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PEDOLOGICAL CHARACTERIZATION OF SOIL FROM PECICA AREA, ARAD COUNTY

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Abstract: *This paper provides an integrated examination of the soil resources in the Pecica area, Arad County, centering on their identification, analysis, and characterization in relation to the limiting factors that shape their agricultural and environmental performance. Situated in the Lower Mureș Plain, the region displays a diverse pedological framework influenced by alluvial deposits, microrelief variability, and long-term land-use practices. The study synthesizes pedological data and field observations to outline the morphological, physical, and chemical attributes of the dominant soil types, focusing on the constraints that affect their functionality and sustained resilience. The soils of Pecica—ranging from fertile chernozems to alluvial and hydromorphic meadow soils—present distinct limitations, including structural instability throughout intensive cultivation, susceptibility to compaction, surface crusting, reduced aeration in depressional areas, and nutrient imbalance associated with repetitive cropping systems. Textural heterogeneity and shallow humus horizons further restrict root penetration and crop growth in specific sectors. When correlated with current land-use patterns, these limiting factors reveal zones where productivity is hindered and targeted interventions are essential. The study highlights the importance of adopting soil conservation practices such as increasing organic matter, controlled tillage, diversified crop rotations, and structure-improving measures. By bringing out the Pecica area's pedological constraints, the research provides a foundation for sustainable land-use planning. It supports strategies to improve agricultural performance while protecting long-term soil quality.*

72.6% of the territory is arable land

~70% of the soils are chernozems

81.5% of soils are fine-textured

86% of the area affected by gleization

• Introduction

- Intensive arable farming puts pressure on soil structure, organic matter and water quality; excess water, salinity and summer moisture deficit limit yields.
- **Aim:** to characterize the soil types, quantify the limiting factors and propose land-use measures that protect soil and water.

• Material and method

- **Study area:** Pecica, Arad County – 23,580 ha in the Lower Mureș Plain.
- **Data:** General Urban Plan of Pecica (2022), SIGSTAR-200 database, Romanian Soil Taxonomy (SRTS-2012).
- **Analysis:** areas of soil types, textures, groundwater depth and limiting-factor classes expressed as % of the territory; dryness assessed with the Walter–Lieth criteria.
- **Limits:** existing data only (scale 1:200,000), no new laboratory analyses.

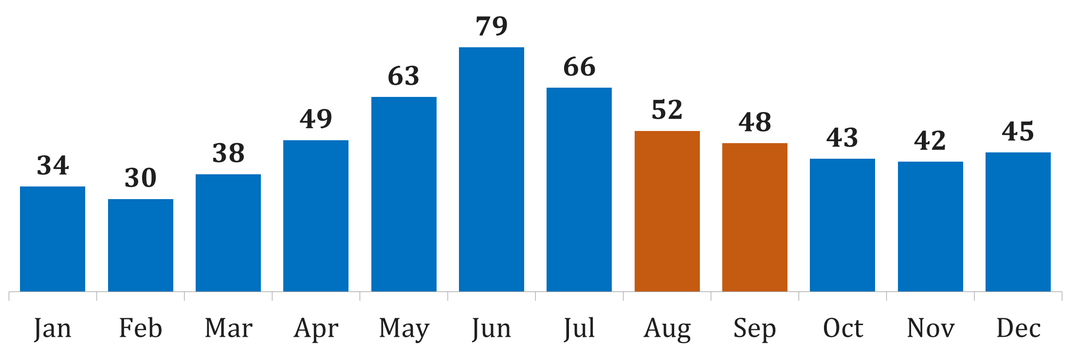


Figure 1. *Monthly precipitation (mm), Arad station, 1980–2015. Orange: August and September, when rainfall falls below the dryness threshold (P < 3T).*

2× In July, potential evapotranspiration (130–140 mm) is about twice the rainfall (65.8 mm) – a key limit for chernozems.

• Results and discussions

- Arable land covers 17,120 ha (72.6%); with pastures and hay meadows, agriculture reaches about 82% of the territory (wheat, barley, maize, sunflower, soybean).

Land use	Area (ha)	%
Arable land	17,120	72.6
Forests	2,532	10.7
Pastures and hay meadows	2,102	8.9
Yards, buildings and roads	1,240	5.3
Waters and other land	585	2.5

Table 1. *Land-use balance of the 23,580 ha.*

- Chernozems and alluvisols cover about 85% of the territory; fine textures (clay loam 75.4%, clay 6.2%) retain water but risk stagnation and compaction.

Soil type	Area (ha)	%	Main limitation
Chernozems	16,397	69.5	summer moisture deficit
Alluvisols	3,608	15.3	flood and salinity risk
Gleysols	2,286	9.7	shallow groundwater
Solonetzes	544	2.3	dense sodic horizon, pH 9–10
Vertisols	481	2.0	clay > 40%, narrow tillage window
Erodisols	264	1.1	truncated profile, low fertility

Table 2. *Soil types of the Pecica area (SRTS-2012).*

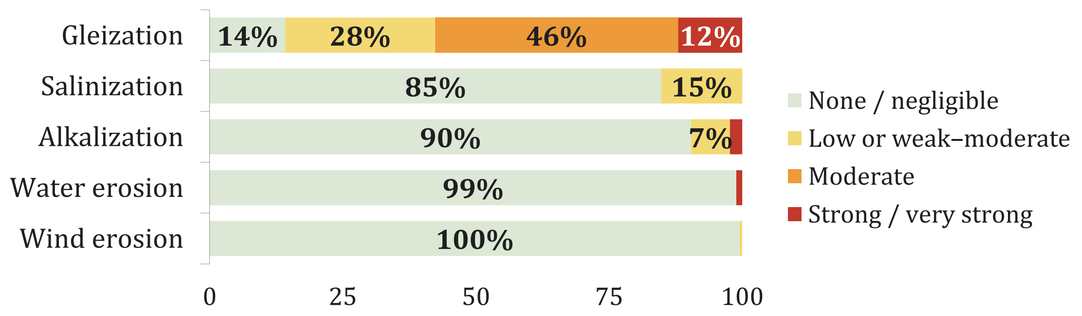


Figure 2. *Intensity classes of the limiting factors, % of territory.*

- Gleization is dominant: only 14.2% of the area is free of excess-water risk and 57.7% has moderate or strong intensity; salinization affects 15.2%.

• Conclusions

- Chernozems (~70%) and alluvisols (15.3%) dominate; clay loam and clay make up 81.5% of the soils.
- Water is the main constraint: gleization affects 86% of the area, chernozems face summer moisture deficit.
- Priorities: organic matter, controlled drainage, reduced tillage, buffer strips, gypsum for solonetzes.
- Groundwater body ROMU20 is in poor status; 1:200,000 data call for soil sampling and monitoring.