Soil biodiversity monitoring in France

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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

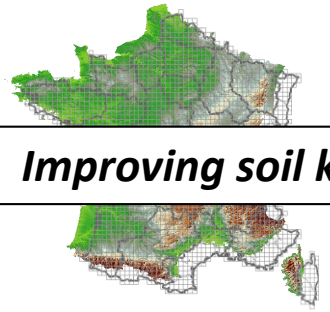
- **Main aims:**
  - Survey and monitor French soils
  - Organize and store soil samples and soil information
  - Give access to soil information and samples
  - Support public policies

Four main soil survey and monitoring programmes

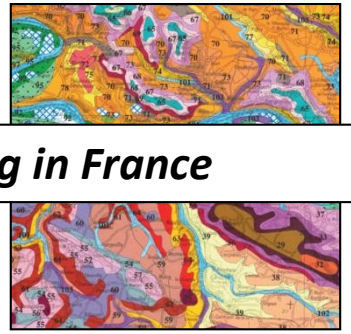
BDSolU

On going
(urban soil data)

RMQS

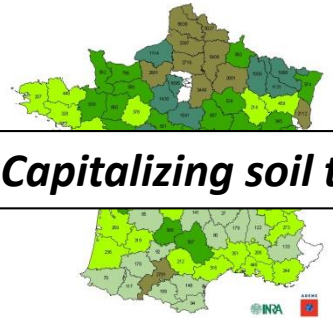


IGCS

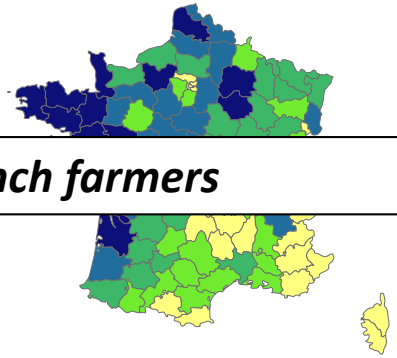


Improving soil knowledge and monitoring in France

BDETM



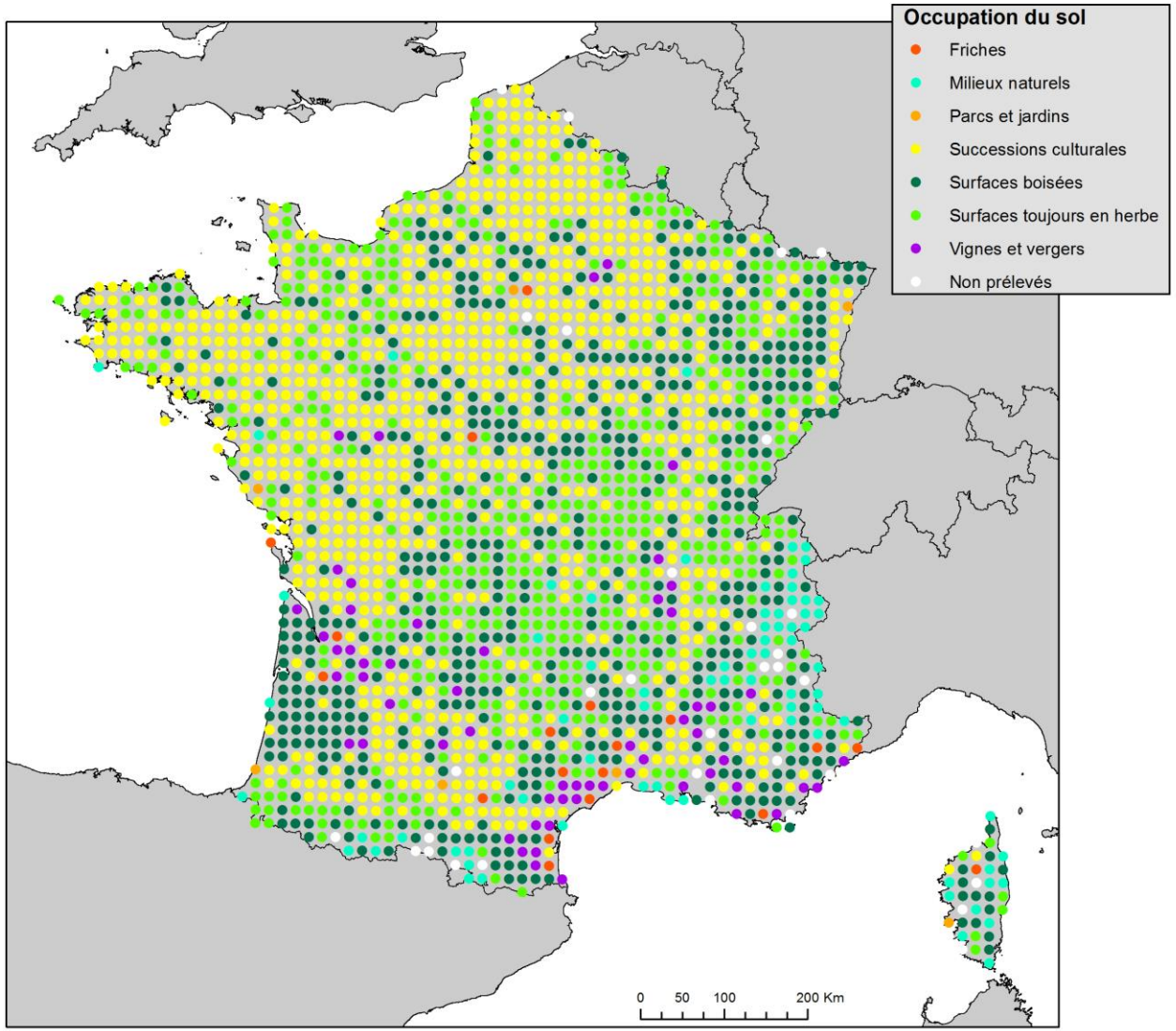
BDAT



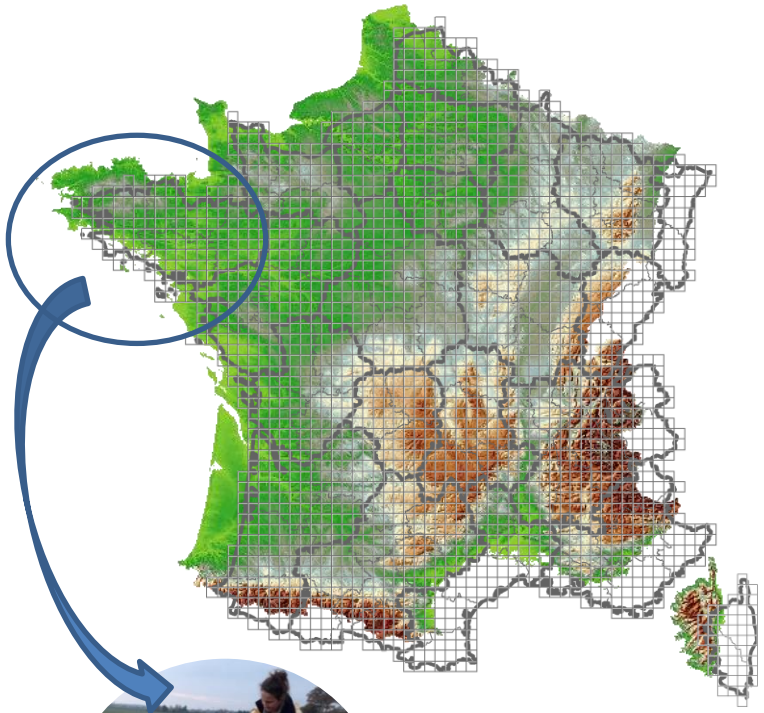
Capitalizing soil tests requested by French farmers

RMQS: French National Soil Quality Network

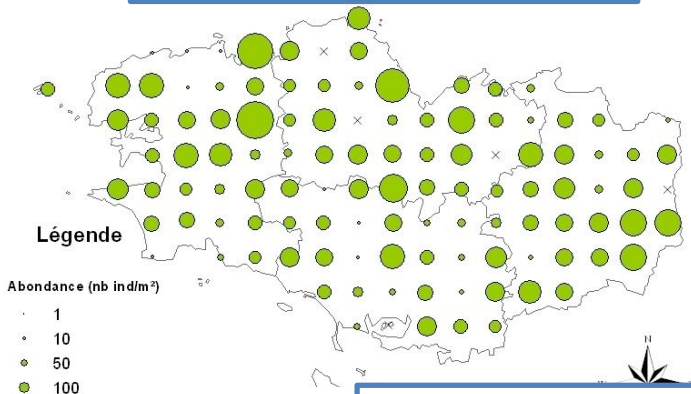
- 2240 sites, 16 km x16 km grid
- On different land uses in continental France and overseas territories
- Each site is sampled every 15 years, since 2000 (2nd campaign started in 2016)
- 12 sub-contracted teams in France doing the fieldwork, based on a common manual
- Data available on soil:
  - Physical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



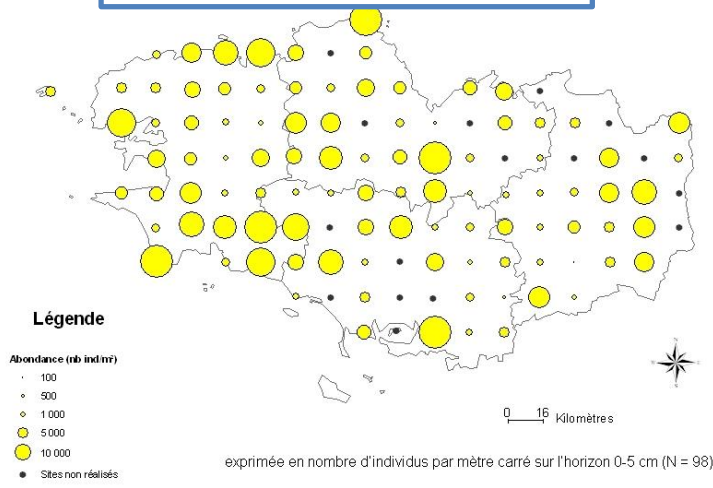
Early experiences – Soil fauna (2005-2010)



Earthworms abundance



Collembola abundance

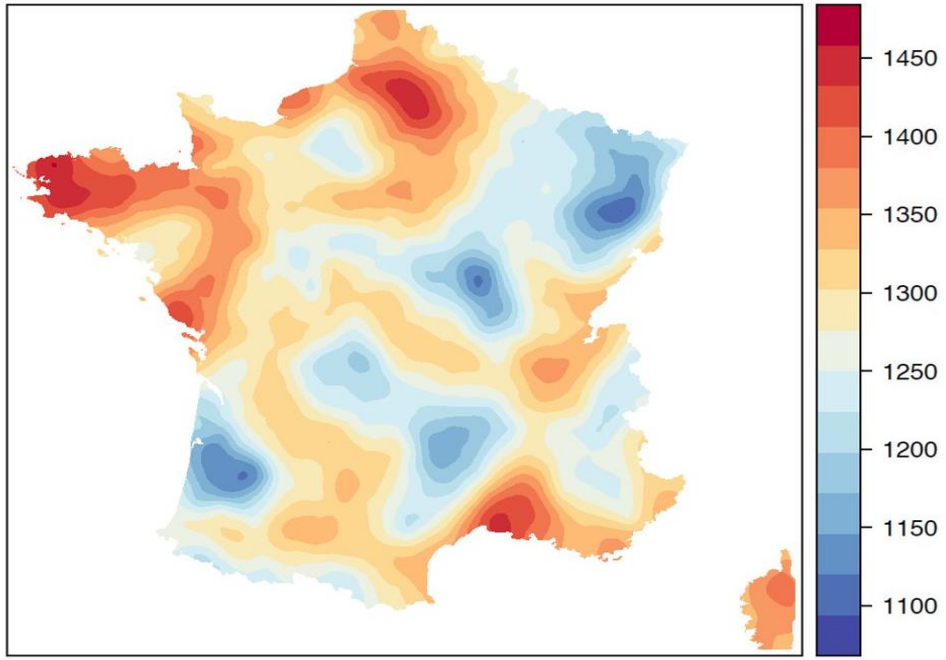


Cluzeau *et al. 2012*. Integration of biodiversity in soil quality monitoring: Baselines for microbial and soil fauna parameters for different land-use types. *European Journal of Soil Biology*, 2012, vol. 49, p. 63-72.

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

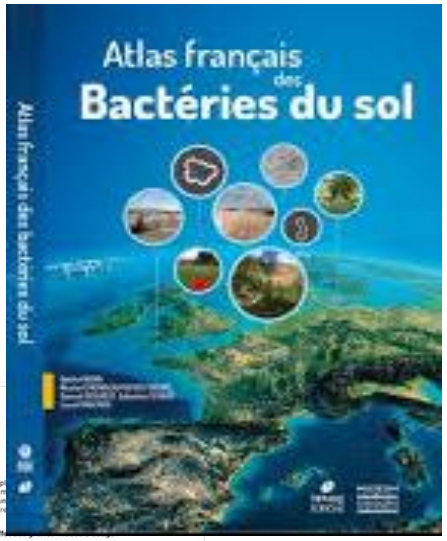
Early experiences – Microbial biomass and bacterial communities *(based on DNA extracts) (2005-…)*

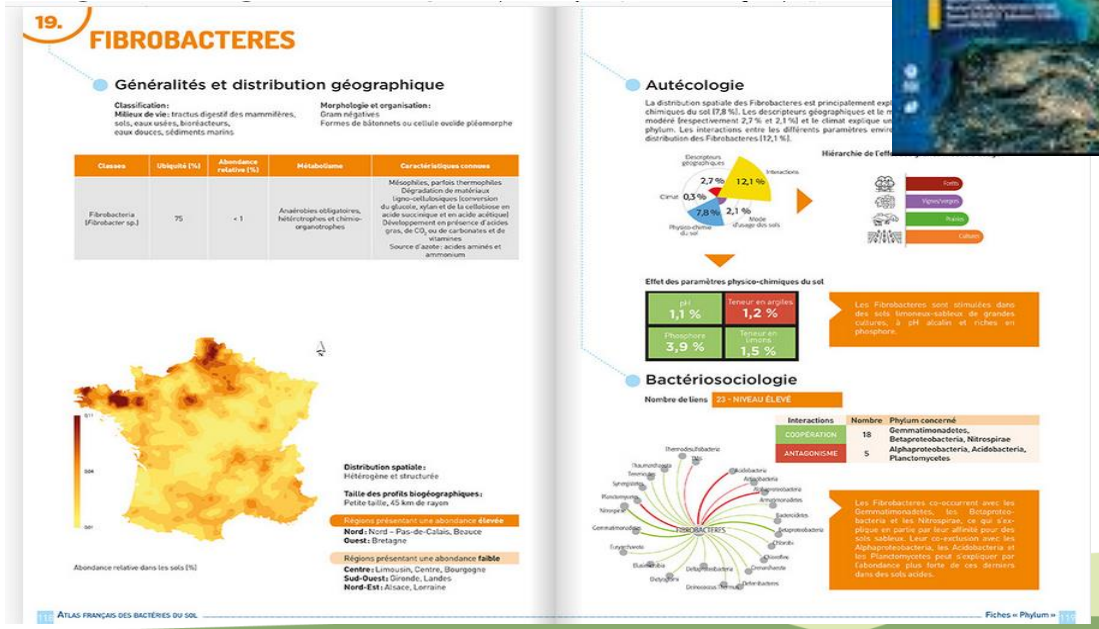
Bacterial diversity of soils – France



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

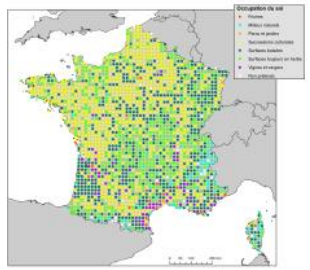
Karimi et al., Environmental Chemistry Letters, 15 (2017)
Karimi et al. Science advances, 4(7), eaat1808. 2018)



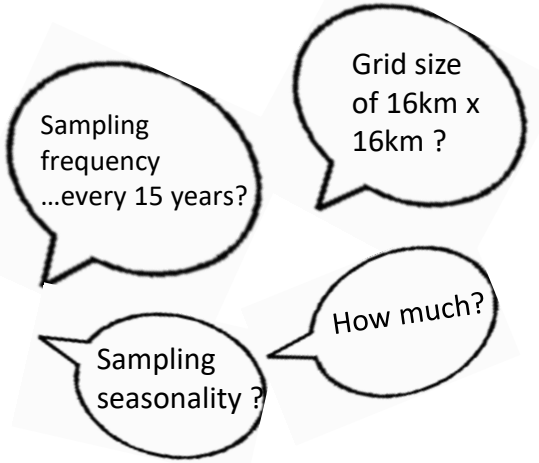


Currently testing the inclusion of soil biodiversity in the RMQS

- **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 constrains, 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…**

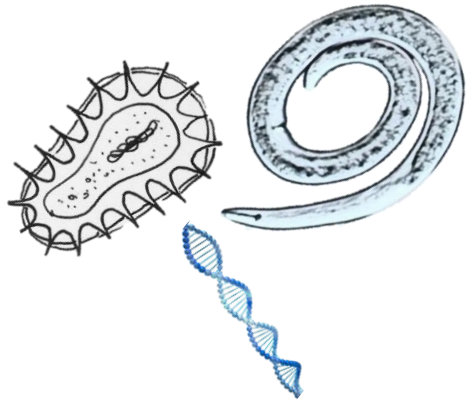


5 protocols selected to monitor both taxa and functions

* 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**

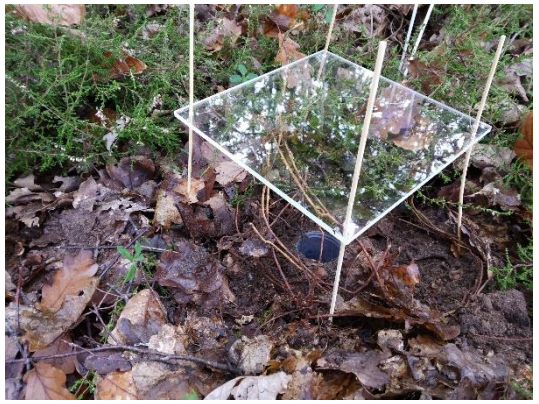
   Soil porosity

5 protocols selected to monitor both taxa and functions

4

6 Pitfall traps

Surface macro and mesofauna



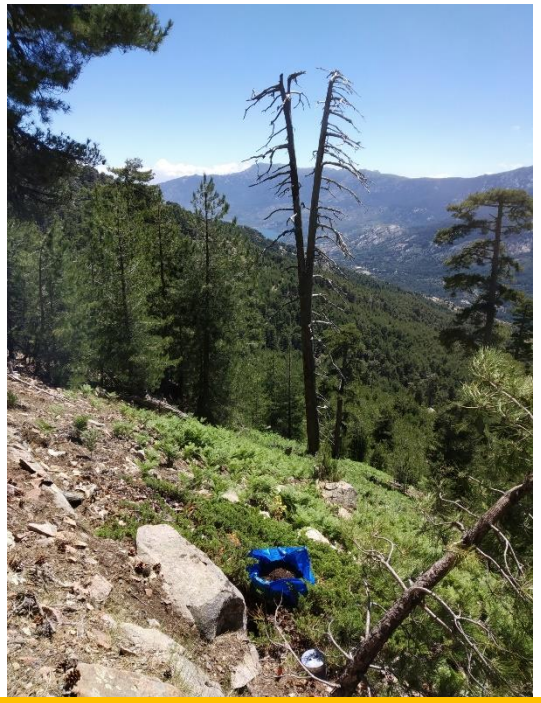
5

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?