Grasslands for soil organic matter storage in crop-livestock systems.

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GRASSLANDS FOR SOIL ORGANIC MATTER STORAGE IN CROP-LIVESTOCK SYSTEMS

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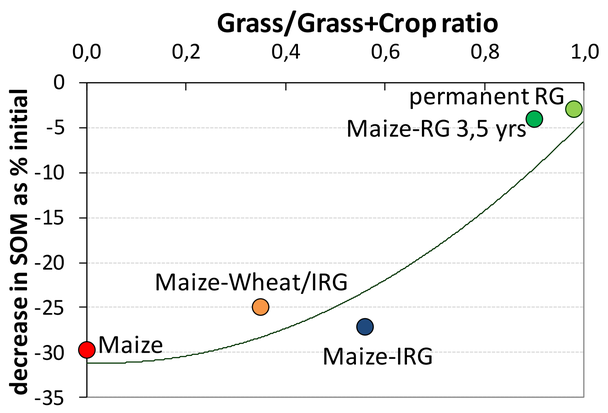
Intensively managed crop-livestock systems combine a diversity of cropping systems differing in i) grass proportion and duration in ley-arable rotations, ii) carbon and nitrogen inputs to soil via plant residues + manure, iii) local soil and climate conditions.

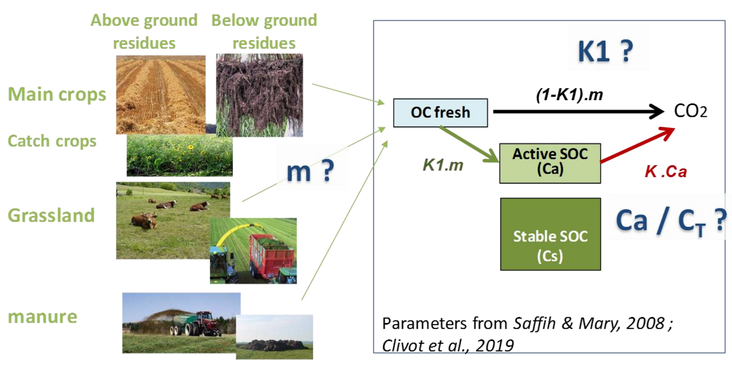
We aimed to identify main drivers of SOC stocks, storage or release comparing 3 types of crop rotations

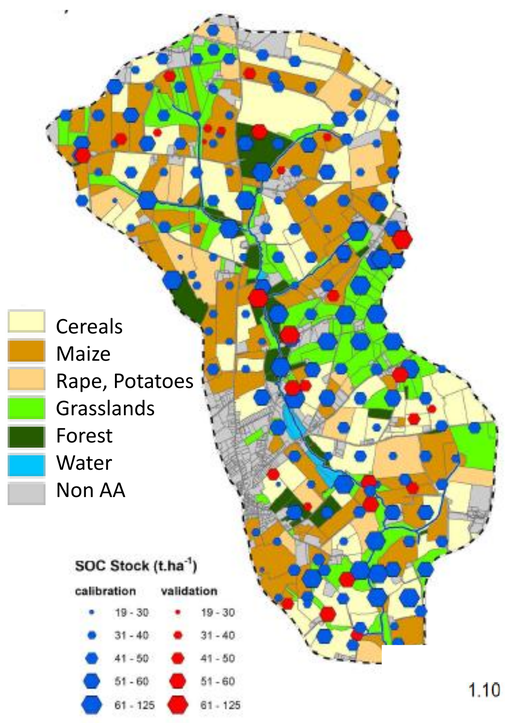
- Crops : Maize monoculture with or without Italian Ryegrass as catch crop, Maize-Wheat+IRG as cc
- Ley-arable : Maize – (cereals) – grasslands
- Permanent grasslands

In a long term experiment (Western Brittany, 27 years, initial C stock (0-25 cm) ≈ 89 tC.ha^{-1} → measurements + simulation of SOC storage/release with AMG Model *(Clivot et al., 2019, Envir. Model. & Software, 118, 99-113)*

In a fields network (Centre-Brittany, SOERE Agrhys, C stocks ≈ 40-60 tC.ha^{-1} (0-25 cm) → measurements + soil quality index *(Viaud et al., 2018, AGEE, 265, 166-177)*







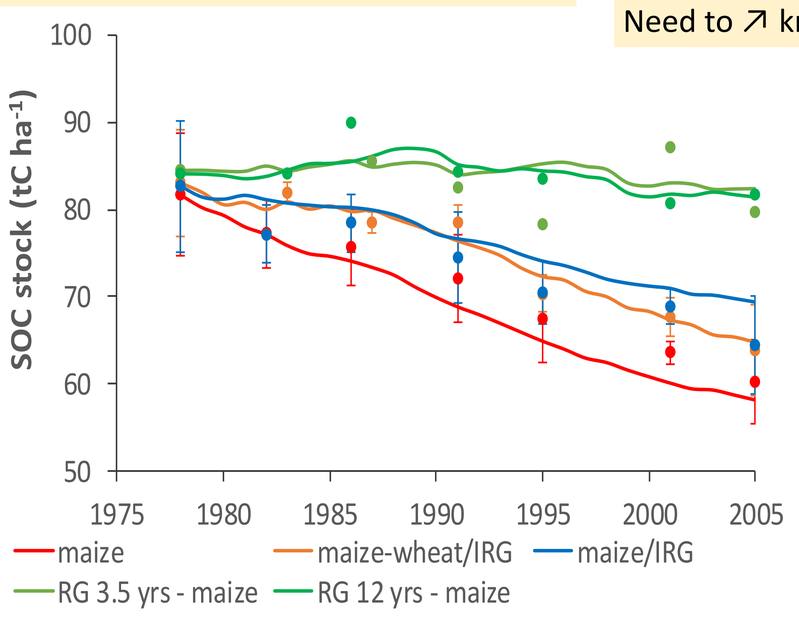
Mean C stocks 47,7 t.ha^{-1} (20-125)

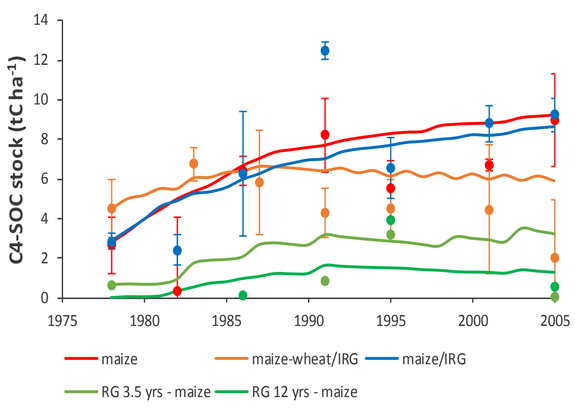
Influenced by crop rotations and management, then silt rate and location along slopes

Proportion of grassland ≈ good proxy to predict long term SOC evolution

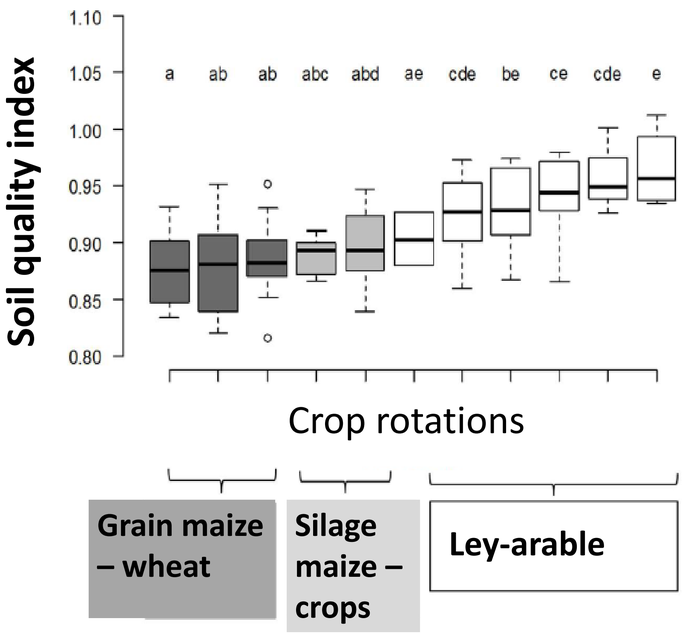
AMG model simulates correct SOC evolution and part of new organized SOC from maize and slurry inputs (C4).

Need to ↗ knowledge on C inputs in grassland soils





Soil Quality Index integrates physical, chemical and microbiological components *(Viaud et al., 2018)*



Proportion and duration of grasslands in rotations appeared as the first factor explaining SOC stocks and their evolution in crop-livestock systems. Grasslands also favored **higher soil biological diversity** (macro-fauna, microorganisms) **and activity**.

Increased SOC stocks with increasing grassland proportion can be explained by higher C inputs to soil compared to annual crops with straw usually exported. **According to AMG simulations, total humified C inputs were more than two fold higher in long-term grassland compared to silage maize monoculture** (2 vs. 0.8 t C ha^{-1}.yr^{-1}).

These results highlight the interest of grasslands for agro-ecological mixed crop-livestock areas.

Further development in CarSolEl

Pour accroitre la sensibilité des outils de conseil 'carbone' à la diversité des pratiques d'élevage

Construction d'une méthodologie et d'un référentiel sur les flux de carbone dans les sols agricoles des territoires d'élevage bovin