CONTEXTUAL SOCIO-ECOLOGICAL TYPES IN KESRA

Authors Zahra Shiri 1,2, Quang Le Bao 1, Aymen Frija 1 , Hichem Rejeb 2

1 International Center for Agricultural Research in the Dry Areas (ICARDA), Tunisia. 2 National Agronomic Institute of Tunisia

Introduction

Tunisian agriculture has always tried to adapt to the increase in food demand for centuries, and the modes of agricultural production have been gradually transformed. Notably, agriculture was intensified, through productivist orientations, with increased land degradation. The opportunities of a sustainable development are more and more weakened. Focusing only on economically profitable agricultural systems has heavily aggravated the agro-environmental landscapes with increasing risks and uncertainties.

The impact of agricultural activities on the environment and its less favorable consequences on resources such as land support and water resources are more harmful in mountainous areas than in the plains since mountain agriculture has specific characteristics: difficult natural environment related to altitude and climate, fragility of natural resources and land resources, the sharp decline in the number of farms due to social and geographical isolation.

The management of natural resources or the farm management at the local level in the mountainous areas need a deep and specific analysis to study the social system (users, managers and governance institutions using technologies and infrastructures) who manage artificial and natural resources. Analyzing socio-ecological context allow encompassing the complexity of the social, ecological and socio-ecological interactions. Hence becomes the necessity to understand the global landscape through different types of socio-ecological context. Understanding these types is important for developing effective strategies for sustainable development, conservation, and adaptation to environmental changes.

Aim

- This study is done in order to identify the different socio-ecological contextual types (CSETs), in the northwest of Tunisia, Kef and Siliana governorates.
- Testing the functionality of these CSETs.

Method

The study took place in the governorate of Siliana, in the delegation of kesra (figure 1), kesra is a part of upper semi-arid bioclimatic stage. The mountain of Kesra is located at an altitude of 1245 m is distinguished by its very uneven relief and soils and water resources (Abaza, 2021). The current vegetation cover of Kesra is a mosaic of plant units composed of floristic groups (rare, endemic and biodiversity-relevant species) of different ecological affinities interwoven into the landscape of the region (Abaza, 2021) and (Mars et al., 2009).

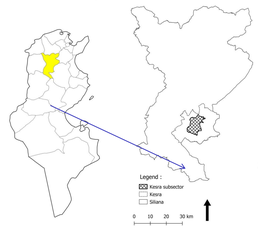

Figure 1. Geographical location of the study site (produced by QGIS)

We followed four steps to get functional context socio-ecological types (fCSET): (I) Used Data, (II) Contextual Socio-Ecological Types identification, (III) Testing the Functionality of CSETs, and (IV) fCSET cartography.

I

Categories	Variables
Biophysical (16 varirables)	✓Climatic (3) ✓Topographic (2) ✓Land cover/use (1) ✓Soil quality constraints (7) ✓Livestock densities (3)
Accessibilities (3 varirables)	✓Distance to road ✓Distance to town ✓Distance to water body
Population Pressure (3 varirables)	✓Pop density ✓Rural pop density ✓Pop density change
Economic Development (2 varirables)	✓Gridded GDP per capita ✓Gridded GDP growth

II

Principal component analysis for identifying key variables

⇩

K-mean cluster analysis (K-CA) for classifying multi-variate contextual types

⇩

Identify suitable number of clusters

⇩

Clustering and CSET identification

III

Testing the significance difference of an indicator (NPP mean and NPP slope) by factor (CSET) using ANOVA

The NPP of ecosystems refers to the net content of dry organic matter produced by vegetation

$$NPP = GPP - Ra \text{ (gC, surface-1, time-1)}$$

NPP = Net Primary Productivity
GPP = Gross Primary Productivity
Ra = Autotrophic respiration

IV

Functional contextual socio-ecologic types cartography using ArcView to represent the spatial distribution of different fCSET within the region.

Results

In the delegation of Kesra, 13 fCSET were identified with a heterogeneous spatial distribution and different types (figure 2). Heterogeneity of socio-ecological contexts refers to the variations that exist between different ecological and socio-economic contexts. These variations can be due to many factors, such as geography, climate, history, culture, economic and social structure (Abaza, 2021), (Alary et al., 2022), (Jorry et al.,2003) and (Abaza, 2016), Different contexts socio-ecological types have different characteristics, (figure 3 and 4) for an example of a dominant fCSET Cropland rainfed in marginalized and inaccessible dryland with an area equal to 4800 ha and fCSET Cropland rainfed with herbaceous cover in difficult mountainous sloping land with an equal to 1600 ha.

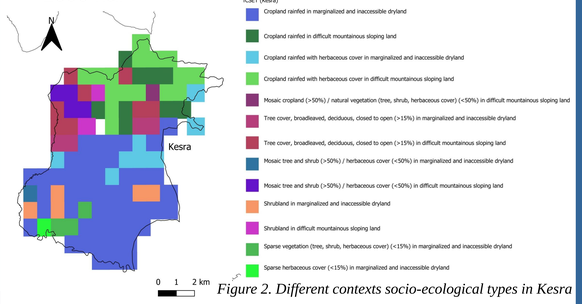

Figure 2. Different contexts socio-ecological types in Kesra

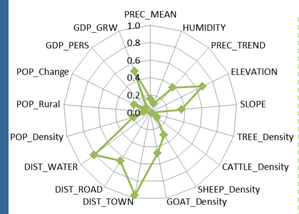

Figure 3. fCSET Cropland rainfed in marginalized and inaccessible dryland

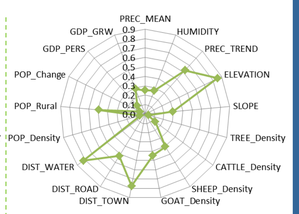

Figure 4. fCSET Cropland rainfed with herbaceous cover in difficult mountainous sloping land

The difference in NPP mean among context socio-ecological types is significant which demonstrate the functionality of these types (figure 5)

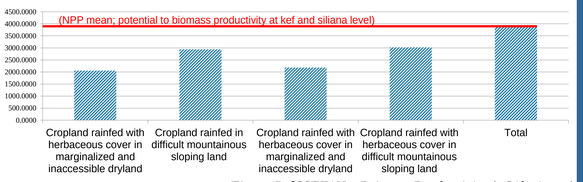

Figure 5. fCSET/ Net Primary Productivity (gC/ ha/ year)

Discussion

- The landscape is defined by its diversity and complexity (Newman, 2019), many context specific conditions (Biophysical, accessibilities, population pressure, economic , development) impacts the effectiveness of different interventions, therefore identifying these conditions is crucial (Vera et al., 2022) for impact assessment and innovation scaling.
- The context of the study area shows a high degree of diversity compared with other zones in the transect of Kef and Siliana which emphasizes the importance of taking into consideration this specificity during interventions' co-design process.
- The results showed low net primary productivity (NPP), reflecting the scarcity of resources and the low dynamics of biodiversity. This can be explained by the high level of human appropriation, which creates high pressure on resources in the mountainous lands of Kesra and surroundings.

Conclusion

The heterogeneity of socio-ecological contexts in Kesra can make it difficult to develop effective environmental and sustainable development policies that meet local needs. Therefore, it is important to understand the complexity and diversity of social-ecological contexts and to take these differences into account when planning and implementing environmental and sustainable development policies, in agroecology transition.

However, it is important to note that the diversity of socio-ecological contexts can also lead to inequalities and conflicts between different communities and social groups. It is therefore essential to adopt an inclusive and participatory approach to environmental management and sustainable development, involving the various stakeholders in the decision-making and implementation processes. This means that environmental management and sustainable development strategies must be adapted to specific contexts to be effective.

Acknowledgements

This work is supported by the CGIAR initiative on Agroecology.