SOUTH AFRICA DISSERTATION/THESIS PROJECT

SA88 Fynbos ecology in the hyper-diverse Cape Floral Kingdom

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The Cape Floral Kingdom of South Africa is the smallest and richest of all the floral kingdoms on Earth. The diversity of fynbos plants is incredible, with over 9000 species of plants, of which over 6000 are endemic, and occur nowhere else in the world. During flowering times, the spectacular shows of proteas, ericas, and different bulbs transform the landscape to a riot of colour. Renosterveld is a type of grassy shrubland fynbos that occurs on fertile soils which are perfect for agriculture. This is why renosterveld is now the most transformed habitat type in South Africa where less than 5% of lowland renosterveld remain, making it a critically endangered vegetation type.

Fynbos is driven by fire and plants have developed different strategies for coping with fire. There is evidence that the CFK supported a diverse large herbivore assemblage in the past, which declined drastically after the arrival of Europeans to the Cape. This means we have limited knowledge of the functional role of large herbivores in fynbos ecosystems, and even less information on how large herbivores and fire can interact to drive these hyper-diverse systems. By setting up long-term experimental plots in conjunction with reserve management, Opwall and its in-country partners WEI, hope to answer the questions of how fire and herbivory separately, and synergistically can alter the diversity of different vegetation types and also animals.

The aim of the vegetation sampling is to assess floristic diversity of different vegetation types in response to large herbivores and fire. The experimental plots will be placed in the three main vegetation types in the reserve to contrast patterns between them: 1) True Fynbos; 2) Renosterveld; and 3) Old fields or Pastureland. In each of these different vegetation types, two experimental plots have been established on north- (dryer) and south- (wetter) facing slopes to establish the effects of moisture on diversity and change after treatment. Each of these six experimental plots (2 plots per 3 vegetation types) consist of four 10 m x 10 m plots (Fig. 1) with the following treatments:

1. Unburned and grazed (open)

2. Unburned and ungrazed (exclosure)

3. Burned and ungrazed (exclosure)

4. Burned and grazed (open)

Within each 10 x 10m plot we will survey the plot by randomly placing 1m2 quadrats on the ground. By intensively sampling these plots we can achieve maximum value for effort as we can build up a catalogue of plant species found in the plots which will make it easier for following groups to survey the same plots. We will catalogue the living and dead coverage of each species (grass and shrub) and record grazing impacts as well as grass volume. Because of the massive diversity in these systems, it is very difficult to identify a high proportion of the plants unless they are flowering. To mitigate this,

we will be categorising each plant according to a functional plant type (e.g. woody shrub or alien species).

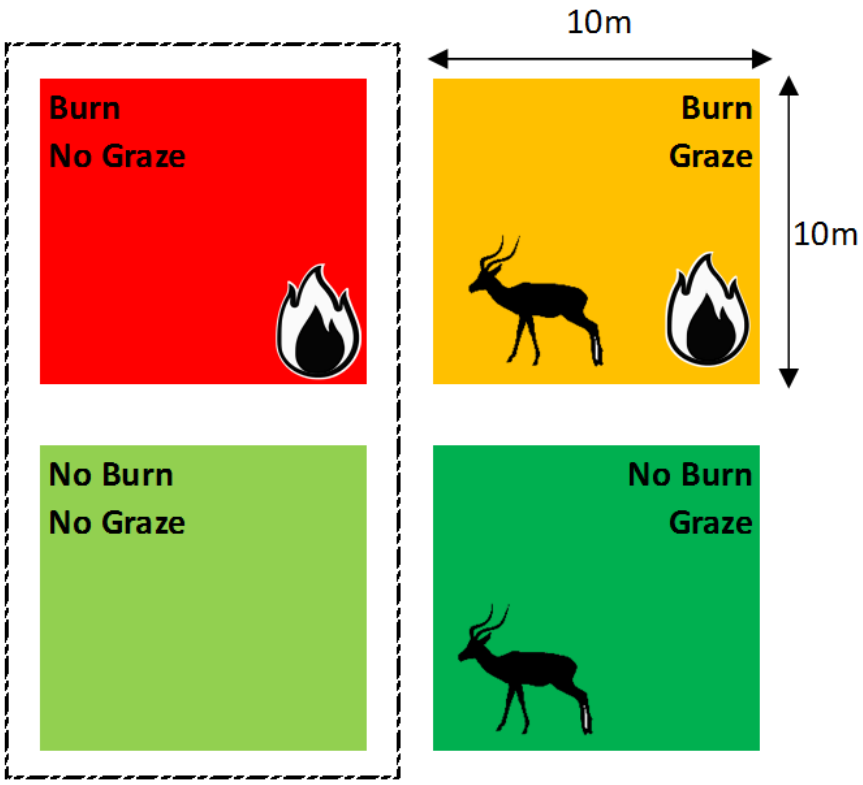

Figure 1. Experimental plot factorial design where each block represents 10 m2 and two blocks are fenced in (exclosed from herbivory) and two blocks are burned.

Students will also be conducting bird point counts at the same sites as our vegetation surveys. The diversity and communities of birds in the plots 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. The species, number of individuals, estimated band distance (at 10m intervals), estimated height observed (ground, lower storey, mid storey, canopy, flying), direction from observer.

Students time will be divided between field and camp activities, with most of the time spent in the field. During time in camp, students will be expected to attend lectures and practicals on African conservation and complete their data entry and processing. There will also be time to add to the on-going reference herbarium which identifies the most common plant species. 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 Gondwana Game Reserve are expected to pitch in and assist with all data collection rather than focussing solely on the data required for their project. In exchange for assisting the reserve management with their conservation project, students will have access to the long-term data sets that belong to the reserve and may use them for their research projects.

Recommended Reading

Barnard, Phoebe, et al. (2017), 'Early warning systems for biodiversity in southern Africa - How much can citizen science mitigate imperfect data', *Biol. Conserv.*, 208: 183-88.

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Cousins, S.R., Witkowski, S.T.F., and Esler, K.J. (2017), Influence of fire on critically endangered Swartland Shale Renosterveld in the Cape Floristic Region. Applied Vegetation Science 21: 144-155.

Jenkins, Julia, et al. (2013), 'The value of the Black Harrier Circus maurus as a predictor of biodiversity in the plant-rich Cape Floral Kingdom, South Africa', *Bird Conserv. Int.*, 23(1): 66-77.

Kraaij, T. & Novellie, P.A. (2010), Habitat selection by large herbivores in realtion to fire at the Bontebok National Park (1974-2009): the effects of management changes. African Journal of range and forage science. 27: 21-27.

Kraaij, Tineke, et al. (2017), 'Vegetation responses to season of fire in an aseasonal, fire-prone fynbos shrubland', *PeerJ*, 5.

Kraaij, Tineke, Richard M Cowling, and Brian W van Wilgen (2013), 'Fire regimes in eastern coastal fynbos: Imperatives and thresholds in managing for diversity', *Koedoe*, 55(1).

Lee, Alan T K and Phoebe Barnard (2017), 'How well do bird atlas reporting rates reflect bird densities? Correlates of detection from the Fynbos biome, South Africa, with applications for population estimation', *Ostrich*, 88(1): 9-17.

Lee, Alan T K, Dale Wright, and Phoebe Barnard (2017), 'Hot bird drinking patterns: drivers of water visitation in a fynbos bird community', *Afr. J. Ecol.*, 55(4): 541-53.

McEwan, Cheryl, Alex Hughes, and David Bek (2014), 'Futures, ethics and the politics of expectation in biodiversity conservation: A case study of South African sustainable wildflower harvesting', *Geoforum*, 52: 206-15.

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Van Wilgen, B. (2013), Fire management in species-rich Cape fynbos shrublands. Front. Ecol. Environ. 11: e35–e44.

Wuest, Rafael O, et al. (2019), 'Dissecting biodiversity in a global hotspot: Uneven dynamics of immigration and diversification within the Cape Floristic Region of South Africa', *J. Biogeography*, 00: 1-12.