	7 038 788
16. Steenbuck	1 163	484	562 892
17. Duiker	4 070	387	1 575 090
18. Grysbok	740	1240	917 600
19. Grey Rhebok	634	2500	1 585 000
20. White springbok	573	2800	1 604 400
21. Black springbok	1 004	818	821 272
22. Wild pigs	335	1100	368 500
23. Blue duiker	335	5333	1 786 555
24. Zebra	564	3029	1 708 356
25. Red Hartebeest	802	2150	1 724 300
26. White blesbok	352	1000	352 000
27. Klipspringer	335	5000	1 675 000
28. Barbary sheep	335	339	113 565

Table 8: Sustainability of game utilisation in the Eastern Cape

Species	Game numbers	Annual numbers utilised	% of total utilised	% Recommended utilisation
1. Kudu	18077	2683	14,84	19
2. Springbok	32501	12674	39	33
3. Blesbok	7322	1780	24,3	28
4. Mountain Reedbuck	22697	2635	11,6	29
5. Warthog	2502	476	19	120
6. Oryx (Gemsbok)	541	80	14,79	15
7. Black Wildebeest	1728	226	13,08	30

8. Impala	5638	790	14,01	30
9. Bushbuck	5004	439	8,77	20
10. Bontebok	253	23	9,09	25
11. Eland	581	48	8,26	20
12. Blue Wildebeest	658	57	8,66	30
13. Nyala	293	33	11,26	28
14. Fallow Deer	4211	684	16,24	35-60
15. Lechwe	401	86	21,45	25
16. Waterbuck	96	0		20
17. Sable Antelope	20	0		20
18. Steenbuck	6989	132	1,9	30
19. Duiker	7587	462	6,09	45
20. Grysbok	1167	84	7,2	
21. Grey Rhebok	1323	72	5,44	20
22. White springbok	213	65	30,52	33
23. Black springbok	694	114	16,43	33
24. Wild pigs	449	38	8,46	
25. Blue duiker	217	38	17,51	
26. Zebra	425	64	15,06	25
27.Giraffe	14	0		12
28. Red hartebeest	445	91	20,45	23
29. White blesbok	217	40	18,43	28
30. Reedbuck	24	0		18
31. Klipspringer	485	38	7,84	30
32. Wild ostrich	38	0		40
33. Mountain zebra	0	0		25
34. Barbary sheep	80	38	47,5	
35. White rhinoceros	2	0		12

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PROVIDING A CONTEXT FOR THE REHABILITATION OF SUBTROPICAL THICKET

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Introduction

Recent work on the dynamics of subtropical thicket (Lechmere-Oertel 2003, Sigwela 1999, 2004) has provided insights into the ecological processes involved in degradation of thicket. A significant feature of degraded thicket is a net loss of biomass, greater than 89 t C ha^{-1} (Mills *et al*. 2003) and a concomitant loss of biodiversity, often resulting in a pseudo-savanna with a strong karroid component (Lechmere-Oertel 2003). Severely degraded thicket exhibits impaired ecosystem services, and has a very low probability of recovery (Turpie *et al*. 2003). Currently lacking is a clear practical understanding of key interventions required to reverse thicket degradation. It has been suggested that spekboom (*Portulacaria afra*) could be critical to thicket rehabilitation because it can grow from cuttings and fixes large amounts of carbon in both soils and biomass at the landscape scale (Lechmere-Oertel 2003; Mills *et al*. 2005).

Subtropical Thicket has been shown to have considerable economic value if the vegetation structure remains intact (Sims-Castley 2002); yet ironically nearly all forms of Subtropical Thicket have moderate to severe levels of degradation (Lloyd *et al*. 2002). Within the thicket vegetation types, spekboom veld or spekboom thickets, which have *P. afra* as a canopy dominant (Vlok *et al.* 2003) are largely restricted to the Eastern Cape (Lombard *et al.* 2002), and have been particularly prone to degradation (Lloyd *et al*. 2002). The scale of degradation and the costs of rehabilitation indicate the need for a considerable financial investment to restore intact thicket (Lechmere-Oertel 2003).

Carbon Sequestration

The current level of atmospheric carbon dioxide exceeds levels not reached for the past 420,000 years. The main factor driving the change in atmospheric carbon dioxide levels is anthropogenic activities, mainly the burning of fossil fuels and land use change (Prentice *et al*. 2001, Watson *et al*. 2000). This increase in atmospheric carbon dioxide in turn is changing the world's climate (Houghton *et al*. 2001). To abate a continued increase in atmospheric carbon dioxide levels, the United Nations Framework Convention on Climate Change has been established and requires that developed countries reduce their emissions (for particulars of the Kyoto Protocol see www.ipcc.ch, http://unfccc.int/).

To facilitate a reduction in overall emissions, an allowance is made under Article 12 of the Kyoto Protocol for the establishment of carbon sequestration projects in developing countries (for guidelines regarding the implementation of such projects see http://www.ipcc-nggip.iges). The carbon sequestered through such a project, seen as a carbon credit, can be offset against the carbon budget of the country or can be traded for a fee. This process is known as the Clean Development Mechanism (CDM) and has been included in the European Union Emission Trading Scheme as well. For developing countries, it provides a source of funding for land rehabilitation projects.

In Subtropical Thicket, *P. afra* has been shown to have exceptional regenerative powers (Swart & Hobson 1994), and an unusual ability to rapidly fix carbon in semi-arid environments: 3.4 t C ha^{-1} yr^{-1} (Mills & Cowling 2006). Carbon storage within intact xeric thicket can exceed 200 t C ha^{-1} (Mills *et al*. 2003, 2005 & Skowno 2003) and is possibly linked to the dominance of *P. afra* in some areas. Furthermore, trial work by Swart & Hobson (1994) suggests that *P. afra* could be the most cost effective method of rehabilitating large areas of the subtropical thicket biome. Yet despite the high rates of carbon sequestration reported by Mills *et al*. (2003), Turpie *et al*. (2003) indicate that the rate of recovery for subtropical thicket would economically preclude the wide-scale employment of carbon sinking as a viable land use practice. Additional sources of funding may therefore be required to implement the project.

Such a project, in addition to sequestrating carbon, restores ecosystem services such as water provision that can regenerate income; it restores biodiversity and halts further degradation. This fulfils the requirements of the United Nations Conventions on Biodiversity and Desertification, to which South Africa is a signatory. Importantly within the context of the Eastern Cape, the physical implementation of the project itself creates jobs for unskilled labour in an area of the country with a low employment rate (Stats SA 2003).

Biodiversity Implications

Although a matrix of *P. afra* may be returned to the spekboom-dominated thicket types by planting *P. afra* cuttings, the challenge of returning the full complement of species will be immense. Not only are many thicket plant species relatively slow growing relative to *P. afra,* but there is also very little evidence of natural recovery. This could compromise the balance in trade-offs between carbon storage and biodiversity (Capparos & Jacquemont 2003). Frugivorous birds may play an important role in seed dispersal within subtropical thicket (Dean 2002), explaining the high number of plant species with fleshy fruits (Vlok & Euston Brown 2002). Vervet monkeys (Foord *et al.* 1994) could also contribute to rehabilitation programmes. Watson *et al*. (2000) recognised mistletoes as keystone species in many parts of the world, often impacting on alpha diversity. Subtropical thickets have been shown to exhibit high levels of mistletoe species richness with a relatively wide variety of hosts (Dean *et al.* 1994). The critical aspect of mistletoes with regard to subtropical thicket rehabilitation is the strong association of *Viscum crassulae* with *P. afra* (Midgley & Joubert 1991). We hypothesise that by employing a combined approach of rehabilitating with *P. afra* truncheons (some infected with *V. crassulae*), and large specimens of *Aloe*, *Euphorbia*, *Crassula* and other succulent spp., thereby effectively creating instant bush structure, the catalyst will be created for an accelerated increase in biodiversity (via zoochorous seed dispersal). This could effectively convert pseudo-savanna and old lands, through the initiation and growth of bush clumps back to intact Subtropical Thicket.

Rehabilitation Project

The Department of Water Affairs and Forestry has initiated a pilot project to assess the viability of using primarily *P. afra* to restore large areas of Subtropical Thicket. A strong focus will be on the potential role of carbon sequestration as a funding source. The Subtropical Thicket Rehabilitation Project aims to illustrate the provision of key deliverables such as improved water retention, restoring biodiversity, the sequestration of carbon and reversing desertification which in turn may kick start a larger rehabilitation project across the entire biome.

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AN ECOLOGICAL-ECONOMIC ANALYSIS OF THE CONVERSION TO GAME FARMING IN THE XERIC SUCCULENT THICKET ♦

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A dynamic ecological-economic model of Xeric Succulent Thicket was constructed in STELLA®. This comprised a vegetation model, grazing effects, biodiversity measures and financial and economic measures, based on existing data and data collected during the Conservation Farming Project. Existing information on the carrying capacity of the vegetation was used to derive a growth curve for thicket vegetation, taking into account the contribution of perennial thicket and the ephemeral grass colonisers of degraded vegetation, and making adjustments to include woody biomass accumulation. Vegetation was defined in 10 classes of cover, which was proportional to biomass.

Three types of farming were distilled into area under livestock and game. The model was set up to run scenarios in which the relative proportions of these farming types were changed, and in which exotic game could be included or excluded. Scenarios were evaluated in terms of biodiversity scores (average alpha diversity or density in the study area), net farm income, and total economic value (including value added on and beyond the farms, consumptive use of natural resources, carbon sequestration and existence value. The model predicted a very slow recovery of thicket. Current farming practices result in continued degradation due to overstocking, but slight recovery would occur if stocking rates were reduced. Game farming favours recovery of thicket, but the recovery is slower with inclusion of exotic game. Overall the value of agricultural activities (stock or game farming) outweigh any other values of thicket, including carbon sequestration. Conversion to game farming only adds value if it comprises high-earning enterprises, with exotic game.

♦ Full article not provided

PLANNING FOR IMPLEMENTATION IN THE THICKET BIOME: MAKING CONSERVATION PLANNING RELEVANT FOR STAKEHOLDERS IN THE GREAT FISH RIVER CATCHMENT

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Challenges for the Conservation and Sustainable Use of Subtropical Thicket

Subtropical thicket vegetation in South Africa comprises part of the internationally recognised Maputaland-Pondoland-Albany biodiversity 'hotspot', one of twenty-six such hotspots recognized across the world (Steenkamp *et al.* 2004). Over 20% of South African subtropical thicket plant species (322 species in total) are classified as endemics, many of which are localized endemics (Vlok *et al.* 2003). It also provides highly productive habitat for a wide range of invertebrates (Ş. Procheş, *pers.comm*.) mammals (Kerley *et al.* 1995) and birds (Dean 2002) as well as reptiles, notably a globally high diversity of tortoise species.

Subtropical thicket also provides the basis for a wide range of production activities, and therefore, the basis for many livelihoods, both rural and urban. It is primarily a pastoral region dominated by goat and cattle grazing, and increasingly, ostrich farming (Low & Rebelo 1998). It is the center for the South African mohair industry (the worlds largest producer). The wildlife and ecotourism industries are rapidly growing (Sims-Castley 2002, Smith & Wilson 2002), and many farmers now run 'mixed' farming ventures of domestic stock and wildlife. Intensive cropping, predominantly along the river valleys, for pineapples, citrus and vegetables occupies considerable areas. Generally speaking, regional-scale land-use is being conducted in a non-sustainable manner. This means that the social-ecological systems of the subtropical thicket are in a state of on-going decline. Over-grazing by domestic stock has drastically reduced species richness and affects large areas; legal and illegal bush clearing and the encroachment of urban areas is rapidly reducing the extant vegetation; and alien plants continue to impact some ecosystems, leading to altered species composition, increased fire hazards, reduced water availability and reduced livestock carrying capacity.

Conservation planning is a discipline that aims to balance production and other forms of exploitation with the conservation of biodiversity in a way that allows for realization of the evolutionary potential of as many life forms as possible (Margules 1999). Internationally, conservation planning is in an 'implementation crisis' (Knight & Cowling 2003a), which manifests as two "knowing-doing gaps" (Pfeffer & Sutton 1999) – the information planning gap and the planning implementation gap (Figure 1). Many conservation assessments are undertaken which never realise *actual* conservation of species, landscapes and the processes that ensure their persistence. This implementation crisis has materialized in part because academic systems value publication over action, and the discipline currently purveys ill-fitting conceptual models of both social-ecological systems and planning processes. Conservation planning has the potential to secure nature and the production activities dependent upon it, but it is a difficult task. Fortunately, South Africa has since the mid 1990s, developed conservation planning expertise (Driver *et al.* 2003) in conducting systematic conservation assessments (see Margules & Pressey 2000), developing implementations strategies, and implementing effective conservation action.

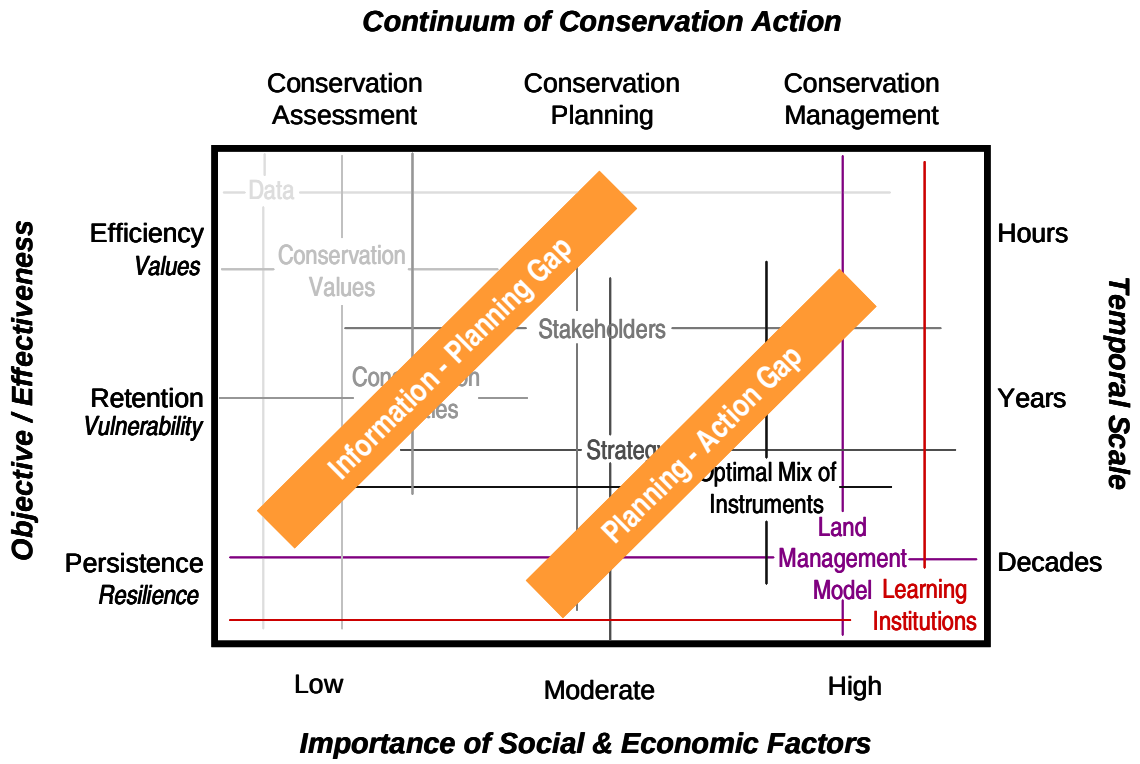

Figure 1: The "knowing-doing gaps" between the stages of a typical conservation planning exercise.

Historically, the solutions adopted for natural resource management problems have often been unsustainable, and poorly planned and implemented. An approach known as "planning for implementation" has been developing in South Africa over the last few years. It attempts to ensure that conservation planning initiatives accurately reflect social-ecological systems and are relevant to stakeholders.

At least five challenges face effective conservation planning:

1. Scale – planning is best done regionally, but action is best implemented locally
2. Grappling with the complexity of social-ecological systems
3. Managing change within natural and human systems
4. Understanding and influencing capital flows
5. Involving people and developing learning institutions.

Planning Solutions for Subtropical Thicket

Scale issues are as pervasive in conservation planning as they are in other disciplines, for example ecology (Levin 1992) and landscape ecology (e.g. Wiens 1989). Accordingly, successful conservation planning initiatives overcome the scale divide between regional-scale planning and local-scale implementation (Figure 1). The conservation and sustainable use of subtropical thicket has targeted solutions at both the regional and local scales.

Recognising the global significance of subtropical thicket, the livelihoods dependent upon it, the rate at which it is being transformed, and the growing conservation planning expertise in South Africa, the Global Environment Facility (GEF) funded a biome-wide conservation planning initiative – The Subtropical Thicket Ecosystem Planning (STEP) Project. Beginning in July 2000, it has provided a suite of tools for re-designing landscapes and sustainable rural futures:

1) a co-operatively developed common vision
2) a model for ecologically sustainable land management (Knight & Cowling 2003b)
3) spatially-explicit conservation priority areas (Cowling *et al.* 2003)
4) an implementation strategy (Knight *et al.* 2003)
5) empowered individuals and institutions

Four years of stakeholder involvement support these tools. They provide the information and prerequisite conditions essential for successful regional-scale conservation action. However, regional-scale information provided by STEP does not directly implement conservation action on-the-ground. So how do we operationalise STEP at the local-scale?

The Land-use and Livelihoods Project is a pilot study focused upon the Fish-Kowie Megaconservancy Network (Figure 2), one of seven regional-scale priority conservation corridors identified by STEP. It is a local-scale initiative that aims to:

1) develop and test a model for translating regional conservation planning into local-scale opportunities – the Pathway for Landscape (Re-)Design (Figure 3)
2) test a methodology for scheduling conservation actions
3) critique the implementation process using an Action Research approach

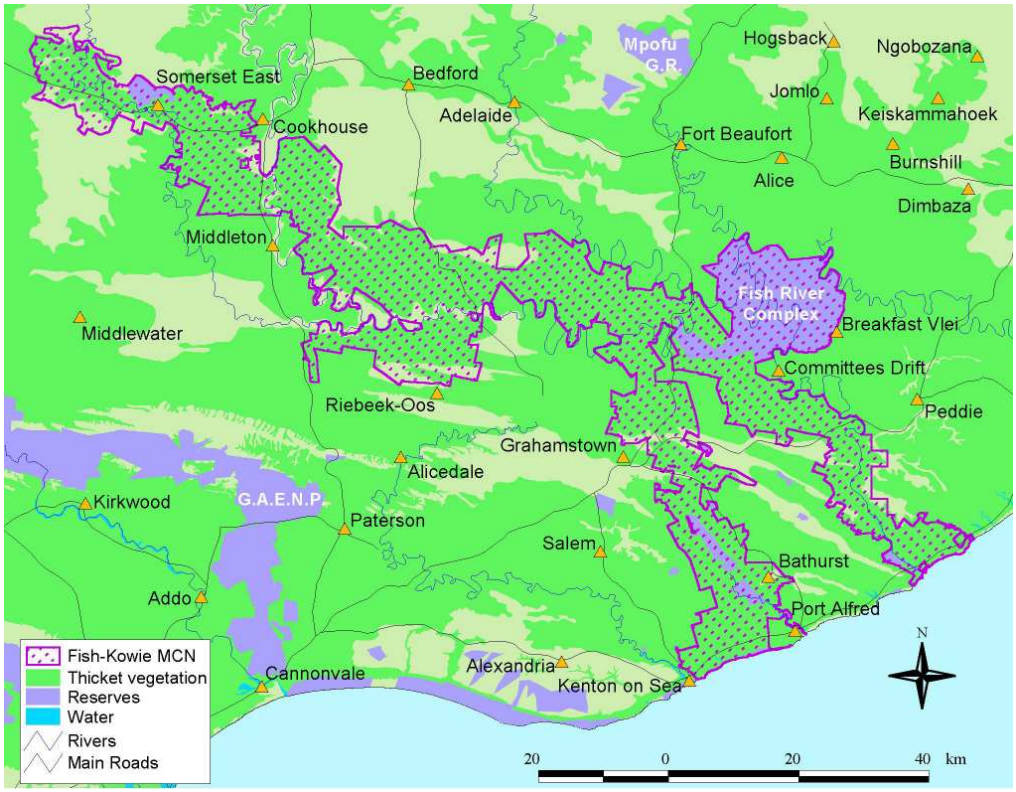

Figure 2: The study area of the Land-use and Livelihoods Project, which is focussed upon the proposed Fish-Kowie Megaconservancy Network.

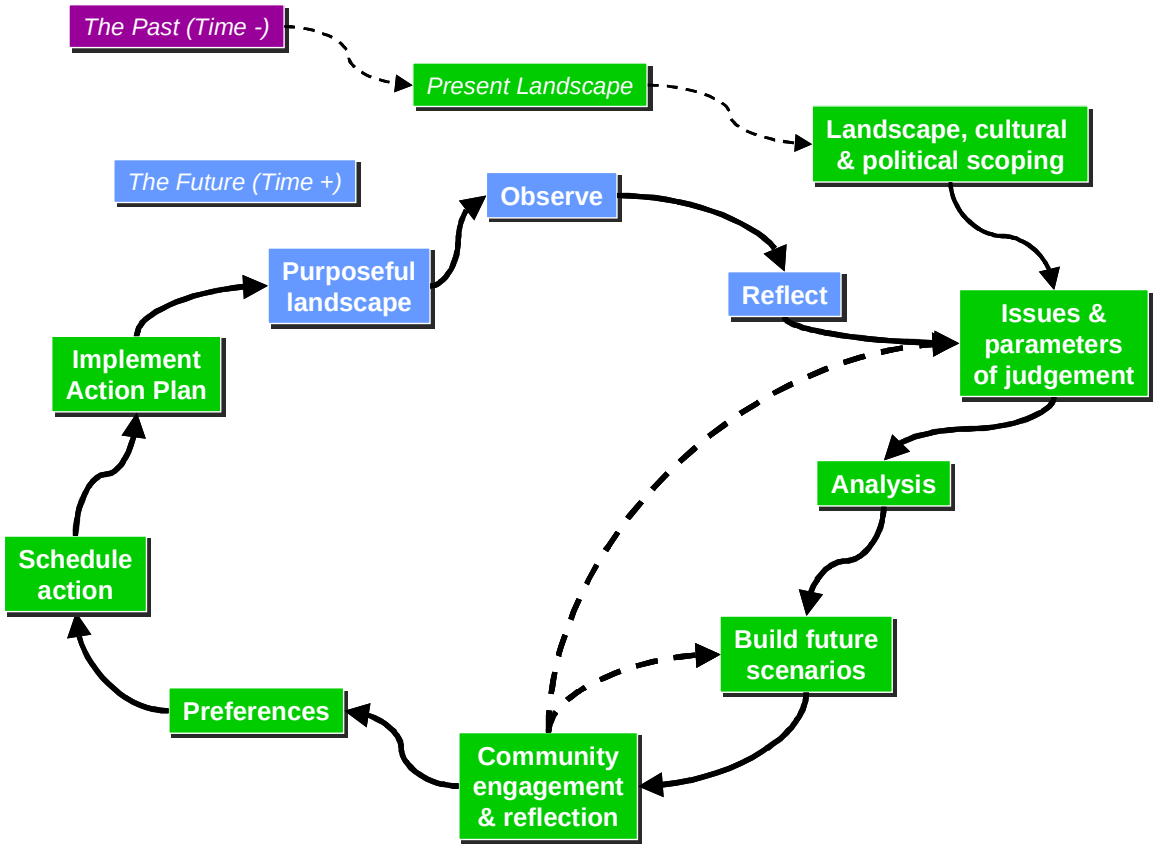

Figure 3: A hypothetical pathway for conservation planning.

The Land-use and Livelihoods Project, along with other initiatives combine to form the Fish River Biodiversity Initiative. It ultimately aims to provide the foundation for the implementation of a Megaconservancy Network (MCN) in the catchments of the Great Fish and Kowie Rivers by bridging the divide between regional- and local-scales, and the "knowing-doing gap" (Pfeffer & Sutton 1999). This process comprises two phases of implementation:

1) Identifying Opportunities for People to Help Themselves
   - Talking and listening to landowners
   - Identifying profitable yet sustainable options
   - Developing an Action Plan

2) Creating Opportunities for People to Help Themselves
   - Implementing a Megaconservancy Network

What is a Megaconservancy Network?

An explicit model of ecologically sustainable land management is essential for the implementation of local-scale action from regional-scale planning. The model provides a vision for implementation, and promotes the co-ordination of integrated property-scale and institutional activities to meet regional goals. The STEP conservation assessment (Cowling *et al.* 2003) identified regional-scale priority corridors that achieved representation and persistence goals (Figure 4). These corridors were designed with the MCN model in mind, so as to ensure that the design

could be tailored to meet existing and future conservation opportunities and constraints.

A MCN is a regional-scale corridor, which is located along hypothesized areas of important environmental processes. It also samples subtropical thicket vegetation types to meet representation target levels (see Desmet & Cowling 2004). Integrating the sampling of processes first, then representation, aims to promote the persistence of landscapes and their component species. Unlike modern agricultural landscapes, Megaconservancy Networks attempt to represent a wide diversity of land-uses (Figure 5), in an attempt to mimic nature's complexity and dynamism. This harnesses a diversity of capital (natural, social, financial) and opportunities, and is expected to enhance the resilience of social-ecological systems (Gunderson & Holling 2002), and promote the conservation of a diverse array of habitats and species.

One important role of MCNs is the provision of a spatial framework for conceptualising and optimising capital flows. For example, a common property resource agreement whereby, say, four farmers manage their property as one ecotourism venture provides an opportunity for conservation and development by aiming to improve financial returns and environmental values, and reduce costs. These capital flows can be better managed through the establishment of spatially-defined institutions which operate at the landscape-scale and take into account the regional-scale environmental processes essential for ensuring the persistence of nature and sustainable development. Ultimately, MCNs are more than just spatially-adjacent properties; they represent landscapes bound together by strong social capital. The aim is to identify opportunities for landowners to access biodiversity-based economies through the fostering of partnerships between aligned interests, thereby enhancing livelihoods.

Opportunities for achieving these goals in the context of a MCN are invariably context specific (e.g. increasing interest in foreign ecotourism), and often exist independent of any influence or input by conservation organisations. Systematically assessing conservation opportunities (as opposed to simply scientifically identified conservation priorities) can be conceived of as comprising four linked elements (see Figure 6):

Landscape Values:	Which sites are of high conservation priority?
People:	Who are the landowners who manage individual sites and what values do they place on natural resources?
Institutions:	What structures or social processes support sustainable management?
Instruments:	Which mechanisms are effective at realising opportunities?

These occupy a spectrum of values, which influence the identification of conservation opportunities for positively adjusting capital flows.

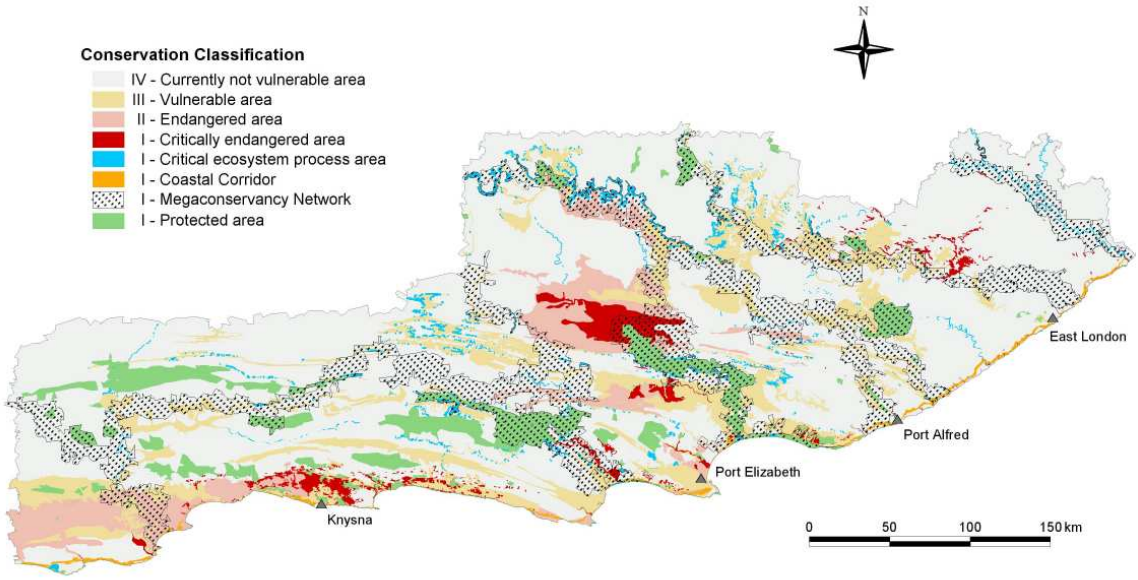

Figure 4: The conservation priority map identified by the STEP conservation assessment (Cowling *et al.* 2003).

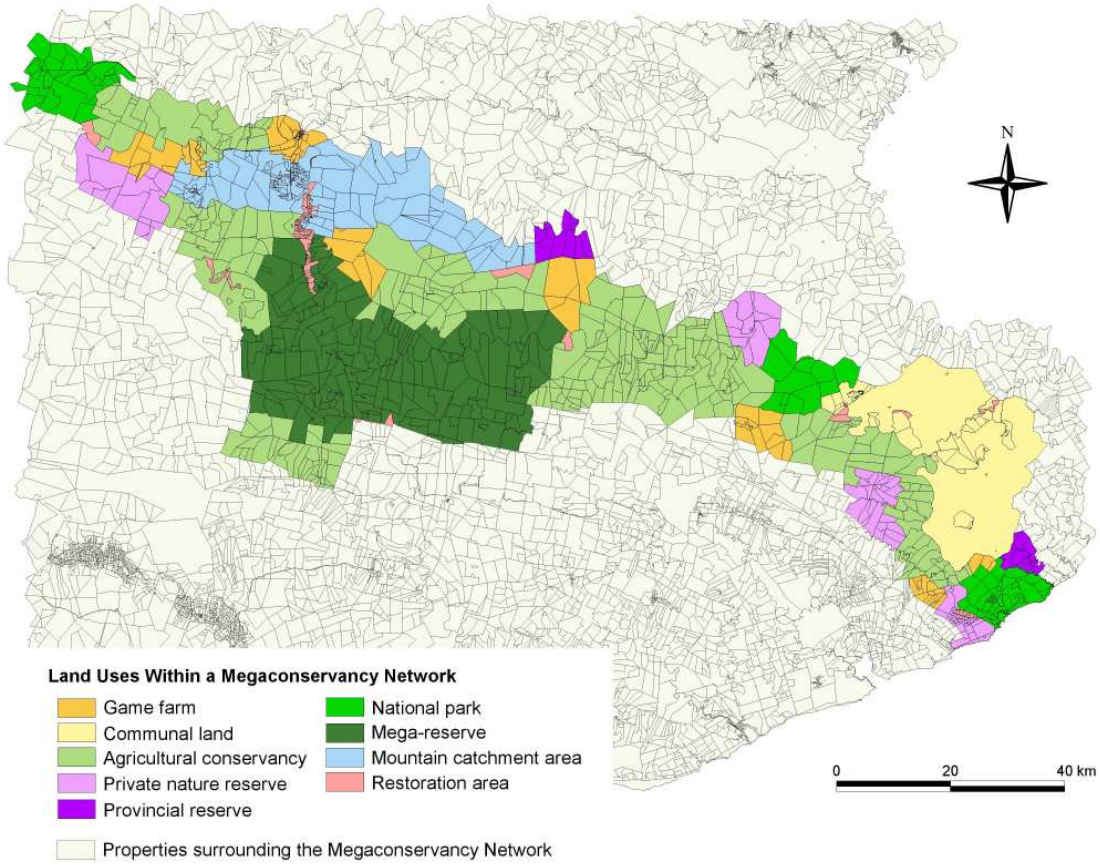

Figure 5: A hypothetical Megaconservancy Network exhibiting a range of possible land-uses.

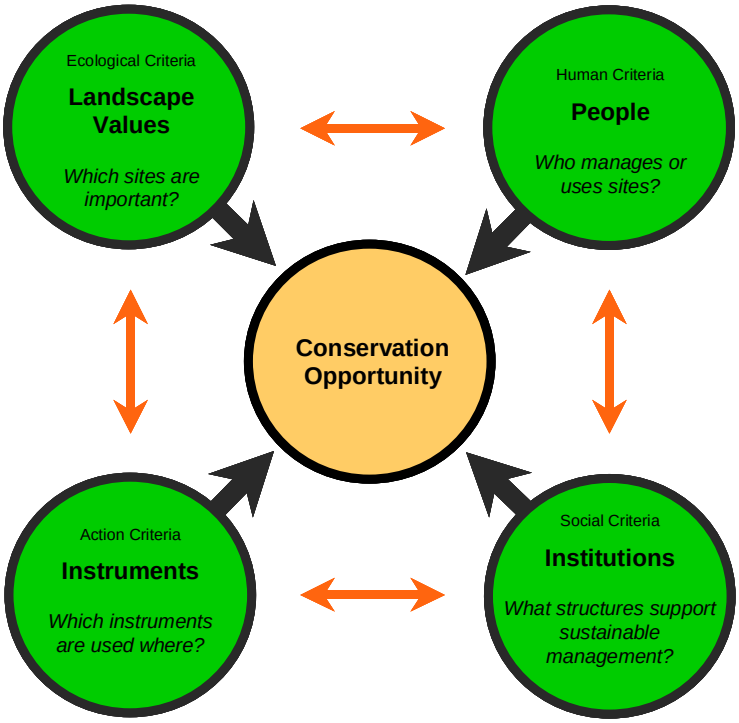

Figure 6: Inter-linked criteria useful for identifying conservation opportunities, rather than conservation priorities.

The persistence of landscapes, their component species and the processes, which ensure their persistence, is dependent upon managing the constant change and complexity of social-ecological systems. The Land-use and Livelihoods Project aims to identify conservation opportunities in a spatial context, and at the same time, foster the beginnings of the institutions to meet the challenges of ecologically sustainable land management. This will involve stakeholders through gathering data on their knowledge and practices of natural resource management, their perceived needs and challenges they face, and the incentives required to encourage ecologically sustainable land management. This information will then be used to formulate future land management scenarios using a social-ecological systems modelling approach. This process will be iterative and undertaken with land managers. The solutions to the questions of conservation and sustainable use today, will not be the solutions at different points in time in the future. Ultimately, adaptive collaborative learning institutions will need to be established. This will require dynamic and flexible institutions, which consciously manage the social and human capital of their members.

Research activities and products

The Land-use and Livelihoods Project aims to undertake a suite of activities:

1. Gain approval and support from the Eastern Cape Implementation Committee (ECIC)
2. Inform the Fish-Kowie catchment community of the project
3. Survey land managers on their values and land management approaches
4. Develop a common vision amongst land managers
5. Build a dynamic systems model as a visioning tool
6. Schedule the actions required to ensure conservation and sustainable use

7. Develop an Action Plan endorsed by the ECIC
8. Critique the process by conducting reviews at key stages

It is intended that these activities deliver a suite of products, which will be useful in supporting the land management organisations currently in operation and the establishment of future adaptive collaborative learning institutions. These products include:

- a GIS database of conservation opportunities
- a testable understanding of the Fish-Kowie social-ecological system
- strong community support for the Fish River Biodiversity Initiative
- an Action Plan endorsed by the ECIC
- enhanced conservation of priority landscapes
- improvement in the livelihoods of rural people

The project looks forward to your future involvement.

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IMPLEMENTING THE GREATER ADDO ELEPHANT NATIONAL PARK THROUGH PARTNERSHIPS

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Abstract
SANParks is mandated by national government to contribute to the expansion of the country's formal terrestrial protected areas in an effort to increase this from 6% to 8% by 2010. There has also been a paradigm shift from a purely preservationist thinking to one that attempts to encapsulate ecological patterns and processes within a broader ecosystems conservation planning approach. Linked to this shift is the recognition that the establishment and expansion of protected areas cannot take place in isolation from the neighbouring land-use matrix. In this light SANParks is in the process of developing land incorporation frameworks that not only highlight the importance of large areas in terms of conservation value, but also their importance and potential as economic development nodes that are able to stimulate sustainable eco-tourism growth. In doing so, expansion is not solely focused on establishing Schedule I protected areas (core conservation areas managed by the SANParks) but also makes provision for contractual areas within the planning boundary that will support innovative conservation and development models involving partnerships with private landowners, local municipalities, communities and the private business sector.

The expansion of the Addo Elephant National Park (AENP) in the impoverished Eastern Cape is an example of such innovation. The Greater Addo Elephant National Park project (GAENP) involves the establishment of a mega biodiversity reserve around the existing AENP, looking at innovative partnerships through concessionaires and contractual agreements, while at the same time establishing increased socio-economic opportunities for the area. In doing so the park has already grown to 145 000ha in the past 5 years from its meagre start at 2270 ha, while predicting to create 1 job / 100 ha in comparison to the 1 job/ 367 ha within the agricultural sector. Ultimately the GAENP would encompass habitats ranging from semi-arid Karoo areas, fynbos slopes, thickets and montane forests extending into coastal grasslands and forests within a 372 000 ha terrestrial zone plus a marine protected area (MPA) of 120 000 ha that would include the Bird and St Croix Island groups in Algoa Bay, offering a unique Big 7 experience.

In turn, this project is being strengthened by lessons learned in other biodiversity conservation projects in South Africa such as the CAPE, STEP and SKEP initiatives.

Introduction
Mention the South African National Parks (SANParks) and immediately one is drawn to the organisational flagship in the lowveld, the Kruger National Park (KNP). This vast expanse of land nestled in the cradle of the neighbouring countries of Zimbabwe and Mozambique has long been a global icon of the typical African wildlife experience. The KNP continues to be a big attraction to visitors, both local and international alike, having recently exceeded 1 million visitors per annum for the first time. However, SANParks has a commitment to the South African public to ensure that South Africa's natural biodiversity is represented within a national system of protected areas for posterity but also human enjoyment. To meet this mandate a series of 20 national parks have been established across the length and breadth of South Africa in an effort

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to capture the unique landscapes, habitats, species combinations and diversity of the country. As a testament to this, four parks have been proclaimed in the last five years.

Recent developments have seen a shift in this focus on the KNP as representative of the Savanna biome, towards the consolidation and expansion of many of the smaller parks to meet the increasing conservation objectives of the country's remaining six biomes (Thicket, Grassland, Fynbos, Succulent Karoo, Nama Karoo and Forest). Conservation in these smaller parks not only focuses on maintaining their natural biological patterns and processes, but also on a diverse range of socio-economic opportunities thereby contributing to sustainable development.

The expansion of the Addo Elephant National Park (AENP) in the impoverished Eastern Cape province is an example of such innovation and this park has taken an unprecedented lead in fine-scale conservation planning for national parks in order to identify conservation priorities within a broader ecological planning domain (see www.addoelephantpark.co.za). Conservation planning itself is a relatively new science and has only recently been adopted by planners and scientists alike as a tool for conservation (Erasmus *et al.* 1999, Pressey 1999, Boshoff *et al.* 2001, Reyers *et al.* 2002). The bulk of the groundbreaking work was undertaken for the CAPE (Cape Action Plan for the Environment) project in the Cape Floral Kingdom (WWF 2000, Younge & Fowkes 2003) but as with many new approaches the learning curve associated with these new ideas was steep and significant growth was seen in subsequent analysis such as the STEP (Subtropical Thicket Ecosystem Planning), SKEP (Succulent Karoo Ecosystem Planning) and GAENP (Greater Addo Elephant National Park) projects. The former two programmes are larger scale initiatives that cover expansive areas while the GAENP initiative had a much finer focus aimed at addressing the immediate expansion needs of a single national park.

The expansion of the AENP has been touted by SANParks development teams as one of the conservation milestones of the decade. Since 1994 there has been a realisation that tourism holds the key to unlocking major economic growth and the development of a greater park within a mosaic of adjacent land uses that captures the diversity of attractions within the Eastern Cape, has been actively supported by national government. Not only does the park continue to meet the conservation objectives for the protection of single species such as the African elephant, Cape buffalo or black rhinoceros, but recent years have also seen a shift towards conserving all facets of the region's natural biodiversity. In this light the GAENP has received significant support for the expansion activities, with national government allocating funds for land purchase to this venture, the first such gesture in decades. Furthermore, the GAENP initiative makes explicit linkages between ecological, social and economic viability and highlights development opportunities across the landscape and is seen not only as a biodiversity hotspot but also an economic engine for the region.

Background to the Greater Addo Elephant National Park:

The GAENP project involves the establishment of a mega biodiversity reserve around the existing AENP where ecosystem degradation and loss of natural resources, through inappropriate agricultural practices, is now beginning to impact on biodiversity. However, there are also threats from within as the increasing elephant population exerts pressure on the natural vegetation. The most important project intervention will be the sustained conservation of the region's globally significant biodiversity while addressing the root causes and threats to biodiversity loss by focusing on integrated ecosystem management. A strategic and rigorous conservation plan to direct future land acquisition was developed and park expansion continues following these recently formulated policies and guidelines.

Over the next five years (until 2009) these bold expansion plans would see Addo becoming the third largest conservation area in South Africa after the Kgalagadi Transfrontier and Kruger National Parks. However, the expansion is not solely focused on establishing Schedule I protected areas (core conservation areas managed by the SANParks) but also makes provision for contractual areas within the planning boundary that will support innovative conservation and development models involving private landowners, local communities and the private business sector.

Framework for the GAENP expansion:
South Africa ratified the Convention on Biodiversity (CBD) on November 2, 1995. In meeting its obligations of this convention a National Biodiversity Strategy and Action Plan is currently being prepared and the GAENP project is directly linked to the efforts of the South African Government to address national and global environmental priorities by reversing land degradation and enhancing biodiversity, while also improving local livelihoods.

Increased direct employment associated with conservation land-use and eco-tourism in the park represents about 1 job/100 ha versus the agricultural norm of 1 job/367 ha and therefore represents a sustainable alternative that meets social requirements. This does not take into consideration the knock on effect of this tourism activity that already makes a significant contribution to the local economy (Geach 1997). The relatively high 50:50 ratio of foreign:local visitors to Addo also bodes well for the regional job creation economy, with possibly as many as 14 000 jobs being created in the region from these tourists alone. Given the fact that the park is already functional, and there is to be greater diversification of the wildlife product, investment opportunities will be enhanced that will undoubtedly attract further foreign investment and hopefully enhance job creation.

In order to achieve the longer-term goals of expanding the GAENP through the inclusion of up to 30% of the protected area under private ownership (Table 1), legal and institutional barriers hindering conversion of farms to conservation areas have been assessed. Farms for possible inclusion will be evaluated on a series of criteria and depending upon the properties conservation importance, offered a suite of incentives (Knight 2003). The project will also develop and implement a sustainable natural resource-use policy with local communities in specific zones. Commercial and recreational fishing in the MPA will be rationalized in specific use-zones and put on a more sustainable footing. The project aims to develop a model of protected area management, which is replicable both within South Africa as well as outside the country. Further, the lessons learned from the project will be shared with other ongoing initiatives such as the implementation of CAPE and the Wild Coast Initiative.

Land will be incorporated into the AENP depending upon: its relative value with respect to enhancing ecological integrity and biological representativeness; improving local socio-economic conditions and minimizing costs of acquisition (including resettlement); and the potential to reduce threats to biological integrity. The new approach adopted by SANParks within the GAENP context seeks to ensure long-term conservation of globally significant biodiversity by creating a framework for surrounding landowners to incorporate their lands into the expanded park through various partnership models and incentives, in addition to more traditional purchase arrangements. Options for land acquisition include direct purchasing, contractual arrangements, management agreements, buffer arrangements, donations, and expropriation. In so doing the project will potentially build strong stakeholder participation and support for planning, monitoring, institutional support, private sector involvement and community/social ecology components.

Development of public/private partnerships:
Recent experience within the GAENP development scenarios demonstrates significant employment gains when private land in the planning domain is converted from marginal agriculture to eco-tourism with direct benefits for employment of local labour. As an example, the new Kuzuko tourism development (one of the contractual areas to the north of the existing park) previously had only 12 workers on the 20 000 ha of pastoral farmland. Not only have these habitats been consolidated for conservation and inclusion into the greater AENP but the development of this land into an eco-tourism venture has seen the direct employment of an additional 38-48 workers in the short term, with predictions for doubling this figure in the medium term. Furthermore, it has also seen the opportunities for these farm labourers to increase their skills through enhanced capacity building programmes.

From a continental perspective, the GAENP project is at the cutting edge of the biodiversity management-private sector-local livelihood enhancement nexus. It will provide replicable experiences and lessons inside and outside of South Africa for the implementation of new models for protected area management supportive of poverty alleviation while meeting biodiversity conservation objectives.

Expansion challenges and new directions – contractual partnerships:
Plans to consolidate and expand the park to capture the regions unique biodiversity will focus on a core area of some 237 000 ha of terrestrial (Table 1) and 120 000 ha of marine habitat over the next 5 years. During this time, the majority of land acquisition will be through new contractual arrangements that will gradually reduce the ratio of purchased:contractual land from 87:13 to 72:28 (Figure 1). This not only emphasizes the important contribution that neighbouring private landowners can make towards meeting conservation objectives but also displays a commitment by SANParks to draw on the strengths of public/private partnerships to achieve their mandate.

Table 1: Land acquisition planned under the Greater Addo Elephant National Park

Time Frame	Purchased Land (ha)	Contractual Land (ha)	Total Land (ha)	Purchased/ Contractual ratio
Present time	136,859	20,085	156,944	87/13
End of project (2009)	170,337	66,337	236,674	72/28
Increment from present	33,478	46,252	79,730	42/58

Participatory management
Meeting SANPark's conservation mandate in a changing management environment has required new approaches to protected area management and committees involving stakeholders are being established across the country as part of the new national park governance regime. National parks are moving to be more consultative which is viewed as a key mechanism to contribute towards community development and improved local livelihoods and ensuring community support is regarded as critical for future success.

Active participation of project beneficiaries and other stakeholders from the initial planning process is important to identify potential problems and solutions, generate support, and foster knowledge sharing. The project rationale, benefits and impacts need to be made clear from the outset. The public participation process in the AENP has been a part of regular park management for some time through the Addo Planning Forum (APF). The GAENP project will strengthen this participatory process by the

establishment of new and more effective institutions that are focused towards specific stakeholder groups at international, national and regional levels.

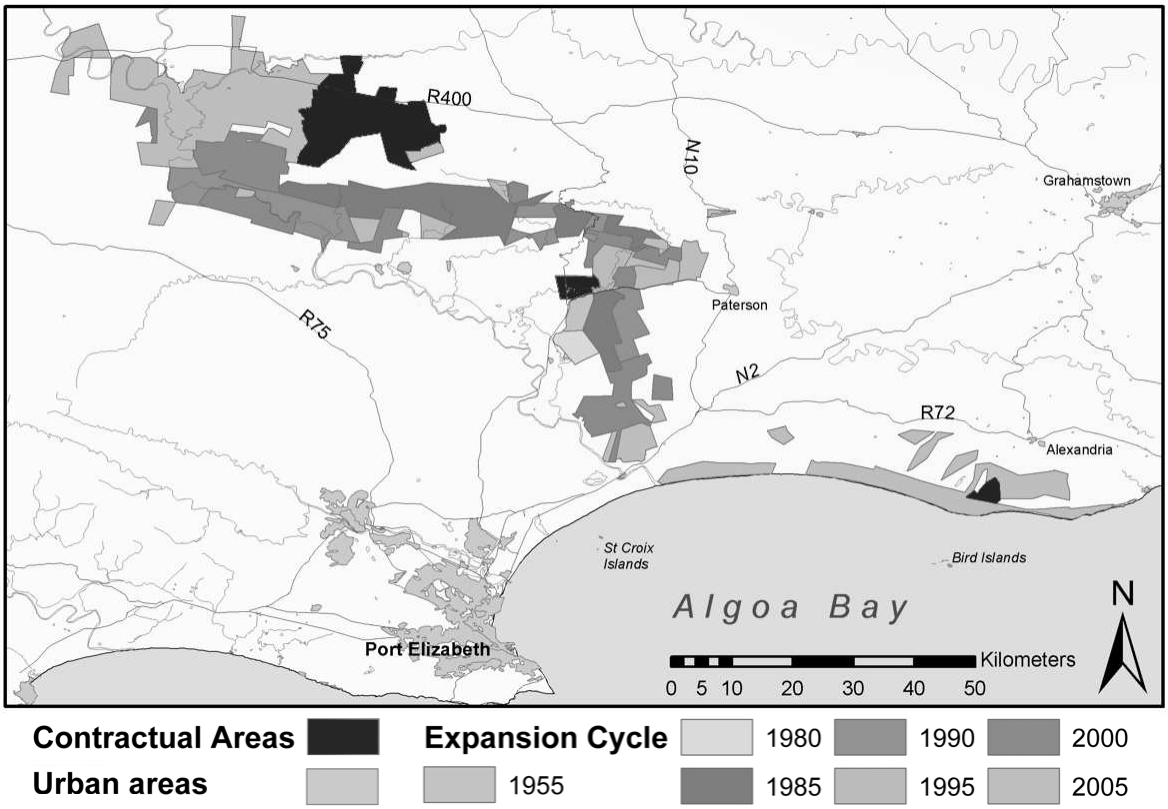

Figure 1: Expansion history and existing contractual arrangements around the Addo Elephant National Park.

The APF, established in 1998, provides a broad platform for constructive and consultative dialogue between a wide spectrum of project stakeholders. Representation on the forum is from a number of sectors in the area including: SANParks, key provincial government agencies, conservation NGOs, agriculture, national government departments (e.g. DEAT, DWAF, DLA) local industry, labour groups, and previously disadvantaged communities. However, there is scope for further representation from DEAT's Marine and Coastal Management section, as well as a farm labourer union of some sort. It is envisaged that as the park management plan development proceeds, the existing APF will be transformed into a dedicated Park Committee (PC). The establishment of the PC that will fulfill a largely advisory capacity will follow the procedure accepted by SANParks in 1999 and entails the nomination of local stakeholders through an independent consultative process.

The public participation process has already identified a number of areas that require SANPark's attention and it will be the responsibility of the APF to ensure that these receive the attention they deserve. Already a number of policy guidelines have been developed throughout the planning process to address issues such as employment, resettlement, integrated regional planning, communication and sustainability. The sustainability of the project is being addressed along institutional, social, financial and environmental lines to improve local livelihoods through eco-tourism development.

The lessons learned from this project will have wide applications for other protected areas in South Africa with respect to its sound conservation planning exercise, participatory planning and implementation, social assessment, resettlement, management information systems, monitoring, land incorporation strategy and public-private partnerships. In turn, this project is being strengthened by lessons learned in other biodiversity conservation projects in South Africa such as the CAPE initiative. More broadly, the GAENP project will demonstrate important and valuable lessons for other countries in the region and beyond when addressing similar marine and terrestrial protected area, and biodiversity conservation challenges.

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REINVENTING TOURISM – GLOBAL TRENDS IN RESPONSIBLE TOURISM

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Tourism Growth South Africa

Current tourism growth trends to South Africa and the Eastern Cape confirm that new strategic direction is required. Foreign tourism to South Africa from within Africa is stagnant and has only grown by 2% in the past five years i.e. from 4.4 million in 1999, to 4.5 million in 2003. Overseas tourism to South Africa has grown by 22% over the past five years i.e. from 1.5 million in 1999, to 1.9 million in 2003. However, South Africa has not yet reached the goal of 2 million overseas tourists targeted for 2000 in the White Paper on Tourism. If it were not for the positive impact on tourism growth of major events such as Rugby World Cup in 1995, World Summit for Sustainable Development (WSSD) in 2002 and Cricket World Cup in 2003, South Africa would be lagging behind the average growth of 4% per annum in global tourism.

Tourism Growth Eastern Cape

The latest foreign and domestic tourism surveys report that foreign tourism to the Eastern Cape has declined from 9.5% in 2002 to 7.7% in 2003 which in effect means a loss of some 110,000 foreign tourists. However, according to the latest domestic tourism survey, some 7.9 million domestic tourism trips were made to the Eastern Cape in 2003 compared to 4.3 million in 2001 a gain of 3.6 million. This is an early indication that the Eastern Cape needs to rethink its tourism growth strategy.

The Value of Foreign Tourism

According to the 2003 domestic tourism survey, domestic tourists made 49.1 million trips within South Africa valued at a total of R47.0 billion. This means that the average domestic tourism trip was worth R957. In 2003, according to the SA Annual Tourism Report, South Africa received 6.5 million foreign tourist arrivals valued at a total of R53.9 billion. This means that each foreign tourist was worth R8282.

Consumer Behaviour

The travel & tourism industry is being driven by more experienced and demanding consumers. Research conducted by Tourism Intelligence (TI) has identified supplier, consumer and destination trends in the top 11 destinations in the world of which South Africa is one. Tourists are taking shorter, more frequent holidays and looking for more interactive experiences. The average length of stay of foreign tourists visiting South Africa has declined from 17 days in 1996 to 10 days in 2003. The key emerging supplier trends are to offer cheaper, shorter and faster holidays, close to home, using information technology. The research also indicated that travellers were more mature and independent and looking for body, mind and soul experiences.

One in every five international tourists now travels from an industrial country to a developing one, up from only one in thirteen during the mid 1970's (Worldwatch Institute). Sixty Seven % of global citizens now want companies to go beyond their role of making a profit, paying taxes and employing people. They want companies to contribute to broader societal goals as well (Global Millennium Poll).

Product Differentiation

Feedback from the 2004 Indaba recently held in Durban, indicates that overseas tour operators and wholesalers are complaining that South Africa is offering too much of the same product. Hence the great interest demonstrated in the SADC countries such as

Kenya, Zambia and Tanzania that are perceived to be offering a different African experience. Tour operators and product owners in South Africa need to find more creative ways to differentiate their products.

Distribution
Tour operators, product owners and destination marketing organisations will need to rethink the traditional distribution channels for their products. Distribution is one of the key activities along the industry's value chain that will take on increasing importance. Technology will have the greatest impact in the areas of distribution. Without adequate air access and product-distribution channels in the marketplace, the best destinations in the world would find it extremely difficult to survive. Two key aspects of distribution are important for tourism destinations: 1) air transportation and 2) the role of tourist boards and promotion agencies in the marketplace. When strengthening distribution channels, tourism destinations need to:

- Ensure adequate access;
- Transform the role of national tourist offices in the marketplace; and
- Focus on product development at home

Paradigm Shift
There is a paradigm shift occurring in the tourism industry the world over. The "golden age" of mass tourism – of unlimited growth and disregard for the environment, of standardised, rigidly packaged products and services – is over. A new tourism is emerging: sustainable, environmentally and socially responsible, and characterised by flexibility and choice. A new type of tourist is driving it: more educated, experienced, independent, conservation-minded, respectful of cultures, and insistent on value for money. Information technology is opening up an astonishing array of travel and vacation options for this new tourist.

To remain competitive, tourism destinations and industry players alike must adapt. For many, the challenge is to "reinvent" tourism. Market intelligence, innovation, and closeness to customers have become the new imperatives. Many countries need tourism to survive. It has the potential to bring huge economic and social benefits to millions of people, including the poor. However, tour operators must now take their social responsibilities more seriously. They must also report more comprehensively on their practices in destinations, particularly in the developing world.

New research is providing evidence that attitudes are changing. The evidence is clear. Holidaymakers are beginning to realise that their visits to exotic, sun-baked paradises have an impact on local people and the environments. Increasingly, they want to ensure their holidays make a positive contribution to local development. People appear willing to favour companies that can show they are bringing real benefits to those living in the destinations – and even to pay more for this peace of mind and better quality product.

" 'Responsible' will become to travel what 'organic' is to food – a mainstream consumer favourite that is more enjoyable for you and better for local people and the planet" – Justin Francis, founder responsibletravel.com

International travel is one of the fastest growing industries, and it is making a growing contribution to international economic development. Many travellers and tourists like to feel that their visits, particularly in developing countries, make a contribution toward this. One way of ensuring this is to find out about the ethical policies of the organisations that provide travel services including those of the partners they use

overseas. The more enquiries they receive, the more likely it is that the providers will make sure that their services meet the highest social, environmental and ethical standards.

South Africa, and in particular the Eastern Cape, is blessed with unique ecosystems, of which the Thicket Biome is one, and biodiversity in the form of its fauna and flora. The challenge to us, is thus to market the Eastern Cape, and the Thicket Biome in particular, as a destination of choice for conservation-minded and environmentally discerning tourists.

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Documents, or links to the documents, referred to in this paper can be found at the following websites:

http://www.southafrica.net/satourism/research/
http://www.polity.org.za/html/govdocs/white_papers/tourism.html
http://www.worldwatch.org/
http://www.mori.com/polls/1999/millpoll.shtml

IS BIODIVERSITY DECREASING IN COMMUNAL AREAS? AND SO WHAT IF IT IS?♦

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Communal areas in Succulent Thicket are often viewed as ecological wastelands and it is safe to say they have less biodiversity than adjacent conserved land. But the situation is a bit more complicated than that: certain ecosystem services are increasing under communal land use, and not all taxonomic groups are equally affected. Some taxa are even better off in communal areas than in protected areas. In this paper we ask: Which functional groups of plants and animals are decreasing and increasing in Thicket communal areas? What are the underlying causes of their decrease or increase? And how does this affect human well-being? Our main findings are: fast-growing spiny plants are happy in communal areas, but slow-growing bird dispersed plants are not. Generalist feeders increase, but specialist feeders have a tough time. Land degradation and institutional collapse go hand in hand, and this makes people very vulnerable to climatic, economic and political change. Under most scenarios biodiversity loss in communal areas in the Thicket Biome has a serious negative impact on human well-being. Local people know this but will need a lot of help to turn it around.

♦ Full article not provided

SCIENTIFIC RESEARCH, THEN AND NOW – IIMPLICATIONS FOR MANAGEMENT OF THE ADDO ELEPHANT NATIONAL PARK

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Abstract
The Addo Elephant National Park (AENP) has been the platform for a number of scientific research activities since its inception in 1931. The projects were undertaken by national parks staff as well as external tertiary institutions. Early research was focused on inventory analyses and the remnant elephant population. However, as the park has been expanded over the years there has been a progression towards more applied research. The research efforts in the thicket habitats of Addo have largely focused on the faunal and floral components and interactions between these, principally the impacts of herbivores on the vegetation. Research initiatives that consider the implications of ecosystem functioning, drivers of change and ecological processes have become more prevalent. This in effect has seen the shift of research from single species studies to that of a suite of multidisciplinary initiatives with direct management applications. There are a number of cases where research efforts have had direct management application and where possible these recommendations have been implemented. Examples of these include the introduction of elephant into the Addo population from the Kruger National Park and the cessation of kudu culling. Recently South African National Parks (SANParks) Scientific Services section has launched a process to strategically investigate the research requirements for each of the national parks. This approach has seen a number of thematic areas being assigned where research is required. Importantly this thematic research focus extends beyond the boundaries of the thicket given that the AENP encompasses a number of different biomes. The research focus attempts to maintain the linkages between these landscapes in setting research priorities.

Introduction
How protected areas are managed is often influenced by the information available to managers. Whether the management of these protected areas is effective depends to a large extent on how applied research recommendations are incorporated into adaptive management strategies. Ecosystem management is one arena where rotational learning and continual adaptation can improve the management of natural resources and guide the implementation of policies for their management (La Peyre *et al.* 2001, Mackay *et al.* 2003).

One could argue that the scientific research undertaken within protected areas provides the basis from which management recommendations are formulated and ultimately implemented. The effectiveness of such management interventions is dependent on continued research and monitoring but also on lessons learnt during implementation. Assessing this management efficacy remains a critical step in the conservation of biodiversity (Ervin 2003, Hockings 2003) and may in turn provide the impetus for future research initiatives by highlighting gaps in our current understanding. Ensuring that research (ecological, sociological and economic) is adequately addressed in management interventions remains a challenge for protected area management in South Africa and within South African National Parks. However, there appears to be some debate over the need to include research findings into planning

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and management, and the availability of adequate data and research activities to provide such recommendations (Ervin 2003). The lack of adequate data and research may undermine effective adaptive management (Salafsky *et al.* 2001).

This paper outlines where previous research efforts were focused and provides examples of how research efforts within the Addo Elephant National Park (AENP) have been adopted by management for implementation. It also provides a framework for guiding future research initiatives in the park with the development of strategic research action plans.

Research History

A review of scientific peer reviewed publications dealing with the AENP was used as a basis to identify historical research foci in the park and highlight trends in research activities. Publications from 1930 (the park was established in 1931) were grouped according to the nature of the research and then categorized into various thematic research areas (Table 1).

Table 1: Categorization of scientific publications emanating from the Addo Elephant National Park.

Nature of paper	Thematic Area (Primary)	Focus Area (Secondary)
Internal – SANParks	Avifauna	Conservation, distributions, raptor diets, reproduction, taxonomic, vegetation classification
	Disease	Parasites, wildlife disease, other diseases
External – University / Technikon	Elephant	Capture, culling, diet, distributions, genetics, monitoring, physiology, population trends, preservation, ranching, reproduction, thicket regeneration, vegetation impacts, veterinary
	Other fauna	Behaviour, browse impacts, capture, diet, distributions, introductions, parasites, black rhino, small mammals, taxonomic, vegetation impacts
Management application	General ecology	Conservation, desertification, distributions, park expansion, tourist perceptions
	Herpetofauna	Diet, distributions, introductions, population trends, reproduction, taxonomic
	Invertebrates	Distributions, dung beetles, parasites, thicket regeneration, taxonomic
	Physiology	General physiology
	Introductions	Floral and fauna introductions
	Tourism	Economics, expectations
	Vegetation	Genetics, introductions, surveys, taxonomic, vegetation impacts
	Landscape mapping	Vegetation classification, vegetation impacts

There has been a steady increase in the number of papers being published from the AENP. However partitioning of research revealed that applied papers only started making an appearance in the 1970's. The number of papers being produced by external institutions has also shown a marked increase compared to those produced by SANPark's researchers. This could be attributed by the increased interest in research within parks by tertiary institutions and also the move away from having dedicated researchers assigned to individual national parks. The number of thematic research areas also increased slightly over this period (Figure 1).

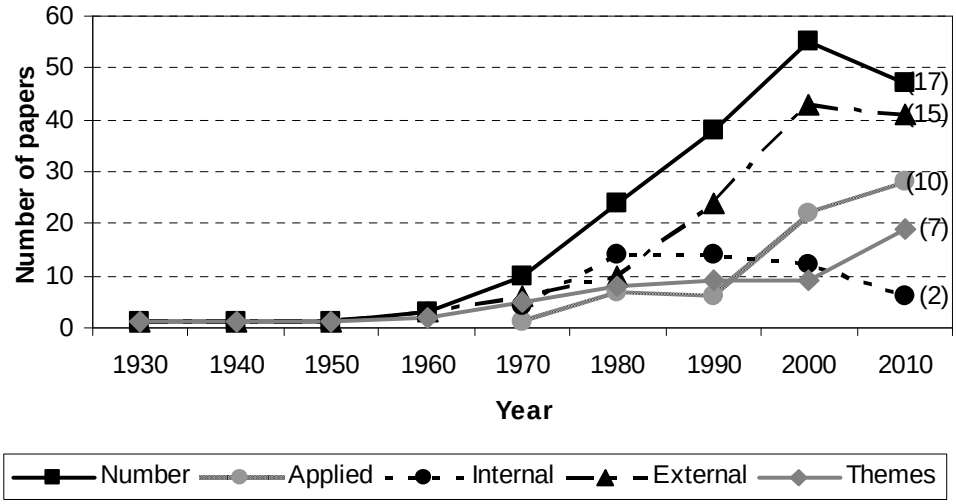

Figure 1: Trends in publications emanating from the Addo Elephant National Park, the figures for the decade up to 2010 have been adjusted to cater for the fact that the review only considered papers up to and including 2003. The actual figures for 2003 are presented in parentheses.

There has been considerable attention given to the research of the mammalian fauna, and African elephants in particular (Figure 2), with 48% of all papers focusing on mammals. This is perhaps to be expected given that that park was established to conserve the last remaining elephants of the subtropical thickets in the Sundays River Valley region.

The research on elephant has also been the most diverse with some 14 focus areas being identified. The bulk of the remaining research effort (37%) has been spent on vegetation (11%), invertebrates (11%), avifauna (8%) and disease (7%) (Figure 2).

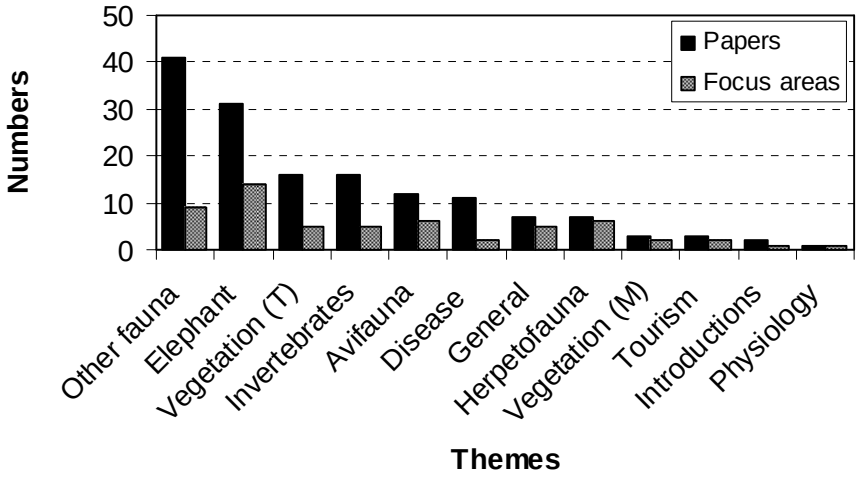

Figure 2: Research intensity within each thematic research area as indicated by the number of papers. Number of focus areas in each thematic area are also indicated.

Recent and current research efforts

Much of the earlier research efforts were focused on taxonomic inventories and autecological analyses. As the park developed there has been expansion of research

activities into the synecological realm in order to deal with the complexities associated with the thicket environment in the AENP, but perhaps also driven by the ecological research environment. However, there is still a need to continue to collate basic baseline biological data to improve our knowledge of the ecosystem in general, particularly since the park has expanded into a diverse array of landscapes and habitats. Much of the current research focus continues to investigate the relationships between plant and animals within the thicket habitats of the park. Additional attention is being given to research into vegetation rehabilitation and its application throughout the five biomes of the expanded park. Recent management interventions, prompted by previous research findings, such as the relocation of elephant to other areas as well as the introduction of elephant bulls from the Kruger National Park (Whitehouse 2002, Whitehouse & Harley 2001, Whitehouse & Kerley 2002), have also stimulated further research effort. Research efforts on black rhino feeding ecology and social aspects of elephant behaviour are continuing and will undoubtedly provide valuable management recommendations. With the park expansion well under way and the development of a wider tourism product, research into the impacts of tourism on the environment may become increasingly important.

The recent application of an Environmental Management System within the park and development of Strategic Management Plans endeavours to incorporate research findings timeously into the adaptive process. Unfortunately, this may not always be immediately possible as management action is constrained within the confines imposed by the park itself (border issues, practicalities, financial considerations etc.) and in some cases compromises are required to meet the management requirements.

Future research activities

Some time ago SANParks took the decision to consolidate their research capacity within regional scientific offices. It is currently the Arid Ecosystems Research Unit (AERU) that coordinates and prioritises the research activities within the AENP amongst others. To this end a research action plan has been developed in conjunction with park management in an effort to highlight priorities for research as well as gaps within SANPark's capacity to successfully undertake these activities. These research activities will be coordinated by a Principal Scientist assigned to the park from AERU. As a result a number of research areas have been identified that can be passed on to tertiary institutions to make use of these opportunities.

The research action plans are structured in such a manner to outline these priorities under five main thematic areas namely; Terrestrial Research, Aquatic Research (freshwater), Aquatic Research (marine), Integrated Environmental Management Systems (IEMS), and Cultural Research. Within each of these broader areas are a number of sub-categories each with a series of associated research and monitoring projects. Objectives for each of the research projects are outlined in order to place these activities within the park context while specific outputs have also been identified. The expected duration of projects as well as the importance is also listed.

Given that the expansion of the AENP has seen the park moving into a number of new landscapes and habitats not all of the research themes will be applicable to the thicket environment and it is primarily the terrestrial research theme that covers the bulk of the thicket research focus. Within this theme a number of projects have already been identified within the listed sub-categories and are outlined in Table 2.

Table 2: Projects identified within the Terrestrial Research Theme in the Addo Elephant National Park research action plan. Note: there are four other themes not listed here.

Sub-category	Project	Priority rating
Fauna	Monitoring of prey behaviour and offtake	High
	Establish predation TPC's and monitoring programme	High
	Predator spatial use	High
	Smaller carnivore studies	Medium-Low
	Dung beetle status and habitat requirements	Medium-Low
	Megaherbivore behaviour and genetics	Medium-Low
Flora	Fine scaled vegetation mapping	Medium-High
	Habitat classification	Medium-High
General Ecology	Rehabilitation policy and plan	Medium
	Classification of degraded areas	High
	Alien infestation assessments and monitoring	High
	Herbivore impacts on vegetation structure	High
	Establishing vegetation TPC's	High
	Herbivore habitat use and population trends	High
	Establishing herbivore TPC's	High
	Herbivore behavioural ecology and demography	High
Park expansion	Conservation planning requirements	Medium
	Integration of STEP and GAENP processes	Medium
	Botanical reserve selection	High
Climate	Climate change impacts	Medium

There are a number of research fields that are not listed in Table 2 but that may have important contributions to improving our understanding of the thicket ecosystem. These baseline assessments and excursions into research fields such as ornithology, herpetology, invertebrate biology and how these species interact within the ecosystem will still have a role to play in improving the management of the AENP.

In summary

The preceding discussions have emphasized the requirements for research within the AENP and the subtropical thicket in particular. Furthermore, SANParks need to be mindful of the developments taking place in the park and acknowledge the potential impacts that these might have. Research efforts are required to highlight the possible trade-offs / conflict areas for thicket in terms of biodiversity conservation and tourism development. Tourist numbers continue to increase in the park and although there may be logistical limits to the number of overnight visitors that can be accommodated this does not necessarily restrict the thousands of day visitors. The impact of increasing tourist numbers in the park on biodiversity needs to be assessed, and the biological and tourism arenas can no longer be viewed in isolation.

As stated previously the AENP is moving beyond just the standard subtropical thicket scenario and the expansion process has incorporated a number of other thicket types such as the noorsveld as well as habitats from other biomes such as fynbos. SANParks needs to be aware of the diversity of these landscapes and needs to look beyond just purely thicket research as many of the issues of concern may overlap with other habitats. Ideally this will foster a holistic ecosystems approach to research and management efforts.

We are only just starting to scratch at the surface and there remains lot of work to be done. There will be a need to continue to identify drivers of change within the thicket and also to improve our understanding of the functioning of the systems. However, we cannot forget that there is still a large amount of baseline information that is still required.

Acknowledgements
The AERU and AENP park management contributed to the development of the research action plan drafted by Dr Stephen Holness who is also thanked for his comments on a draft of this paper.

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AN OVERVIEW OF THE DEPARTMENT OF AGRICULTURE'S ACTIVITIES WITHIN THE THICKET BIOME

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The Department of Agriculture services the whole of the Eastern Cape region, of which the Thicket Biome forms an integral part. Research and service delivery is based on the needs of the community and is dependent on the resources available to the Department. Furthermore, the research undertaken by the Department needs to comply with the strategic objectives of the department, which in short are aimed at: 1) the sustainable utilization of natural resources; 2) strengthening of food security; and 3) increasing economic activity and food production.

Although previous research work undertaken by the Department may not appear compatible with current trends and farming practices, these results have nevertheless contributed significantly to our understanding of the complexity of vegetation types such as the Thicket Biome.

Research within the Department is often directed by clientele needs, which in many cases revolves around day-to-day farming practices and enterprises. As current farming enterprises change, so too does the need for, and the focus of the research change. This, therefore, explains why much of the earlier Thicket Biome research concentrated on the use of goats as browsers, while current research tends to focus on current trends that include land use practices such as game farming.

Departmental research is also required to take all entities into consideration when planning research and can therefore not concentrate solely on the natural resource, but must also consider domestic and social needs, while at the same time ensuring compliance with the strategic objectives of the department, as laid out above.

A brief overview of two thicket-related trials/projects currently being run by the Department of Agriculture is given below:

1. Control of bush encroachment in Coastal Thornveld areas of the Eastern Cape
The officer responsible for this trial was Mr S. Nobatyi, and the objective of the trial was to develop burning guidelines and strategies for the effective control of bush for the Coastal Thornveld areas of the Eastern Cape using both browsers (goats) and fire. The trial involved the mechanical clearing of bush from plots, which were then subjected to various treatments that included: a control, goat browsing, winter fire, summer fire, winter fire and goat browsing together, and summer fire and goat browsing together.

Bush encroachment and the farming difficulties associated therewith cause major problems for farmers in the Eastern Cape region and it is hoped that the results from this trial will enable this problem to be managed sustainably.

***2. Portulacaria afra* seedling survival in Xeric Succulent Valley Bushveld**
The officer responsible for this project is Mr C.H. de Ridder. According to Knight *et al.* (2003), "The Subtropical Thicket biome is perhaps the least recognised and least understood of South Africa's biomes, dense and often spiny vegetation conceals a diverse abundance of rare and endemic plant species which are found nowhere else on earth. Pastoralism is an essential industry throughout the Subtropical Thicket biome, with this activity making South Africa the worlds leading mohair producer. The

biome also has rapidly expanding eco-tourism and indigenous game-based ventures, making it a growing destination for both domestic and overseas visitors. Our livelihoods benefit from a divers range of industries dependent upon our landscapes. Unfortunately, our Subtropical Thicket biome is in decline." It is believed that the dramatic degradation of the Xeric Succulent Valley Bushveld can be ascribed to the general over-utilisation of this vegetation by livestock. It is often speculated that the use of livestock is incompatible with sustainability and that game would be the only sustainable option for farming this vegetation. In areas where *Portulacaria afra* (Spekboom) is still in abundance, this plant often constitutes the largest portion of the diet of both domestic animals and kudu. The crucial importance of this plant species can therefore not be over emphasised. Spekboom is severely depleted in many areas and its only chance for survival is to propagate itself through vegetative and or seedling recruitment. Investigations into the recruitment and survival potential of Spekboom seedlings were thus initiated at three sites in the Kirkwood vicinity. Preliminary surveys resulted in a hypothesis being developed (Figure 1).

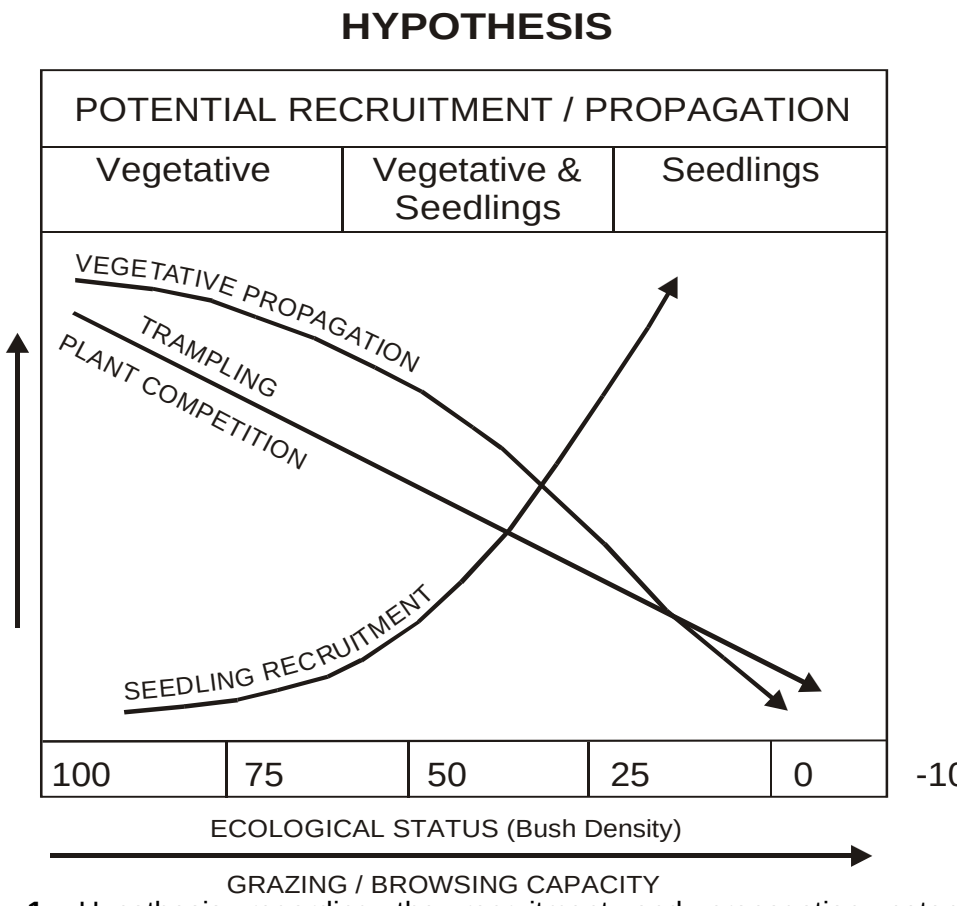

Figure 1: Hypothesis regarding the recruitment and propagation potential of *Portulacaria afra*, as influenced by bush density and browsing pressure.

The following conclusions could be made:

- The sustainable use of Valley Bushveld is compatible with goat browsing, so long as it is at judicious stocking rates.
- Seedling recruitment and survival declines with increased bush density, which is a result of competition and trampling.
- Recruitment alone declines with bush density, because of a reduced seed source.

- The protection of seedlings by sparsely leaved thorny shrubs (*Lycium*) appears crucial for seedling survival.
- A good balance between competition (not too much) and protection (just enough) appears essential for providing a healthy environment for seedling recruitment and survival.
- Extended periods with very light browsing or no disturbance are needed for successful seedling recruitment.

Although the above results have proven that seedling recruitment and survival is possible, other questions still remain unanswered regarding the effect of bush density, stocking rates and various farming practices on the survival of seedlings over time, under different localities and distributions. A trial was thus undertaken to investigate these factors, and the general procedure can be outlined sequentially as follows:

1. Newly germinated seedlings were collected and grown in seed trays up until the 2 - 4 leaf pair stage.

2. Transects were marked out in areas subjected to three different farming practices, which included:
    a) Continuous browsing with goats and game
    b) Rotational browsing with goats and cattle
    c) Game alone.

3. Each of the above three farming practice sites was then also sub divided into three collection sites that included:
    a) (i) stocked at 72% of recommended stocking rate
    (ii) 126% of recommended stocking rate
    (iii) 297% of recommended stocking rate

    b) (I) dense bush
    (ii) moderately dense bush
    (iii) open bush

    c) (I) dense bush
    (ii) moderately dense bush
    (iii) open bush

4. Each of the collection sites had three transects, each 1 m^2 in size, that differed with respect to their locality to existing Spekboom plants (Figure 2), described as either:
    a) Under Spekboom canopy
    b) On periphery of Spekboom
    c) Within an open area.

5. Sites and transects were permanently marked to be revisited at regular intervals.

6. The Spekboom seedlings were planted out in transects (10/transect). No post-planting treatment was given, and plants were entirely dependant on natural rain and weather conditions.

7. All sites were revisited at regular intervals and seedlings counted to determine survival rates.

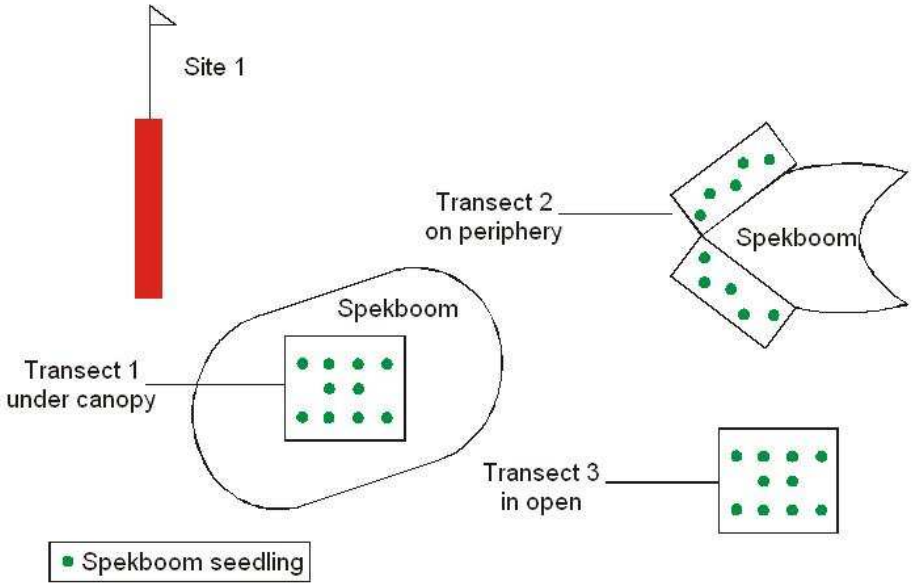

Figure 2: Transect layout in three different farming practices

Results

- The seedlings survived better in the heavily stocked continuously grazed camps, than in their lighter stocked counterparts. The heavily browsed camps seemed to fall into the same category as the moderately dense bush. Dense bush (competition and trampling pressure) once again appeared to be the biggest cause of seedling loss. The goats were removed from this experiment on the 10th January 2000 and as a result, the seedling loss after this date could not be attributed to goat browsing (Figure 3).

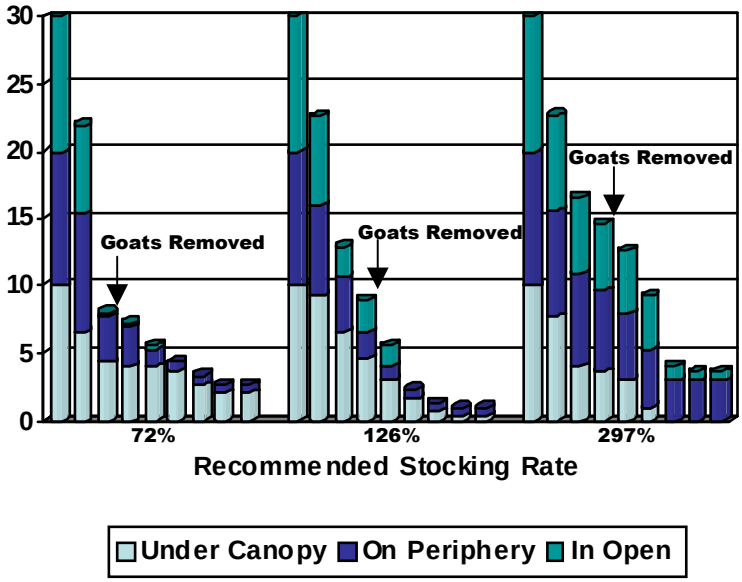

Figure 3: Mean seedling count in three different bush densities over time (counts/m²) 1999-2003 (Goats / Game only)

- Seedling survival was greatest under moderate conditions compared to that of dense and open bush, the latter being the worst. As there was no goat browsing

during this period, seedling losses could only be attributed to competition in dense bush and lack of protection in open bush. Cattle grazing did not have a major effect on the seedlings and their survival rate stayed constant during this period (Figure 4).

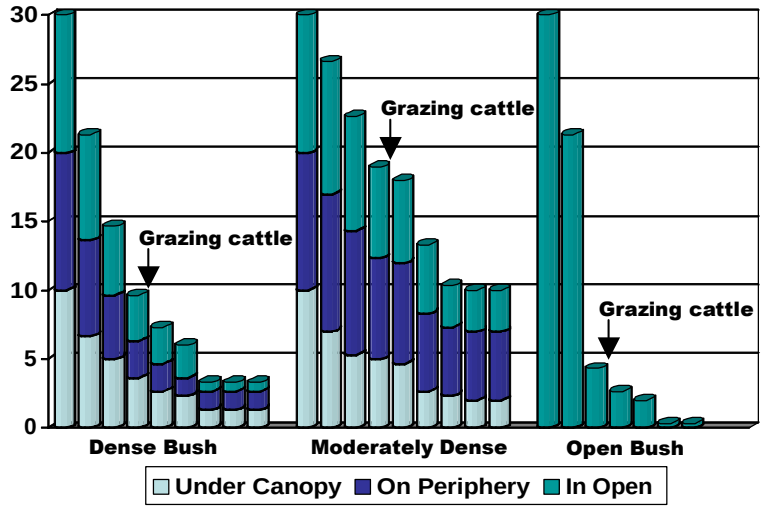

Figure 4: Mean seedling count in three different bush densities over time (counts/m²) 1999-2003 (Goats / Cattle only)

- Under the game farming conditions the seedling survival was the greatest in dense bush followed by open and moderately dense bush. Seedling loss under canopies seemed constant in all three-bush densities. The higher losses in moderately dense bush (in the open and on the periphery) can only be attributed to browsing pressure (Figure 5).

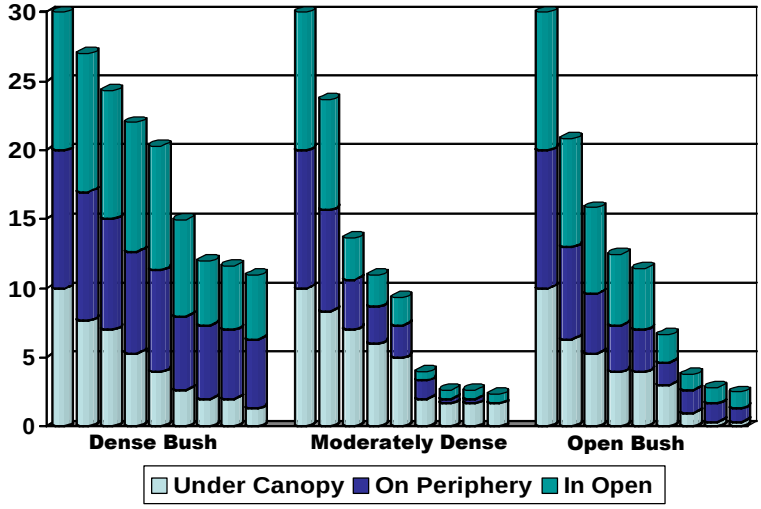

Figure 5: Mean seedling count in three different bush densities over time (counts/m²) 1999-2003 (Game only)

- Seedlings growing on the periphery of Spekboom plants and in the open, in the game alone treatment, showed better survival rates than those growing under the Spekboom canopy (Figure 5). Goats/cattle achieved different effects with

seedlings showing higher survival rates on when growing on the periphery of Spekboom plants (Figures 3 and 4). The best seedling survival rates were found in sites stocked only with game, while the poorest survival was seen in sites with both game and goats that were continuously heavily stocked.

Conclusions

1) Under domestic stock farming conditions
   - Seedlings only survived well in moderately dense bush
   - In dense bush (high plant competition/trampling) few seedlings survived
   - Seedling survival rate was even lower in the open bush (no bush/protection).

2) All seedling losses could not be attributed to goat browsing as goats were not allowed to browse in all the camps, and because seedling losses still occurred following the removal of goats from the stocking rate camps.

3) The results from the game farming alone sites differed to that of the domestic stock farming sites, as dense bush had the highest seedling survival rate compared to that of open and moderately dense bush.

4) Points to consider when comparing these differences are that in:
   - Dense bush - goats are concentrated in small areas / game move at will over large areas (low trampling)
   - Moderately dense bush - some game species prefer these areas and usually move within the area in large groups (impala)
   - Open bush - goats in camp systems are concentrated in these areas / game on the other hand seem to avoid them

5) On average, higher survival rates were achieved with game farming alone (17%) compared with that of goats / cattle (16%) and game / goats continuous heavily stocked (9%) (Figure 6).

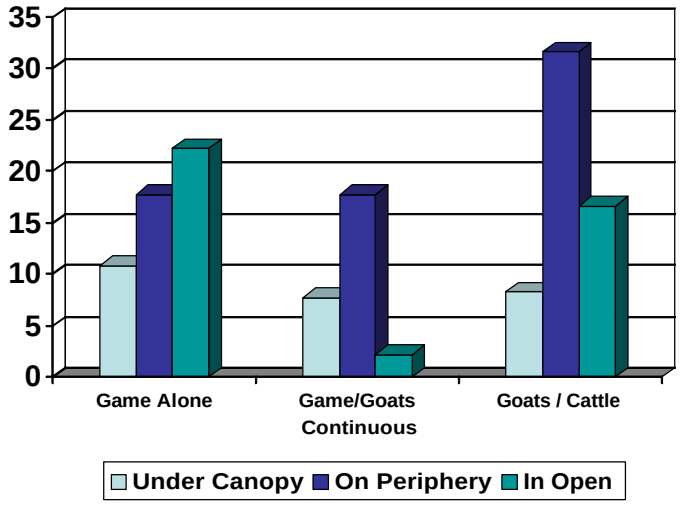

Figure 6: Mean percentage survival of seedlings under three different practices (99/04/21 - 03/05/07)

Discussion

Although these trials are still ongoing, it is clear from the results to date that there is a certain percentage of seedling survival under all of the different farming practices,

including both stock and game. Based on the results of this study, it can be concluded that the current perception that domestic animals are incompatible with ensuring the sustainability of Valley Bushveld, and that game is the only sustainable option, is unfounded. What is, however, evident is that Valley Bushveld should be stocked at judicious stocking rates and that this applies to both game and domestic animals. It is, therefore, crucial that the browsing habits (including area selection) of all the animals that are to be stocked in an area are investigated and taken into consideration, before any management strategies are decided on.

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ASSESSMENT OF VELD CONDITION IN THE THICKET COMMUNITIES OF THE GREAT FISH RIVER RESERVE IN THE EASTERN CAPE PROVINCE OF SOUTH AFRICA

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Introduction

The Great Fish River Reserve (GFRR) is located in the Fish River valley between Grahamstown and Alice in the Eastern Cape Province. Originally it comprised three separate game reserves in the form of the Andries Vosloo Kudu Reserve established in 1973, the Double Drift Game Reserve established in 1986 and the Sam Knott Game Reserve established in 1987. It comprises a total area of approximately 45000 ha of which the major portion comprises Valley Bushveld (Acocks 1988) located in the valley of the Great Fish River and a smaller portion in the False Thornveld of the Eastern Cape (Acocks 1988) in the northern sector of the reserve. The area is arid receiving a relatively low annual rainfall of between 400-500 mm p.a. resulting in very sweet veld, and is extremely well suited to a wide diversity of wild life species. Arising from its suitability for wildlife an active campaign of re-introducing large wildlife species is being followed, the most notable being the re-introduction of black rhinoceros to the Kudu Reserve in 1986 together with subsequent introductions in other sectors up until the present time. White rhinoceros were re-introduced into the Double Drift section in the late 1980's together with three elephants in 1995. Nine hippopotami were re-introduced into the Fish River during the early 1990's and their numbers have increased three fold. Cape buffalo have also been introduced and have become very well established in the southern section of the reserve. Arising from these re-introductions of large framed wildlife species it has now become imperative to introduce and develop a program to assess and monitor the impact of these animal species on the botanical composition, structure and cover of the vegetation. The black rhinoceros and elephants have the ability in particular to have a major physical effect on the vegetation, especially trees and shrubs, which could in turn significantly affect other animal species in the Reserve. It is therefore critical that the monitoring program for the vegetation be introduced as soon as possible in order to monitor the effect of these large herbivores on the vegetation as their densities increase. Besides this being a unique opportunity to quantify the effect of these animals on the vegetation in the Valley Bushveld and Thornveld areas, the monitoring program will also provide the wildlife managers in the GFRR with quantitative data on the condition of the vegetation that is essential for formulating and adapting range management practices e.g. stocking rates, location of watering points, composition of grazers and browsers, ratios of bulk to concentrate grazers and controlled burning.

The necessity for introducing a program to monitor the condition of the vegetation in the GFRR is fully recognised and supported by the wildlife managers in the reserve. However, the limiting factor to initiating such a program has been the non-availability of suitable techniques for assessing and monitoring the condition of the grass sward and woody components of the vegetation. This is particularly a problem in the thicket communities of the Valley Bushveld veld type where previous attempts by researchers have not been very successful in developing practical and effective methods for surveying the bush vegetation. This is as a result of the dense, intertwined and spiny nature of the tree and shrub communities preventing easy movement through the vegetation thereby making the effective sampling of individual plants difficult. Thus

during the year 2000 intensive thought and effort was focused on assessing and evaluating currently available techniques for assessing the condition of herbaceous and bush vegetation. The following methods for assessing the condition of bush were assessed and evaluated:

- Bush Assessment Method developed by Teague, Trollope & Aucamp (1981) and Trollope (1986);
- Bush Assessment Method for Valley Bushveld developed by Stuart-Hill (1989);
- Biomass Estimates from Canopy Volume (BECVOL) developed by Smit (1989a & 1989b).

An assessment of the methods developed Teague *et al.* (1981), Trollope (1986) and Smit (1989a & 1989b) were concluded to be unsuitable because data collection involved using belt transects which are logistically impractical in the aforementioned dense, intertwined and spiny thicket plant communities. Conversely the method described by Stuart-Hill (1989) was assessed to be more promising in that it involved using the Point Centred Quarter (PCQ) method developed by Cottam & Curtis (1956) for conducting bush surveys. This plotless procedure overcame the problems associated with physically sampling the dense thicket communities. However, it did not attend to the problem associated with the PCQ method of oversampling the small short woody plants and undersampling the taller trees and shrubs in the vegetation. It was also felt that the technique was too complex and laborious and did not fully fulfill the requirement of being simple, rapid and repeatable which is essential in a technique used for assessing and monitoring vegetation on a field scale for management purposes.

The following methods for assessing the grass sward were assessed and evaluated:

- Benchmark Method developed by Foran, Tainton & Booysen (1978) and adapted by Trollope (1986) and Danckwerts (1989);
- Weighted Palatability Composition Method developed by Barnes, Rethman, Beukes & Kotze (1984);
- Key Grass Species Methods developed by Mentis (1983), Heard, Tainton, Clayton & Hardy (1986), Willis & Trollope (1987), Beckerling & Trollope (1993) and Trollope, Potgieter & Zambatis (1989).

It was concluded that the adapted techniques developed for assessing the condition of the grass sward in the grassland and thornveld areas of the Eastern Cape by Trollope (1986) and Danckwerts (1989) were also well suited for use in the thicket communities of the Valley Bushveld. It was also felt that with adequate field data a simplified key grass species technique could be developed along the lines described by Willis & Trollope (1987), Beckerling & Trollope (1993) for the grassland and thornveld areas of the Eastern Cape and Trollope *et al.* (1989) for the savanna areas of the Kruger National Park.

Procedure

In the assessment and monitoring of the condition of the veld in the GFRR the vegetation has been categorized into the following ten recognizable homogeneous vegetation units (HVU's) :

- Tall *Euphorbia* Thicket – characterised by tall growing *Euphorbia* tree species;
- Short *Euphorbia* Thicket - characterised by short growing *Euphorbia bothae* shrubs;
- Medium *Portulacaria* Thicket – characterised by dense *Portulacaria afra* shrubs;

- Dry Forest – characterised by tall growing *Schotia latifolia, Hippobromus pauciflora, Viperus undulata* and *Harperphylum caffrum* trees and shrubs occurring on southern aspects;
- Bushclump Karroid Thicket – characterised by *Rhus spp* and *Scutia myrtina* bushclumps and a karroid herbaceous layer;
- Riverine *Acacia* Thicket - characterised by dense *Acacia karroo* tree communities growing on river banks;
- Karroid *Cynodon* Shrubland - characterised by short growing Karroo shrublets and a stoloniferous grass cover of *Cynodon dactylon*;
- Bushclump Savanna – characterised by dense thornveld dominated by *Rhus spp* and *Scutia myrtina* bushclumps;
- *Acacia* Savanna – characterised by open thornveld dominated by *Acacia karroo* trees and shrubs;
- Grassland – characterised by open grassland dominated by either *Themeda triandra, Sporobolus fimbriatus* and *Digitaria eriantha* grass species

In the development of the monitoring program permanently marked sample sites have and are being located in the different homogeneous vegetation units in the GFRR. However, as a result of the GFRR comprising an extensive area of 45000 ha and limited manpower, the location of sample sites in the aforementioned HVU's has had to be been done on a subjective basis. Great care has been taken to select sample sites that are visually representative of the vegetation in the different HVU's and the number of sample sites per HVU is being allocated on a proportional basis i.e. the larger the HVU the more sample sites. The final number of sample sites for the GFRR depends upon the availability of manpower and an initial target of 100 sites was set in 1999. The adequacy of this number of sites will be determined by experience and adjustments will be made on the basis of adaptive management related to achieving the objectives of the trial. To date a total of 56 permanent sample sites have been established where bush and grass surveys have been conducted using the following procedures:

Bush Vegetation:

- Determine the *Botanical Composition, Density & Structure* of the bush vegetation in the aforementioned permanently marked sample sites using the Point Centred Quarter Method (PCQ) for locating recording points (Cottam & Curtis 1956). The PCQ procedure for sampling tree and shrub vegetation operates most efficiently when the distribution of the woody vegetation is fairly uniform and not dominated by discontinuous bushclumps. Generally the woody vegetation on the GFRR fulfills this requirement thereby permitting the use of the PCQ survey method for the aforementioned purpose.
- Lay out two parallel *Transects* 110 m and 120 m long and 25 m apart, locating 12 and 13 *recording points* respectively at 10 m intervals in each of the transects i.e. a total of 25 *recording points* per sample site.
- Record the following parameters of the nearest rooted tree or shrub in each of the four quarters surrounding the recording point viz. *distance from recording point, species, overall height, height of lowest browseable material, maximum canopy diameter* and *height of maximum canopy diameter;*
- In the case of height
    i) In the first two quarters record the nearest tree or shrub < 2 m in height that is within 10 m from the *recording point*;
    ii) In cases where there are no trees or shrubs that are < 2 m within 10 m in the first and/or second quarters record zero plants;
    iii) In the third and fourth quarter record the nearest tree or shrub that is > 2 m in height that is within 10 m from the *recording point*;

iv) In the fourth quarter record the tallest tree or shrub > 2 m that is within 10 m of the *recording point*;
v) In cases where there are no trees or shrubs that are > 2 m within 10 m in the third and/or fourth quarters record zero plants;

- Survey data are used to describe the *botanical composition, density, structure, phytomass* and *browsing potential* of the trees and shrubs. These characteristics of the vegetation are derived from the data on the *species, overall height, height of lowest browseable material, maximum canopy diameter, height of maximum canopy diameter*. The *phytomass* is represented by the number of *tree equivalents* of the recorded trees and shrubs. The concept of a *tree equivalent* was proposed by Teague *et al.* (1981) and is defined as a tree or shrub that is 1.5 m high. It provides the opportunity of combining the density and size of woody vegetation into a single value representing the standing crop of tree and shrub vegetation and has proven itself to be very useful in describing the overall structure of woody vegetation. The *browsing potential* is represented by the number of *browsing units* of the recorded trees and shrubs. The concept of a browsing unit was also proposed by Teague *et al.* (1981) and in this case will be defined as a palatable tree or shrub that is 1.5 m high or has available browse material in units of 1.5 m in different available height classes. Changes in these parameters over time will reflect the impact of the wildlife populations and the climate on the condition of the woody vegetation in the GFRR.
- In cases where zero plants are recorded within 10m of the recording points in one or more of the quarters, this introduces an error of approximately 100 plants/ha. This is because in these cases in the calculation of the density of the trees and shrubs, a distance of 10 m from the recording point is assumed for calculating the density i.e. 10000 $m^2/10m^2$ = 100 plants/ha. In practical terms this is a negligible error but it is necessary to introduce this adjustment so as to allow for situations where a significant but not dominant number of trees and shrubs are greater than 10 metres from the recording points i.e. sparsely wooded areas.

The procedure for surveying bush vegetation was developed because the resultant data:

- describes the *botanical composition* of the bush communities;
- provides estimates of the *density, structure* and *phytomass* of the bush communities;
- has the potential to monitor change in the *botanical composition, density* and *structure* of the bush communities. This conclusion is supported by an investigation into the sampling intensity required to show differences in the density, structure and phytomass of the woody vegetation. The results showed that for trees and shrubs < 2 m in height less than 25 recording points are required to show 30% differences in these parameters between sample sites but that more recording points are required to determine significant differences for taller trees and shrubs. On the basis of these results it was decided to standardise on 25 recording points per sample site as a practical means of showing major differences in the condition of the vegetation between sample sites and in response to the impact of the re-introduction of large herbivores like black rhinos and elephants on the vegetation;
- has the potential to estimate the browsing capacity of the bush communities;
- has shown itself to be time efficient and practical to apply for assessing the condition of the woody component in the thicket communities of the GFRR.

Grass Sward:

- Determine the *botanical composition* and *basal cover* of the grass sward with a point quadrat survey in the same sample sites used for assessing the condition of the tree and shrub vegetation. This comprises recording the *species* and the *distance* of the basal portion of the nearest rooted herbaceous plant to 100 points located parallel and approximately one meter to the right of the two transects used for sampling the bush vegetation i.e. record the nearest rooted 50 herbaceous plants to 50 point quadrats located at approximately two meter intervals in each of the two transects. The distance measurement is known as the *point to tuft distance* and the concept was developed by Hardy & Tainton (1993) and serves as an index of the basal cover of the grass sward;
- Classify the grasses and other herbaceous plants into decreaser and increaser species according to their reaction to a grazing gradient ranging from high to low stocking rates. This was done by Trollope (1986) for all the veld types in the Eastern Cape Province north of the Fish River and this classification is being used for assessing and monitoring the condition of the grass sward in the GFRR.
- Estimate the *standing crop of grass* adjacent to each of the point quadrat recording points either with a *disc pasture meter* or a *subjective estimate* if the sample site is unsuitable for the use of the *disc pasture meter* – data expressed in kg/ha. A calibration for the general use of the disc pasture meter in the grassland and thornveld areas of the Eastern Cape Province is available and is described in the following equation:

  $$y = 340 + 388{,}3x$$

  where: y = mean standing crop of grass - kg/ha;
  x = mean disc height – cm (Trollope, 1983).

In cases where subjective estimates of the standing crop of grass are necessary this is done on a three point scale using the guidelines 1 = < 1000 kg/ha; 2 = 1000-2000 kg/ha and 3 = >2000 kg/ha.

The survey procedure for surveying the grass sward was developed because the resultant data:

- describes the condition of the vegetation in relation to its forage production potential and resistance to soil erosion i.e. conforms to the definition of veld condition;
- indicates the ecological status of the grass species along a grazing gradient i.e. relative proportions of *decreaser* and *increaser* grass species;
- has the potential for simplifying the veld assessment technique through the identification of *key grass species*;
- has the potential to estimate the *grazing capacity* of the grass sward;
- has the potential to indicate the susceptibility of the grass sward to *soil erosion*;
- has the potential to “drive” a *controlled burning* program when and if necessary e.g. areas in the False Thornveld of the GFRR;

The aforementioned procedures for assessing the condition of the herbaceous and woody vegetation in the GFRR are currently being tested in the different vegetation communities. Preliminary indications are that they produce realistic, quantitative and functional descriptions of the vegetation representing veld in different conditions relative to its potential for forage production and resistance to soil erosion.

Analysis of Veld Condition Data
Bush Vegetation:

i) Botanical Composition

- Determine the total number of different tree and shrub species recorded in the four different quadrats used in the PCQ procedure;
- Express the frequency data for each species on a per quadrat basis for the three height classes i.e. < 2 m, > 2 m and the tallest tree/ shrub within 10 m of the *recording point*. In the case of data collected in quadrats 1 and 2 and quadrats 3 and 4 the different number of plant species must be divided by 2 in order to express the number of trees/ shrubs on a per quadrat basis for the < 2 m and > 2 m height classes. No correction is necessary for the tallest plants > 2 m recorded within 10 m of the recording points because these plants were recorded in only one quadrat. ;
- Express the frequency for each recorded tree and shrub species as a percentage of the total number of plants recorded on a per quadrat basis. An example of the procedure used for calculating the botanical composition of the different tree and shrubs species is presented in Table 1. It should be noted in Table 1 that although the palatability of the different bush species to the different ungulate species in the GFRR has not been thoroughly researched and determined the species have been divided into palatable and unpalatable species according to the observed feeding preferences of kudu on the Reserve.

ii) Density

Estimate the total density of tree and shrub species and express it in plants/ha. The density of plants is calculated using the distance of the different trees and shrubs from the *recording point*. The density of the trees and shrubs is calculated by dividing the square of the distance from the recording point, expressed in square metres, into the area of a hectare i.e. 10000 m^2 / D^2 (Cottam & Curtis 1956). The resultant density of trees and shrubs is expressed as the number of plants per hectare – P/ ha. It should be noted that in this calculation the density of plants is estimated separately for each height class and the total density for the survey is calculated by determining the sum of the mean densities of trees and shrubs estimated for the three different height classes i.e. < 2 m, > 2 m and the tallest tree/ shrub > 2 m within 10 m of the *recording point.* Therefore the densities of trees and shrubs < 2 m in quadrats 1 and 2 are calculated using the combined mean distance for trees and shrubs recorded in these two quadrats. Similarly the densities of trees and shrubs > 2 m in quadrats 3 and 4 are calculated using the combined mean distance for trees and shrubs recorded in these two quadrats. Finally the densities of the tallest tree/shrub > 2 m are calculated using the mean distance for trees and shrubs recorded in quadrat 4. An example of the procedure used for calculating the density of trees and shrubs is presented in Table 2.

iii) Physiognomic Structure

Determine the physiognomic structure of the tree and shrub vegetation in terms of the number and proportion of trees and shrubs in 0.5 m height classes. This is achieved by sub-dividing the total number of plants/ha estimated for the < 2 m and > 2 m height classes on a proportional basis equal to the number of plants that were recorded in the 0.5 m height classes for the < 2 m and > 2 m categories expressed on a per quadrat basis. In the case of the category the tallest plants >2 m within 10 m of the recording points these numbers of plants are added to the appropriate height classes in the > 2 m category of plants recorded in quadrats 3 and 4. The calculation of the number and proportion of plants in 0.5 m height classes is presented in Table 3 using the density of plants estimated in Table 2 for the different overall height classes.

Table 1: Analysis of bush data for describing the botanical composition of tree and shrub vegetation and the observed palatability of different species to kudu when recorded using the Point Centred Quarter sampling method.

Species	Number	%	Species	Number	%
Palatable Species			**Unpalatable Species**		
Acacia caffra	5	7	*Aloe ferox*	10	13
Acacia karroo	10	13	*Azima tetracantha*	5	7
Boscia oleoides			*Diospyros lycioides*	5	7
Brachylaena elliptica	5	7	*Euclea undulata*		
Brachylaena ilicifolia			*Euphorbia triangularis*		
Cussonia spicata			*Euphorbia tetragona*		
Coddia rudis			*Opuntia ficus-indica*		
Ehretia rigida	15	20			
Euphorbia bothae					
Grewia occidentalis	15	20			
Grewia robusta					
Leucas capensis					
Lippia javanica					
Maytenus heterophylla	5	7			
Maytenus polycantha					
Olea europeae					
Pappea capensis					
Phyllanthus verrucosus					
Portulacaria afra					
Putterlickia pyracantha					
Rhus lucida					
Rhus refracta					
Schotia brachypetela					
Schotia latifolia					
Scutia myrtina					
Sideroxylon inerme					
Xeromphis rudis					
Ziziphus mucronata					
Total	**55**	**74**		**20**	**27**

Table 2: The procedure used for calculating the density of trees and shrubs using data collected with the Point Centred Quarter sampling method.

Quad	Species	Height (m)	Distance (m)	Distance^2 (m^2)	Density 10000/ Distance^2 (P/ha)
1	A	< 2 m	3		
2	A	< 2 m	2		
Mean			**2.5**	**6.25**	**1600**
3	A	> 2 m	4		
4	A	> 2 m	3		
Mean			**3.5**	**12.25**	**816**
4	A	Tallest	8	64	156
Total Density – P/ha					**2572**

Table 3: The procedure used for estimating the density of plants (P/ha) in 0.5 m height classes using data collected with the Point Centred Quarter sampling method.

Height Class	No. of plants recorded in all quadrats	No. of plants recorded per quadrat	No. of plants recorded per hectare	% Plants per 0.5 m height category
0 – 0.50	40	20	753	29
0.51 – 1.00	16	8	301	12
1.01 – 1.50	14	7	264	10
1.51 – 2.00	15	7.5	282	11
TOTAL - < 2 m		**42.5**		
2.01 – 2.50	10	5	233	9
2.51 – 3.00	12	6	280	11
3.01 – 3.50	4	2	93	4
3.51 – 4.00	4	2	93	4
4.01 – 4.50	5	2.5	117	5
TOTAL - > 2 m		**17.5**		
4.51 – 5.00	5	5*	156	6
TOTAL-Tallest > 2 m		**5**		
TOTAL	**125**	**65**	**2572**	

NOTE: These plants were the category of trees and shrubs that were the tallest plants >2 m recorded within 10m of the recording points.

iv) Phytomass

- Calculate the number of *tree equivalents* per hectare, which represent the phytomass of bush in all height classes in the sample site. A tree equivalent is defined as a tree or shrub that is 1.5 m high. The tree equivalents are calculated by multiplying the number of trees and shrubs in each height class by the median for each height class. The sum of the products is divided by 1.5 m to convert them to tree equivalents. An example of the procedure used for calculating the number of tree *equivalents* using the data in Table 3 is presented in Table 4.

Table 4: Procedure for estimating the number of *Tree Equivalents* using the Point Centred Quarter sampling method.

Height class (m)	Total number of bushes	Median (m)	Product (m)
0 - 0,50	753	0.25	188
0,51 - 1,00	301	0.75	226
1,01 - 1,50	264	1.25	330
1,51 - 2,00	282	1.75	494
2,01 - 2,50	233	2.25	524
2,51 - 3,00	280	2.75	770
3,01 - 3,50	93	3.25	302
3,51 - 4,00	93	3.75	349
4,01 - 4,50	117	4.25	497
4,51 - 5,00	156	4.75	741
TOTAL	**2572**		**4421**

Tree Equivalents = (4421m/1.5m) = 2947 TE/ ha

v) Available Browse

At this stage insufficient information is available for the thicket communities to categorise the data from the bush surveys into *palatable & available*, *palatable & unavailable* and *unpalatable* tree and shrub species for the different browsing ungulate

species in the GFRR. Nevertheless it is considered important to be able to give some indication of the available browse to the dominant browsing ungulate species in the major height classes in the Reserve viz. kudu – < 2 m and giraffe > 2 m. Based on field observations it will be assumed that for all practical purposes the palatability of the different bush species in the GFRR is similar for kudus and giraffes and is represented by the information presented in Table 1. It will also be assumed that the mean feeding height for kudus is 0 - 2 m and for giraffes > 2 m and that in all cases the lowest browseable material is down to ground level i.e. 0 m. While this will not be strictly valid for all bush species > 2 m in height, the physiognomy of GFRR thicket communities in general is such that in the majority of cases this assumption will hold. The procedure for estimating the amount of available browse will comprise calculating the number of browsing units available in the height classes 0 – 2 m and > 2 m. The number of browsing units are calculated by multiplying the number of palatable and available trees and shrubs in each height class by the median for each height class of the feeding height being considered. An example of the procedure used for calculating the number of browsing units is presented in Table 5.

Table 5: Procedure for estimating the number of *Browsing Units* using the Point Centred Quarter sampling method.

Height class	Acceptable browse species				Available browse <2m feeding height		Available browse >2m feeding height	
	Available		Unavailable		Median	Product	Median	Product
	No	%	No	%				
0 – 0.5	552	xxx	0	xxx	0.25	138	-	-
0.51 – 1.00	221	xxx	0	xxx	0.75	166	-	-
1.01 – 1.50	194	xxx	0	xxx	1.25	243	-	-
1.51 – 2.00	207	xxx	0	xxx	1.75	362	-	-
2.01 – 2.50	171	xxx	0	xxx	2	342	0.25	43
2.51 – 3.00	205	xxx	0	xxx	2	410	0.75	154
3.01 – 3.50	68	xxx	0	xxx	2	136	1.25	85
3.51 – 4.00	68	xxx	0	xxx	2	136	1.75	119
4.01 – 4.50	86	xxx	0	xxx	2	172	2.25	194
4.51 – 5.00	114	xxx	0	xxx	2	228	2.75	314
TOTAL	**1886**	**73**	**0**	**0**	**-**	**2333**	**-**	**908**

Browsing Units < 2 m = (2333 m/1.5 m) = 1555 BU/ ha
Browsing Units > 2 m = (908 m/1.5 m) = 605 BU/ ha

Grass Sward:

i) Botanical Composition, Basal Cover & Standing Crop of Grass

- Using the data collected with the *point quadrat* surveys and the *disc pasture meter* calculate the percentage frequency for the different grass and herbaceous species, the mean point to tuft distance and the standing crop of grass material;
- Use these data to complete the veld condition forms that have been developed for assessing the condition of the grass sward in the two veld types occurring in the GFRR viz. Valley Bushveld and False Thornveld of The Eastern Cape. Examples of the assessment of the grass sward in these two veld types are presented in Tables 6 and 7.

Table 6: Procedure for assessing the condition of the grass sward used for wildlife management in the thicket communities of the Valley Bushveld veld type in the Great Fish River Reserve in the Eastern Cape Province.

Category	Species	Frequency %	Forage Factor	Forage Score
Decreaser	*Digitaria eriantha*	6	4	24
Species	*Panicum deustum*		10	
	Panicum maximum		10	
	Setaria neglecta	7	10	70
	Sporobolus fimbriatus		7	
	Themeda triandra		10	
Decreaser Total		**13**		
Increaser I	*Cymbopogon plurinodis*		4	
Species	*Melica decumbens*		0	
	Merxmeullera disticha		2	
Increaser I Total		**0**		
Increaser II	*Aristida congesta* .	14	0	0
Species	*Cynodon dactylon*	1	4	4
	Eragrostis chloromelas	4	2	8
	Eragrostis curvula	2	2	4
	Eragrostis obtusa	8	1	8
	Eustachys mutica		2	
	Microchloa caffra	2	0	0
	Sporobolus nitens		2	
	Tragus berteronianus	18	0	0
	Forbs – non-succulent		2	
	Forbs – succulent		0	
	Karroid species		0	
	Bare ground	38	0	0
Increaser II Total		**87**	**Forage Score**	**118**
TOTAL		**100.0**		

CONCLUSIONS:

1) FORAGE POTENTIAL

POTENTIAL	SCORE	FORAGE
		Tick
Very high	> 500	
High	401 – 500	
Medium	301 – 400	
Low	200 – 300	
Very low	< 200	xxx

2) TREND

CATEGORY	%	GRAZING	Tick
Decreaser Spp.	13	Moderate	
Increaser I Spp.	0	Under	
Increaser I Spp.	0	Selective	
Increaser II Spp.	87	Over	xxx

3) SOIL EROSION

FACTOR	POTENTIAL FOR EROSION		
Point to tuft distance:	Low	Mod	High
	<5 cm	5-10 cm	>10 cm
Distance = 10.2 cm			xxx
Grass std. crop	Low		High
	≥500 kg/ha		<500 kg/ha
kg/ha = 490			xxx
Overall Soil Erosion Potential			xxx

Table 7: Procedure for assessing the condition of the grass sward used for wildlife management in the False Thornveld of the Eastern Cape veld type in the Great Fish River Reserve in the Eastern Cape Province.

Category	Species	Frequency %	Forage Factor	Forage Score	Fuel Factor	Fuel Score
Decreaser Species	*Heteropogon contortus*		7		7	
	Panicum maximum	1	10	10	8	8
	Panicum stapfianum		7		7	
	Setaria neglecta	36	10	360	10	360
	Themeda triandra	14	10	140	10	140
Decreaser Total		**51**				
Increaser I	*Hyparrhenia hirta*		4		10	
Species	*Cymbopogon plurinodis*	6	4	24	10	60
	Melica decumbens		0		5	
Increaser I Total		**6**				
Increaser II	*Aristida congesta*		0		1	
Species	*Aristida diffusa*		1		2	
	Cynodon dactylon		2		2	
	Digitaria eriantha	19	4	76	4	76
	Eragrostis capensis		2		2	
	Eragrostis chloromelas		2		3	
	Eragrostis curvula		2		4	
	Eragrostis obtusa	3	0	0	1	3
	Eustachys mutica	1	2	2	3	3
	Karrochloa curva		0		0	
	Microchloa caffra		0		1	
	Sporobolus africanus		2		3	
	Sporobolus fimbriatus	5	7	35	7	35
	Sporobolus nitens		2		2	
	Tragus berteronianus		0		1	
	Forbs	4	0	0	2	8
	Karroid species		0		7	
	Bare Ground	11	0	0	0	0
Increaser II Total		**43**	**Forage Score**	**647**	**Fuel Score**	**693**
TOTAL		**100.0**				

1) FORAGE/ FUEL POTENTIAL

POTENTIAL	SCORE	FORAGE	FUEL
		Tick	
Very high	> 500	xxx	xxx
High	401 – 500		
Medium	301 – 400		
Low	200 – 300		
Very low	< 200		

2) TREND

CATEGORY	%	GRAZING	Tick
Decreaser Spp.	51	Moderate	xxx
Increaser I Spp.	6	Under	
Increaser I Spp.	6	Selective	
Increaser II Spp.	43	Over	

3) SOIL EROSION

FACTOR			
TUFT DISTANCE	POTENTIAL FOR ROSION		
	Low	Mod	High
Distance = 2.4 cm	<3 cm	3-5 cm	>5 cm
Grass Std. Crop	xxx		
	Low		High
kg/ha = 2798	>1500 kg/ha		<1500 kg/ha
Overall Soil Erosion Potential	xxx		

4) CONTROLLED BURNING

BOTANICAL COMPOSITION	%	BURN	
		Yes	No
Decreaser Species	51	xxx	
Increaser I Species	6		
Increaser II Species	43		
Fuel Load = 2798 kg/ha		xxx	
Overall Decision to Burn		xxx	

- The *forage factors* for the different grass and herbaceous species in Tables 6 and 7 and the *fuel factors* in Table 7 represent functional characteristics of the herbaceous vegetation in the two veld types occurring in the GFRR. The *forage factors* and *fuel factors* are indices of the sustained f*orage* and *fuel production potential* of a plant species. They are used to calculate the *forage* and *fuel scores* which represent the potential of the grass sward to produce forage for grazing animals and the potential of the grass sward to produce grass fuel to support a fire on a scale of 0-10 respectively. The *forage* and *fuel scores* are the sum of the products of the percentage frequency and the forage and fuel factors respectively for the different grass herbaceous species recorded in a survey of the grass sward at a sample site;
- The veld condition data presented in Tables 6 and 7 are interpreted using the following guidelines that have been developed through personal field experience gained in formulating veld management practices in southern and east Africa in general and in the Eastern Cape in particular by the senior author:
    a) **Forage & Fuel Potentials:** The range in the forage and fuel scores from very high (> 500) to very low (< 200) reflect the potential of the grass sward to produce forage for grazing wild ungulates and to produce grass fuel to support a high intensity grass fire. These categories have proven to be ecologically meaningful with highly applicable practical management implications;
    b) **Trend:** This refers to whether the veld is being moderately grazed, under grazed, selectively grazed or over grazed. The criteria used for deciding the intensity of grazing is that if the veld is dominated by decreaser grass species then it is being moderately grazed. If it is dominated by Increaser I grass species then it is being under grazed. If it is dominated by Increaser II grass species then it is being over grazed. Finally, if it is dominated by both Increaser I and Increaser II grass species, it is being selectively grazed.
    c) **Soil Erosion:** The effect of the herbaceous vegetation on soil erosion depends upon the basal and canopy cover of the grass sward. If the basal and canopy covers are high then the potential for soil erosion is low and *vice versa*. Simple indices have been identified for these two parameters. Basal cover is satisfactorily described by recording the distance from a measuring point to the edge of the nearest grass tuft and is easily measured in the field. Different categories of point to tuft distance reflecting low, moderate and high potentials for soil erosion have been formulated for the Valley Bushveld and False Thornveld of the Eastern Cape veld types to reflect the different potentials of these two veld types to develop a dense grass cover as influenced by the very xerophytic conditions in the Valley Bushveld and the more mesophytic conditions in the False Thornveld of the Eastern Cape. The standing crop of grass is an excellent index of the canopy cover of the grass sward and is readily measured in the field with a disc pasture meter particularly in the False Thornveld areas.
    d) **Controlled Burning:** In the case of the GFRR the only areas that may require controlled burning, albeit on a very infrequent basis, are in the False Thornveld of the Eastern Cape sectors of the Double Drift section of the Reserve. The necessity for veld to be burnt or not depends upon its ecological status and physical condition. In order to maintain the potential of the grass sward to produce forage, burning should not be applied if it is in a pioneer condition dominated by Increaser II grass species like *Aristida congesta* caused by overgrazing. Burning should not be applied when the grass sward is in this condition in order to allow it to develop to a more stable and productive stage dominated by Decreaser grass species like *Themeda triandra* and *Setaria neglecta*. Conversely when the grass sward

is in an under or selectively grazed condition dominated by Increaser I species like *Cymbopogon plurinodis*, it needs to be burnt to increase the better fire adapted and more productive Decreaser grass species. Finally controlled burning is also necessary when the grass sward has become overgrown and moribund as a result of excessive self-shading. When in this condition it is necessary to remove the old unpalatable grass material to restore the vigour of the grass sward and allow new nutritious regrowth to occur. Field experience indicates that when the standing crop of grass $\geq$4000 kg/ha the grass sward has become moribund and needs to be defoliated by burning or any other means.

General Discussion and Conclusions

One of the major stumbling blocks in the development of a program for monitoring the condition of the vegetation in the GFRR has been the lack of a simple, practical and effective technique for describing the condition of the vegetation in functional terms pertinent to wildlife management. It is firmly believed that this objective has been achieved because the technique that is presented in this paper has been specifically designed to describe in quantitative terms the botanical composition, density, structure, phytomass and forage potential of the bush and grass components of the vegetation. However, an immediate and urgent requirement is to thoroughly test the technique over the full range of plant communities and differences in veld condition in the GFRR to determine whether it is capable of monitoring the impact of the re-introduction of the large herbivores like black rhinoceros and elephants on the vegetation, particularly the woody vegetation.

One of the initial objectives in developing the technique for assessing the condition of the vegetation was to be able to assess the grazing and browsing capacity of the veld as a means of formulating realistic stocking rates for the current and future different ungulate species on the GFRR. However, it was soon realised that the current quantitative knowledge on the feeding habits and preferences of the different grazing and browsing wildlife species for the different thicket communities in the Valley Bushveld is very limited. In addition there is a virtual absence in knowledge on the autecology of the key browse and grazing plant species in this vegetation type together with their responses to intensity, frequency and season of defoliation. This effectively precludes for the moment realistic estimates of the grazing and browsing capacity of the thicket communities until a comprehensive research program has been conducted on these key aspects. This realization should not result in pessimism about the future of this important biome but rather as an exciting and fascinating challenge for biological research in the future.

Finally it will be noted that not all the parameters that are being measured in the woody plant surveys are being used in the analysis of the veld condition data viz. maximum canopy diameter and height of maximum canopy diameter. Initially it was intended that these data could be used together with the vertical height measurements to estimate the volume of the canopies of the different thicket plant communities in the GFRR. However, the inclusion of these parameters increases the complexity of the calculations involved in analyzing the survey data very significantly. In addition estimating the maximum canopy diameter is both difficult and time consuming in the densely intertwined and spiny thicket plant communities. Both these factors result in deviating from one of the important objectives of the study, namely, the development of a simple and rapid technique for assessing veld condition in the thicket communities. However, it has been decided to retain these measurements for the time being until it has been satisfactorily established that vertical measurements of the woody vegetation

alone are adequate for monitoring the impact of large herbivores on the tree and shrub vegetation.

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THICKET FORUM WORKSHOP – WHERE TO FROM HERE?

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The recommendation of establishing a Thicket Forum emerged from the priority actions outlined in the implementation strategy of the Subtropical Thicket Ecosystem Planning (STEP) Project. The Thicket Forum was conceptualised as an affiliation of stakeholders from a broad range of institutions that meet annually to discuss and formulate priorities for future research and management actions to ensure the sustainability of the Thicket Biome. At the inaugural meeting, a planning forum workshop was facilitated by the Bioregional Programmes Co-ordinator, Dr Mandy Cadman, to reach consensus about whether a Thicket Forum was needed, and if so, to discuss the format and the organisational arrangements for future meetings.

The workshop comprised of a participatory discussion and smaller group discussions. During the participatory discussion delegates were instructed to note on cards what they expected to gain/contribute by attending the Thicket Forum. Responses were summarised under the following six categories, which included:

1) General interest e.g. to learn more about thicket
2) Research and information gathering e.g. to assist in prioritising thicket research and collaborate initiatives.
3) Implementation process of STEP e.g. to become involved in the implementation (integrating research and management) process of STEP.
4) Network e.g. to share experiences and communicate ideas.
5) Cultural e.g. to discuss of the cultural value of Thicket.
6) Interest in the tourism and game ranching industries.

Small group discussions were facilitated by group leaders (Andrew Knight, Ayanda Sigwela, Suzi Vetter, Fanie Fouche, Warrick Stewart and Jill Gordon). A rapporteur was selected from each group to summarise group discussions at the report back session. The following questions were addressed in the small group discussions:

1) How often should the forum be held?
2) What form should the forum take and which issues should it address?
3) How should the forum be driven?
4) What resources are required and where should they come from?
5) Should the forum publish proceedings of the meetings?
6) What are the priorities for future research and management?

Discussions that arose from the workshop were collated to formulate the following recommendations:

- The Thicket Forum should be held annually, over the duration of three days during the month of May.
- A mixed format including, paper presentations, poster presentations (important for students), workshops and fieldtrips should be adopted under specific themes but that an open session should also be established for flexibility.
- Themes for the Forum should retain a strong research-implementation / management link, be reflective of new issues and span the interest of all

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stakeholder groupings. Land-use planning and management issues and conservation: development issues were highlighted as important themes.

- A multi-institutional organising committee should be elected to serve for a period of two years. When a new committee is elected, two members of the current committee should stay on to ensure continuity. The Secretariat of the committee should be established in one organisation for a period of two years.
- The resources needed to fund the Thicket Forum could be sort from: the National Research Foundation, the Development Bank of South Africa, through charging delegates a nominal registration fee, and through seeking financial support from thicket based industries.
- Proceedings of the Forum should be published comprising at least abstracts, key references and a complete list of contact details of delegates.

The following actions were derived from the meeting:

- In-principle support for the Thicket Forum should be sought from the Eastern Cape Implementation Committee (ECIC); Mandy Cadman would place an item on the agenda for the next meeting.
- An interim Organising Committee was elected at the close of the Thicket Forum; the WESSA-BCU volunteered to assume Secretariat Functions; DEAET, SANParks, the Department of Agriculture, and the Centre for African Conservation Ecology (formerly the Terrestrial Ecology Research Unit) gave their commitment to serve on the Committee.

Priority research activities formulated during the workshop included:

- Communal wildlife management
- Land use and transformation / Continued monitoring of degradation
- Global change issues including the impact of global warming on thicket biodiversity and functioning
- Thicket rehabilitation including job creation opportunities from rehabilitation
- Private landowner conservation
- Promotion of action research
- Management issues
- Legislation awareness
- Education
- Ecological capacity, monitoring and evaluation
- Management driven research and curiosity research
- Translocation and policies
- Sustainable use of medicinal plants
- Compatibility between agriculture and conservation
- Economics of land use in thicket
- Community based natural resource management
- Understanding ecosystem level processes and functions
- Policy and administrative frameworks
- Review and collate published information on thicket
- Maintenance/updating of databases
- Research/resource access
- Monitoring and evaluation
- Decision making tools
- Training/building capacity
- Impacts of extralimital species and alien invasive plants
- Sustainable game stocking rates for range of species
- Success in land use planning interventions

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