

**Advanced biodiversity monitoring for results-based
and effective agricultural policy and transformation**

**Deliverable D3.1
Guideline for trial implementation**

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Table of Contents

Executive summary	6
1. Introduction	7
2. Field sampling implementation	7
2.1. Field site categories	7
2.2. WP2 Involvement: Overall sampling scheme	8
2.3. Year 1 – Testing the devices	9
2.4. Year 2-4 – Testing biodiversity detectability in different systems	10
3. WP4 Involvement: Combining monitoring data with stakeholder knowledge	10
Appendix: Field site information sheets	11



Executive summary

This deliverable presents detailed site descriptions of each major research site and existing information of additional sites being more relevant in the project years 2 to 4. It summarises and presents agricultural practices performed at BioMonitor4CAP research and Demonstration sites with links to local/regional nature conservation goals and targeted species. Furthermore, the conceptual approach relevant for trial implementation is presented and described.



1. Introduction

This document presents gathered information of agricultural practices performed at BioMonitor4CAP research and Demonstration sites with links to local/regional nature conservation goals and targeted species. Based on these baseline information this document provides guidance on how, when and to what extent research groups of WPs 2 and 4 are integrated into the activities of WP3. It supports specifically achieving the following outcomes (Part B, section 2.3): A and B "Strategy on monitoring soil biodiversity at farm scale adopted by science, end users, and policy" and E "Roadmap on expanding enhancing application and implementation of agri-environmental measures committing to the preservation of biodiversity; particularly agroforestry." This deliverable is an output of task 3.1.

2. Field sampling implementation

2.1. Field site categories

The BioMonitor4CAP research and demonstration sites cover major climatic/biogeographical regions as well as different farming systems in the EU. Within that framework field sites represent: i) agriculture, grassland or agroforestry farming systems); ii) conservation status (e.g. Natura 2000, Ramsar) or biodiversity research sites ensuring the application of agricultural practices considered to enhance biodiversity; and iii) mineral and organic (peat) soils. Three locations in Peru are included representing one of the most biodiverse regions globally as a reference location, where devices can be tested against a wider species spectrum (Figure 1).

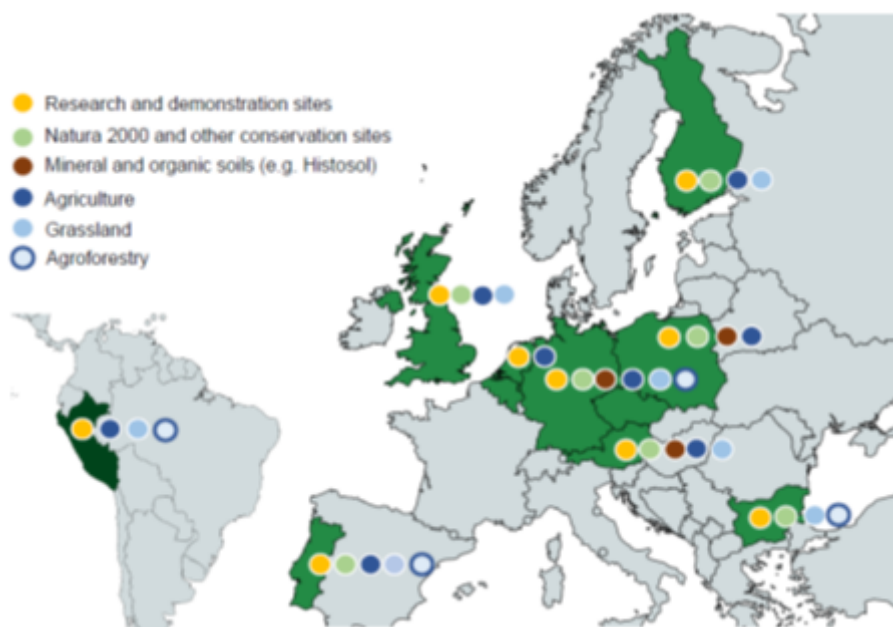


Figure 1 : Map of BioMonitor4CAP research and Demonstration sites in Europe and Latin America.



In total 22 sites are included in the project classified into three categories: 5 Major research sites (M), 10 Selected research sites (S) and 7 Demonstration sites (D) (Table 1). Multiple fields are proposed per site to ensure replication relevant for validation and demonstration coordinated through WP3 (See Chapter: 2.2 WP2 Involvement: Overall sampling scheme)

Table 1 : Research site classification.

Major research sites (M)	Selected research sites (S)	Demonstration sites (D)
High-intensity research activities are proposed for selected areas within conservation areas (mainly Natura 2000) in Bulgaria, Finland, Germany, Great Britain and Portugal.	Additional sites will ensure geographical coverage and/or allow assessment of specific species and habitats in Austria, Finland, Germany, Peru, Portugal and Poland,	These sites will be used for demonstration and training across land-use types (e.g. arable land, grassland, agroforestry) covering European agri-environmental regions in Austria, Germany and the Netherlands.
Total sites: 5	Total sites: 10	Total sites: 7

2.2. WP2 Involvement: Overall sampling scheme

The overall methodological approach of BioMonitor4CAP is based on the objectives to develop and support implementation of effective, affordable, and reliable methods, tools, and technologies to assess and monitor in-situ biodiversity of agricultural areas, considering spatiotemporal variabilities of above- and below-ground biodiversity across scales and agroecological zones.

The project will collect the biodiversity data in multiple, complementary ways. The classical in-situ and ex-situ surveys (field observations and measurements) will be combined with new methods: DNA (eDNA) sampling, optical methods, acoustic sensors, drone-based systems, and satellite earth observation. The potential for using participatory methods such as citizen science-based approaches are examined. Farmers' perceptions about and willingness to engage in biodiversity monitoring activities will be investigated. In addition, farm extension services' capabilities to advise and support farmer-led biodiversity monitoring activities are preliminary clarified/screened in WP4.

The challenge is to harmonise various monitoring procedures and their protocols in order to identify multi-purpose tools and approaches that are suitable for diverse taxa and habitat types. The development of such a protocol is well underway under the lead of WP2 in collaboration with the input of experts on different taxa and monitoring approaches abundantly available within the consortium. Thus, through compilation of sampling strategy advice and best practices for biomonitoring using eDNA, soil biomonitoring, bioacoustics, insect surveys and bird surveys, and for standardisation purposes, BioMonitor4CAP has adapted the European Pollinator Survey Grid (Potts et al., 2020) to compile as follows:

A 1x1 km grid, divided into nine equal areas with data collected from the centre of the four corner areas and the central area following a figure of five ensuring a distance of at least 200 m between points (Figure 2).



BM4CAP Grid

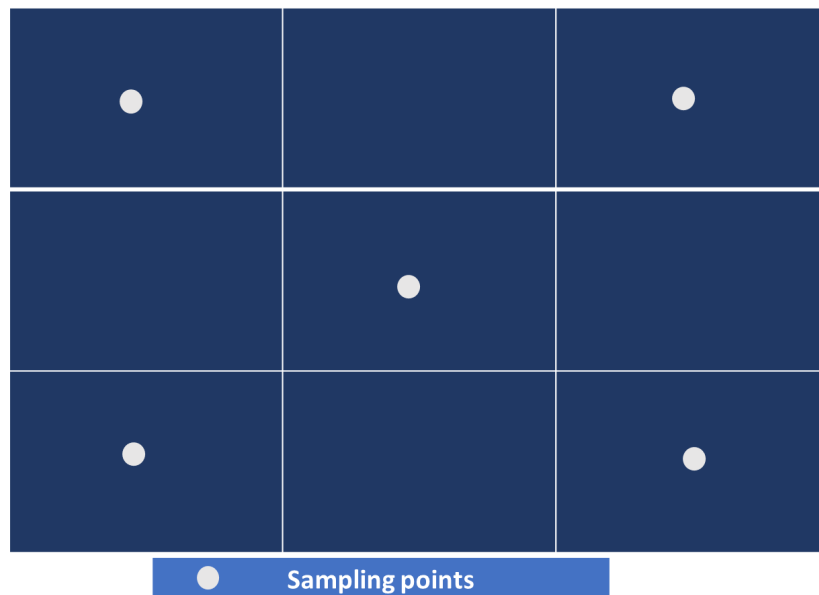


Figure 2 : 1x1 km sampling grid adopted for the BioMonitor4CAP project purposes.

Open land terrestrial habitats are the main focal sampling habitat types. BioMonitor4CAP acknowledges the heterogeneity expected in European rural landscapes, therefore, the following standardized exceptions apply:

- Woodland/woody landscapes and riparian environments are not targets of BioMonitor4CAP (with the exception of target agroforestry environments). If a grid point falls within any of these habitats, a random sample will be collected instead within a 50 m radius of the point.
- If the 50 m radius falls in its entirety outside the target habitat types, the position of the full grid must be adjusted.
- If representative landscapes are not continuous to the extent of fitting a full grid; random replicate samples can be collected from similar fields in close proximity. These samples must maintain a distance of at least 200 m and maintain the sampling density as per the grid.

Remote sensing approaches will be applied to account for habitat heterogeneity in and around the grid (e.g., density and distribution of non-target habitats).

2.3. Year 1 – Testing the devices

Research activities are set to start in June 2023 at the five Major research sites where the new methods can be tested, compared to and validated against ongoing monitoring activities on site. Soil samples for eDNA and physicochemical analysis will be collected at each of the five sampling points defined in the BioMonitor4CAP grid. In addition, one Audio Moth and a pan trap will be installed for a total of 21 days (e.g., at three different time points during the season for a consecutive time of seven days) aiming to cover main peak phenology of most insect families. Additional devices and sampling regimes will be ad hoc tested at different locations (e.g., full bird surveys in the UK site) to maximize local resource capacity.

At least one grid will be determined and tested in the first year, however, the number of grids per site varies between one (Portugal) and six (Great-Britain), depending on the available personnel resources.



2.4. Year 2-4 – Testing biodiversity detectability in different systems

In years 2 - 4 the focus will be moving forward from purely testing devices towards exploring monitoring performance of the new technologies in different settings along a biodiversity gradient. The data collected from year 1 will assure the development/adjustment of a reliable sampling strategy and sampling distribution for consecutive years and trials with the expectation that at least three grids will be defined per research site. In addition to Major research sites, Selected research sites will be fully included in the trials. While Selected research sites will ensure geographical coverage and/or allow assessment of specific species and habitats, Demonstration Sites will be used for demonstration and training across land-use types (e.g. arable land, grassland, agroforestry) covering European agri-environmental regions.

3. WP4 Involvement: Combining monitoring data with stakeholder knowledge

WP4 “Socio-economic proofing of agrobiodiversity measures” uses data and experiences originating from WP3 as input or stimulus materials in multi-actor focus group interviews (clarifies the state of stakeholders’ agrobiodiversity perceptions, M6-M18), co-creation workshops (prepares policy measure development in WP5, M24-M36) and farmer workshops (sets implementation guidelines for novel agrobiodiversity measures, M12-M30). Particularly, T4.1 “Usability assessment of agrobiodiversity data and co-creation of framework for agrobiodiversity-enhancing measures with the rural stakeholders” (M06–M36) will use field site-specific and novel monitoring technology-related information as input materials in focus group interviews and co-creation workshops with multiple stakeholders in six partner countries (Finland, Germany, Austria, Poland, Portugal, and Bulgaria).

Focus group interviews and co-creation workshops provide information about farmers’, farm advisory services representatives’ and researchers’ perspectives on monitoring technologies, their feasibility, and stakeholders’ willingness to engage in monitoring activities. Stakeholders’ perspectives are also used in policy measure development in WP5. General feedback and information about site-specific circumstances on farm and landscape-levels are collected and provided for enhancing the biodiversity monitoring activities conducted in WP3.

Collaboration between WP3 and WP4 employs a multi-actor approach. WP3 provides researcher-led biodiversity monitoring data collected from the field sites whereas WP4 classifies these data in an easy-to-understand format, uses it as input materials and provide stakeholders’ perceptions associated with monitoring activities. These data are combined with stakeholders’ locally and regionally situated, practical, and experiential knowledge that feeds back to developing biodiversity monitoring activities conducted in WP3.



Appendix: Field site information sheets

Field site information sheets are extended documents with detailed information for each research site, encompassing environmental conditions (e.g., soil, biodiversity, climate), agronomic management (e.g., land use type, agricultural practices), and, where available, conservation plans are available for internal use, but have been removed from this report due to data protection reasons.

