Earth Observation for Rangeland Monitoring

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INTRODUCTION

Grass nitrogen (N), as an indicator of rangeland quality, plays a crucial role in understanding the distribution, densities and feeding patterns of both wild herbivores and livestock.

Zebras and livestock in the grazing and agricultural lands

- How can grass nitrogen be mapped for assessing and monitoring of rangeland quality at wider or regional scales?
- Conventional point-based techniques for assessing rangeland quality proved to be expensive, laborious and time consuming.
- The emergence of high resolution multispectral sensors with red-edge information such as WorldView-2, RapidEye, Sentinel-2 (to be launched in 2013) and SumbandilaSAT moves remote sensing towards routine assessment and monitoring of rangeland resource quality.
- The objective of this study is to estimate and map grass N as an indicator of rangeland quality.

METHODOLOGY

- Grass samples on various selected plots were collected in the field. Chemical analysis was done to extract leaf N (%) from the samples.
- Leaf N was multiplied by the fraction of photosynthetic vegetation (PV) to derive canopy N (unit-less).
- RapidEye images were acquired at the same time as field data collection.
- Red edge based vegetation indices were computed, and correlated with leaf N.
- The best performing vegetation index was combined with environmental variables using multivariate statistics (henceforth referred to as the integrated modelling approach) to map leaf and canopy N.
- The conceptual framework for the methodology is presented in **Figure 1**.

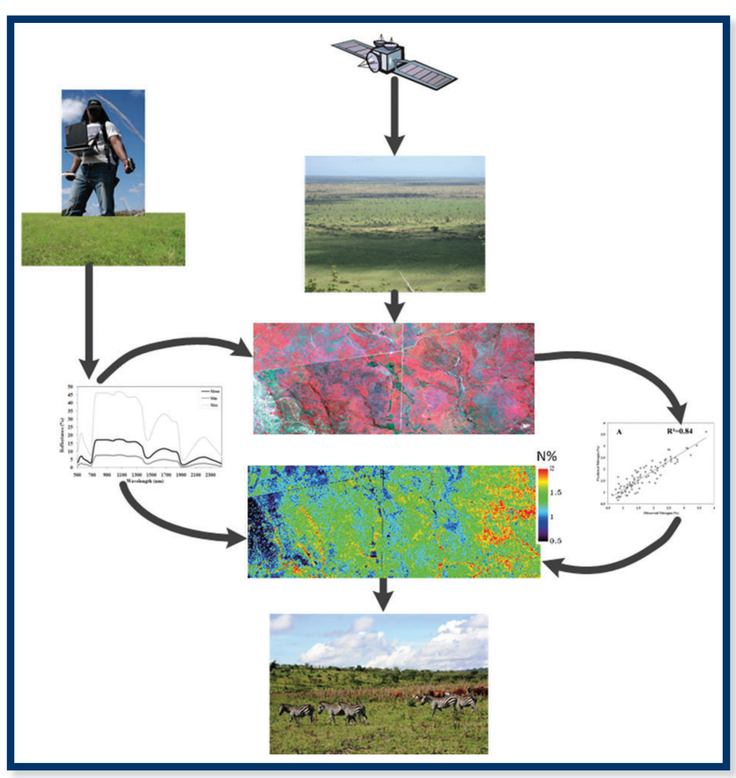
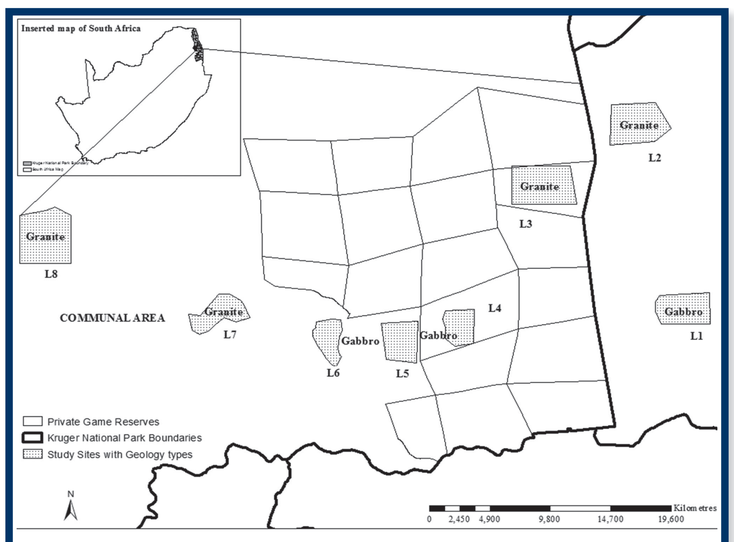


Figure 1: Conceptual framework for the development of grass nutrient estimation models, using remote sensing at various scales

The emergence of high resolution multispectral sensors with red-edge information such as, WorldView-2, RapidEye, Sentinel-2 (to be launched in 2013) and SumbandilaSAT moves remote sensing towards routine monitoring of rangeland resource quality.

RESULTS

- The integrated modelling approach explained between 48% and 64% of leaf and canopy N variability in the study area.
- Leaf and canopy N conforms to the underlying geology (**Figure 2**).



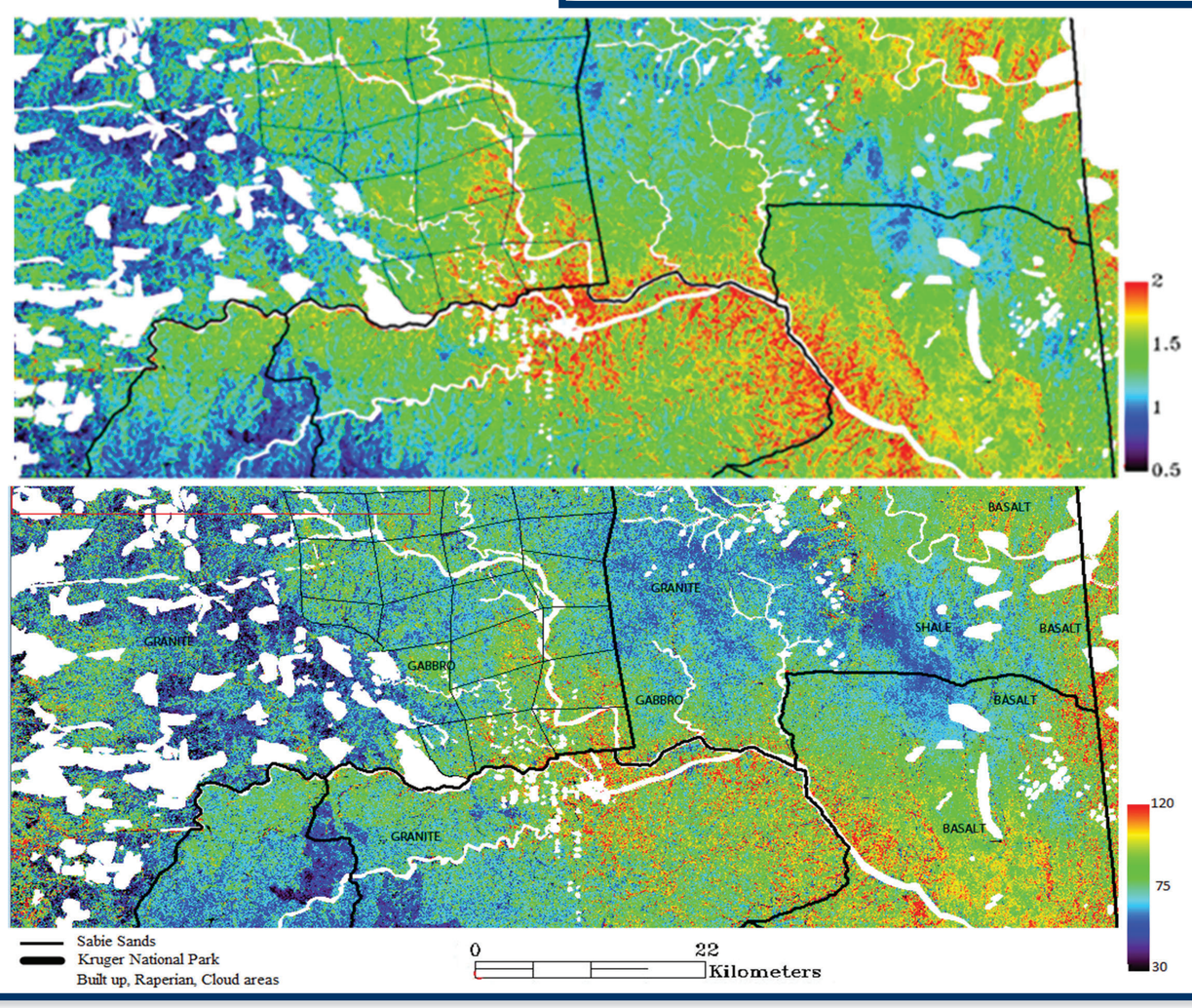


Figure 2: Spatial distribution of the leaf (middle) and canopy N (below) as indicators of rangeland quality, showed together with the study area map (top). Nutrient maps extracted from a published paper: Ramoelo et al. 2012, International Journal of Applied Earth Observation and Geoinformation, 19, pp. 151-162

CONCLUSION

- The study exhibits a potential to estimate and map grass nutrients at a regional scale which is important for planning and management of rangeland resources.
- Techniques to estimate grass nutrients across various seasons, using physically-based or radiative transfer models, are being further developed.

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