

# Saline soils in the Baixada Maranhense: a case study in Maranhão state, Brazil

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## Introduction, scope and main objectives

The Baixada Maranhense region is located in northeastern Brazil in the Maranhão state. Is an interior plain with around 6266 km<sup>2</sup>. It comprises hydrophilic floodplain fields, halophilic mangroves, muddy tidal plains. Gleysols (Solonetz) and Vertisols are the dominant salt-affected soils. The natural vegetation is a hygrophilous tropical (Dantas *et al.*, 2013). The main land use systems are extensive livestock and shrimp farming.

The main goal of this study is to show the characteristics of two saline soils and the contents of PAW to crop sustainable production.

## Methodology

The study area is located in the Maranhão state, Brazil in a region called Baixada Maranhense. The climate is hot and humid, type Aw, with an average annual rainfall of 1580 mm and air temperature of 26.5°C. We selected two soil profiles to discuss the saline soil in this region, the profiles are described in Oliveira *et al.* 2020 and classified using the Brazilian Soil System of Classification (EMBRAPA, 2018) and to World Reference Base Soil (FAO and IUSS, 2015).

The Vertissolo Hidromórfico Sáfico which corresponds in WRB to a Katogypsic Vertisol (saline soil)–03° 00' 24.7" S e 44° 21' 30.8" W and Gleissolo Sáfico Sódico which corresponds to a Katoveritic Pantogleyic Epigeoabruptic Solonetz (saline sodic soil)–03° 22' 37.0" S e 44° 51' 16.4" W.

We selected chemical, physical, mineralogical data to discuss these saline soil characteristics. The characterization of these profiles are in Oliveira *et al.* (2020). Plant available water (PAW) was estimated by subtraction of the volumetric soil moisture in 6, 10, and 33 kPa (field capacity) from the moisture at the permanent wilting point - 1500 kPa (Teixeira *et al.* 2020).

## Results

The Solonetz profile studied has a predominance of the fine sand and silt fractions with smectite in both profiles.

The exchangeable sodium percent are around 30 percent in some horizons and the electrical conductivity is >4 dS/m that characterize a “Sáfico Sódico Gleissolo” in the Brazilian Classification.

The values of PAW ranged from the lowest value of AW33 of 1.18 mm/cm (in the Apw horizon in the Vertisol) to the highest AW10.45 mm/cm in the Ag horizon in the Solonetz.

## Discussion

The dominant salt-affected soil in this region is the saline-sodic Solonetz in an estimative more than 70000 hectares (BDIA, 2020). The prismatic soil structure of these profiles reflect it pedogenesis and the presence of smectite and are a good visual indicator of them (Calderano *et al.*, 2020).

Mostly Solonetz in this region is saline and sodic soils, typical soils in saline mangroves. Apart from high salinity, the productivity of those eutrophic soils is restricted due to such soil factors as iron toxicities and deficiency of oxygen to the roots caused by the large periods of saturation. According to Teixeira *et al.* (2020) the plant available water (PAW) in saline soils may be restricted to high osmotic potential, normally are neglected.

### Conclusions

The large areas of Solonetz show many agricultural reactions that reduce their agricultural aptness. Irrigated rice plantations with tolerant varieties and adapted pastures to saline soil are among the feasible options.

The PAW for salt-affected soils should be more investigated as the standard criterion to estimate PAW may super estimate the real available water.

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