

Annex 2. EJP SOIL call topics

Topic: Climate change Adaptation (CA)

CA4/SP3 Contribution of soils to climate mitigation and adaptation, sustainable agricultural production and environment in agro-ecological systems

Rationale/Specific challenge: Agro-ecological systems are characterized by higher biodiversity at all levels (intra- and interspecies, cropping and farming systems, landscapes and non-agricultural elements) than traditional highly intense agricultural systems. Such agro-ecological systems are potentially better adapted to local environmental conditions and to social and economic requirements. Transition of current agriculture to agro-ecological systems leads to more sustainable and climate responsive agricultural production. Such a transition is a relevant contribution to the implementation and success of the EU Green Deal and EU policies on biodiversity, on circular economy and on climate change. This approach towards agro-ecological systems fits the recommendations by the Mission Board on Soil Health and Food and the Farm to Fork Strategy and will contribute to reach the target “25% of agricultural land under organic farming”.

This agro-ecological transition can be considered as a highly potential opportunity to respond in particular to changes and challenges posed by climate change across the European continent. Examples and experiences include better soil exploration by deep rooting in mixed crops or deep rooting crops to enhance water and nutrient availability. Also, facilitation of symbiosis of roots with microbes may enhance nutrient uptake. More soil carbon will stimulate soil biodiversity and enhance resilience to climate change and climate variability and ability of soils to sustain more frequent extreme events (prolonged drought, extreme wet conditions, extended warm periods, and higher risk for diseases to occur). However, the impact of the transition to agro-ecology on the resilience of agroecosystem to climate change in many European regions is poorly understood and documented, especially for its soil components. Understanding and quantifying this impact is particularly relevant when the climate is changing and forces local and regional agricultural systems to adapt.

To date, most long-term experimental studies and meta-analyses on the effects of management on agricultural soils have focused on the impact of a single practice or a specific technology. As a consequence, they have not considered scope and options of the full context of an agro-ecological farming system, nor considered the broad range and diversity of agricultural systems that exist in Europe. These alternative and new systems and practices need to meet multiple goals on soil health, agricultural production, climate change adaptation and mitigation and support and sustain ecosystem services. These systems also need to be recognized by local farmers to fit their specific conditions and socio-economic needs and perceptions.

Several recent H2020/FP7 projects among others have investigated elements concerning soil degradation processes and remediation practices, the assessment of soil's contribution to the provision of ecosystem services and relations to climate change mitigation. This project will utilize and build upon the knowledge and data provided in these recent and completed FP7/H2020 projects.

Scope: The agro-ecological systems and the underlying climate-smart sustainable soil management practices considered in this project will be selected on their *a priori*

positive effect on climate change adaptation and mitigation (e.g., agroforestry, conservation agriculture, organic farming, integrated crop-livestock-forestry systems). This will be combined with their actual adoption or potential for adoption by farmers in climate regions and agro-ecological zones across the EU and relate to the projected climate change. This will require the sourcing and use of results of completed projects and existing data in EJP SOIL.

The research will evaluate soil functions and ecosystem services provided by soils in relation to climate change adaptation and mitigation. This will include the provisioning service for food, the ability of the soils to contribute to climate change mitigation (conserve or increase SOC stocks, decrease N₂O emissions), and the ability of soils to contribute to climate change adaptation (e.g. soil water infiltration & storage and yield stability). The research will use available tools (existing models and indicators). The project will identify and use, and adapt if needed, a series of long term and highly instrumented case studies in different pedo-climatic conditions. This will be based up on long term experiments (LTE's) of the EJP SOIL consortium allowing for retrospective analysis of soil conditions, crop yields and climate conditions and change. In complement, the project will also identify pioneer farmers in different EU countries as lighthouse farms to enhance the regional applicability and allow farmers to recognize their local conditions and systems. This research could also be performed by modelling the complex soil – plant interactions in agro-ecological systems, to evaluate them regarding their resistance and resilience under different climate scenarios (RCPs). These different research approaches can be combined.

Expected outcomes:

- Identify and report on the effect of climate variability across EU agro-ecological zones on soils and crop in various agro-ecological systems.
- Assess the impact and contribution of soils and soil management across the range of agroecological systems to climate mitigation and adaptation and relate to future regional climate conditions.
- Develop and propose guidelines for soil management to fit the complex and diverse agroecological systems in different EU pedo-climatological and environmental zones.

Project outcomes should feed into the to be realized partnership on agro-ecology and living labs.

Expected impacts:

- EJP SOIL EI1: Fostering understanding of soil management and its influence on climate mitigation and adaptation, sustainable agricultural production and environment.
- EJP SOIL EI5: Fostering the uptake of soil management practices which are conducive to climate change adaptation and mitigation.

Project Type: Large size research project (up to 5M€).