AEGES: Attenuation Of Greenhouse Gas Emissions In Grasslands

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CONTEXT

Agricultural activity is responsible to over 10% of total anthropogenic emissions of GHG and, among them, for over 70% of global N_2O.

A variety of options exist to mitigate GHG emissions in agriculture. The most prominent options are the improvement of crop and grazing land management in upland soil (agronomic practices, crop selection, tillage and residue management) and the restoration of degraded soils.

The introduction of temporary grasslands in crop rotations is one of the prominent options to improve both soil organic matter (SOM) and biodiversity, conversely the effects in N_2O emissions, together with the quality of SOM, can be highly variable.

PROJECT AEGES

The main goal is the reduction of uncertainties associated with the prediction of GHG emissions, C storage and N content in the agro-ecosystems at French scale.

The project consist of different objectives:

- Improve the GHG estimation integrating the experimental knowledge on microbial activities (denitrification, nitrification and decomposition) of C and N;
- Study of management's effects on SOM composition, GHG emissions and microbial activity;
- Improve and calibrate simulation models to reproduce the effect of agronomic practices on SOM and GHG at field scale by using data from ongoing long-term experiments;
- Propose management options in order to attenuate GHG emissions from agriculture systems.

Effects of agronomic practices on GHG emissions, C and N storage — TASK 2

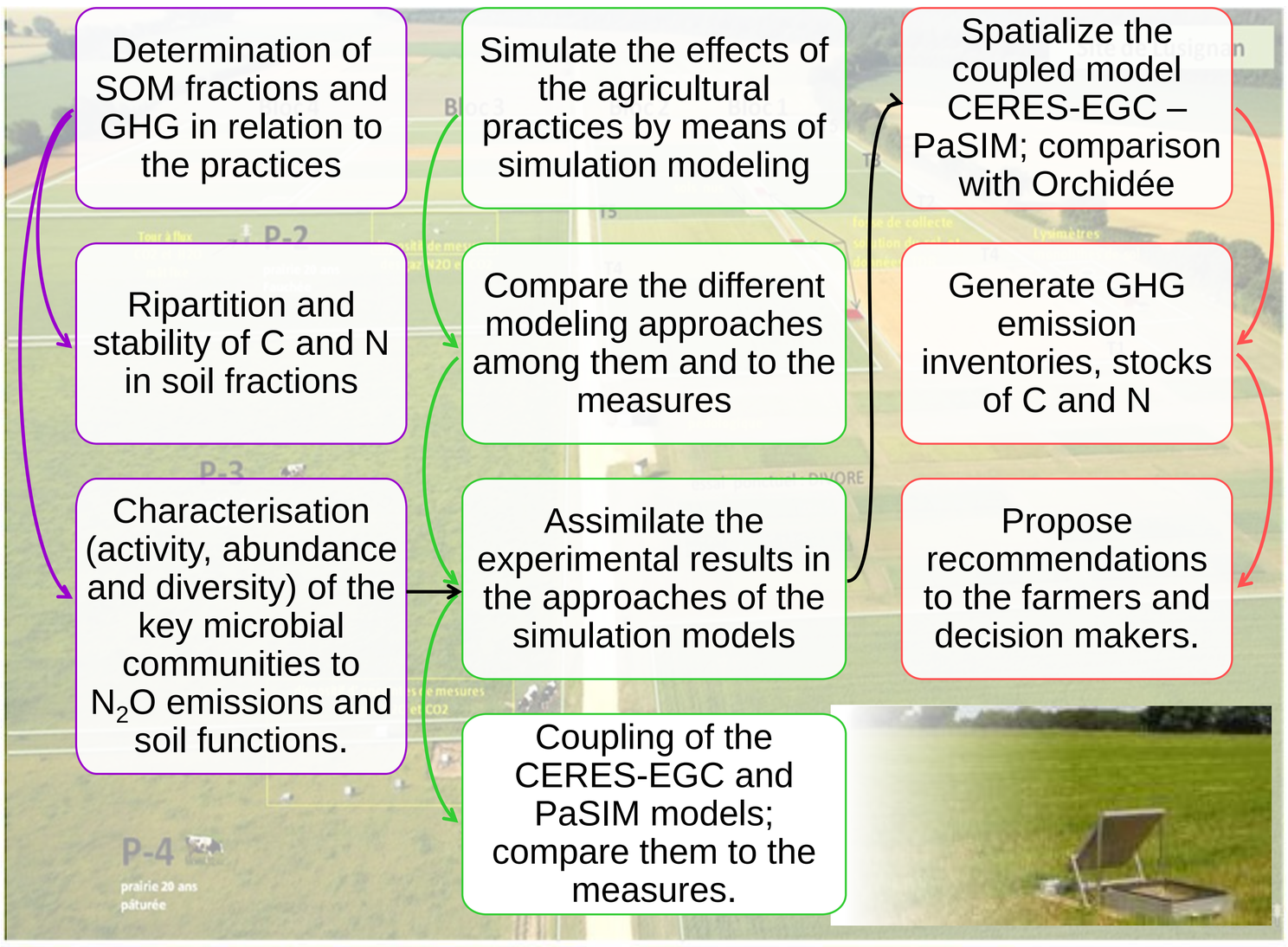
- Determination of SOM fractions and GHG in relation to the practices
- Ripartition and stability of C and N in soil fractions
- Characterisation (activity, abundance and diversity) of the key microbial communities to N_2O emissions and soil functions.

Model parameterisation and assessment to reproduce agronomic management at field scale — TASK 3

- Simulate the effects of the agricultural practices by means of simulation modeling
- Compare the different modeling approaches among them and to the measures
- Assimilate the experimental results in the approaches of the simulation models
- Coupling of the CERES-EGC and PaSIM models; compare them to the measures.

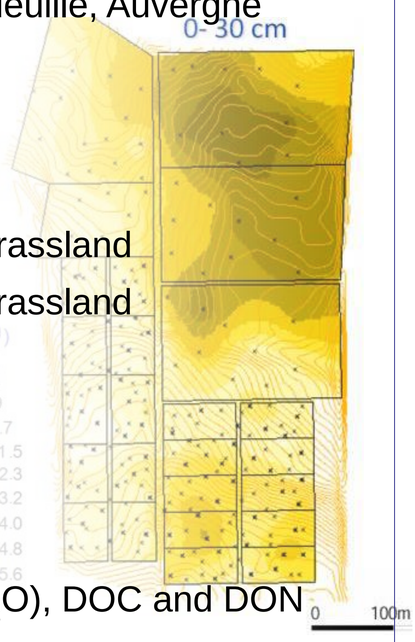
Integration on French national scale and estimation of uncertainties — TASK 4

- Spatialize the coupled model CERES-EGC – PaSIM; comparison with Orchidée
- Generate GHG emission inventories, stocks of C and N
- Propose recommendations to the farmers and decision makers.



TEST SITES (SOERE ACBB observatory):

- Temporary grasslands (crop-grassland rotations) Lusignan, Poitou-Charentes
- Permanent grasslands: Theix-Laqueuille, Auvergne
- Crop rotations: Grignon, Yvelines



MANAGEMENT TESTED:

- Crop-grasslands rotations:
  - 3 years of crops + 3 years of grassland
  - 6 years of crops + 3 years of grassland
- Livestock load: high vs low
- Load of N fertilisation
- Pastures vs cutting

DATA:

- Fluxes of GHG (N_2O, CO_2, CH_4, H_2O), DOC and DON
- C, N and SWC content in different layers
- Phisical and chemical soil caracteristics
- Crop parameters, aboveground and root biomass
- Microrganism caracteristics (nitrifiers and denitrifiers)
- Solid deposit
- Management and meteo data

SPATIALISED DATA (FRENCH SCALE):

- 8 × 8 km meteo data from Safran model
- Management from Agreste cultural practices
- Soil maps from Donesol (1:250000)

MODELING APPROACHES

PASIM a biogeochemical and mechanistic model for the grasslands ecosystem at field scale; able to simulate fluxes of C, N, energy, water and the dynamics and the interactions of grasslands, atmosphere and livestock.

CERES-EGC a mechanistic crop model with the main domain in the agro-ecosystem; able to reproduce biogeochemical dynamics (C, N, water) and environmental losses such as N_2O, NO_3^-, NH_3, NO and CO_2.

ORCHIDEE is a model employed to extend the emissions at regional or global scale in different ecosystem, used here to compare the estimations of CERES-EGC – PaSIM coupled model.

Project founded by the French Environment and Energy Management Agency (**ADEME**)

In the **REACCTIF** call (Research on climate change mitigation by agriculture and forestry)