Arbeitsgemeinschaft Tropische und Subtropische Agrarforschung (ATSAF) e.V.
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Junior Scientists Tandems
Final Report

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Title: Characterization of salt-affected rice soils across gradient in the Zambezi River Delta, Mozambique

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I. INTRODUCTION

The present report summarizes my experience during the career exploration stay under the Junior Tandem Program. The stay is taking place at Martin Luther Halle-Wittenberg (MLU), Germany, from August 2025 to January 2026, under the supervision of Prof. Dr. Robert Mikutta, Jakob Hermman and staff from the soil science division.

The research focuses on salt-affected soils in Zambezi Delta, central Mozambique, specifically from the districts of Quelimane, Namacurra and Nicoadala. This region is an important rice – producing area increasingly threatened by soil salinization, which negatively affects yields. Despite the severity of the problem, limited studies have characterized the physicochemical properties and nutrient dynamics of coastal saline soils in Mozambique.

The main objective of this work is to understand how soil salinity and texture interact to influence nutrient availability and overall soil fertility in rice – based production systems. The expected outcomes include improved understanding of the processes controlling soil functioning under saline conditions and the generation of knowledge to support site – specific management strategies for coastal rice farming systems.

II. ACTIVITIES DURING THE STAY

The activities being carried during the stay, combined field work, laboratory training and analysis, scientific communication, and professional and cultural experiences that have strengthened both my technical capacity and my ability to operate within an international research environment.

Before traveling to Germany, I participated in the first field campaign in the Zambezi Delta, where we collected soil samples and described soil profiles in the areas affected by salinity (Figure 1). To capture landscape variability, sampling was explicitly designed along salinity gradients and across two contrasting textural classes (sandy and clayey soils). Rice straw samples were also collected to assess nutrient uptake in relation to soil salinity and texture. The combined sampling strategy ensured that subsequent laboratory analyses could address pedological variability and agronomic implications for rice production.

Upon arrival at MLU, I initiated systematic laboratory work. My laboratory activities include sample preparation, routine physical and chemical analyses, and more advanced assessments. Initial work focused on establishing protocols for pH, electrical conductivity and soluble salts measurements, verifying sample homogeneity, and implementing quality control procedures. These preliminary measurements provided the first overview of the spatial patterns of salinity across the study sites.

In September 2025, I presented preliminary results through an online poster at the Tropentag 2025 Conference in Bonn, Germany, summarizing early findings for soil salinity (ECe) and sodicity (SAR) and linking them to the sampling design. I am currently working on detailed analyses of nutrient dynamics including available phosphorus, nitrogen, Silicon, soil organic carbon, exchangeable cations, and cations exchangeable capacity, as well as mineralogical assessment to identify parent material and salt – bearing phases.

Beyond technical activities, the stay at MLU has provided important opportunities for scientific learning and personal development. Participation in seminars and research group meetings has expanded my understanding of current themes in soil science, while interactions with researchers and students have supported methodological exchange and collaboration. Outside the laboratory, adapting to life in Germany, beginning language self – learning, and engaging with the academic community have further contributed to my professional growth.

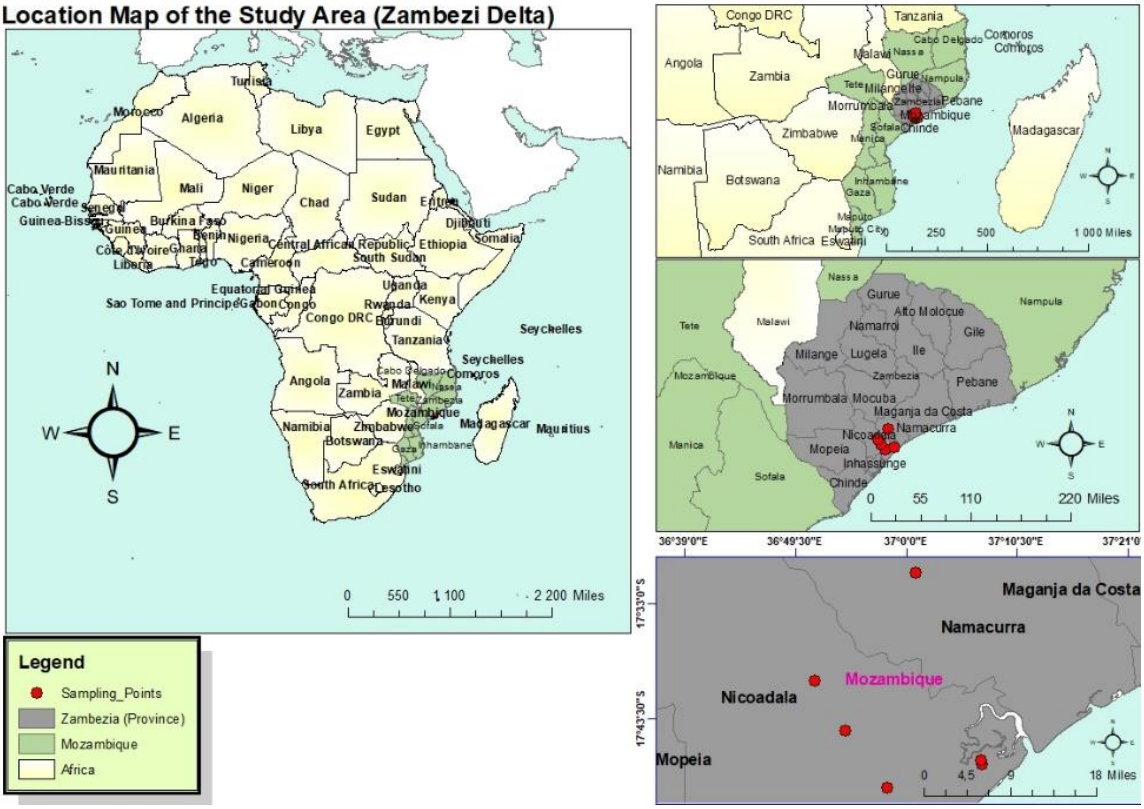

Figure 1: Location of sampling sites across the coastal salinity gradient in the in Zambezi Delta, Mozambique

III. PRELIMINARY RESULTS

The initial results highlight the combined influence of soil texture and proximity to the coast on salinity patterns. In the clayey fluvisols (transect 1) both salinity (ECe) and sodicity (SAR) increase with depth. Surface layers display lower salinity, whereas deeper horizons exhibit higher values, suggesting subsurface salt accumulation that may affect soil structure and rice root development.

The sandy arenosols (transect 2) salinity is higher near the surface and decreasing with depth. This pattern reflects stronger influence of seawater intrusion and evaporation – driven concentration in the upper layers typical of interdunal wetland environments.

Overall, the preliminary findings (Figure 2) indicate that salinity increases toward the coast, consistent with seawater intrusion processes. The early results provide a crucial foundation for forthcoming analyses on nutrient dynamics, fertility status, and crop response. They will ultimately support the development of site – specific management practices to mitigate salinity impacts and improve rice productivity in Zambezi Delta.

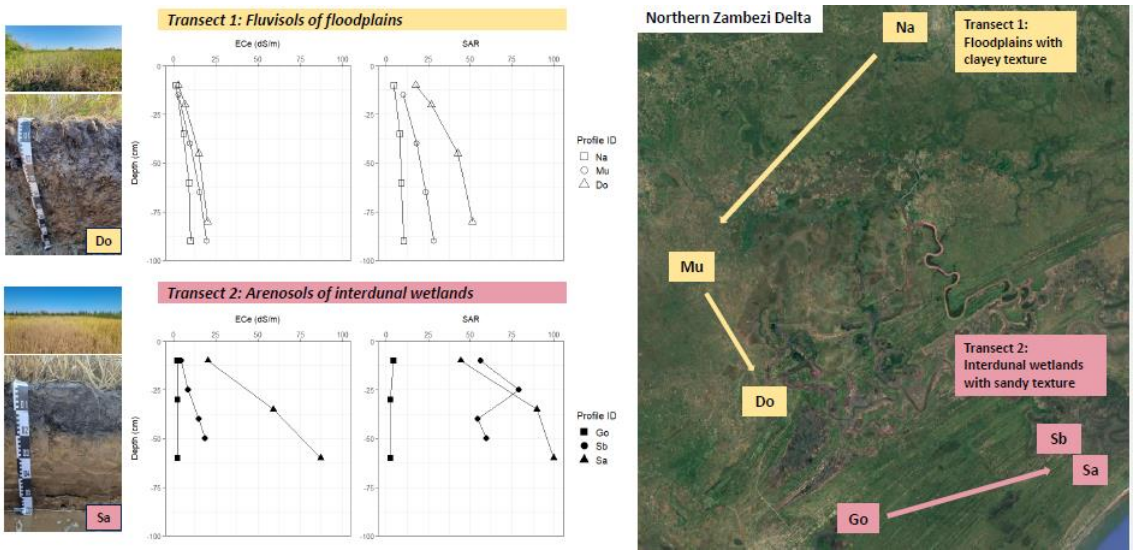

Figure 2: Horizontal and vertical variation of CEe and SAR across the sandy and clayey transects

IV. ANNEXES

Figure 4: (a) Opening a soil core sampler ("satellite") for collecting soil samples and (b) Field team after completing soil sampling activities

Figure 3: A1 Sample weighing for nutrient extraction and A2 Pipetting for soil texture confirmation

Figure 5: Participation at Tropentag 2025 Conference in Bonn