



## Soil biodiversity monitoring in France

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# Soil biodiversity monitoring in France

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A. Leveque and N. Bougon, OFB

on the behalf of GIS Sol



# GIS Sol a Scientific Interest Group on soils dedicated to collect, use and give access to soil data in France

- **Involvement:**

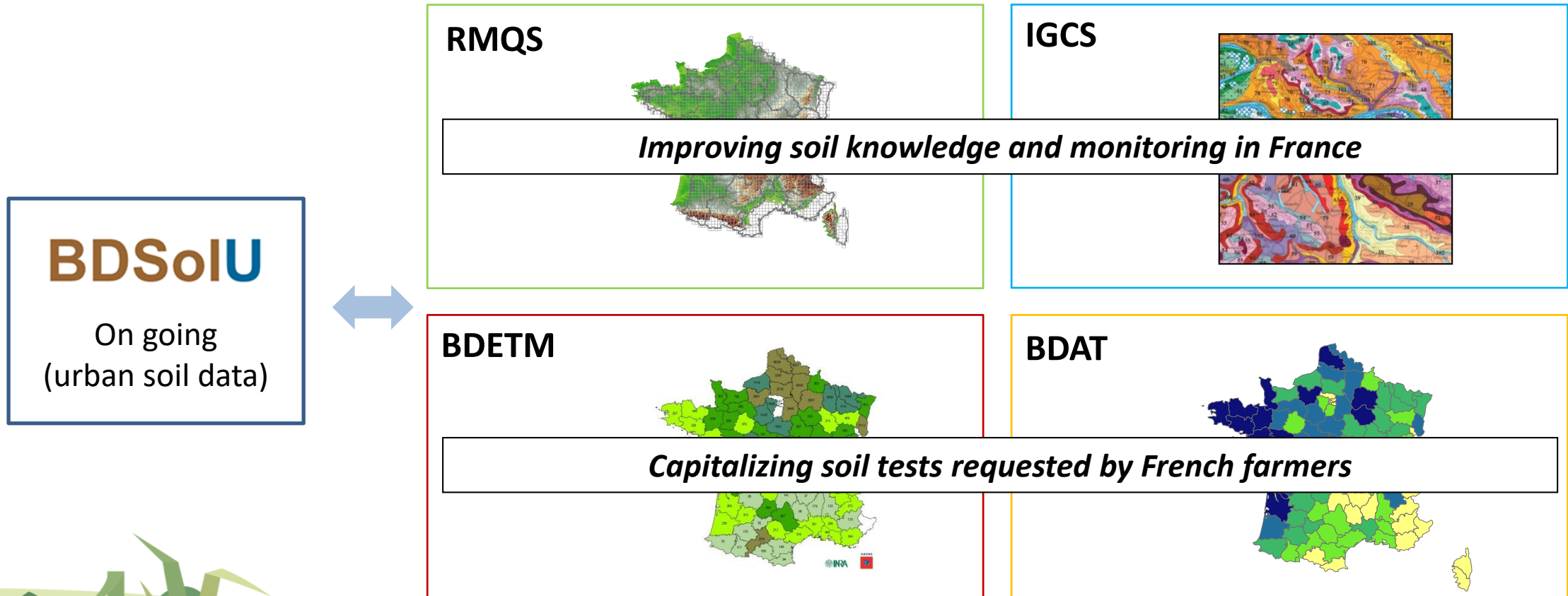
- 2 ministries (Agriculture and Environment),
- 2 national agencies (Environment and Biodiversity)
- 4 research institutes (INRAE, IRD, IGN and BRGM)
- INRAE InfoSol: coordination of programs and databases

- **Main aims:**

- Survey and monitor French soils
- Organize and store soil samples and soil information
- Give access to soil information and samples
- Support public policies

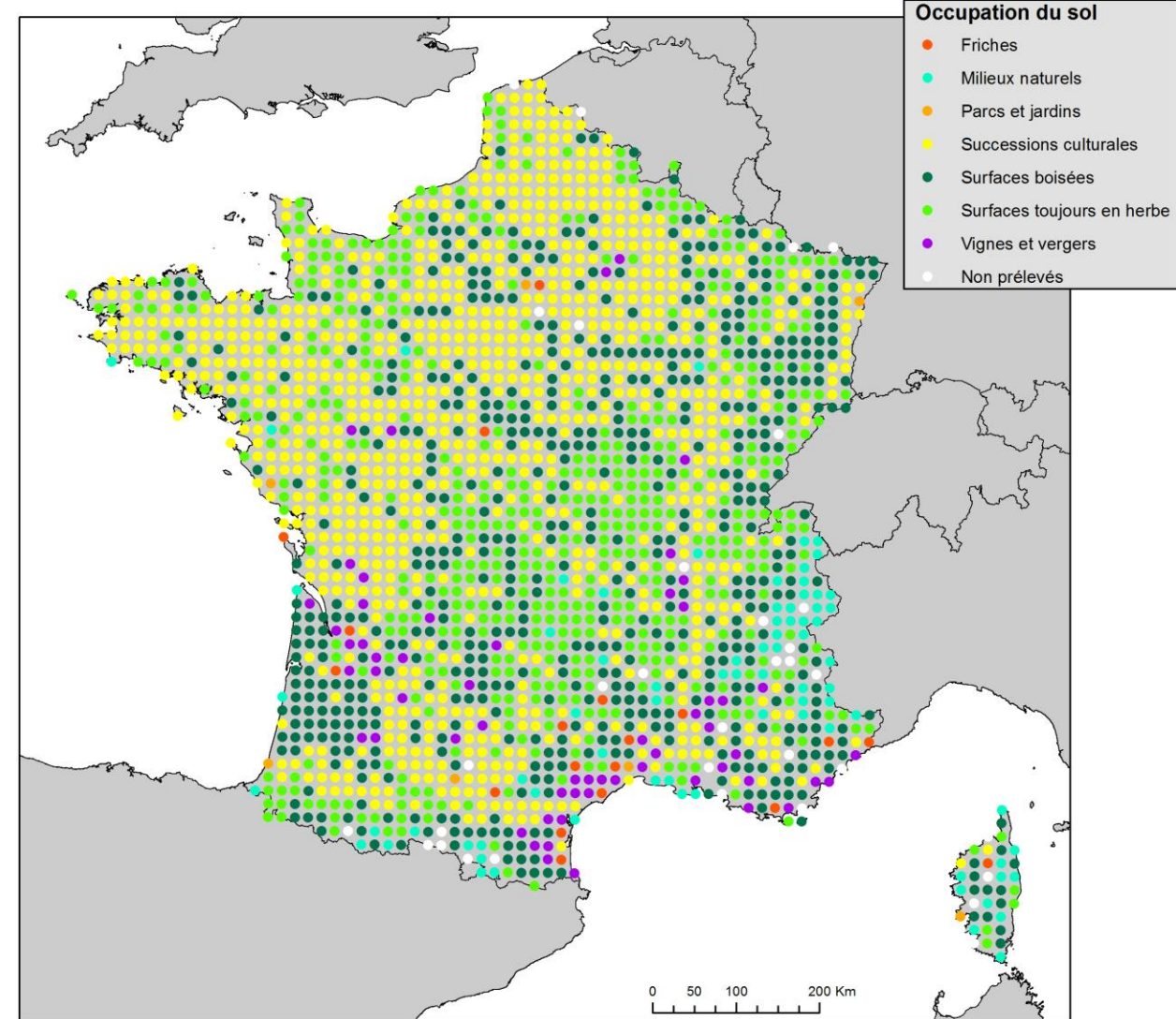


# Four main soil survey and monitoring programmes



# RMQS: French National Soil Quality Network

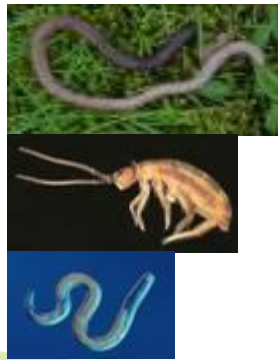
- 2240 sites, 16 km x16 km grid
- On different land uses in continental France and overseas territories
- Each site is sampled every 15 years, since 2000 (2nd campaign started in 2016)
- 12 sub-contracted teams in France doing the fieldwork, based on a common manual
- Data available on soil:
  - Physical and chemical characteristics,
  - Contaminants,
  - Biodiversity,
  - Management practices



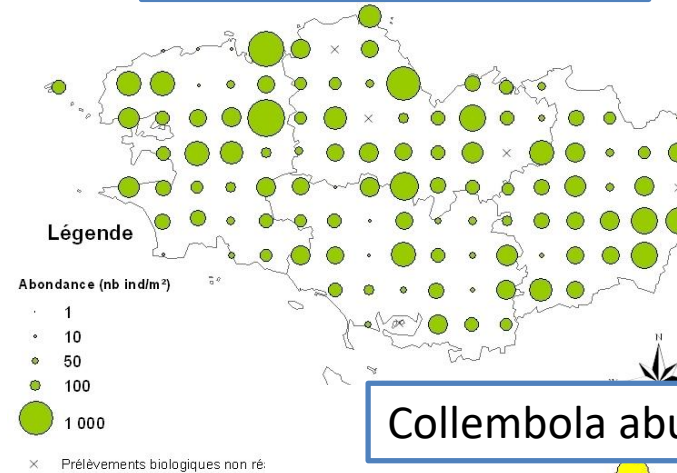
# Early experiences – Soil fauna (2005-2010)

Cluzeau et al. 2012. Integration of biodiversity in soil quality monitoring: Baselines for microbial and soil fauna parameters for different land-use types. *European Journal of Soil Biology*, 2012, vol. 49, p. 63-72.

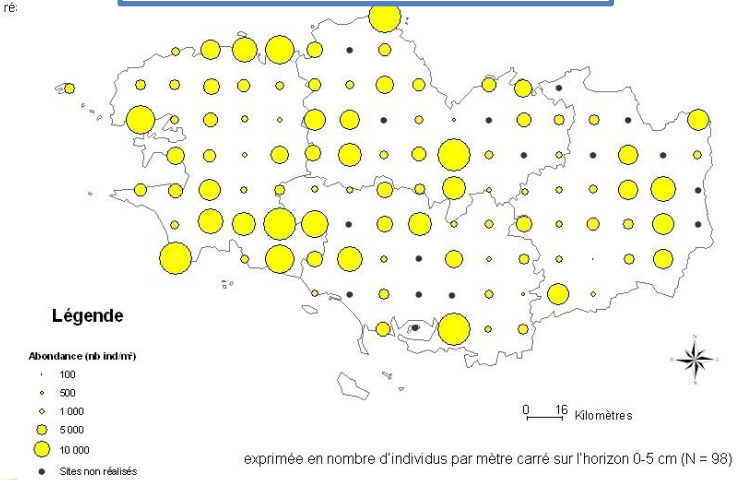
Ponge et al. (2013). The impact of agricultural practices on soil biota: a regional study. *Soil Biology and Biochemistry*, 67, 271-284.



## Earthworms abundance

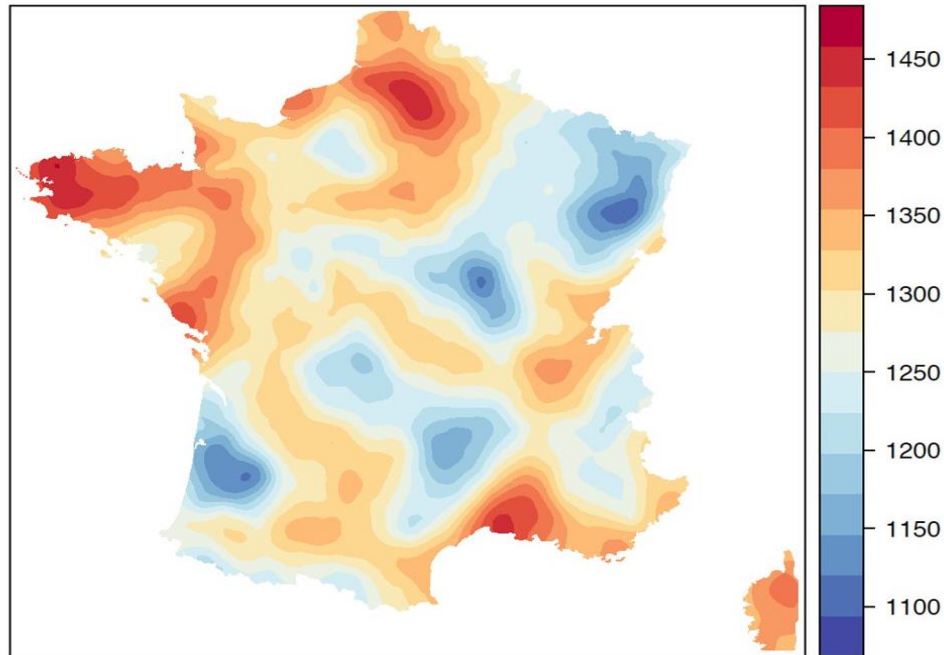


## Collembola abundance



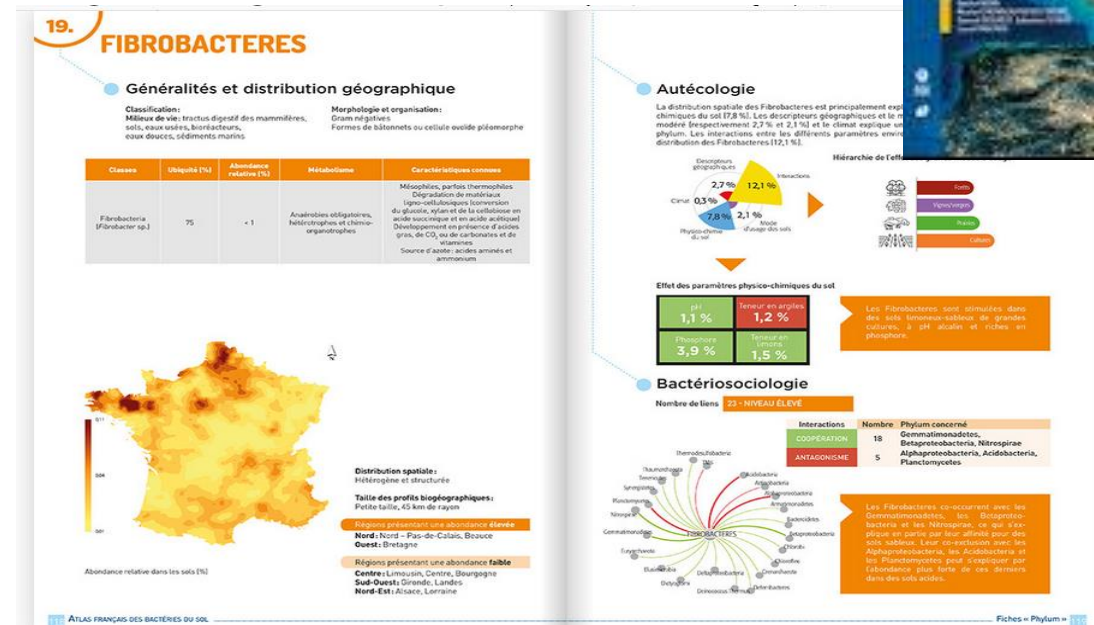
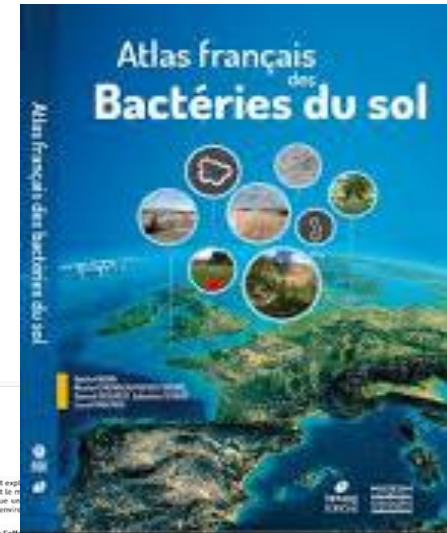
# Early experiences – Microbial biomass and bacterial communities *(based on DNA extracts) (2005-...)*

Bacterial diversity of soils – France



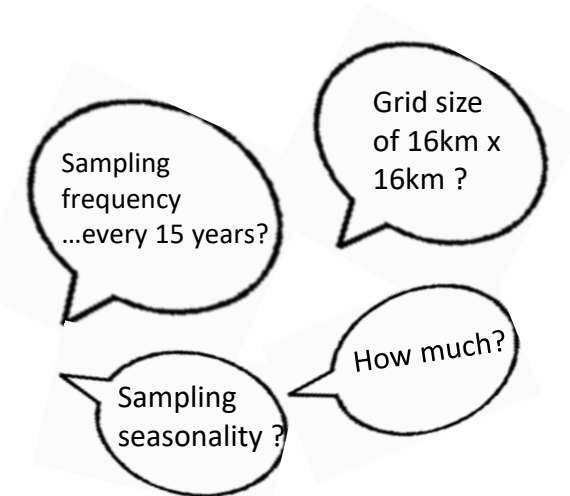
Source : © GIS Sol, UMR Agroécologie – équipe BIOCOM, plateforme GenoSol

Karimi et al., Environmental Chemistry Letters, 15 (2017)  
Karimi et al. Science advances, 4(7), eaat1808. 2018)



# Currently testing the inclusion of soil biodiversity in the RMQS

- **OFB is in charge of a French long-term biodiversity monitoring network?**
  - Based on these early experiences, in 2018, OFB approached the GIS Sol about the possible inclusion of soil biodiversity in this national network
  - RMQS being the possible device for such measurements (*as already implemented in mainland France and overseas territories*)
- **Our strategy**
  - Ask experts (on the indicators, the sampling strategy, the sampling procedures, the logistical constraints, the costs...)
  - Develop a handbook to be tested, identify relevant labs and estimate costs
  - Test the handbook on field with all partners across France
  - Analyze the results and feedbacks from field operators and labs
  - Conclude...



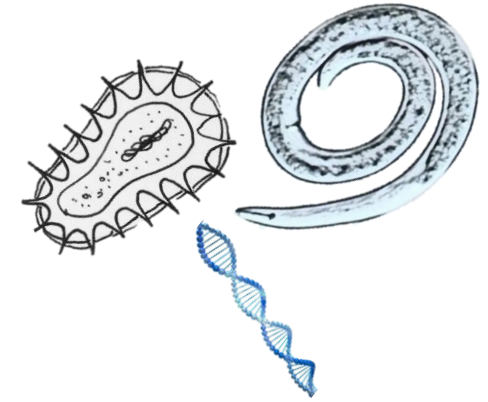
# 5 protocols selected to monitor both taxa and functions

\* Already done in the RMQS

1

Surface soil  
composite sample\*

Bacteria, Fungi and Protists  
Nematods  
Soil seed bank  
Enzymatic activity  
Organic matter degradation



2

Cylindrical split  
corer ø 5 cm

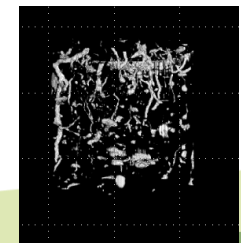
Below-ground mesofauna



3

Cylindrical split  
corer ø 16 cm

Soil porosity

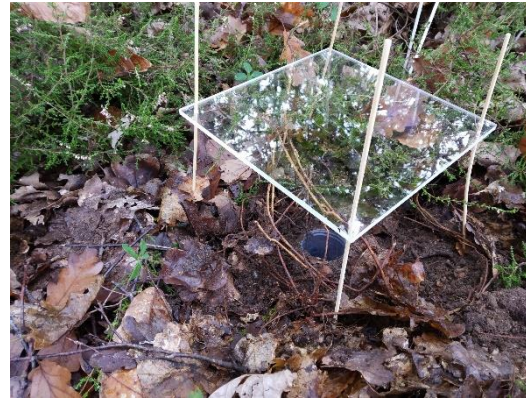


# 5 protocols selected to monitor both taxa and functions

4

6 Pitfall traps

Surface macro and mesofauna



5

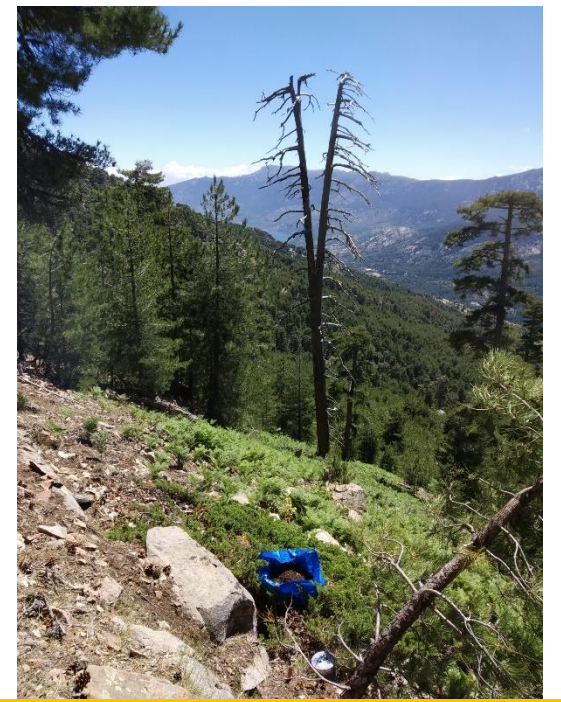
6 Hand sorting of a soil block + mustard

Earthworms and larvae



# First lessons from the field

Until now : around 20 sites sampled  
(10 to come...)



Mean duration for applying on field the 5 protocols: 8h (min ~6h and max ~11h )  
with 2 (or 3) people in addition to the team already involved for classical monitoring



# Next steps and conclusion

- **Next steps :**

- Finish the field testing (February 2022)
- Update the manual, manage and analyze the data (spring 2022)
- Conclude and decide with OFB about what to monitor and how

- **1st conclusions**

- Sampling soil biodiversity is feasible on an existing network (as demonstrated by early experiments)
- Requires time (and money)
- Will we need to adapt the overall monitoring process?

