CEPF MPAH BOTSOC GRANT 59606: Appendix 1

BIODIVERSITY MONITORING IN KWAZULU-NATAL MESIC GRASSLANDS

Development of a long-term monitoring project to investigate the relationship between plant diversity and rangeland condition at biodiversity stewardship sites in KwaZulu-Natal mesic grasslands with managed grazing regimes.

Forb-rich mesic grassland at a biodiversity stewardship site in KwaZulu-Natal.

The primary aim of this project is to determine the effect of controlled stocking rates on plant biodiversity in biodiversity stewardship nature reserves through monitoring plant diversity and rangeland condition. It should be noted that this study is still in the preliminary stages and no conclusive results have been obtained as yet. However it is anticipated the ongoing results obtained from this investigation, together with those from tertiary institutions and others, can assist in resolving meaningful scientific questions around the impact of livestock grazing on grassland biodiversity in mesic grasslands.

Introduction

KwaZulu-Natal mesic grasslands experience high rainfall in the growing season and frequent fires in the dry season. They are characterised by long-lived tufted sourveld grasses and geophytic and bulbous forbs with limited capacity to recover from intensive disturbance. By far the majority of species are re-sprouters rather than re-seeders and there is typically little recruitment in intact areas. Although currently under debate it is thought that historic intensive grazing by mega-herbivores was not significant and that these grasslands are therefore not adapted to high density stocking rates (Uys, 2006).

Traditionally grassland studies have concentrated on grass species because of their role in animal production. However while grasses make up the bulk of grassland phytomass they contribute comparatively little of the total plant species richness. Forbs[1] may constitute over 80% of the total plant species richness of mesic grasslands in KwaZulu-Natal, which also have amongst the highest reported rates of forb species depletion with heavy grazing (Scott-Shaw & Morris, 2014). Therefore it is important that forb species measurements are routinely included in assessments of the response of mesic grassland to grazing and other disturbances.

Many biodiversity stewardship sites, including those declared as nature reserves in terms of the Protected Areas Act, are subject to cattle grazing. Although a large body of scientific knowledge exists around veld management aligned with animal production, there is little scientific understanding of the drivers of loss of biodiversity associated with livestock grazing, particularly in mesic grasslands. As it is a critical to maintain biodiversity levels of biodiversity stewardship sites, a monitoring programme to determine the effects of cattle grazing at biodiversity stewardship sites was established in 2012. This programme is a combined effort between the Botanical Society and the Biodiversity Stewardship Unit with assistance and advice from partners including the Natural Resources Division of the KwaZulu-Natal Department of Agriculture at Cedara and NGO partners

[1] 'Forbs' are herbaceous flowering plants that are not graminoid (i.e. not grasses, sedges and rushes).

Linking this monitoring programme to the biodiversity stewardship programme provides the opportunity to develop a long-term reliable dataset, as an ongoing relationship exists with the sites in which management interventions around livestock grazing can be carefully observed and recorded. It is envisaged that this will ultimately influence adaptive management recommendations with regard to stocking rates at these sites.

Methods

The biodiversity monitoring will be undertaken in the same locations in which rangeland condition assessments are undertaken at the biodiversity stewardship sites, as this will enable comparisons to be made between rangeland condition as measured for grazing capacity and stocking rates of livestock and plant biodiversity condition. Forb and rangeland condition measurements will be carried out at the same fixed sites to eliminate variation. As forb diversity plots are considerably more time-consuming than rangeland condition plots, not as many replicates can be obtained. We plan to repeat these measurements at approximately five year intervals in order to discern long term trends. This is thought to be the shortest time period to detect changes in species composition, at least for grasses.

Forb diversity measurement methods

In order to maintain consistency and comparability with previous data we used the method developed by Rob Scott Shaw of EKZNW (Scott-Shaw & Morris, 2014) which records all plants in 16 x one m^2 subplots randomly placed within a $100m^2$ plot. This gives measures of species richness, abundance and evenness. A further 20m x 20m including the 10m x 10m plot would be sampled. All plants that occurred within the plot area that had not been sampled in 16 1m x 1m quadrates would be identified and listed. In addition, any other plants species of significance in the property will be identified and listed – these will include alien plant infestations or rare and threatened species that the landowner, DCO or regional ecologist is aware of. The number of plots in biodiversity stewardship site will be determined by the heterogeneity of the site and, as far as possible, will be undertaken at the same locations as the veld condition assessments undertaken.

Measuring forb diversity at Bosch Berg Nature Reserve January 2014

Rangeland condition measurement methods:

Rangeland condition assessments were carried out following the method of (Camp & Smith, 1997). Grass species nearest to 200 random points in a 25x50m plot were recorded, their ecological grouping and grazing value used to calculate the rangeland condition score. This score ranges from very good >90% to critical <30% of the benchmark for the Bioresource Resource Group (Camp & Smith, 1997). From these results the grazing a grazing capacity and stocking rate for the camp can be assigned.

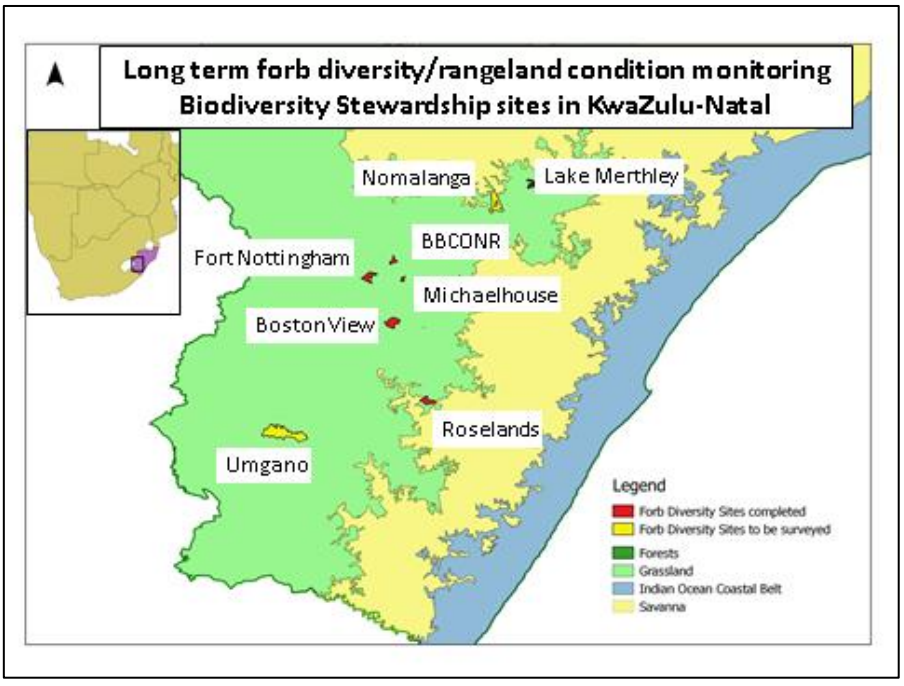
Rangeland condition reports and management recommendations are made to the landowner based on the results of the rangeland condition surveys. Regular follow-up meetings should be held with the landowner/manager in order to ascertain whether these management recommendations are being followed.

Follow up repeat assessments at approximately five yearly intervals will be done at the same plots to determine whether plant biodiversity has increased, decreased or remained constant. Rangeland condition reports will ascertain whether grazing quality of the grassland has improved or degenerated. This should give an indication over a time scale of whether there is an interaction between these two indicators. Rainfall and other factors need to be taken into account.

Management recommendations will be adjusted based on these findings.

Rangeland condition assessment at Babanango/Emcakwini in January 2015

Biodiversity Stewardship sites at which monitoring sites have been established thus far are Bill Barnes Crane and Oribi Nature Reserve, Bosch Berg Nature Reserve and Boston View Biodiversity Agreement site, Fort Nottingham Nature Reserve, Lake Merthley Nature Reserve, Michaelhouse Nature Reserve and Roselands Nature Reserve (Fig. 1). Nomalanga and Umgano Nature Reserve surveys are scheduled for the current season (2015/2016) and will be carried out when there has been sufficient rainfall

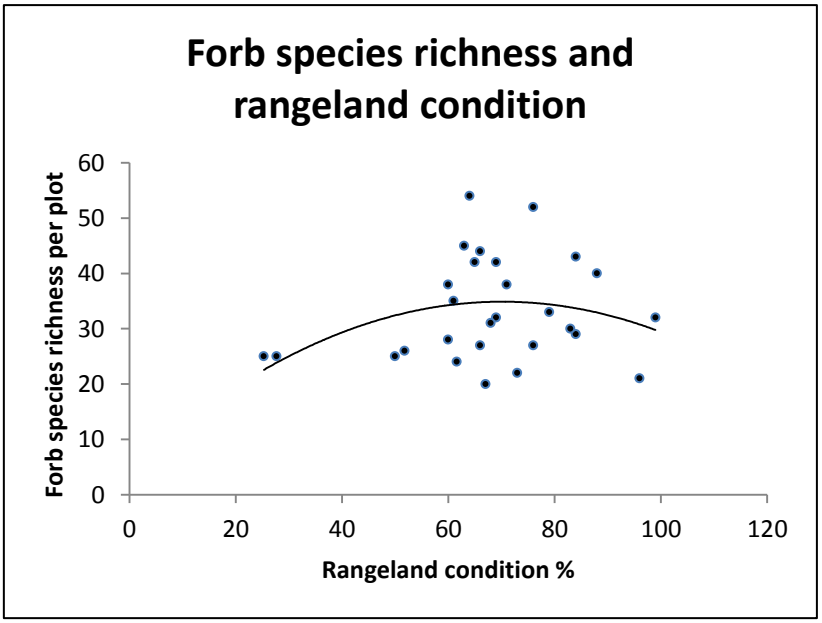


Map showing location of long term biodiversity monitoring plots.

Results and discussion

Most plots in biodiversity stewardship properties had rangeland condition scores ranging from 60 to 80% of the benchmark. This was to be expected since grasslands in very poor condition are not selected for conservation in the Biodiversity Stewardship Programme unless there are threatened species present. Forb species richness ranged from 22 to 54 species per plot. These results are similar to those found by Scott-Shaw & Morris (2014) in Mistbelt grassland.

Preliminary results based on these initial surveys indicate that there is no clearly defined relationship between plant diversity and rangeland condition, except that forb diversity is generally lower in very poor rangeland condition areas. This is similar to the findings of other studies (Ngwenya, 2012; O'Connor , Kuyler , Kirkman & Corcoran, 2010; Scott-Shaw & Morris, 2014) in KwaZulu-Natal mesic grasslands.



Graph showing relationship between rangeland condition (%) and forb species richness in the plots sampled in this study at biodiversity stewardship sites.

The aim of the study is to monitor the long term changes in response to grazing management regimes and these initial results will form the baseline for future assessments at the same plot positions. Thus while there is no discernible trend from the current results, the trends over time are the focus of the investigation.

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