

# AGRINNOV: AN INNOVATIVE PARTICIPATIVE APPROACH TO IMPLEMENT OPERATIONAL INDICATORS AND SET OF REFERENCES FOR SOIL BIOLOGICAL STATUS IN VINEYARDS

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## CONTEXT AND OBJECTIVES

Soil is a non-renewable resource which plays a key role in agroecosystem functioning thanks to its biological component. Today, a crucial need in agriculture is to reduce the use of external inputs while preserving soil fertility and quality through innovative agricultural systems. In this context of cropping system evolution, new tools have to be developed to assess the impact of these systems on soil quality. AgrInnov (2012-2015) is a French participative project associating researchers and farmers which aims at developing operational tools to characterize soil biodiversity and building up a set of references to understand and interpret this biodiversity. To do so, AgrInnov has the following objectives:

- ◆ To select and validate operational soil biological and agronomical indicators
- ◆ To transfer the selected indicators and the associated knowledge to soil users (training)
- ◆ To implement a set of references for soil biological status in vineyards

## STRATEGY

The method consisted in:

1. Selecting operational bio-indicators and agronomic indicators among the existing ones, on the basis of:
  - ◆ Scientific robustness
  - ◆ Applicability to a network of farming systems
  - ◆ Interest of farmers and easiness for use
  - ◆ Cost
  - ◆ Existence of labs able to analyse these indicators during and after the project
2. Building a network of vineyard plots which integrates a large diversity of pedoclimatic and practices backgrounds at the French territory scale
3. Winegrowers training to indicators usage and soil sampling
4. Performing laboratory analyses and feeding back the results to winegrowers
5. Data analysis on a national scale (still under process)

## ACHIEVEMENTS

### Selection of the indicators and implementation of the network of vineyard plots

#### Biological indicators



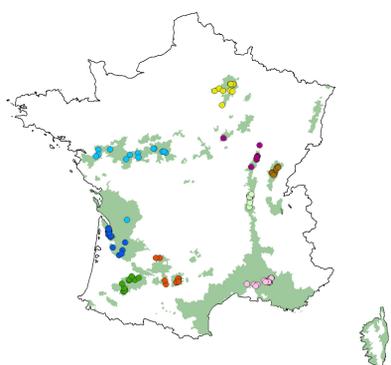
Microorganisms: Bacterial and fungal abundance and diversity



Nematodes abundance and diversity



Earthworms abundance and diversity



#### Network of 117 vineyard plots

Large diversity of pedoclimatic backgrounds and agricultural systems

#### Agronomic indicators



Soil physico-chemical properties



OM degradation: litter bags



Soil structure: spade compaction test

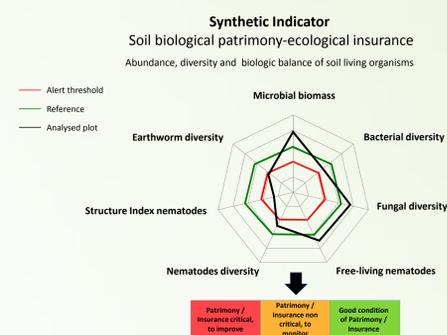
### Winegrowers training efficiency and soil sampling

After receiving a one-day training:

- ◆ 94% of the viticulturists have carried out soil sampling allowing soil physico-chemical, microbiological and nematological analyses
- ◆ 88% of the viticulturists have performed spade test with earthworms hand-sorting
- ◆ 70% of the litterbags have been returned

### Feed back to winegrowers

One of the main objectives of AgrInnov was to provide viticulturists with a set of indicators as diagnostic tool for biological soil quality. To complete this diagnosis, two synthetic indicators – “biological patrimony-ecological insurance” and “biological fertility” – were proposed to report the biological and ecological functioning of the soil. They were built by aggregating elementary indicators and are still being improved.



### Implementation of a set of references

Results obtained allowed to establish a range of variation for each indicator in different pedoclimatic contexts. This is an important step because perennial cropping systems are among the least informed regarding soil biodiversity

### Illustration of the synthetic indicator “soil biological patrimony – ecological insurance” for one plot from the AgrInnov network.

For each elementary indicator composing the synthetic indicator, alert thresholds were defined below which soil functions may no longer be insured. If the value of one of the elementary indicator is below the alert threshold, we consider that the biological status of the plot needs to be monitored; if more than two elementary indicators are below the alert threshold, the biological status of the plot needs to be improved.

|        | Microbial community     |                        |                            |                         | Nematodes                                       |                    |                              | Earthworms                  |                                       |                                          |                                                    | Agronomic Indicators                             |                                         |                  |                                |                               |
|--------|-------------------------|------------------------|----------------------------|-------------------------|-------------------------------------------------|--------------------|------------------------------|-----------------------------|---------------------------------------|------------------------------------------|----------------------------------------------------|--------------------------------------------------|-----------------------------------------|------------------|--------------------------------|-------------------------------|
|        | Biomass (µg DNA/g soil) | Fungal/Bacterial ratio | Bacterial species richness | Fungal species richness | Abundance of free-living nematodes (ind/g soil) | Nematode diversity | Nematofauna Enrichment Index | Nematofauna Structure Index | Total abundance (ind/m <sup>2</sup> ) | Endogeic abundance (ind/m <sup>2</sup> ) | “Blackhead” Anecic abundance (ind/m <sup>2</sup> ) | “Redhead” Anecic abundance (ind/m <sup>2</sup> ) | Epigeic abundance (ind/m <sup>2</sup> ) | Species richness | % OM degradation (litter bags) | Compaction class (spade test) |
| n      | 12                      | 12                     | 12                         | 12                      | 12                                              | 12                 | 12                           | 12                          | 12                                    | 12                                       | 12                                                 | 12                                               | 12                                      | 12               | 10                             | 11                            |
| min    | 13.6                    | 0.7                    | 460                        | 250                     | 0.3                                             | 0.9                | 33.9                         | 12                          | 33                                    | 17                                       | 0                                                  | 17                                               | 0                                       | 2                | 30                             | 1                             |
| max    | 49.7                    | 4.0                    | 735                        | 579                     | 11.7                                            | 2.8                | 96.9                         | 96                          | 1092                                  | 625                                      | 283                                                | 142                                              | 175                                     | 9                | 76                             | 5                             |
| median | 22.6                    | 1.3                    | 580                        | 364.5                   | 2.7                                             | 2.3                | 56.0                         | 60                          | 315                                   | 210                                      | 2                                                  | 58                                               | 46                                      | 6                | 56                             | 2                             |

Example of range of variation for each indicator in the case of the Gascony Vineyard (South West of France) (n = 12 plots): minimum, maximum and median values of biological and agronomic indicators.

## PROSPECT

AgrInnov project will end up in June 2015. The data analysis on a national scale (which is still under process) should give more information on the impact of vine management systems and practices on soil biology and services it provides. However several developments of the project have already been identified: training for farmers and agronomists, network expansion by including additional farmers, but also other soil users, and developing a new sector of analyses and agronomic consulting.