

Annex 2. EJP SOIL call topics

Topic: Climate change Mitigation (CM)

CM5 - Effects of the soil biome on the persistence SOC storage and its drivers

Rationale/Specific challenge: Agricultural soils are currently facing a decrease in soil biodiversity (abundance and diversity of soil biota) as a consequence of intensification, simplification of crop rotations or monocropping, mechanization and excess use of pesticides and fertilizers (FAO, ITPS, GSBI, SCBD and EC, 2020). Preserving and restoring soil biodiversity is now recognized as a major challenge at the EU level (Veerman et al. 2020)¹. The EU Biodiversity Strategy expresses the ambition of the EU to reverse biodiversity loss (European Commission, 2020)² and its targets with that of the Farm to Fork Strategy (European Commission, 2020)³ of reducing the use of pesticides by 50% in 2030, achieving 25% of total farmland under organic farming by 2030 and at least 10% agricultural land under landscape features with high biodiversity, should have a positive effect on soil biodiversity. Farming practices and agricultural systems have a major effect on the soil biome (fauna and microbial communities) and its functioning (e.g. carbon use efficiency). Yet, the extent to which soil biome controls SOC sequestration and whether this can be managed is not sufficiently known. Such knowledge is needed for recommendations of management options that preserve or increase soil organic carbon stocks. For instance, in organic agriculture, as yields are generally lower, organic inputs are consequently smaller, but SOC stocks can be maintained or even increased which is ascribed to changes in the carbon use efficiency of soil microorganisms. The importance of stoichiometry, especially carbon/nitrogen/phosphorus ratios, in controlling carbon use efficiency by soil organisms and its consequences on the balance between SOC storage and GHG emissions also warrants further research.

Scope: The project will aim to study the relationships between soil carbon cycling and the diversity of the soil microbiome and fauna. An important question is the effect of soil management practices, especially through the stoichiometry of organic matter inputs (crop residues, organic amendments, below ground inputs from plants) on the carbon use efficiency of soil microorganisms and, ultimately, on SOC sequestration. The effects of soil biome on SOC sequestration should be investigated in real case-studies (on-farm and/or experimental field sites) representing a diversity of soil management and pedo-climatic conditions. A special focus should be placed on the identification of the drivers related to soil status and management, which may favor or hamper the adequate functioning of soil microbial communities regulating SOC sequestration. The measures and agricultural systems included in the Green Deal targets could be considered. Improving existing biogeochemical SOM models by

¹ Veerman, C., Correia, T.P., Bastioli, C., Biro, B., Bouma, J., Cienciala, E., Emmett, B., Frison, E.A., Grand, A., Filchew, L.H., Kriauciūnienė, Z., Pogrzeba, M., Soussana, J.-F., Olmo, C.V., Wittkowski, R., 2020. Caring for soil is caring for life – Ensure 75% of soils are healthy by 2030 for food, people, nature and climate. Report of the Mission Board for Soil health and food. ISBN 978-92-76-21602-5 European Commission Directorate-General for Research and Innovation and Directorate-General for Agriculture and Rural Development Directorate B – Quality, Research & Innovation, Outreach Unit B2 –Research and Innovation, Brussels.

² Commission, E., 2020. Biodiversity Strategy for 2030 Bringing nature back into our lives. COM/2020/380 final

³ European Commission (2020). A Farm to Fork Strategy for a fair, healthy and environmentally-friendly food system. COM/2020/381 final

incorporating new knowledge on the effects of soil biome on carbon and nitrogen cycles should also be investigated in order to evaluate the trade-offs between SOC storage and GHG emissions.

Expected outcomes:

- Identifying drivers related to soil management effects on soil biome which may enhance/prevent SOC sequestration and other co-benefits in different EU pedo-environmental zones.
- Qualifying farming systems promoting soil biodiversity in terms of their potential for mitigating climate change (increased SOC sequestration, decreased GHG emissions).

Expected impacts:

- EJP SOIL EI2: Understanding how soil carbon sequestration can contribute to climate change mitigation at regional level including accounting for carbon.

Project Type: Medium size research project (up to 2M€).