CEPF SMALL GRANT FINAL PROJECT COMPLETION REPORT

I. BASIC DATA

Organization Legal Name: Percy FitzPatrick Institute of African Ornithology, University of Cape Town

Project Title (as stated in the grant agreement): Impacts of Herbivores on the Succulent Karoo Vegetation of Anysberg Nature Reserve

Implementation Partners for This Project:

Project Dates (as stated in the grant agreement): January 1, 2005 – June 30, 2005

Date of Report (month/year): August 2005

II. OPENING REMARKS

This project was initiated upon the suggestion of the Conservation Manager of Anysberg Nature Reserve. The ecological portion of the project formed part of a Conservation Biology MSc degree, the monitoring portion being performed after degree completion. The aim of the project was to bring together scientific research and practical management in order to tackle the problem of introducing herbivores into a vegetation reserve. This was to be achieved by investigating impacts of herbivores currently on the reserve and developing a monitoring program to detect vegetation change with increasing herbivore population sizes.

Anysberg Nature Reserve (ANR) is an approximately 66 000 ha Cape Nature reserve in the Western Little Karoo. The reserve was established for vegetation conservation (Fynbos, Renosterveld and Succulent Karoo). Indigenous herbivores are being reintroduced into the reserve but vegetation conservation remains the main aim.

III. NARRATIVE QUESTIONS

1. What was the initial objective of this project?

The initial objective of the project was “to document the use of the landscape by various game species and to investigate the possibility that trampling or grazing by game might be posing a threat to persistence of the endemic plant species of quartz patches, or causing unwanted changes to vegetation or soil in some parts of the landscape”. It was expected that results would inform management where the various herbivore species spend most time and whether they are damaging plant species endemic to quartz patches.

2. Did the objectives of your project change during implementation? If so, please explain why and how.

The objectives of the project did not change during implementation but the data collected meant that questions could be addressed in more detail than initially planned. Prior to implementation it was suggested that extra quartz patches would be surveyed for impact, this was not performed as it would have resulted in biased sampling. Also, knowing whether or not quartz patches are used does not help unless they can be compared to other vegetation types. Lack of use could indicate either avoidance or simply low numbers of animals. Quartz patches were therefore surveyed with the same intensity as other vegetation types in order to obtain a picture of how herbivores use the entire landscape.

3. How was your project successful in achieving the expected objectives?

The project was successful in achieving the expected objectives. Herbivore (ungulate, rodent and lagomorph) usage of the landscape was documented and vegetation sampling detected browsing intensity. There was no evidence that current utilization by ungulate herbivores is causing damage to plants on quartz patches. Current numbers of herbivores

do not appear to be causing changes to vegetation or soil though historic impacts of overgrazing during livestock farming are still visible. Current stocking rates on ANR are low; with increasing population sizes herbivore impacts will become more intensive and widespread. Long-term monitoring of vegetation, soil and herbivores is required in order to determine whether indigenous herbivores will cause degradation as their population sizes increase.

All of the deliverables were met as follows:

1. *Identification of parts of the Anysberg Nature Reserve that are highly utilised by game*

ANR can be divided into sectors based on topography and acquisition history. These sectors can be further subdivided into vegetation types (Figure 1).

Presence or absence of dung at each of 1000 sample points on a 1 ha grid was used as an index of frequency of use of sample areas by herbivores. 21 grids were performed across the reserve. At the scale of the sector, Vrede is the most highly used area of ANR. This sector is the valley between the Anysberg Mountain and the Matjiesgoedberg and Skerpkranz mountains. It is the oldest part of the reserve and was the area in which game was initially restocked. Herbivores reintroduced into this area were mainly restricted to the valley until extensions to the reserve in 2000. Figure 2 illustrates the utilization of each sector (as indicated by dung frequency), standardized per unit area for comparison. The vegetation on Spitzkop is largely highly degraded Scholtzbosveld.

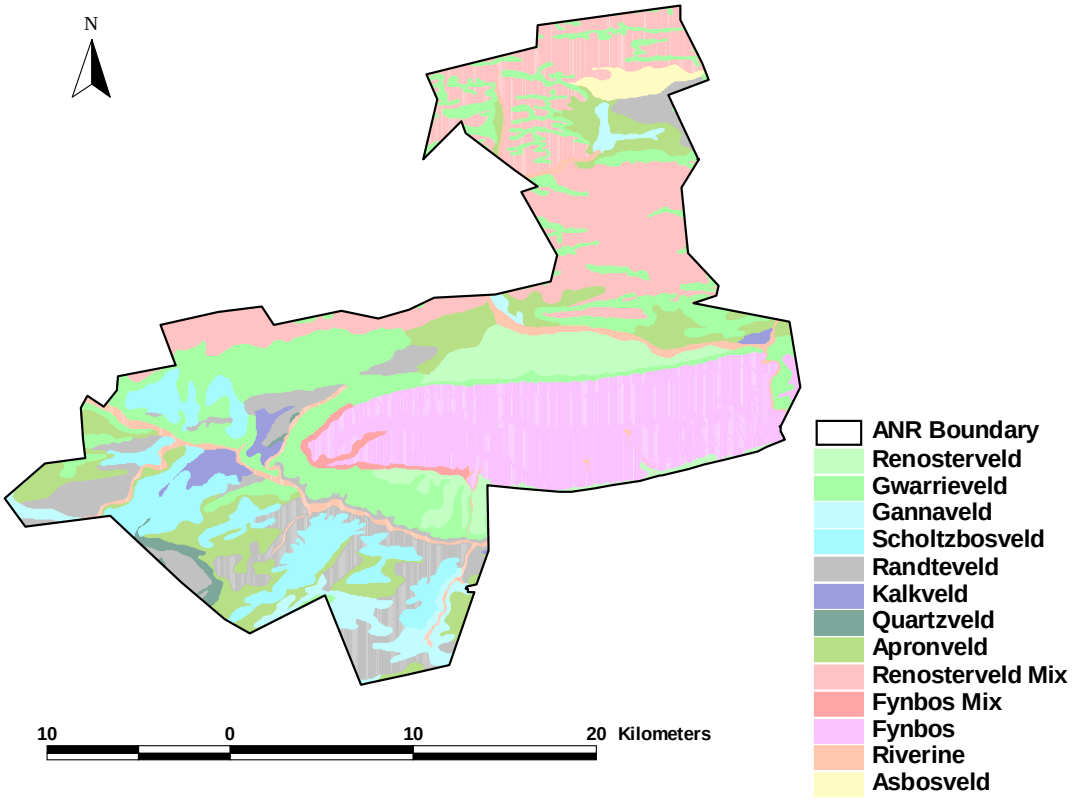

Figure 1: Map of Anysberg Nature Reserve showing vegetation types and sector divisions. Vegetation types indicated by colors as shown in figure, shades of blue and green indicate vegetation types sampled. Sector divisions indicated by dashed lines, names indicated by numbers: 1 = northern mountains, 2 = Vrede, 3 = Allemorgens, 4 = Spitzkop, 5 = Touwsfontein, 6 = Kleinspreeufontein, and 7 = Anysberg. Vegetation map from Vlok, J.H.J., Cowling, R.M. and Wolf, T. 2005. A vegetation map for the Little Karoo. Unpublished maps and report for a SKEP project supported by CEPF grant no. 1064410304.

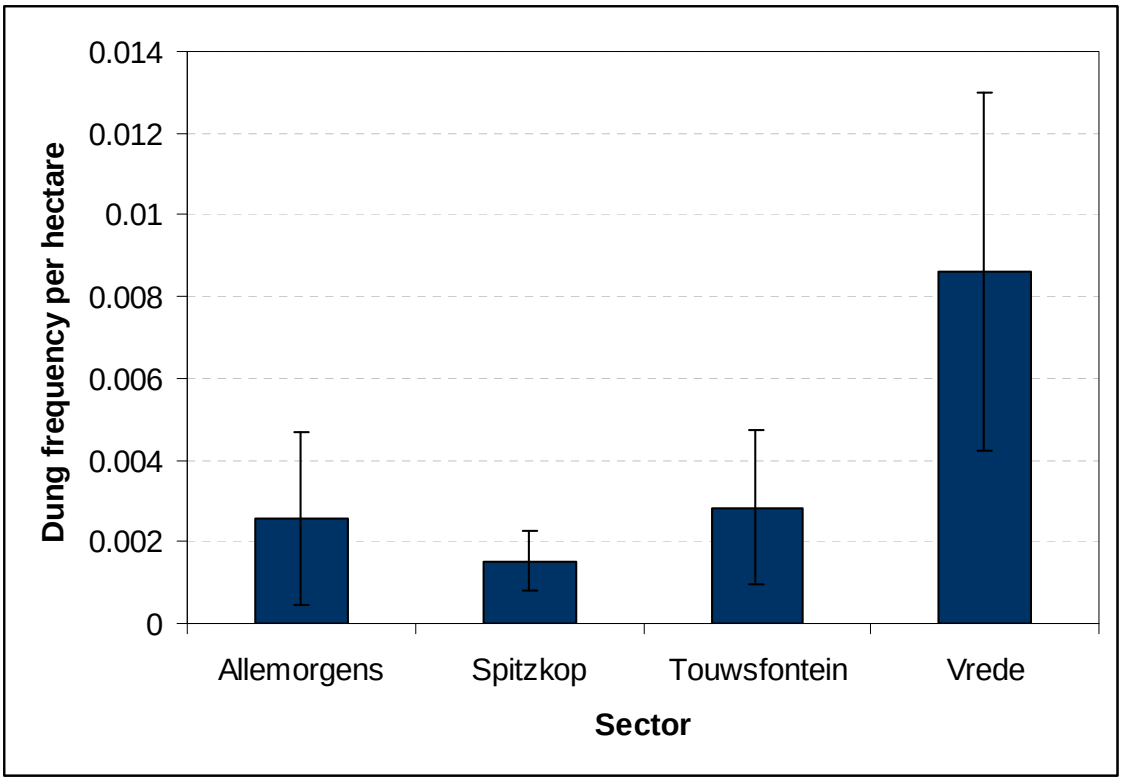

Figure 2: Herbivore dung per unit area of sampled sectors of Anysberg Nature Reserve illustrating different levels of use. Error bars represent standard deviation based on different sampling sites. These values are for vegetation types combined within sectors.

2. An analysis of the use of various vegetation types in relation to their cover

A total of 13 vegetation types have been identified on ANR, seven of these were surveyed during field work (Figure 3). Vegetation types not surveyed were riverine and those found on the mountains which are inaccessible to the majority of the ungulate herbivores in the reserve. Additionally, observation data collected by reserve staff from 1990 to 2004 indicated that these areas had a lower usage (Table 1).

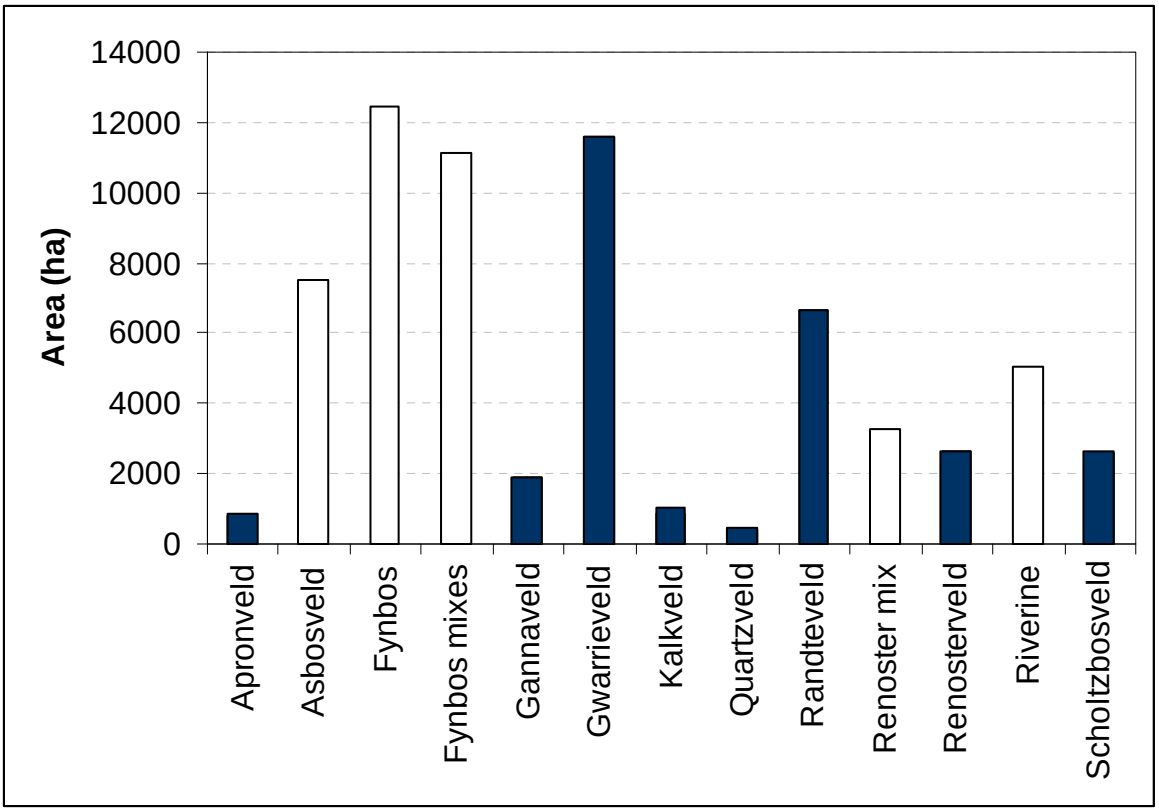

Figure 3: Vegetation types of Anysberg Nature Reserve and their extents. Blue bars indicate vegetation types sampled during the study.

Table 1: Usage of vegetation types from geo-referenced observational data collected by staff of the Anysberg Nature Reserve. The top section of the table shows sampled vegetation types.

Vegetation Type	Observation Count	Observations per Hectare
Apronveld	366	0.448
Renosterveld	314	0.120
Gannaveld	58	0.030
Gwarrieveld	346	0.030
Scholtzbosveld	67	0.026
Randteveld	149	0.022
Kalkveld	13	0.015
Quartzveld	0	0.000
Renosterveld mix	338	0.104
Riverine	211	0.042
Fynbos	58	0.005
Asbosveld	27	0.004
Fynbos mix	2	0.000

Vegetation type utilization is indicated by the preference indices as these are calculated from dung counts. A high preference represents utilization of the vegetation to a greater degree than would be predicted from the spatial extent of the vegetation unit. Due to the low stocking rate on ANR at the time of the study it is likely that these preferences are for optimal conditions. At higher stocking rates less difference would be expected between the preferences. As dung was used to indicate utilization there is unlikely to be much of a seasonal bias. Kalkveld and Renosterveld, both grassy vegetation types, were the most highly preferred vegetation types (Figure 4).

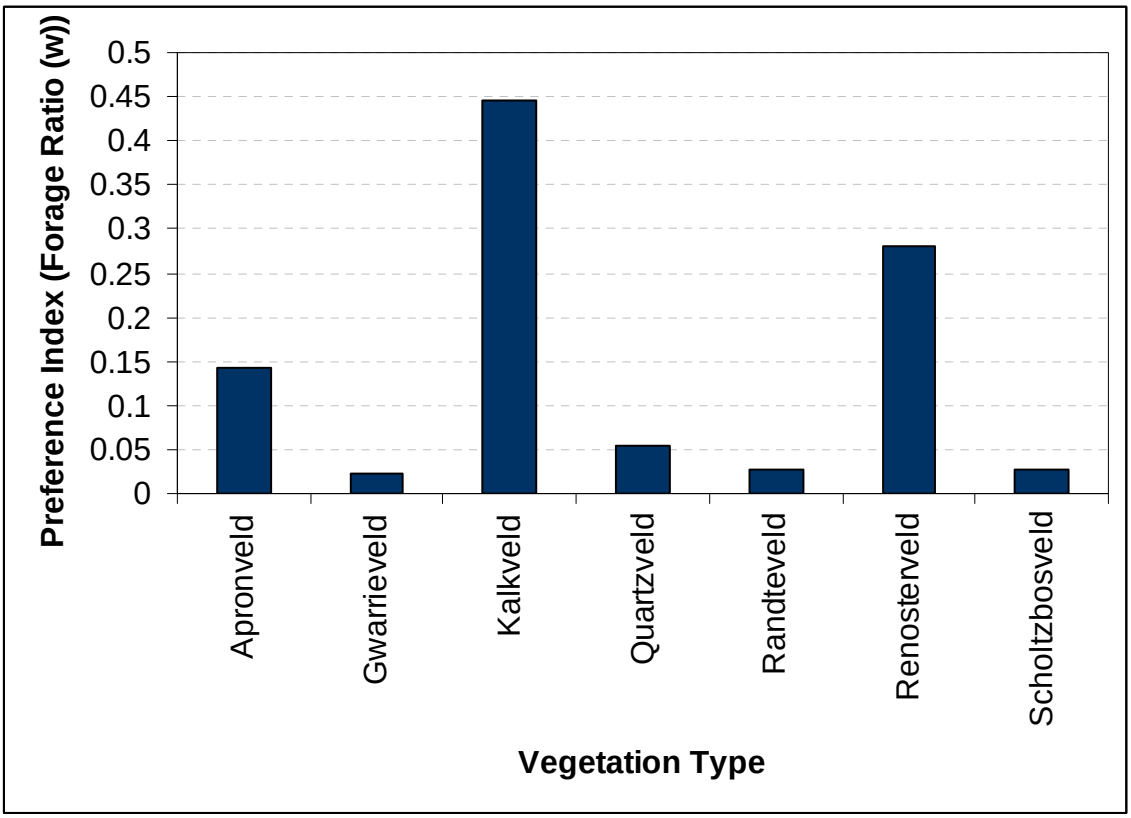

Figure 4: Preference indices (calculated from dung counts using the Forage Ratio, *w*) for sampled vegetation types of Anysberg Nature Reserve.

Kalkveld, one of the rarest vegetation types on the reserve, was used far more than its area would suggest giving it a high preference index. Gwarrieveld was the most extensive vegetation type surveyed but its preference index was one of the lowest. One of the dominant plants in Gwarrieveld is *Euclea undulata*, a small tree which grows in clumps

to a height of approximately 2.5m. Due to the bush clumps, visibility in this vegetation type is limited, potentially leading to its avoidance. Randteveld and Scholtzbosveld were well represented on the reserve but not highly used. Randteveld is a rocky vegetation type and it has been suggested in scientific literature that rocky vegetation types are reserved for use in times of drought and are otherwise avoided. Scholtzbosveld is dominated by *Pteronia pallens* (Scholtzbos) which is toxic to ungulate herbivores. Quartzveld was the rarest vegetation type on the reserve and was not highly used. This could partially be due to the lack of forage available; the palatability of this vegetation type was very low. Additionally, the rockiness and brightness of the quartz patches may dissuade usage. Utilization of Quartzveld tended to consist of trails passing around the edges of the quartz patches. One patch surveyed was in an area that had been highly overstocked with sheep, this patch showed signs of degradation. An interesting further study would be the impact of Whistling Rats (*Parotomys brandtsi)* on Quartzveld as their burrows were found in relatively high densities around the edges of quartz patches.

3. An account of food selection by common game species during spring months

The most frequently browsed species differed between vegetation types as a result of changes in species composition (Table 2). Generally, highly browsed species were less common. The exception was in Scholtzbosveld where the dominant species, *Pteronia pallens*, was the most highly browsed species. This irregularity is accounted for by the presence of Whistling Rats in large numbers in this vegetation type; *Pteronia pallens* is a common food source for whistling rats.

Over the entire reserve, irrespective of vegetation types, 12 plant species provide over 55% of the forage (Table 3). The most important species are *Stipagrostis zeyheri* and *Cynodon dactylon* as together these two grasses provide 30% of the total forage.

Table 2: Frequently browsed species in vegetation types and their contribution to cover. Contribution to cover was determined through the percentage of canopy counts recorded as that species.

Vegetation Type	Most highly browsed species	Cover contribution
Apronveld	*Drosanthemum* sp.4	3.9%
Gwarrieveld	*Justicia cuneata*	7.7%
Kalkveld	*Stipagrostis zeyheri*	22.9%
Quartzveld	*Zygophyllum retrofractum*	2.9%
Randteveld	*Hirpicium integrifolium*	5.7%
Renosterveld	*Cynodon dactylon*	12.6%
Scholtzbosveld	*Pteronia pallens*	44.9%

Table 3: Plant species contributing over 1% to total browse in the study area.

Plant species	Plant type [a]	Contribution to total browsing (%)	Cumulative contribution to total browsing
Stipagrostis zeyheri	g	17.0	17.0
Cynodon dactylon	g	13.4	30.3
Drosanthemum sp.4	s s	5.1	35.4
Hirpicium integrifolium	n s	4.2	39.6
Pteronia pallens [b]	n s	4.1	43.7
Justicia cuneata	n s	2.6	46.3
Drosanthemum sp.3	s s	1.9	48.2
Zygophyllum retrofractum	s s	1.8	50.0
Limeum aethiopicum	h	1.5	51.5
Ruschia cradockensis [b]	s s	1.4	52.9
Gazania krebsiana	h	1.2	54.1
Merxmuellera rufa	g	1.1	55.2

[a] g = grass; s s = succulent shrub; n s = non-succulent shrub; h = herb

[b] potentially influenced by feeding of whistling rats

Plant chemical data was used to look at the effects of various chemical attributes on the palatability of plants to indigenous herbivores. The data was obtained from a database constructed from nutritional analysis of forage plants. Data was available for 30 plant species, analysis revealed three groups of plants: (1) high protein and mineral plants which were highly preferred; (2) high sugar plants which were moderately preferred; and (3) high ether extract plants which were avoided. These results were also contrasted with the preferences of domestic livestock found in the literature. Forage plant preferences of indigenous herbivores and domestic livestock were correlated although indigenous herbivores showed a greater avoidance of high fiber levels.

4. Identification of areas that require vegetation impact monitoring

At current stocking rates, no vegetation type was observed to be used to an unsustainable degree. Areas which had previously been overstocked and overgrazed by domestic livestock are showing signs of recovering some of the more palatable species. As a result, it is recommended that all vegetation types be monitored to the same degree so as to enable determination of changes in distribution of herbivores and their impacts across the landscape. The monitoring protocol developed uses the sampling grids from the study resulting in a total of 21 sites over the reserve. If it is found that this number of sites is maintainable in the long-term, the sample size will be increased. As none of the vegetation types appear vulnerable at this stage, targeted monitoring will be inefficient and it is better to maintain a landscape scale understanding.

The more highly preferred vegetation types (Kalkveld and Renosterveld) do have the potential to act as early warning indicators of change. If degradation in these vegetation types is accelerated it could be assumed that other vegetation types will be used to a greater degree. As the selectivity for Quartzveld is low it is likely that usage of this vegetation type will remain very low until stocking rates become extremely high, approaching levels which are not anticipated for the reserve.

5. Updating of the field herbarium for the reserve

388 plant species were collected during fieldwork. All of these species were collected as ecoscraps suitable for a field herbarium and 23 were collected as full herbarium specimens. Some plants were identified by the NBI; various experts were consulted for names for other species. Names were unavailable for 25 specimens but 217 were identified to the species level. The remaining 146 were identified to the genus level and then assigned to numbered species (sp.1, sp.2 etc.) based on morphological characters.

Ecoscraps were collected in scrapbooks during field work but were transferred to cards for easy future reference. Cards were arranged in boxes based on morphological similarities for easy searching by people without knowledge of plant taxonomy. A digital herbarium to accompany the ecoscraps is under construction. Many, but not all, plants and their flowers were photographed during field work. It is hoped that the remaining photos required will be obtained in November 2005.

6. Collaboration with field rangers and the reserve manager to develop a protocol for monitoring plant species and attributes to detect grazing-induced change and to determine thresholds of potential concern requiring management response.

During field work the researcher developed an understanding of how current monitoring is prioritized and performed. Field rangers participated in data collection and were introduced to the sampling technique and plant identification system. In January 2005 a workshop was held to discuss the development of a monitoring protocol based on Thresholds of Potential Concern (TPCs) for the Little Karoo. Attendees at the workshop were from both scientific and practical backgrounds (four farmers, two conservation managers and seven scientists with various expertises).

The workshop identified the need for a two-pronged monitoring approach with immediate and relevant feedback to management. It was decided that monitoring would need to look at browsing impact, herbivore distribution and soil respiration and TPCs

were set for each of these variables. A simple check was designed to be performed every year by reserve staff. If TPCs are crossed a more detailed investigation will be initiated. It is likely that this detailed investigation would be performed by one of Cape Nature's scientific advisors rather than reserve staff. The monitoring protocol will involve the erection of exclosure plots. Additional research by academic institutions in the exclosures would also provide important information to the reserve.

7. Presentation of findings at Arid Zone Forum

The project and its results were presented to a variety of audiences at a variety of venues. Two presentations were given at the Arid Zone Ecology Forum (AZEF) in September 2005, one to present the preference work and the other to present the monitoring work. The project was also presented at the South African Wildlife Management Association Symposium (SAWMA) in October 2005. The presentations in date order are:

1. Factors influencing spatial use of the landscape by indigenous herbivores: relevance for vegetation monitoring in the Succulent Karoo (25th January 2005, 20 minutes)

   Theory, method and preliminary results presented to 13 people during the monitoring workshop.

2. Vegetation Monitoring and Thresholds of Potential Concern (TPCs) (25th January 2005, 20 minutes)

   Theory and problems in monitoring and theory and application of TPCs presented to 13 during the monitoring workshop.

3. Factors influencing spatial use of the landscape by indigenous herbivores: relevance for vegetation monitoring in the Succulent Karoo (8th February 2005, 10 minutes)

   Project background, method overview and lessons learnt during the early stages. Presented to approximately 35 people at the Percy FitzPatrick Institute as part of a day of Conservation Biology MSc project presentations.

4. An investigation into factors influencing spatial use of the landscape by indigenous herbivores in the Little Karoo: implications for a vegetation monitoring program (20th May 2005, 30 minutes)

    Theory, method and results of preference work and monitoring presented to approximately 30 people at the National Biodiversity Institute at Kirstenbosch, Cape Town, as part of the lunchtime seminar series.

5. Development of a monitoring protocol for vegetation change due to herbivory using thresholds of potential concern and stakeholder involvement: a case study from the Little Karoo (13th September 2005, 15 minutes)

    The development of the protocol and the protocol itself presented to approximately 120 people from primarily scientific backgrounds at the Arid Zone Ecology Forum.

6. Factors influencing spatial distribution of herbivores in a large protected area in the arid Little Karoo: the influences of soil chemistry and plant palatability (14th September, 15 minutes)

    Results and management implications of the preference work was presented to approximately 120 people from primarily scientific backgrounds at the Arid Zone Ecology Forum.

7. The hidden costs of making money: monitoring herbivores in a vegetation reserve (3rd October, 15 minutes)

    The results of the preference work and development of the monitoring protocol presented to approximately 100 people from primarily conservation management backgrounds at the Southern African Wildlife Management Symposium.

8. Popular article and scientific article with findings

Scientific articles are being submitted to a variety of journals. Due to the large size of the project, separate articles were written to cover different sections. Popular articles are also being prepared. The preference work was submitted for partial fulfillment of an M.Sc. degree at the University of Cape Town.

Completed:

Farmer, H. 2005. An investigation into factors influencing spatial use of the landscape by indigenous herbivores in the Little Karoo, South Africa. Unpublished MSc Project. University of Cape Town, South Africa.

Project sections:

(i) Forage preferences: do domestic smallstock and indigenous herbivores agree?

(ii) Factors influencing spatial distribution of herbivores in a large protected area in the arid Little Karoo, South Africa: the influences of soil chemistry and plant palatability

Submitted – Scientific Papers:

Farmer, H. & Milton, S.J. Forage preferences: do domestic smallstock and indigenous herbivores agree? Submitted to South African Journal of Science.

Farmer, H. Lagomorph distribution across Little Karoo vegetation types. Short note submitted to South African Journal of Wildlife Research.

In Preparation – Scientific Papers:

Farmer, H., Milton, S.J. & van Deventer, C. Vegetation preferences of indigenous herbivores in the Little Karoo. To be submitted to South African Journal of Wildlife Research.

Farmer, H., Kalwij, J.M. & Milton, S.J. Spatially explicit management of herbivores in heterogeneous vegetation. To be submitted to Journal of Applied Ecology.

Farmer, H. Science and management: working together to monitor herbivore impact in a vegetation reserve. To be submitted to Conservation Biology.

In preparation – Popular Articles:

Farmer, H. & van Deventer, C. Afrikaans article (Is game really better than domestic livestock?). To be submitted to Landbou Weekblad.

Farmer, H. The best restaurant in the Karoo. To be submitted to Africa Geographic (if synopsis accepted)

9. Workshop for protected areas managers, game and livestock farmers to share perceptions on herbivore effects on plants of quartz patches

This was combined with the monitoring workshop on 25th January 2005. It was felt that herbivores do have impacts on quartz patches but only at very high stocking rates. It was noted that springbok have been seen to feed on shrubs on quartz patches and that baboons dig up succulents to get at insects in the roots. At the stocking rates currently found on ANR there seemed to be no reason for herbivores to have a negative effect on plants of quartz patches.

4. Did your team experience any disappointments or failures during implementation? If so, please explain and comment on how the team addressed these disappointments and/or failures.

- Placement of sampling grids was based on a vegetation map made for ANR. During the study, a new, updated, map was released. Some of the sampling grids had to be relocated.

- The preference section of the project was initially going to be based more equally on results from field work and the opportunistic animal observation database compiled by reserve staff. The database shrank from approximately 3500 to 2108 observations after data cleaning. The database was spatially biased and data were not randomly collected leading to problems with statistical analysis. As a result, the use of the database had to be decreased. It has been recommended to ANR that opportunistic observations on the reserve be replaced by alternative herbivore population monitoring methods.

5. Describe any positive or negative lessons learned from this project that would be useful to share with other organizations interested in implementing a similar project.

- Cape Nature, particularly Anysberg Nature Reserve, is very open for external academics to perform research.

- If a database belonging to another person or organization is to be used it is imperative that the data collection methods be fully examined as well as the database itself. Opportunistic data collections can be hard to deal with statistically.

- Valuable lessons were learnt during the planning and running of the monitoring workshop. Practitioners were more open to the idea of the workshop and more ready to attend than scientists although all people contacted were interested in feedback. During the workshop the importance of communication and working outside comfort and knowledge zones was emphasized. Important ideas and opinions were learnt from both practitioners and scientists but there was a tendency for scientists to be more limited to their knowledge zones. Managers used case studies to explain and understand and were therefore able to see other points of view more easily. The workshop was successful as an efficient means of disseminating results and learning requirements of the interest group. However, in a mixed stakeholder workshop, good facilitation is required.

6. Describe any follow-up activities related to this project.

- The monitoring protocol developed will be put in place to start in Anysberg Nature Reserve in 2006. It is hoped that the protocol will be applied on some of the neighboring properties as well. Cape Nature has expressed an interest in encouraging wider use of the protocol.

- Further work is needed on the use of soil respiration as an efficient, easily applied and low budget monitoring approach. This could form an Honours or MSc project.

- Collections for the herbarium are ongoing. It is hoped that the digital herbarium will be complete after the 2005/06 flower season.

7. Please provide any additional information to assist CEPF in understanding any other aspects of your completed project.

IV. ADDITIONAL FUNDING

Provide details of any additional donors who supported this project and any funding secured for the project as a result of the CEPF grant or success of the project.

Donor	Type of Funding*	Amount	Notes

***Additional funding should be reported using the following categories:**

A *Project co-financing (Other donors contribute to the direct costs of this CEPF project)*

B *Complementary funding (Other donors contribute to partner organizations that are working on a project linked with this CEPF project*

C *Grantee and Partner leveraging (Other donors contribute to your organization or a partner organization as a direct result of successes with this CEPF project.)*

D *Regional/Portfolio leveraging (Other donors make large investments in a region because of CEPF investment or successes related to this project.)*

Provide details of whether this project will continue in the future and if so, how any additional funding already secured or fundraising plans will help ensure its sustainability.

This project is not planned to continue in future. The monitoring protocol will be worked into management of Anysberg Nature Reserve. Publication of scientific and popular articles and presentation of the work will enable wider dissemination of the work. Cape Nature has expressed an interest in applying the monitoring protocol over a wider area but no funding has as yet been secured to support this.

V. ADDITIONAL COMMENTS AND RECOMMENDATIONS

VI. INFORMATION SHARING

CEPF aims to increase sharing of experiences, lessons learned and results among our grant recipients and the wider conservation and donor communities. One way we do this is by making the text of final project completion reports available on our Web site, www.cepf.net, and by marketing these reports in our newsletter and other communications. Please indicate whether you would agree to publicly sharing your final project report with others in this way.

Yes ___X____

No _____

If yes, please also complete the following:

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