Società Italiana di Agronomia
52° Convegno Nazionale

La ricerca agronomica per la transizione verde

Portici, 25-27 settembre 2023

Quantifying Non-Photosynthetic Vegetation in a Mixed Grassland Using Hyperspectral Data: A Case Study in Kenya

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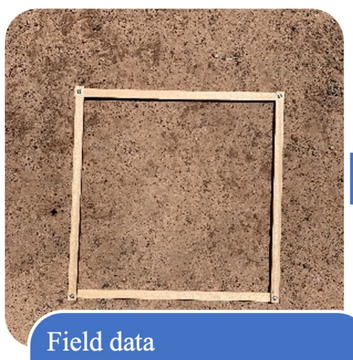
Introduction

NPV is important in water, nutrient, and carbon cycling in agroecosystems, making it a key variable to be mapped using satellite data. New generation spaceborne hyperspectral sensors like PRecursore IperSpettrale della Missione Applicativa (PRISMA) sense the 0.4-2.5 µm spectral range with narrow bands, thus offering unprecedented opportunities for NPV mapping in crops and grasslands exploiting subtle absorption features.

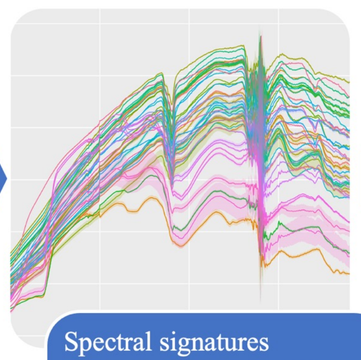
Objectives

This study is a first attempt to quantify the NPV fraction in a semi-arid grassland site located in Kenya. We have first applied a model already developed and calibrated for crop analysis to predict grassland NPV from field spectral reflectance data. The second step will be to refine the model and apply it to the PRISMA image to obtain a quantitative map.

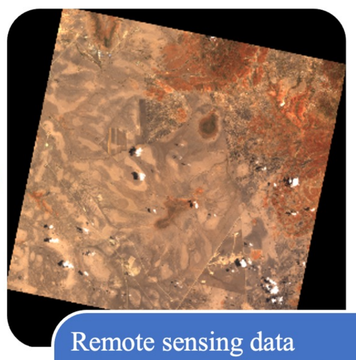
Materials and Methods



Field data
- Nadir photos are taken with the aim of capturing the range of NPV values from 0% to 100%.
- The collected data is classified into categories of NPV and bare soil using the SamplePoint software.



Spectral signatures
- Application of the RF model, originally designed for the cropland domain, trained with a large spectral library resampled to PRISMA resolution. The goal is verify its portability towards grasslands domain.

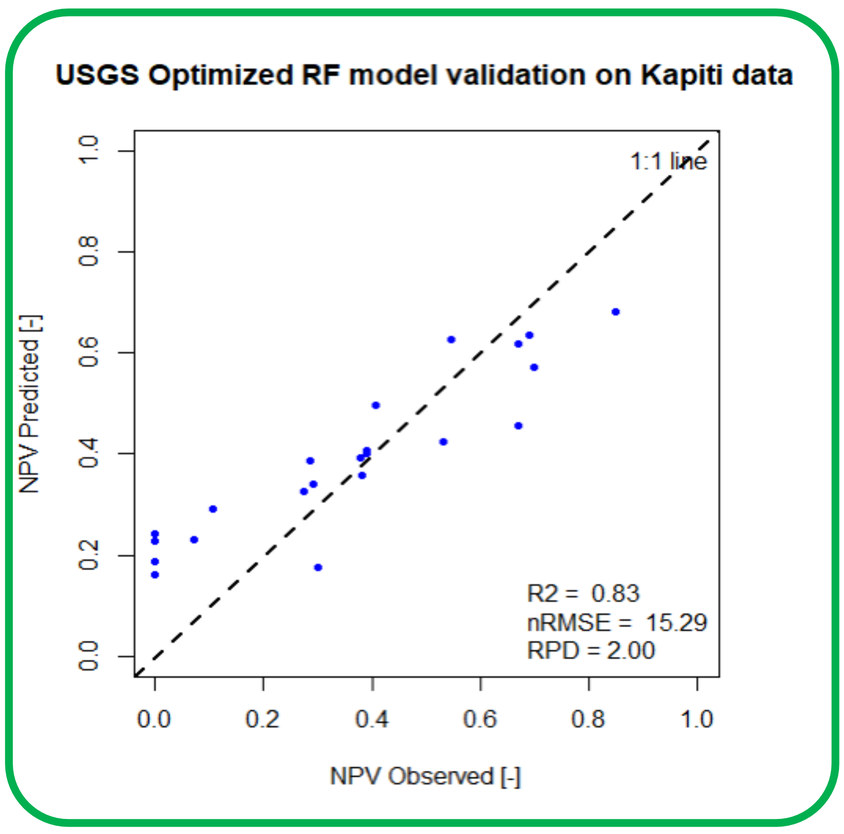


Remote sensing data
- The PRISMA image is pre-processed using a specific chain of procedures.
- The RF model coefficients are applied on the PRISMA hyperspectral image.

1. The file is imported and converted using the prismaread algorithm.
2. Coregistration is performed using the AROSICS Python library.
3. The data is then subjected to a smoothing process.

Results

From the statistical analysis the model proved to be robust enough to be further tested on PRISMA data for NPV mapping over the whole study area (**R2** ~ 0.83; **RPD** ~ 2.0; **nRMSE** ~ 15.3).



Conclusions

Overall, our findings demonstrate the potential of hyperspectral remote sensing to assess NPV on mixed grasslands and the robustness of a RF model trained with a large spectral library for crops also for heterogeneous grassland vegetation. Overall, this work can open up a new frontier of research on extensive pastoral environments, which have been little studied so far, thanks to the use of models and latest generation hyperspectral sensors.

The algorithm development was co-founded in the framework of the ASI - PRIS4VEG project [Contract 2022-5-U.0], the application to rangeland is performed within the framework of the ESA HyRELIEF project [Contract No. 4000139461/22/I-DT], the attendance at the conference is supported by the Path of Excellence at the University of Milan