



## SOUTH AFRICA DISSERTATION/THESIS PROJECT

### SA85 Savanna community ecology in a human-affected ecosystem

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## Introduction

Long term data collection is vital for effective management of wildlife, particularly in the fenced reserves that are the base model for wildlife conservation in South Africa. Dinokeng Game Reserve is one such conservancy, created by multiple land-owners contributing their land to allow space for wildlife and to benefit financially. Many landowners still live within the reserve or own commercial property within it. Some landowners opted to not join the reserve, and so effectively became island properties within the reserve that have other land-uses. This creates a busy reserve with a complex mosaic of human activity and disturbance, putting pressure on the resident wildlife. It might be expected that their movement, habitat utilisation and general interactions could be negatively impacted. However, wildlife numbers in Dinokeng are high and populations appear to be in good health. Understanding some of the key underlying community ecology dynamics in this reserve is therefore important to manage the reserve effectively. This project has a broad base, presenting a great opportunity for any student to develop their own specific research question focusing on key species or taxonomic groups of interest (of both flora and fauna).

Opwall and their partners Wildlife and Ecological Investments (WEI) have been collecting baseline data within Dinokeng continuously since 2016. We have inventories of birds, mammals and vegetation; from point counts, vehicle transects and quadrat sampling respectively. Birds are particularly good indicators of ecosystem health because they are highly mobile and can leave poor quality habitats easily in search of better areas. Understanding what feeding guilds of bird are utilizing what areas may also be of interest; this may vary due to vegetation abundance, diversity, structure and the level of mammalian foraging impact within the biodiversity sites. Mammalian habitat selection, age-sex structure, and herd condition links directly to reserve management strategies in South Africa as game is both a natural and economic asset. Again, species cooccurrence, abundance, density and diversity are all of interest. Vegetation type, season, water availability, human disturbance and even relief could all play a role. Vegetation underpins many ecological processes; food-webs, herbivore distribution, predator distribution and animal abundance/diversity are all influenced by vegetation availability. By sampling the same biodiversity sites consistently for a long period of time we can begin to answer questions on, for example: species co-occurrence, the effect of variation in vegetation structure and the drivers of avian abundance and diversity.

These data sets could be taken in isolation or combined to answer questions on community ecology in Dinokeng. Assisting with the management of wildlife and ecological processes within a reserve which houses humans and wildlife simultaneously is both an important and exciting challenge, especially when considering that this type of reserve may be key in the future of African conservation.

Generally, your expedition will be divided between field and camp activities, with the majority of time spent in the field. During time in camp, students will be expected to attend lectures and practicals on African conservation and complete project data entry. The data collected by students is part of a long-term population monitoring and land management project and thus all students joining the Opwall expedition to Dinokeng Game Reserve will assist with all data collection rather than focussing only on the data required for their project. In exchange for assisting the reserve management, students will have access to historical data sets from the reserve and may use them for their research projects.

## **Methods**

### **Bird Point Counts**

The diversity and communities of birds at biodiversity sites are measured with bird point counts in the three hours following dawn, when birds are most active. After a two-minute quietening down period, each bird seen or heard within a 10-minute time-period is recorded. Information on the species, number of individuals, estimated band distance (at 10m intervals), habitat structural use (ground, lower storey, mid storey, canopy, flying) and direction from observer are all noted. Density of birds can be calculated from this data.

### **Mammal Transects**

To count mammals, game transects are driven throughout the reserve along set routes at slow speeds. During these, each time an animal is seen, the species will be identified, the number of individuals recorded, the distance along the transect line, the location of the animals and the habitat type will be recorded in addition to the perpendicular distance of the animal from the observer when first encountered. Using a software program, this distance sampling enables density and population estimates to be calculated.

### **Vegetation Surveys**

Vegetation surveys are carried out in intensively sampled 25mx25m quadrats. The data collected include density and diversity of woody species and grass species and volume. We also measure herbivory or grazing on both trees and grasses, recording impact from specific species, such as elephant, giraffe and rhino. Recording impact from fire also gives us an idea of the impact on specific species and size classes. This data can be used to answer questions on the drivers of plant diversity and regeneration such as elephants and fire and the response in terms of birds as an indicator group. Combining this data can be done in a variety of ways, it is down to you how you what interests you most. You will be expected to participate in all surveys and will learn the necessary skills needed to collect the data accurately and reliably.

## **Summary of Data Available**

- Woody vegetation structure, abundance, diversity, fire impact and herbivory
- Grass biomass, abundance, diversity and grazing impact
- Dung counts at vegetation plot sites
- Large mammal location, abundance, diversity and condition recorded on game transects
- Key mammalian study species note – Impala, Kudu, Plains Zebra and Blue Wildebeest
- Bird abundance and diversity data from bird point counts
- Base habitat map of Dinokeng
- Spatial datasets of roads and properties

By utilizing a portion of these available datasets a prospective student will be able to design and carry out a set of analysis, while also contributing to the long term data collection of Opwall and WEI in Dinokeng using our long-term survey methods. This project is great for someone interested in savanna community ecology, conservation management and spatial ecology.

## Example questions that can be asked for this project

These are some examples of the types of questions that can be answered in this project and serve as a guideline only.

1. Is bird diversity higher in sites with greater elephant impact?
2. Do sites that are closer to human disturbance have a greater number of generalist birds (eg. Crows) and fewer shy and inconspicuous birds compared to other sites of similar habitat elsewhere?
3. Can we predict bird or tree diversity based on NDVI calculated from Sentinel 2 satellite imagery?
4. Does habitat type or road surface have a greater effect on medium-sized ungulates such as impala?
5. Are sex-ratios of common medium-sized ungulate species skewed in a human-disturbed reserve compared to other areas?

## Recommended Reading

- Peron G. & Altwegg R. (2015) Twenty-five years of change in southern African passerine diversity: nonclimatic factors of change. *GLOBAL CHANGE BIOLOGY* 21(9): 3347-3355.
- Eby S. & Ritchie M.E. (2016) Alternative hypotheses for mammalian herbivore preference of burned areas in a savannah ecosystem. *AFRICAN JOURNAL OF ECOLOGY* 54(4): 471-478.
- Landman M., Mqatsa N., Cromsigt J.P.G.M. & Kerley G.I.H. (2019) Elephant effects on treefall and logfall highlight the absence of megaherbivores in coarse woody debris conceptual frameworks. *FOREST ECOLOGY AND MANAGEMENT* 438: 57-62.
- MacFadyen S., Hui C., Verbug P.H. & van Teeffelen A.J.A. (2019) Spatiotemporal distribution dynamics of elephants in response to density, rainfall, rivers and fire in Kruger National Park, South Africa. *DIVERSITY AND DISTRIBUTIONS* 25(6): 880-894.
- Martin J., Benhamou S., Yoganand K. & Owen-Smith N. (2015) Coping with Spatial Heterogeneity and Temporal Variability in Resources and Risks: Adaptive Movement Behaviour by a Large Grazing Herbivore. *PLOS ONE* 10(2) e0118461
- Mtui D.T., Lepczyk C.A., Chen Q., Miura T. & Cox L. (2017) Assessing multi-decadal land-cover - land-use change in two wildlife protected areas in Tanzania using Landsat imagery. *PLOS ONE* 12(9) e0185468.
- Parker D.M. (2019) The elephant in the "room": determinants of songbird assemblages in the Thicket Biome, South Africa. *EMU-AUSTRAL ORNITHOLOGY* 119(2): 157-165.
- Power R.J. & Olivier P.I. (2019) Zoogeography of a South African Province: A framework for management. *AFRICAN JOURNAL OF ECOLOGY* 57(2): 198-211.
- Smit I.P.J. & Archibald S. (2019) Herbivore culling influences spatio-temporal patterns of fire in a semiarid savanna. *JOURNAL OF APPLIED ECOLOGY* 56(3): 711-721.
- van Coller H. & Siebert F. (2019) The impact of herbivore exclusion on forb diversity: Comparing species and functional responses during a drought. *AFRICAN JOURNAL OF ECOLOGY* DOI 10.1111/aje.12676