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BOOK OF ABSTRACTS

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Species distribution modelling for mapping tree diversity in Sahelian agroforestry farming systems: A case study of Faidherbia albida parkland in Senegal

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The paramount importance of agroforestry systems (AFS) for African smallholder farmers and the myriad of ecosystem services provided are no longer to be demonstrated in a context of climate change. Used for centuries by farmers that have contributed to shape Sahelian AFS, studies reported that trees are one of the drivers for improving people's resilience to future changes while contributing to biodiversity conservation. Thus, the characterization and monitoring of tree species diversity are important for sustainable management of AFS. At the landscape scale, geospatial techniques are widely used for the characterization of parklands structures, but they still do not allow to correctly identify the different species. In particular, authors used the species distribution models (SDM) for mapping tree species (Franklin, 2010).

Beyond the prediction of species distribution using SDM, this study aimed to map tree diversity through different diversity indices while subsequently analyzing the relationship between tree diversity and the human impacts on the environment. The study area is located in the Senegalese Peanut Basin. It is characterized by a tree-based farming system dominated by Faidherbia albida. A robust and representative dataset of 9258 trees encompassing 63 different species (see Ndao et al., 2021) was used. The predictors were derived from various sources of geospatial data including 33 environmental variables related to different categories (e.g. climate, vegetation, landform, human habitats). For each of the main tree species, six SDM algorithms were tested through four scenario of modelling approaches in order to achieve the best prediction performance. Subsequently, knowing that probability of occurrence of a species is closely related to its environmental conditions, we assumed that between two species, if the probability of presence is higher for one, the environmental conditions are more favorable for it and therefore its abundance should be relatively higher. Thus, the probabilities of occurrence resulting from the SDM predictions were translated into relative species abundances in order to calculate diversity indices (e.g. richness, Shannon). A Kruskal-Wallis test and a Focused Principal Component Analysis were used to analyze relationship between tree species diversity indices and the distance to village used as a proxy of the human impacts on the environment.

The results showed that there is no single 'best' SDM algorithm or modelling approach for all species. Combining climatic variables with non-climatic environmental variables and anthropogenic variables leads to the best performance in most cases. The resulting tree species diversity indices are significantly correlated with the anthropisation of the environment.