

## Annex 2. EJP SOIL call topics

### **Topic: Harmonizing soil information (DATA)**

#### **DATA1 - Innovative techniques to monitor SOC stocks and soil degradation/restoration changes in the EU, using spectral systems/NIRS/MIRS, and other proximal sensing tools**

**Rationale/Specific challenge:** SOC stocks and soil quality (degradation/restoration) evolve under the combined effects of land use, soil management and climate change. These dynamics may be quite fast (decades) and are insufficiently known and monitored as traditional monitoring methods are expensive and time consuming. Much faster and high throughput methodologies of soil characterization are needed to meet the needs of soil policies, such as assessing changes in soil condition, SOC and erosion rates under agricultural management in the CAP context, or assessing soil nutrient status in the context of the Farm to Fork strategy targets (European Commission, 2020)<sup>16</sup>. Soil spectroscopy (both near and mid infra-red, i.e. both NIRS and MIRS) has been developed in the last years and various proximal sensing techniques offer promising technologies to speed up and reduce the costs of the soil surveying activity. Spectral libraries already exist at different levels: national (or regional) spectral libraries in several of the EJP SOIL partner countries and the LUCAS spectral library that is the most comprehensive and freely available. Some initiatives for combining and harmonizing these spectral libraries also exist, such as the work made by the GLOSOLAN working group on spectroscopy. However, there is still a need for further harmonization of spectral measurements. Calibration in relation to the laboratory analysis as well as producing procedures to derive soil parameters from soil spectra are needed to fully validate these techniques and allow them to be deployed at a large scale in Europe. Proximal sensing is complementary to remote sensing approaches developed, e.g. for SOC monitoring, in the EJP SOIL STEROPES project and in the ESA WorldSoil projects.

**Scope:** The project will focus on the use of proximal sensing for soil monitoring in the field, and will aim to validate proximal sensing techniques for estimating soil properties (e.g. carbon content, soil texture, pH, nutrient contents etc.). The project should investigate the reliability and applicability of such spectroscopic techniques. A key point will concern calibration of the different estimated soil properties with actual measured data. Developing inter-comparisons is relevant for this topic, e.g. the same soil samples contemporarily analyzed by reference European laboratory and scanned for its spectra. Using freely available spectral libraries such as LUCAS, national and other spectral libraries and cooperation with international spectroscopic harmonization activities (like GLOSOLAN, IEEE) is encouraged. A critical analysis of innovative tools and methods in terms of accuracies and harmonization of soil spectral libraries is expected in order to evaluate their potential use for rapid and low-cost assessment of soil properties. The project should deliver a list of soil characteristics that can be determined by validated proximal sensing methods.

In a potential secondary step, this project could also determine the advantages and limitations of combining proximal and remote sensing. This combination would permit to enlarge the evaluations done at one site by proximal sensing, to larger areas, using the same sensors (for example VIS-NIR), For this step, cooperation should be sought

with the EJP SOIL project STEROPES and WorldSoils and possibly other research initiatives.

**Expected outcomes:**

- Improving the development and availability of proximal sensing methods allowing to speed-up the monitoring of soil characteristics in the field, that could possibly be used directly by farmers (citizen science) or for soil monitoring at the national and the European scale.

**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 EI4: Supporting harmonized European soil information, including for international reporting.

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