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SPATIAL DELINEATION OF PEDOGENETIC ENVIRONMENTS AND IMPLICATIONS FOR SOIL ORGANIC CARBON MANAGEMENT IN THE BANAT PLAIN, WESTERN ROMANIA

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Abstract: The Banat Plain includes contrasting geomorphological, lithological and hydrological settings that generate different soil-forming pathways and capacities for soil organic carbon (SOC) accumulation and stabilization. This study proposes a preliminary spatial framework for a doctoral research programme focused on SOC dynamics. Ten representative sectors were selected across high, transitional, low and alluvial plains, with emphasis on hydromorphic, vertic and salt-affected environments. The synthesis links landscape position and pedogenesis with future SOC measurements, bulk density, profile depth and GIS analysis. The framework supports differentiated strategies for organic-matter conservation, carbon accumulation and sustainable soil management in the Banat Plain.

Keywords: *Banat Plain; pedogenetic environments; soil organic carbon; soil organic matter; hydromorphism; sustainable soil management*

• Introduction

- SOC is a key component of soil organic matter, supporting fertility, aggregation, water retention and resilience.
- The Banat Plain combines well-drained higher surfaces with low subsident sectors affected by shallow groundwater, temporary stagnation and local salt accumulation.
- Pedogenetic processes modify carbon inputs, stabilization and losses; therefore SOC cannot be interpreted independently of soil genesis.
- Aim: delineate representative pedogenetic environments and identify the processes most relevant to SOC accumulation, stabilization and vulnerability.

• Material and method

- Integrated pedological, geomorphological, hydrological, climatic and land-use information.
- Spatial stratification into four landscape settings: high plain, transition plain, low plain and alluvial plain.
- Ten representative sectors selected to capture drainage, lithological and pedogenetic contrasts.
- Target processes: bioaccumulation/humification, gleying/stagnogleying, vertic processes, salinization/sodification and eluviation–illuviation.
- Next stage: soil profiles and auger observations, SRTS/WRB classification, SOC, bulk density, texture, pH, carbonates and hydrophysical indicators integrated in GIS.

LANDSCAPE POSITION → **PEDOGENETIC PROCESS** → **SOC BEHAVIOUR**

Representative sectors: Tormac • Gătaia • Percosova–Butin • Deta–Denta • Opatița–Berecuța • Banloc–Livezile • Ciacova • Diniaș–Foeni • Timiș Plain • Aranca Plain

• Results and discussions

- Relief and water regime are the main landscape controls on soil differentiation and expected SOC variability.
- The low plain represents 50% of the preliminary network because it contains the strongest gradients in drainage, clay content, hydromorphism and salinity.
- Hydromorphism occurs in 8/10 sectors, salinization/alkalization in 4/10, vertic processes in 3/10 and bioaccumulation/argillization in 2/10.

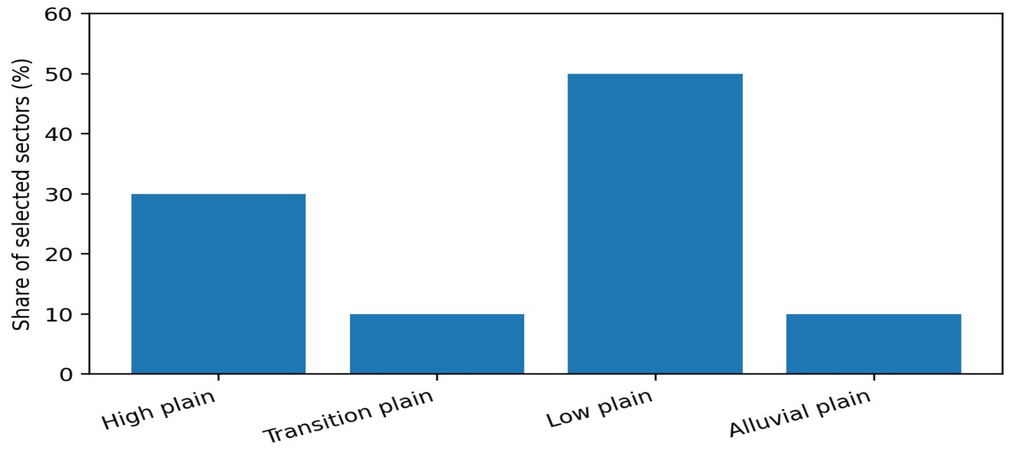


Figure 1. Distribution of representative sectors by geomorphological setting

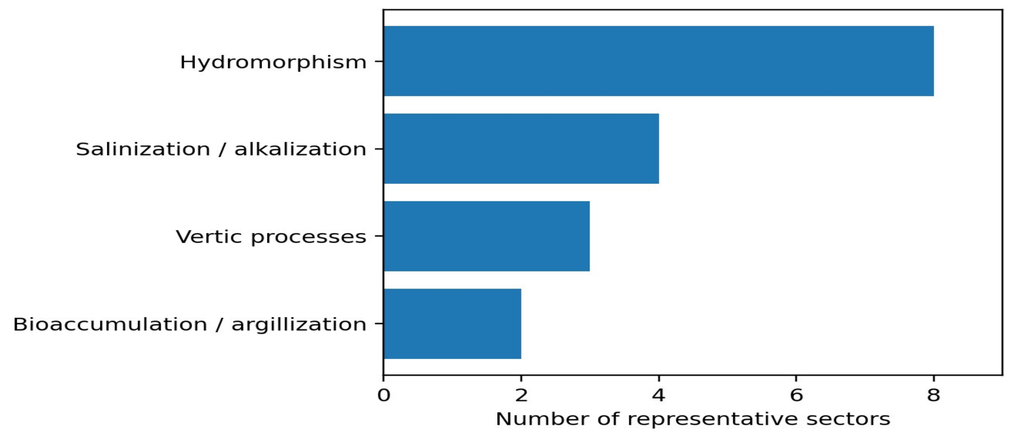


Figure 2. Frequency of the main pedogenetic processes in the preliminary network

• Conclusions

- The Banat Plain is a heterogeneous pedological system; SOC assessment requires stratified sampling by landscape and drainage conditions.
- Hydromorphic, vertic and salt-affected environments are priority sectors for evaluating SOC preservation, redistribution and vulnerability.
- The proposed network provides the basis for future SOC stock calculations and GIS-based comparison of carbon-storage potential.

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