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"Reconcile land system changes
with planetary health"

Characterisation of salt-affected rice soils across a coastal gradient in the zambezi river delta, mozambique

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Abstract

Land degradation is accelerating globally, intensified by climate change. In Eastern Africa, including Mozambique, soil salinity and sodicity pose growing threats to ecosystems and agricultural productivity. Rice is one of the most prominent crops cultivated on salt-affected soils in the region. Salinity constraints are common to coastal rainfed and irrigated lowland rice production systems, with either direct seawater influence or irrigation with saline and/or sodic water resources. While the development of locally adapted salt-tolerant rice varieties is progressing, there is a major research deficit regarding the pedological variability and associated soil biogeochemical processes in the salt-affected rice production systems of Eastern Africa. However, respective knowledge is essential in order to devise sustainable soil and water-based salinity management strategies. The presented research aims at addressing this knowledge gap, focussing on Mozambique's principal rice production system in the lowlands of the Zambezi River Delta, where progressing seawater intrusion and agricultural encroachment on saline wetland ecosystems lead to pedological situations with varying degrees of salinity impact. An exploratory field campaign in July 2024 (early dry-season) confirmed multidimensional salinity gradients across a coastal soil sequence. Fourteen rice fields were sampled along a transect with varying proximity to the coast and seawater-influenced watercourses. At each site, soil samples were collected at three depths (0–20 cm, 20–40 cm, and 40–60 cm). Soils were predominantly classified as Fluvisols, characterised by fine-grained sediments with low textural variability (silty clay loam), and largely neutral pH conditions (pH 5.0 – 7.5). The electrical conductivity (ECe) ranged from 1.5–10 $^{dS}/_{m}$ in topsoils and 1.5–90 $^{dS}/_{m}$ in subsoils. Salinity consistently increased with proximity to the coast and watercourses, as well as with soil depth, likely due to salt leaching during the preceding wet-season rice cultivation. A follow-up survey, to be conducted in June 2025, will include detailed soil profile descriptions, including assessment of salt loads, organic matter contents, and mineralogical properties. Semi-structured focus group discussions and farmer interviews will complement the biophysical data, providing

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insights into local perceptions of experienced environmental change and prevailing agronomic practices.

Keywords: Applied pedology, climate change adaptation, East Africa, land degradation, local knowledge, paddy soils, seawater intrusion, soil biogeochemistry, soil salinity