



Summer School on Sustainable Organic Amendment
Applications from a Soil and Groundwater Management
Perspective



SOIL HEALTH – AN EVIDENCE FOR THE BIOGEOCHEMICAL
INDICATORS ON REGIONAL VS. GLOBAL SCALE

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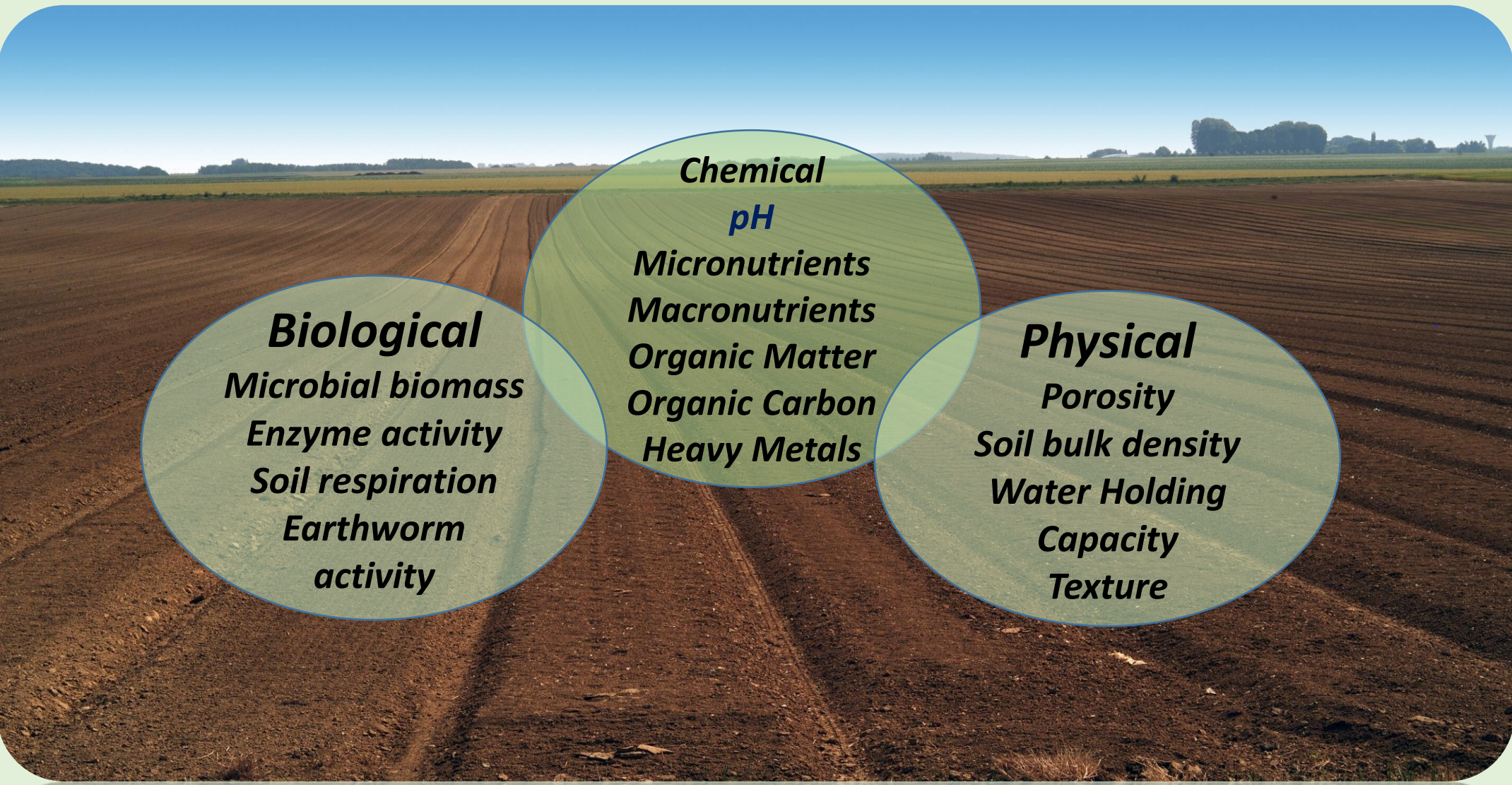
ABSTRACT

Soil health is a critical component of sustainable agriculture and environmental management. This study evaluates biogeochemical indicators of soil health, comparing regional data from N. Macedonia with global standards. Indicators such as soil organic carbon (SOC), nutrient levels (nitrogen, phosphorus, potassium), pH, conductivity and microbial biomass was analyzed. Data were collected from various soil health monitoring programs and research studies. The results highlight significant regional variations in soil health indicators in N. Macedonia compared to global averages. The comparison reveals that at the global scale we have an advanced and integrated approach, and the Republic of N. Macedonia should make additional efforts to harmonize and implement global standards and practices. In the Republic of N. Macedonia regulations and soil health monitoring are in the process of development and alignment with European and global standards. This study provides recommendations for improving the national framework and practice, in order to achieve more effective protection and sustainable management of soil resources. Also, this study highlights the global significance of localized data in developing effective soil management strategies and demonstrates the value of biogeochemical indicators at both regional and global scale.

INTRODUCTION

Biogeochemical indicators are important tools for assessing soil health and fertility in agricultural systems [1]. They provide information about the chemical, physical and biological processes that regulate nutrient cycling, organic matter decomposition and soil structure [2]. Assessing soil health requires a comprehensive evaluation of biogeochemical indicators, witch provide insights into soil quality, nutrient availability and overall functionality. This study focuses on evaluating biogeochemical indicators of soil health in regional scale and comparing them with global standards. The results provide significant information on the current state of soil health in the region, highlighting the need to align with international best practices to ensure sustainable management of soil resources [3]. Also this study underscores the broader significance of localized soil data in shaping effective global soil management strategies.

SOIL BIOGEOCHEMICAL INDICATORS



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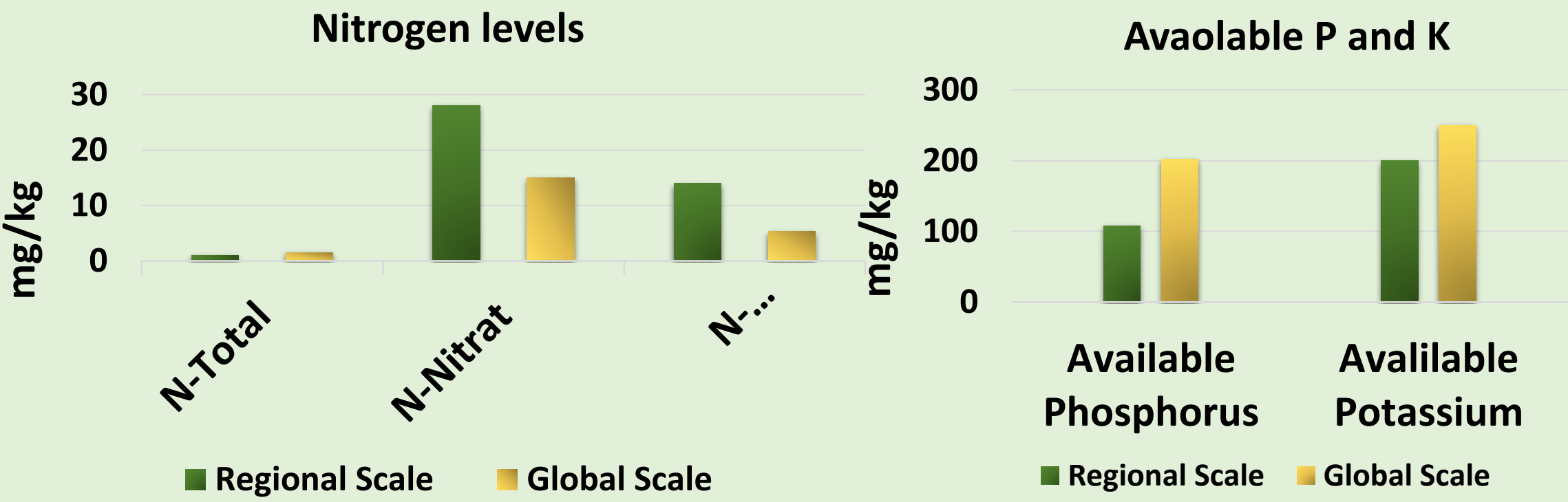
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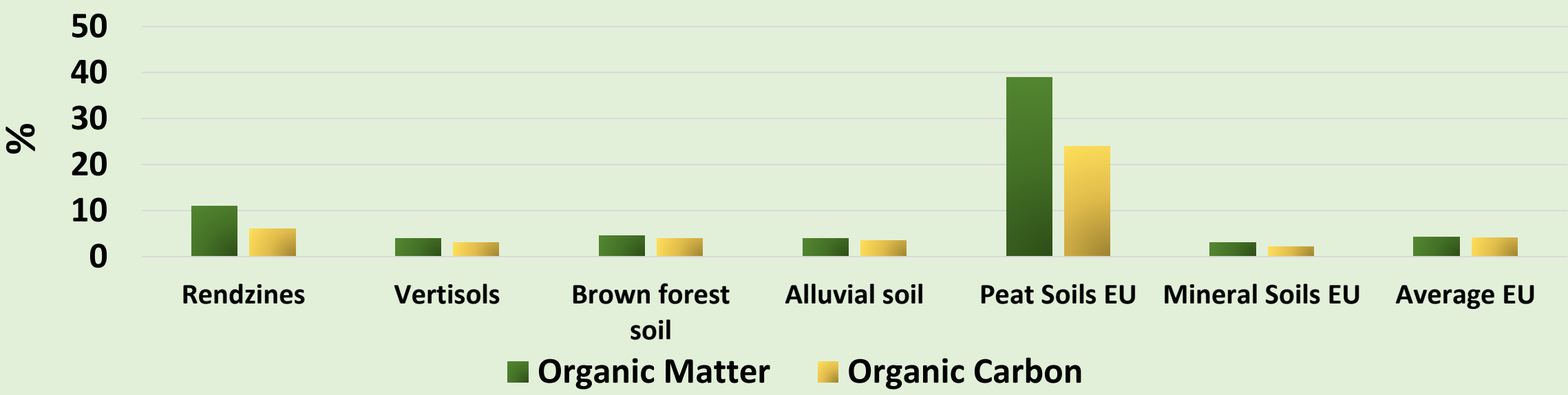
[4] European Soil Data Centre (ESDAC).

BIOGEOCHEMICAL INDICATORS REGIONAL VS. GLOBAL SCALE

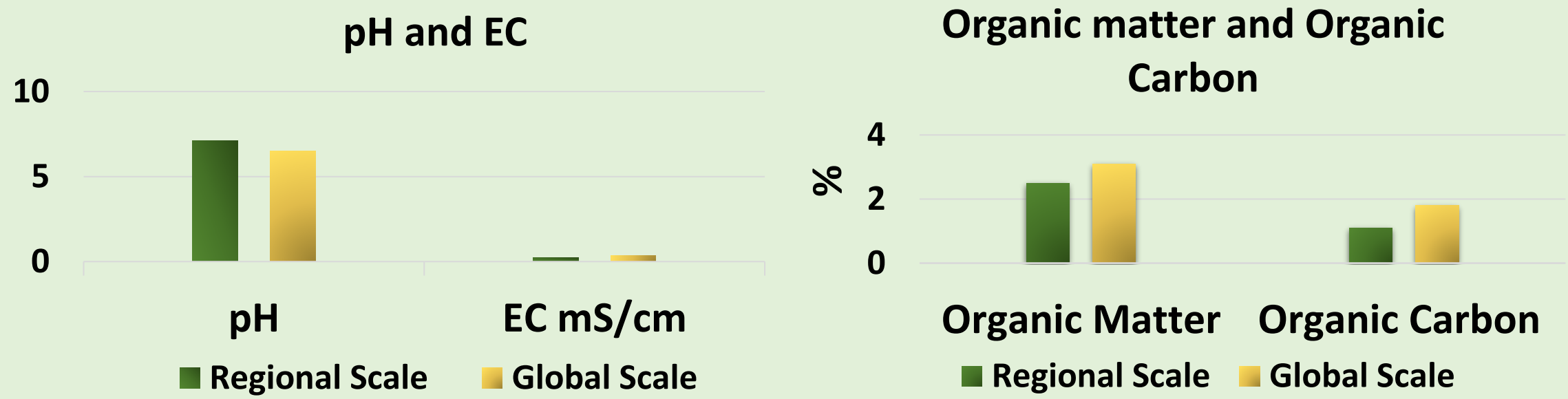


Picture 1. Content of N, P, K at Regional Scale vs. Global Scale [4]

Comparison of Organic Matter and Organic Carbon in different types
of Soil (Regional vs. EU)



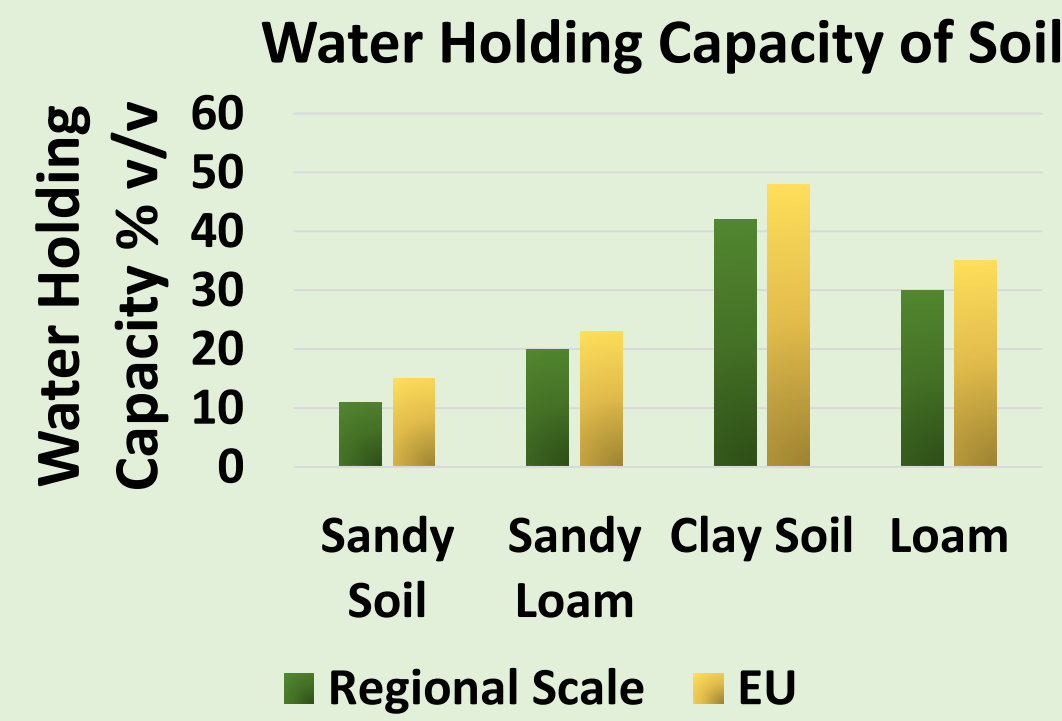
Picture 2. Comparison of Organic Matter and Organic Carbon in different types of Soil (Regional Scale vs. EU) [4]



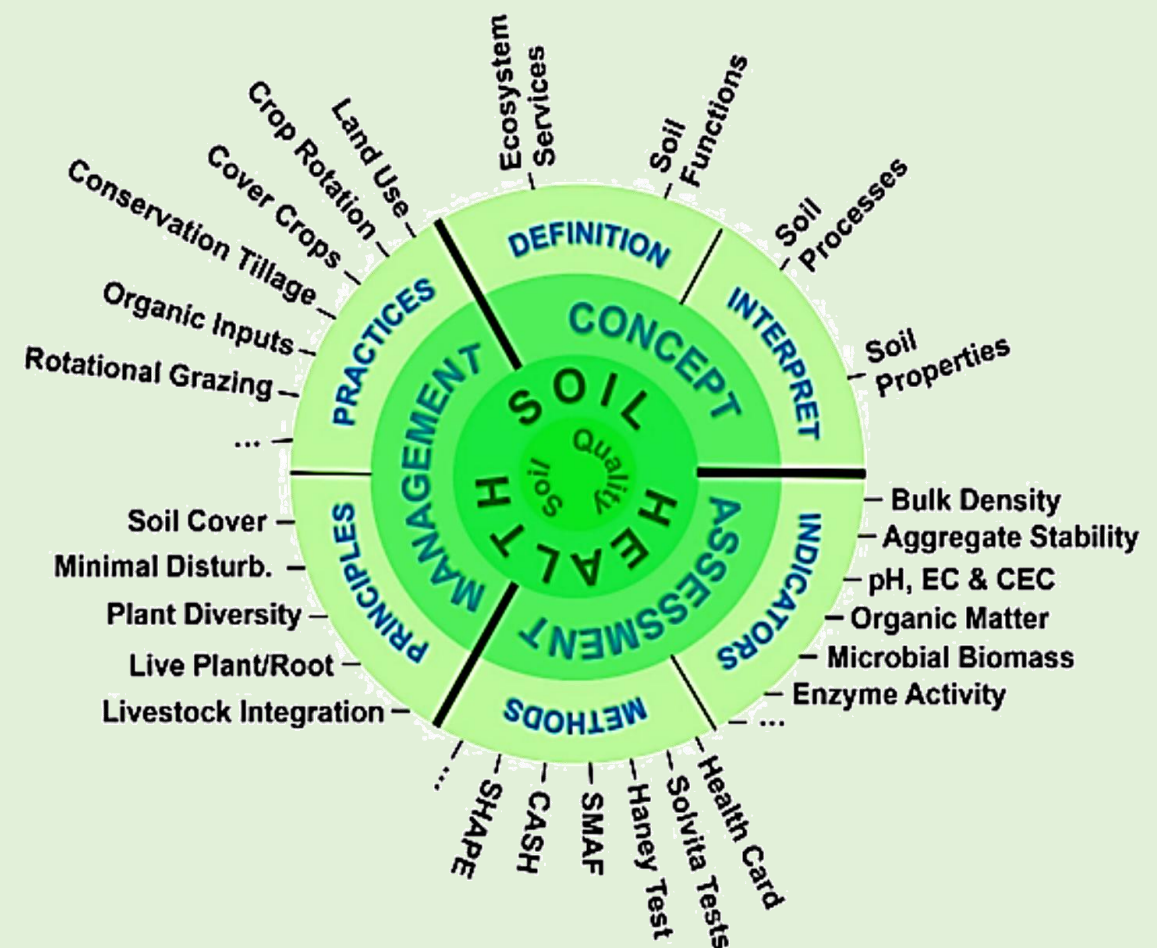
Picture 3. Comparison of pH, EC, OM and OC in soil at Regional Scale vs. Global Scale [4]

Table 1. Average values of microelements and heavy metals in soils (Regional Scale vs. EU) [4]

mg/kg	Fe	Mn	Zn	Cu	B	Mo	Cd	Pb	As	Hg
Regional	25	40	2.5	1.2	0.5	0.1	19	470	45	3.2
EU	30	50	3.2	1.8	0.8	0.2	0.2	32.6	8.6	0.1



Picture 4. Water Holding Capacity of different types of soils (Regional Scale vs. EU) [4]



CONCLUSION

A comparison of the most important biogeochemical indicators between regional and global scale, shows significant differences in soil health and fertility. Regional soils exhibit a slightly alkaline pH (average 7.5) compared to the global pH levels (average 6.8), which may influence nutrient availability and microbial activity. Regarding soil organic matter (SOC) and organic carbon (OC) regional soils contain (average 2.5% SOC and 1.2% OC) while European soils show higher values (average 3.2% SOC and 1.8% OC). This suggests that European soils may have better carbon sequestration potential and microbial activity, contributing to improved soil fertility. Macronutrient levels also differ significantly. Total N is lower in the region compared to European levels, which may indicate limited nitrogen availability for plant growth. These findings highlight the importance of monitoring biogeochemical indicators to ensure sustainable soil management. The observed differences can be attributed to various environmental and anthropogenic factors, including climate, land use and agricultural practices. Understanding these variations is crucial for developing targeted soil fertility management strategies that enhance agricultural productivity and long-term ecosystem stability.