SOUTH AFRICA DISSERTATION/THESIS PROJECT

Savanna community ecology in a human-affected ecosystem

Introduction

Long term data collection is vital for effective management of wildlife, particularly in fenced reserves, which is the base model for wildlife conservation in South Africa. Dinokeng Game Reserve is one such conservancy, created by multiple land-owners combining portions of their land into one reserve. Donating it to allow space for wildlife and to benefit financially. Some of the landowners within Dinokeng opted to stay within the reserve, only donating a portion of their land, many of them still live within the reserve or own commercial property within it. This creates a busy reserve with a complex mosaic of human activity and disturbance. The wildlife within Dinokeng is therefore under pressure from this human disturbance. 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 how they are making the most of a potentially unfavourable reserve is both interesting and important. 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).

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 are expected to 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.

Opwall and their partners Wildlife Ecological Investments (WEI) have been collecting baseline data within Dinokeng for four years; we have information on birds, mammals and vegetation; from point counts, transects and quadrat sampling respectively. These data sets could be taken in isolation or combined to answer questions on community ecology in Dinokeng. Constant assessment of essential ecological questions is required in order to effectively advise reserve management on the patterns and trends within the community of wildlife in Dinokeng - this is one of the key objectives of both Opwall and WEI. 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. Human population growth, increased wildlife tourism and habitat degradation outside of protected areas is likely to result in a greater need for protected areas incorporating humans as well.

As stated above there are three main data collection methods to be used in this project. 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), estimated height from the ground up (ground, lower storey, mid storey, canopy, flying) and direction from observer are all noted. Game transects are driven throughout the reserve along set routes. 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 GPS

location of the animals (calculated from the GPS location of the vehicle and the distance and direction of the animals to the vehicle), and the habitat type will be recorded in addition to the perpendicular distance of the animal from the observer when first encountered. Vegetation surveys are carried out in intensively sampled 25mx25m quadrats, divided into sections for ease. The data collected during vegetation surveys include density and diversity of woody species, grass volume and measured herbivory impact from specific species, such as elephant, giraffe and rhino. 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.

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 cooccurrence, the effect of variation in vegetation structure and the drivers of avian abundance and diversity. There are many relationships to consider within these datasets which makes them an excellent opportunity for undergraduate research with a strong component of experimental design.

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. By sampling bird life we can make inferences into the health of a new and changing reserve, which is under the process of succession from its previous use as agricultural land. 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 and herd condition is also very important to assess and links directly to reserve management strategies in South Africa, game is both a natural and economic asset meaning it's value is two-fold. Again, species cooccurrence, abundance, density and diversity are all of interest. Especially when habitat variation is considered. Vegetation type, water availability, human disturbance and even relief could all play a role.

Summary of Data Available

- Woody vegetation structure, abundance, diversity, fire impact and herbivory
- Grass biomass, abundance and diversity
- 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

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 standing survey methods. This project is great for someone interested in savanna community ecology, conservation management and spatial ecology.

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., Mgqatsa 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 DI 10.1111/aje.12676