

Socio-ecological network analysis for grasslands conservation management in Argentina, Colombia and Paraguay

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Introduction

- We can use satellite multispectral and hyperspectral information (e.g. EnMAP) to predict detailed features of terrestrial ecosystems.
- However, there is a lack of application of these products to know the conservation status of grasslands and savannahs in Latin America.

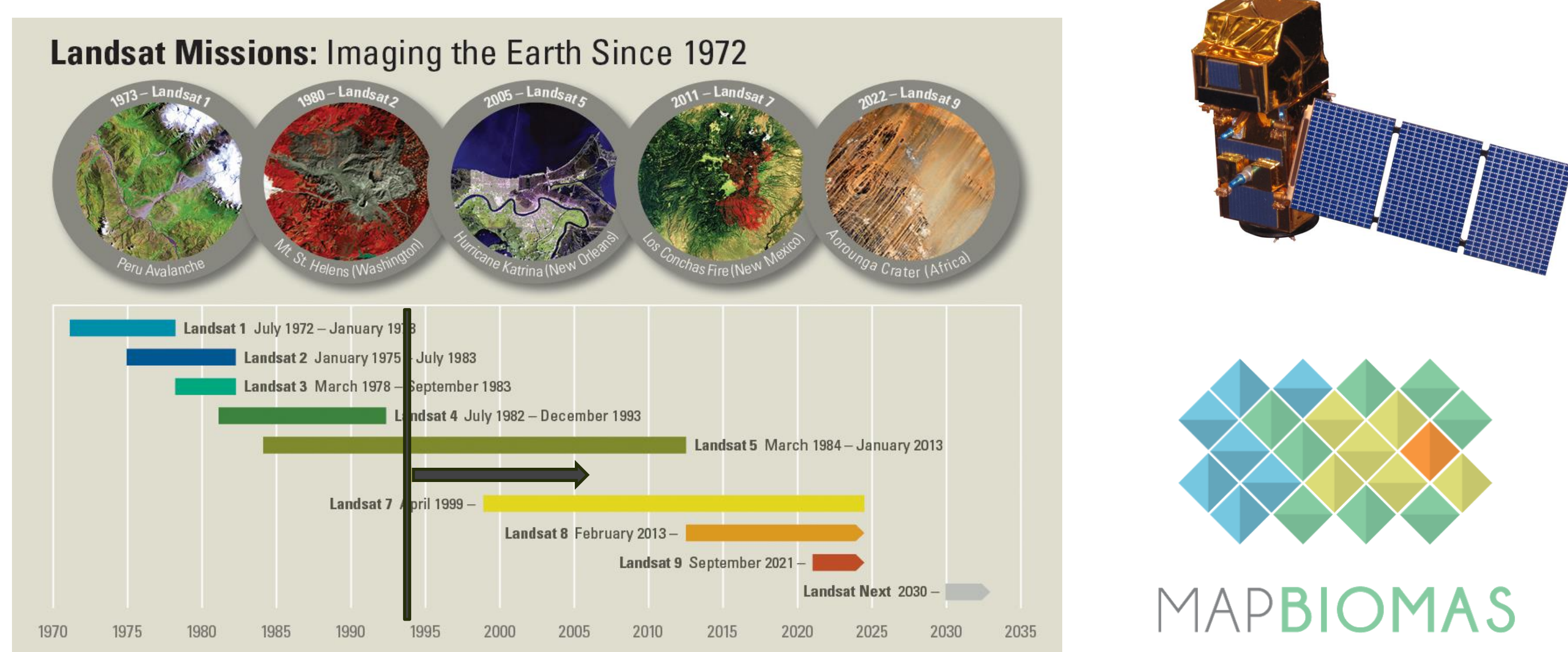
Objective

- Explore the conservation status and efforts in Latin American grasslands through the analysis of the relationship between the spatial distribution of socio-ecological components in complex networks.

Methodology

Spatiotemporal Analysis of Satellite Information

To understand the productivity dynamics in private reserves over the last 30 years we proposed to use spectral indices derived from Landsat and Sentinel-2 collection available in GEE.



- Red edge Chlorophyll index (CIR)
- Inverted Red-Edge Chlorophyll Index (IRECI)
- Perpendicular Vegetation Index (PVI)
- Soil Adjusted VI (SAVI)
- Transformed soil adjusted VI (TSAVI)
- Soil Adjusted Ratio VI (SAVI2)

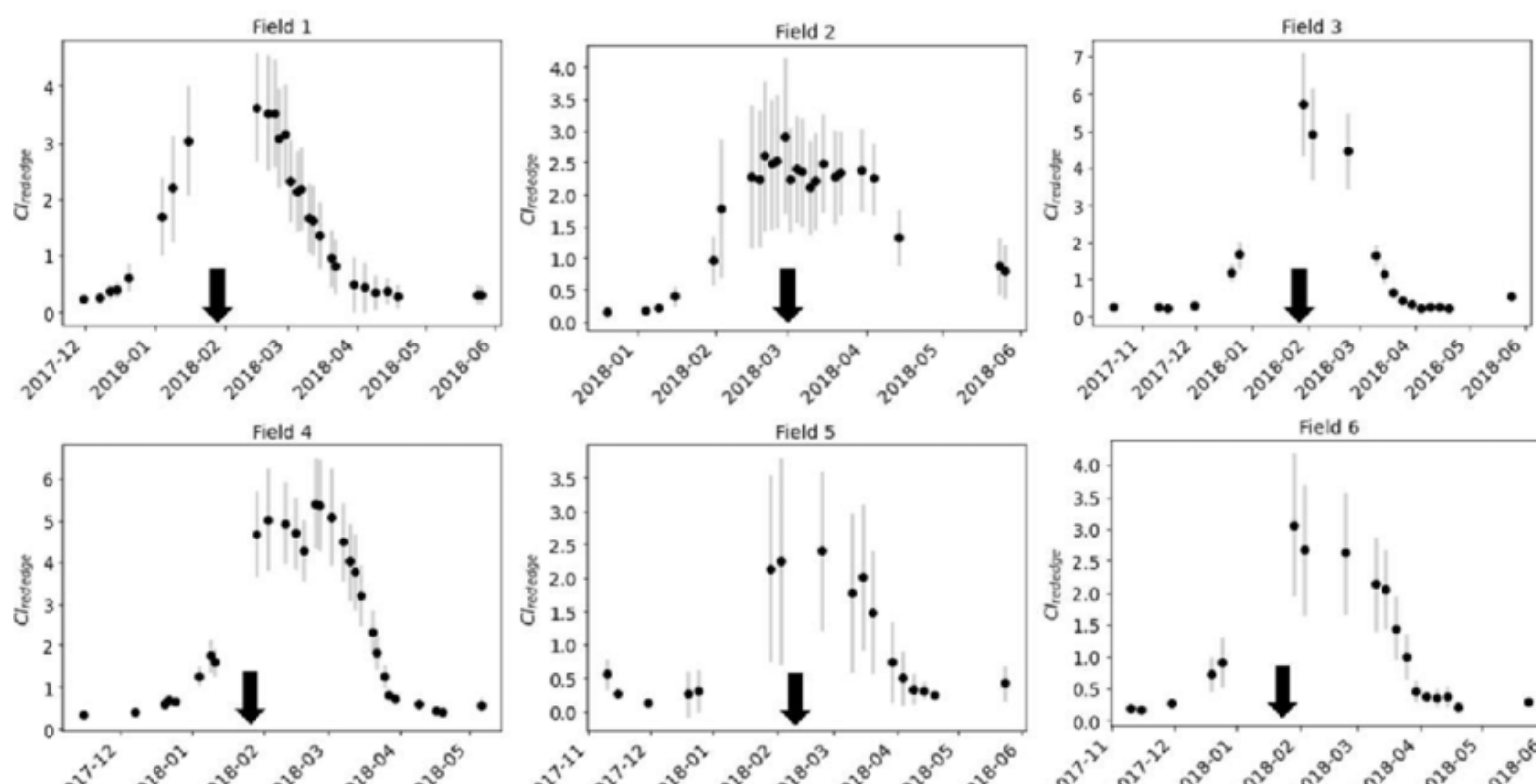
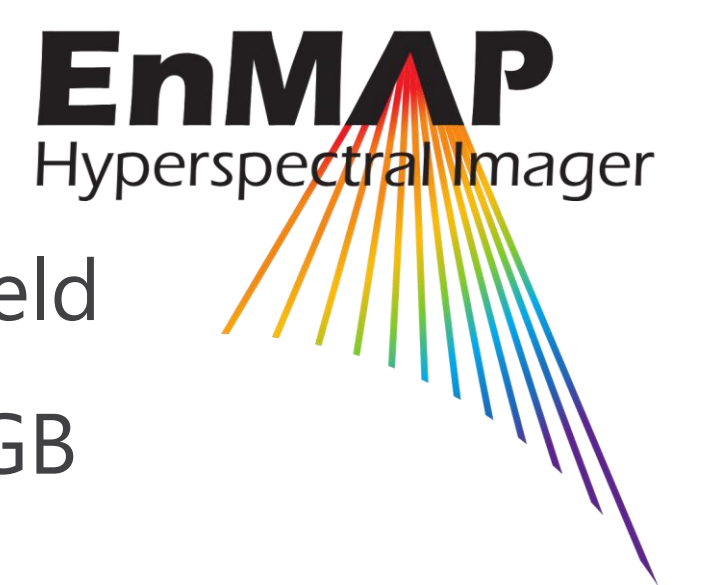


Fig 1. Indices and products to explore productivity dynamics in grasslands and savannahs inside private reserves in the three countries. Taken from Gaso et al. (2021)

First insights

- In South America, some conservation indices of grasslands has been developed to know the conservation contribution from farmers, this could be support and probably estimated using RS information.
- The use of spectral indices related with chlorophyll content and the vegetation reflectance in red and red-edge can be used to analyze productivity dynamics in these ecosystems.

Prediction of Biophysical Parameters



We propose to use Machine Learning models and on-field characterization to predict biophysical parameters as AGB and pastures' height, features related to biodiversity occurrence data using Multispectral (Sentinel-2) and Hyperspectral Information (EnMAP).



Conservation gradient

Reserves Silvopastoral systems Intensive cattle systems

Fig 2. On-field sampling methodology proposed to characterized the management gradient.

Construction of Socio Ecological Networks (SEN)

To do a comparison between the three studied countries Argentina, Colombia and Paraguay, we proposed to do a network analysis, since the characteristics, ecosystems and species compositions are different between countries due differences in the Latitude and climate regimes.

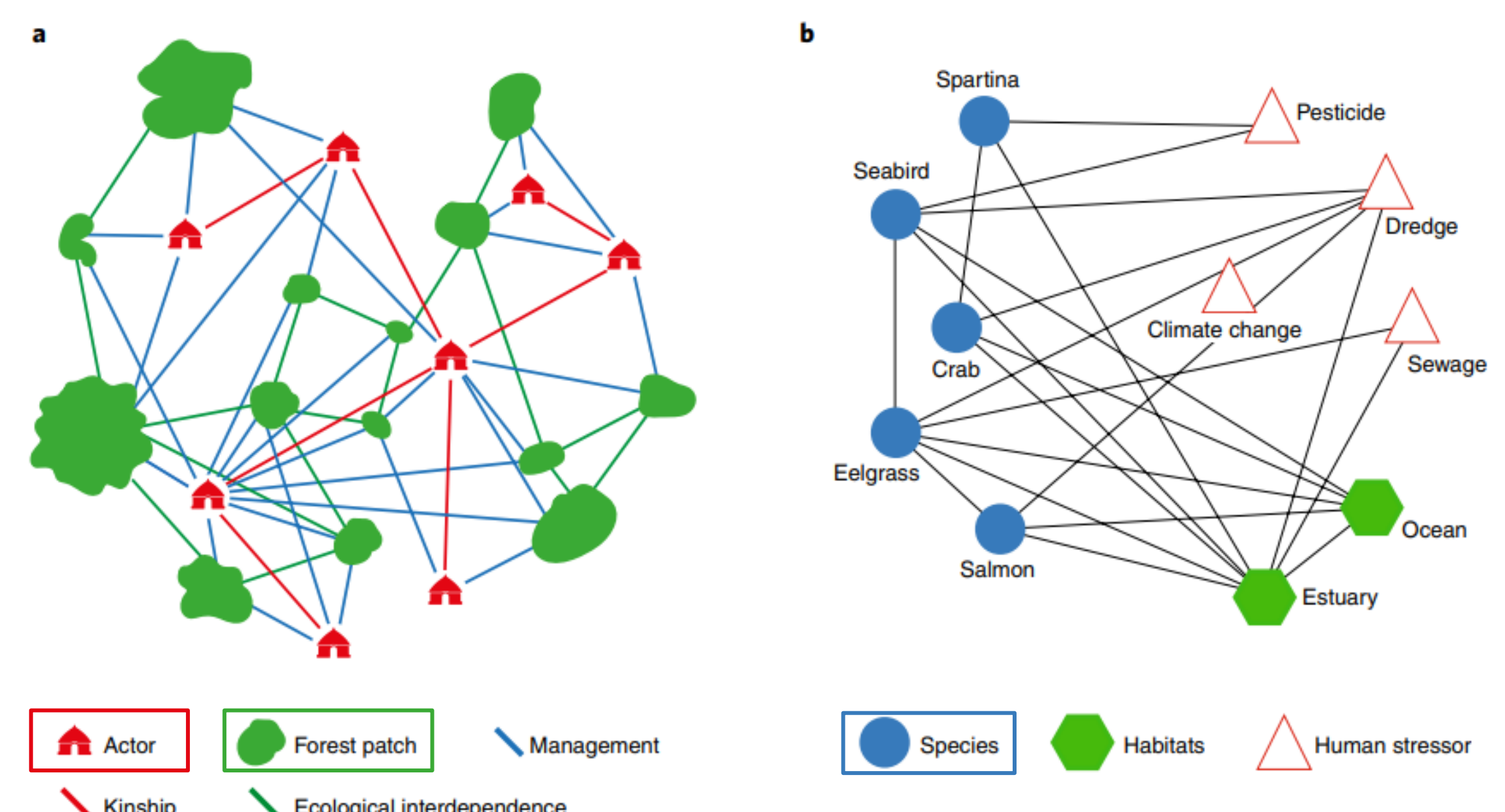


Fig 3. Example of Socio Ecological Networks, where nodes can represent habitat patches, location of social actors and species occurrences, while links represents relationships between them. Taken from Bodin et al. (2019)

Challenges and possibilities

- A clear identification of natural or semi-natural grasslands it is difficult especially backwards and depends on the season and the phenology of the species.
- There is an opportunity to estimate biophysical parameters which can help to understand the management and conservation status in some protected areas using Sentinel missions.
- Using the infrastructure and products derived from initiatives as MapBiomass and iNaturalist we can understand the ecosystem and the distribution of species present in grasslands and savannahs.