Digital assessment of soil salinity across Paraguay

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INTRODUCTION

Salinization represent an important form of soil degradation. According to FAO and GTIS, 2015, salinity and sodicity are one of the most important threats to soil health. Paraguay has two different edaphoclimatic regions. The Western Región with dry climate, 850mmm average rainfall and the Eastern Region with humid climate (Grassi, B. 2020. Although the presence of salts is known in Paraguay, a soil salinity map is not available. Therefore soil salinity mapping is a first step to generate new knowledge and monitor the expansion of soil salinity. Thus, the main objective of this study is to develop a digital soil salinity map at the national level in Paraguay.

METHODOLOGY

The methodology used to map salt affected soils (SAS) was based on the Global Soil Partnership approach proposed by the Global Soil Partnership (Omuto et al., 2021), which emphasizes three steps: a) harmonization of input data, b) spatial modeling of input soil indicators using spatial predictors, and c) classification of soils affected by salts. The study data included 80 soil sampling sites with measured EC values and 204 sites with measured pH and PSI values that are standardized to 0-30 deep. Environmental predictors remote sensing imagery, thematic maps, geomophometry and climate surfaces. The algorithm used for modeling is an ensemble of regression trees based on bagging known as Quantile Regression Forest.

Table 1. Percentages of coverage of each class of Electric Conductivity in soils of Paraguay, from 0 to 30 cm deep

Electric Conductivity (EC) 0 – 30 cm.	
Class	**%**
0.02 - 0.75	***99***
0.75 - 2.00	***0.9***
2.00 - 2.30	***0.1***

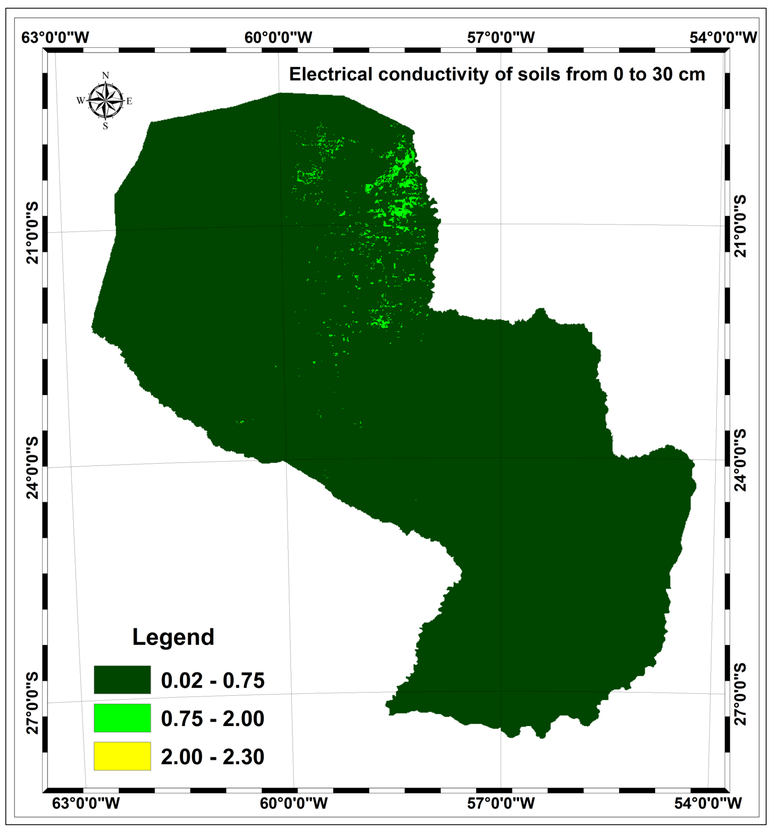

Fig 1. Soil Electric Conductivity map, 0 to 30 cm. deep in Paraguay

RESULTS

Most of the soils of Paraguay (97.49%), at depths of 0 to 30 cm, do not present salinity or sodicity. However, low sodium levels can be observed in soils of the lower chaco, likewise low salinity levels are found east of the middle chaco, occupying only 1.60% and 0.91% of the national territory, respectively. Thus our results represent a first benchmark to assess the expansion of salt affected soils across the country. The presence of salts and sodium in soil of Paraguay could indicate relation to the level of soil moisture. Bannari, Abderrazak and Zahra M. Al-Ali 2020 also mention that the amount of precipitation is closely related to the salinization of soils.

Table 2. Percentages of coverage of each class of Exchangeable Sodium Percentage, in soils of Paraguay, from 0 to 30 cm deep.

Exchangeable Sodium Percentage	
Class	***%***
0 - 15	***98.40***
15 - 30	***1.60***

CONCLUSIONS

The first salinity and sodium map of soils in Paraguay shows the highest concentrations are found in the western region or the Paraguayan Chaco. Considering the scale of this first work, the low quantity and little updating of available data, as well as the depth superficial study, it is recommended to promote monitoring programs with information more detailed, updated and with more in-depth studies.

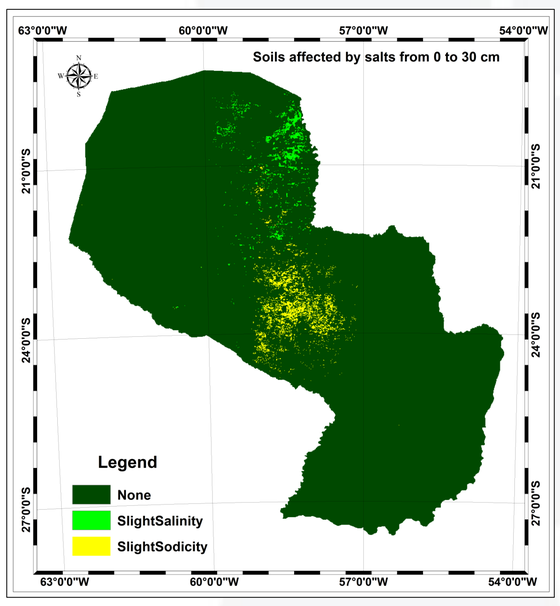

Fig 2. Map of soils affected by salts.0 to 30 cm. deep in Paraguay

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