



Summary report on European Spatial survey sampling

Milestone no 3 & 9.

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1. Introduction

One of the main goals of the Papillons project is to conduct a spatial survey in seven European countries to explore the role of agricultural plastics (AP) as a source of microplastics (MP) to farmed soils, in comparison to inputs from biosolid or selected compost products application or atmospheric deposition. This European Spatial Survey increases the understanding how local or regional agricultural practices influence levels of MNPs and biodiversity. This work generates data on MP occurrence and distribution in European agricultural soils and will provide baselines for national and European level assessments of soil ecosystem quality and protection acts.

The main activities of the European Spatial Survey are situated within Task 2.1 (WP2) and Task 3.3 (WP3), whilst Tasks 1.2 and 1.3 (WP1) provide important inputs related to the definition of sources and identification of key geographic areas. Involved partners are: NIVA, SYKE, LUKE, IMDEA, UBT, AUA, UNIBA, BONN, RECETOX, FUB and VU.

2. Setup

The European Spatial Surveys comprises field sampling and completion of farmer questionnaires in seven countries in Europe representing different climatic regions and agricultural settings. These were: Finland, Germany, Spain, Greece, Italy, Norway, and the Czech Republic. In each country, up to 11 field sites were chosen for monitoring. These sites represented four different categories:

- 1) Sites where APs had been used within the past 10 years
- 2) Fields subjected to application of sewage sludge-derived biosolids within the past 10 years
- 3) Fields subjected to application of compost or digestate products potentially contaminated by plastics within the past 10 years
- 4) Control fields with no documented history of above mentioned activities

At these sites, a sampling scheme (Figure 1) was followed to take samples for:

- i) analysis of MNP content in soil
- ii) analysis of MNP content in earthworms
- iii) analysis of plastic additive content in soil
- iv) analysis of soil properties
- v) in-situ assessment of macroplastics content
- vi) assessment of earthworm community composition
- vii) assessment of microbial communities (laboratory incubation)

A questionnaire was devised to the farmers owning or managing the fields to obtain necessary metadata about the selected fields and gather information on specific agricultural practices related to the sources described above. In addition to this, a letter of consent was developed to communicate the purpose and practical aspects of the European spatial survey, as well as addressing the necessary GDPR aspects.

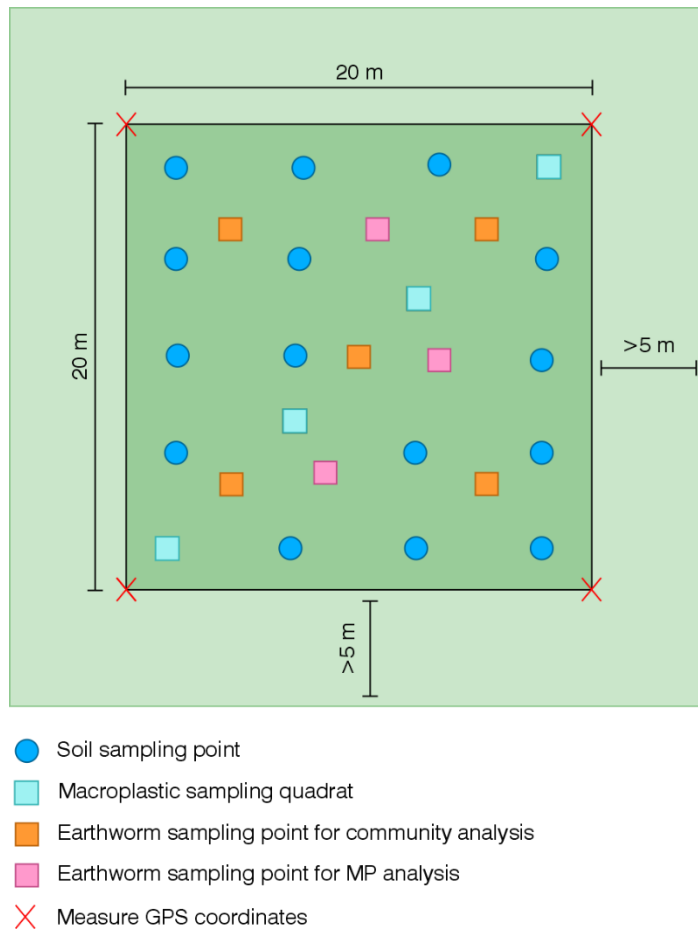


Figure 1. Field sampling design adopted in the PAPILLONS European Spatial Survey. The sampling scheme was applied to each selected field.

3. Sampling of macroplastics

Macroplastic survey was done in four 0.5 m x 0.5 m or 1 m x 1 m quadrat to a depth of 10 cm (Figure 2). Macroplastics, larger than 2.5 cm in size, present in this excavated soil, were counted and characterised.



Figure 2. Sampling of macroplastics and macroplastics found in the soil. Photos: Annika Johansson (upper left and right), Evelia Schettini (lower left) and Jakub Hofman (lower right)

4. Soil sampling

Soil samples to a depth of 10 cm were collected from 15 sample points and mixed to form a composite sample. From this, soil was taken into 4 glass jars for MP, additive and soil property analysis as well as for microbial experiments. One empty jar was opened for the duration of the sampling to get a blank field sample.



Figure 3. Soil sampling. Photos: Annika Johansson

Photo credit: Annika Johansson

5. Sampling of earthworms

The earthworm sampling included both earthworm community and earthworm MP analysis to address questions on how the plastic exposure impacts the earthworm diversity in agricultural soils and whether earthworms take up MPs. The earthworm community analysis was taken from 5 sample points and the earthworm MP analysis from 3 points. Both sample types were sampled from two soil layers, one from the top to 20 cm, where worms were collected from the soil by hand, followed by the layer below 20 cm by chemical expelling deeper living earthworms using allyl isothiocyanate. The earthworms were placed in a cool box with dry ice to freeze them and transport to the laboratory.



Figure 4. Earthworm sampling. Photos: Annika Johansson

6. Photographic documentation of the sampling in different countries



Figure 5. Sampling in Finland. Photographs: Annika Johansson



Figure 6. Sampling in Norway. Photographs: Rachel Hurley



Figure 7. Sampling in Germany. Photographs: Sarmite Kernchen



Figure 8. Sampling in Spain. Photographs: Paula Redondo-Hasselerharm



Figure 9. Sampling in Czech Republic. Photographs: Jakub Hofman



Figure 10. Sampling in Italy. Photographs: Evelia Schettini

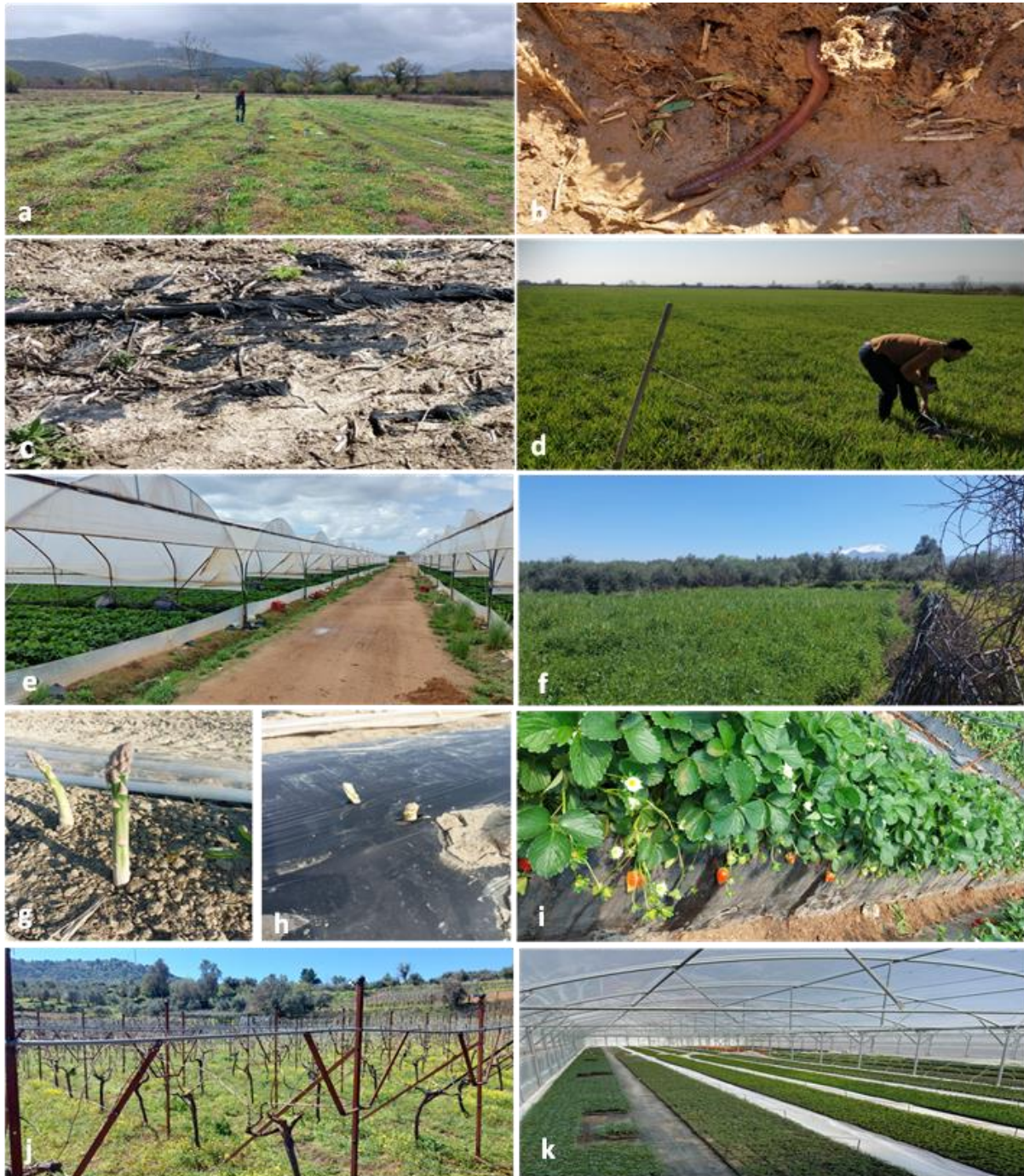


Figure 11. Sampling in Greece. Photographs: Christina Pyromali and Christos Briassoulis