Changes in nutrients contents (P, K, Mg) in topsoil over the past 30 years in mainland France

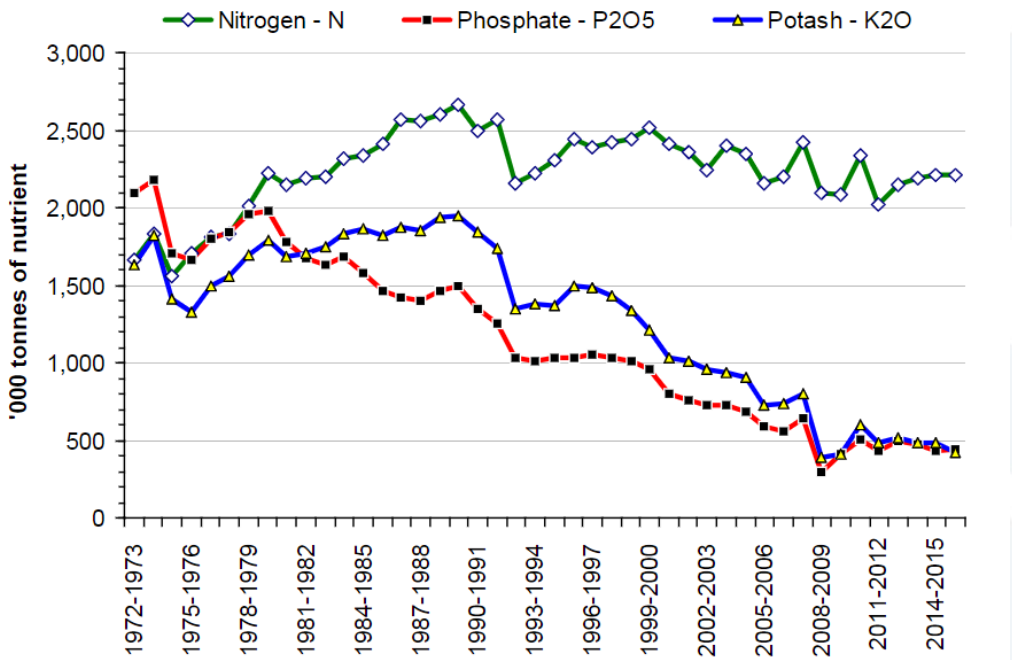
Caubet Manon, Lemercier Blandine, Saby Nicolas, Gay Laura, Bispo Antonio

SOILS: WHERE FOOD BEGINS

Global Symposium on Soils for Nutrition | 26-29 July 2022

Introduction

Deliveries of mineral fertilisers in France (UNIFA)



Amounts of phosphorus and potassium brought to soils through mineral fertilisers have decreased by 70% in France, without organic compensation

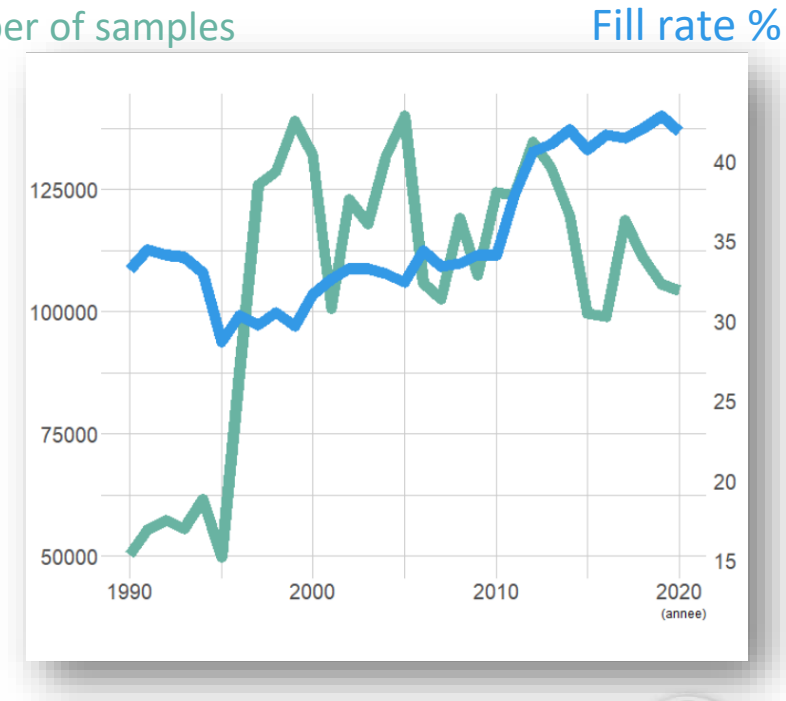
Knowing and monitoring the fertility of arable land is crucial to ensure sustainable productivity of soils and food security

How this decrease in fertiliser's application reflects in evolution of soil nutrient contents ?
P, K, Mg

Material : The French Soil Test Database (BDAT)

Project that gathers soil tests requested by farmers since 1990

- **Sampling:** no control on the strategy - sampling year
- **Georeferencing** : municipality of the plot
- Analyses provided by **certified** national laboratories
- Standardized **analytical procedures**
- More than 3,000,000 analyses

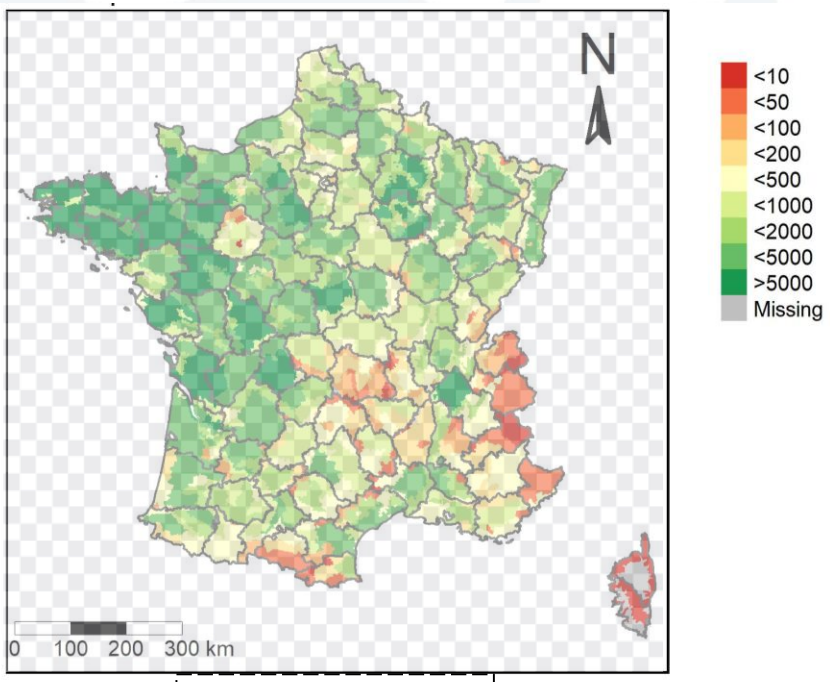


BDAT : https://www.gissol.fr/le-gis/programmes/base-de-donnees-danalyses-des-terres-bdat-62

Material : The French Soil Test Database

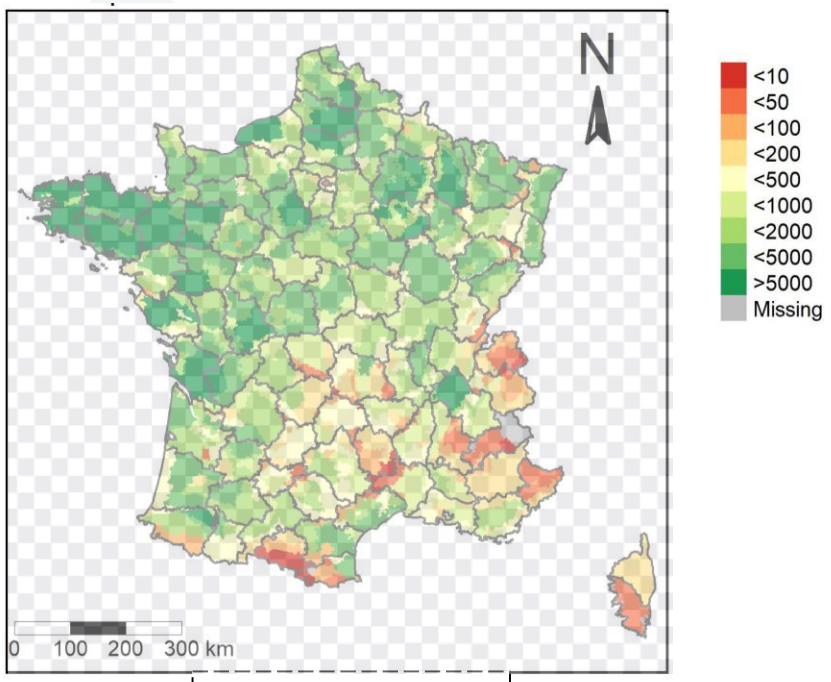
Number of K_2O soil tests by Small Agricultural Region

1994-2002



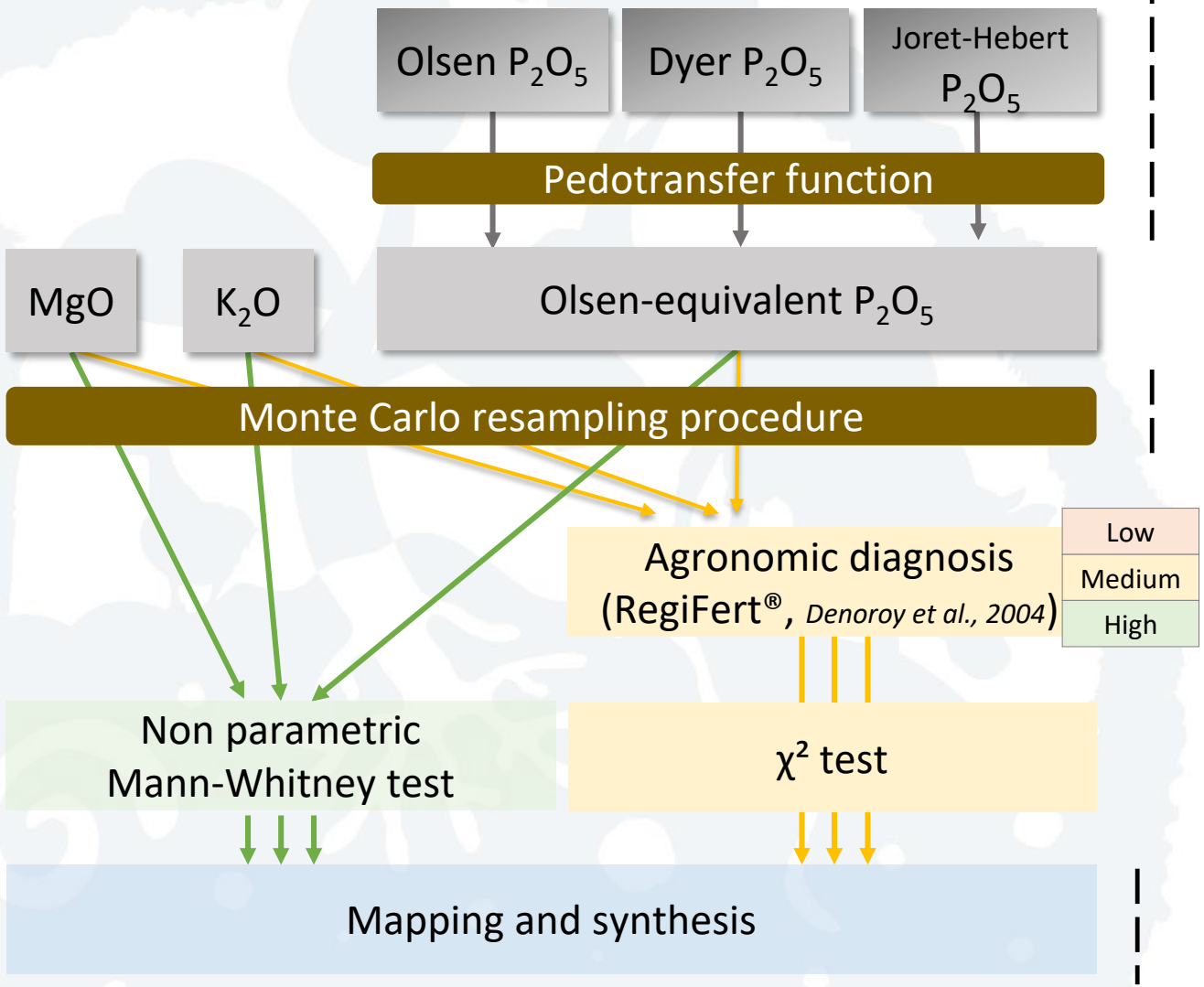
N = 880,284

2012-2019



N = 892,527

Method



Preliminary step:
harmonization of P results
(Hu et al., 2020)

Homogeneous number of analyzes by spatial unit & time period

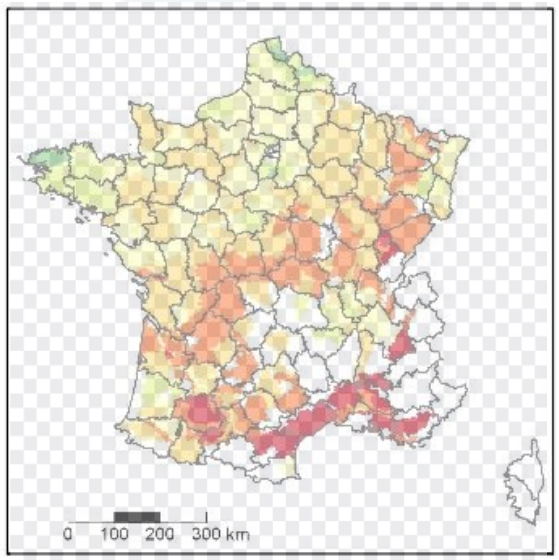
- Spatial resolution : Small Agricultural Regions (SAR)
- Time period :
  - 1994 - 2002
  - 2003 - 2011
  - 2012 - 2019

Comparison of the 2 periods by Small Agricultural Regions (SAR)

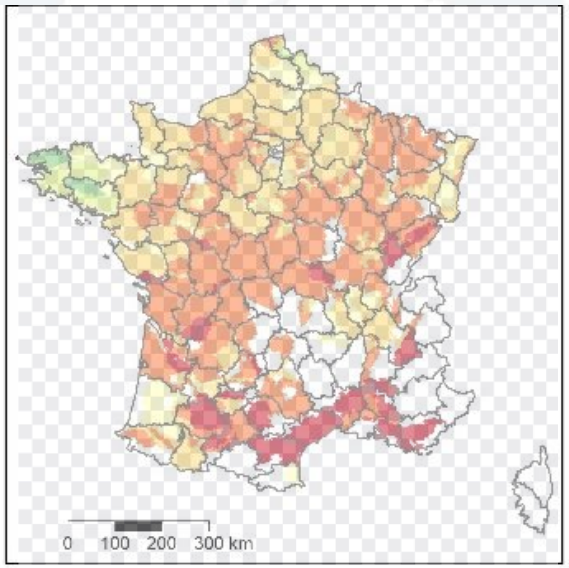
Results

Evolution of P_2O_5

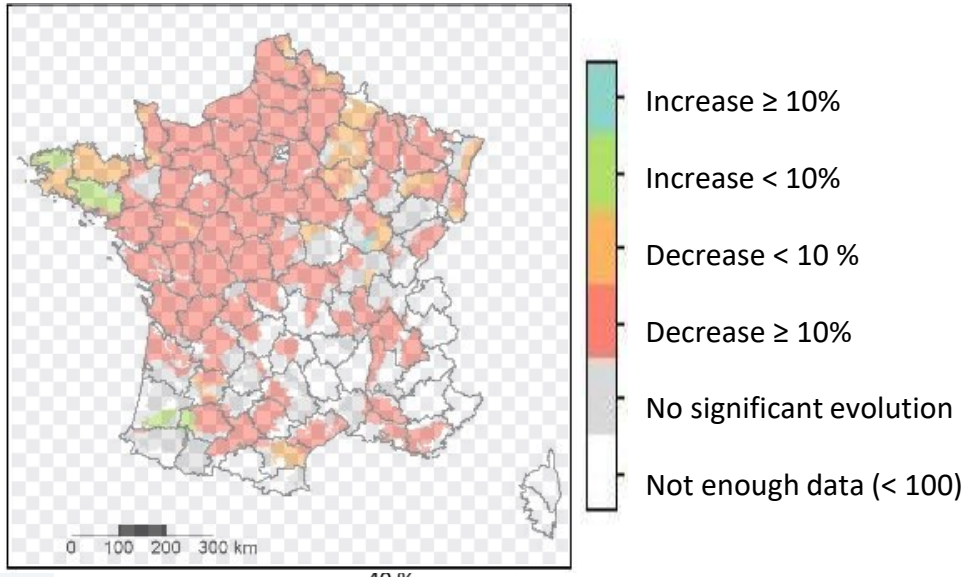
Median of P_2O_5 ($mg.kg^{-1}$)
1994-2002

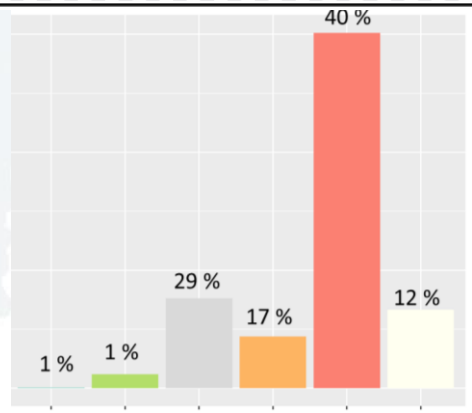


Median of P_2O_5 ($mg.kg^{-1}$)
2012-2019



Evolution of P_2O_5 content

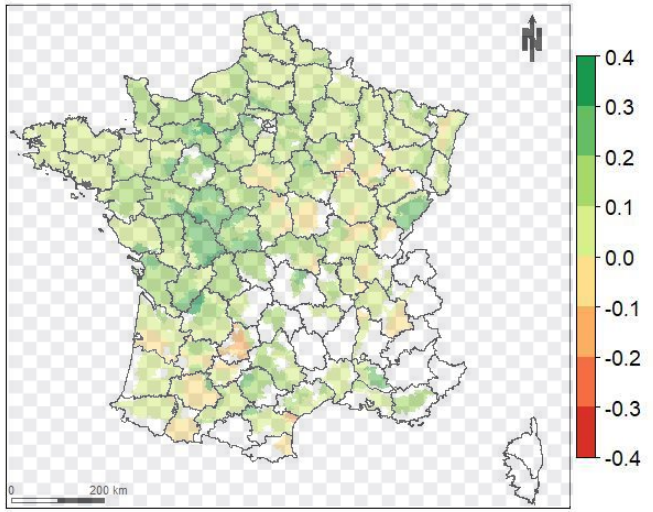




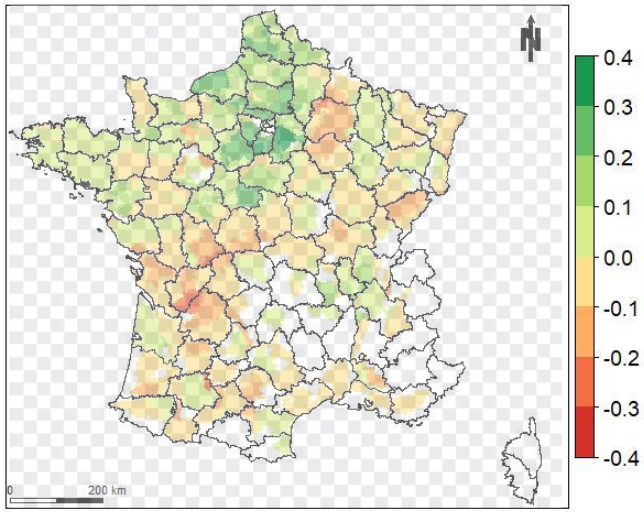
Results

Evolution of P_2O_5 : agronomic diagnosis

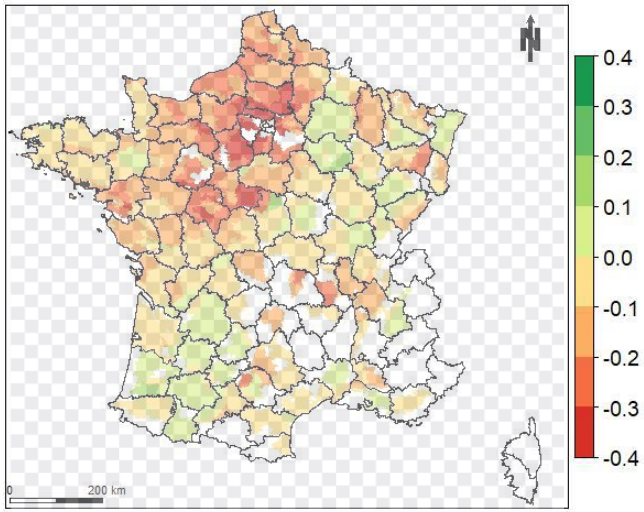
Variation in %: **low** fertility class'



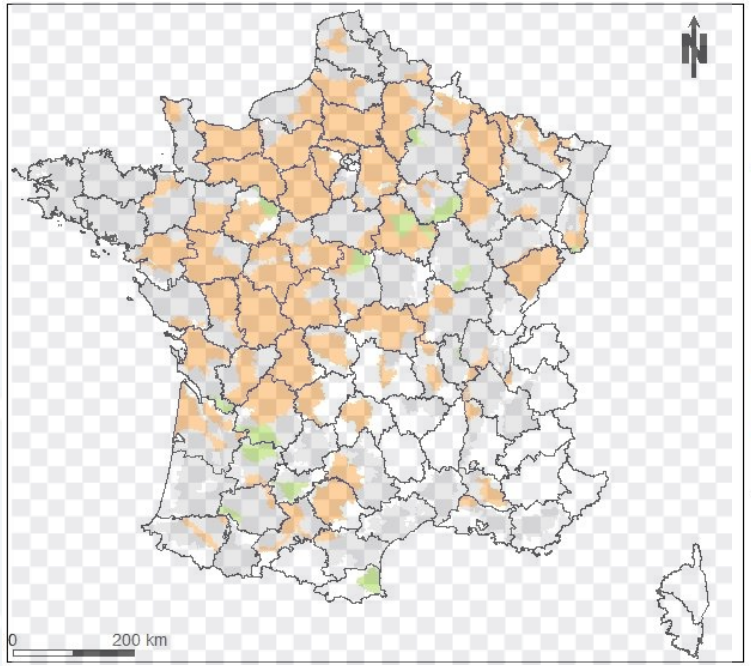
Variation in %: **medium** fertility class'



Variation in %: **high** fertility class'



Significance and trend of the fertility evolution



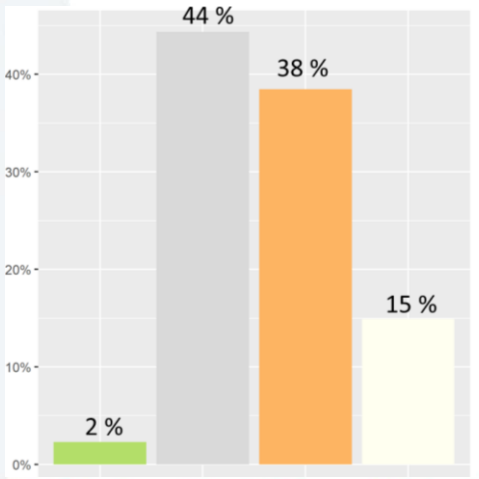
Increase

No evolution

Decrease

Not enough data (< 100)

% of agricultural surfaces in each class



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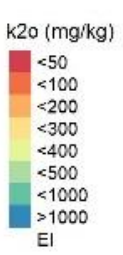
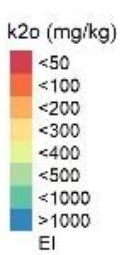
Results

Evolution of K_2O

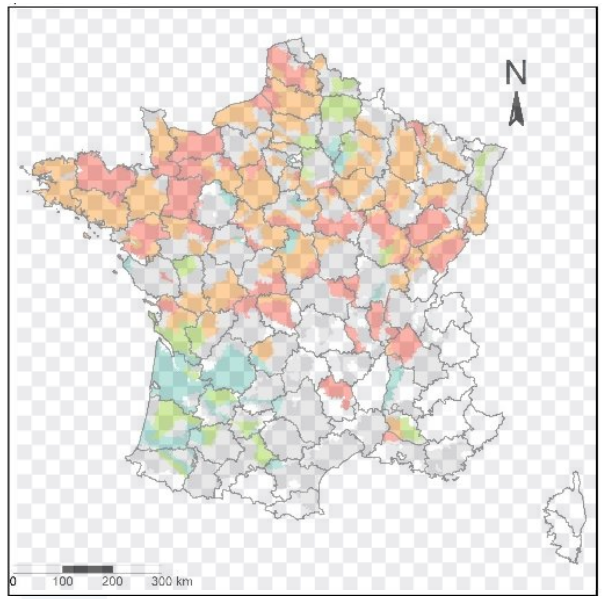
Median of K_2O ($mg.kg^{-1}$)
1994-2002

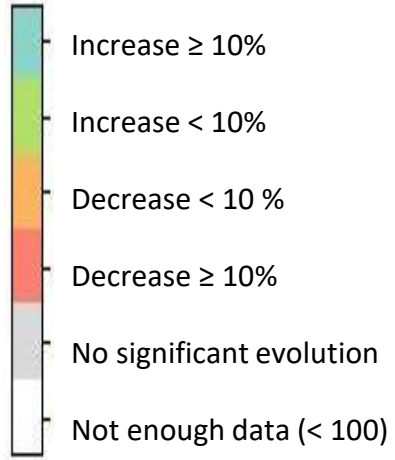


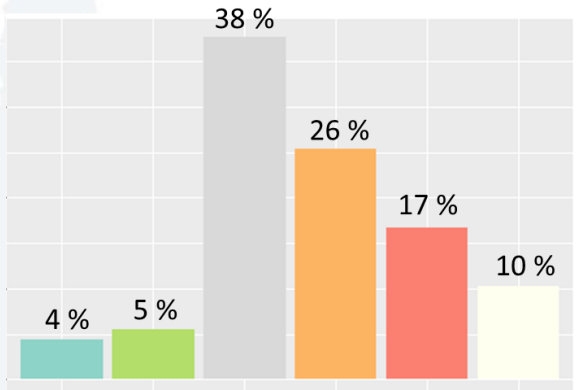
Median of K_2O ($mg.kg^{-1}$)
2012-2019



Evolution of K_2O content



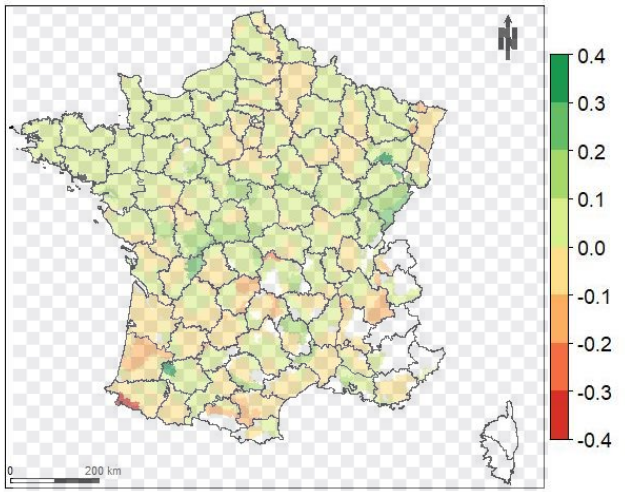




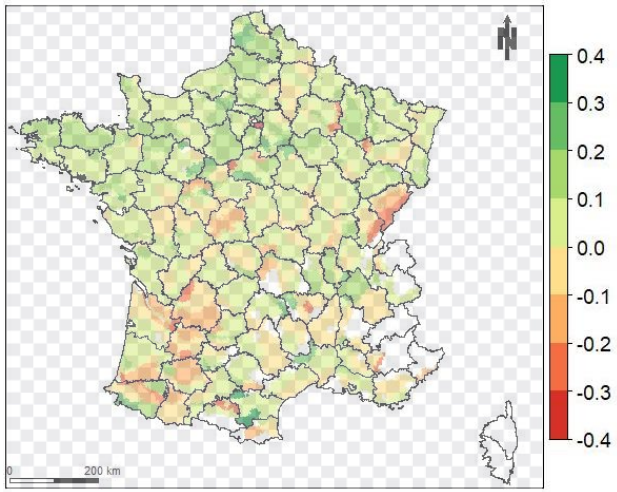
Results

Evolution of K_2O : agronomic diagnosis

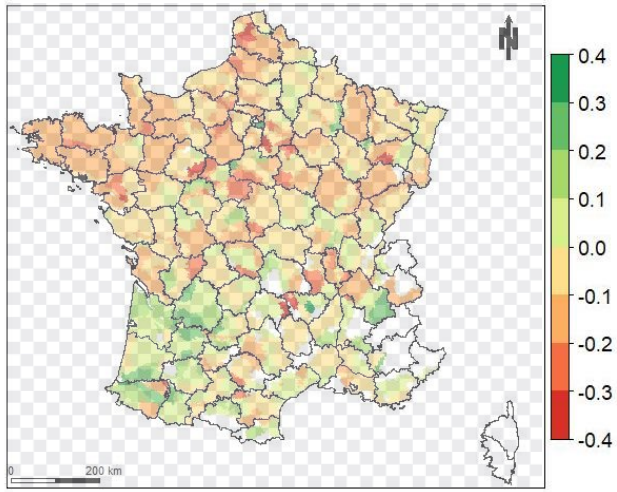
Variation in %: **low** fertility class'



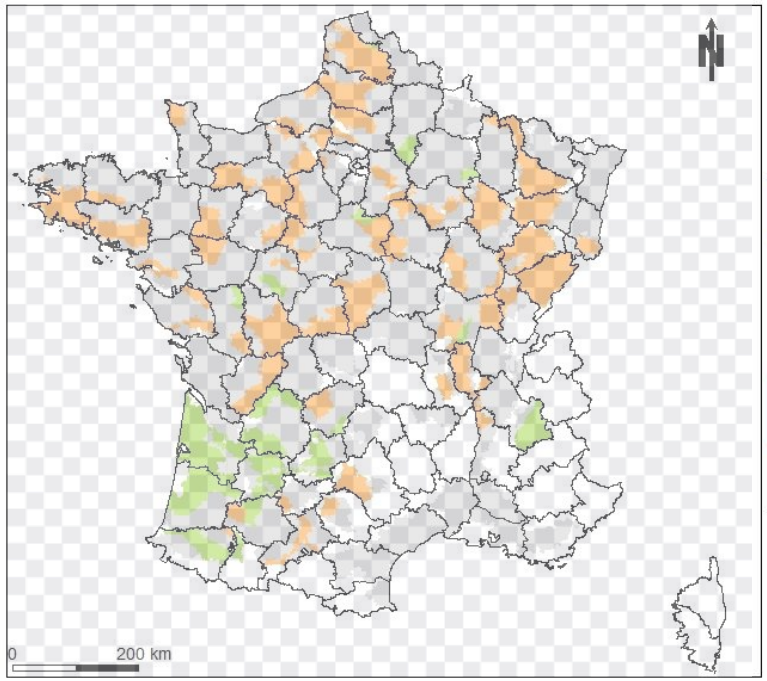
Variation in %: **medium** fertility class'

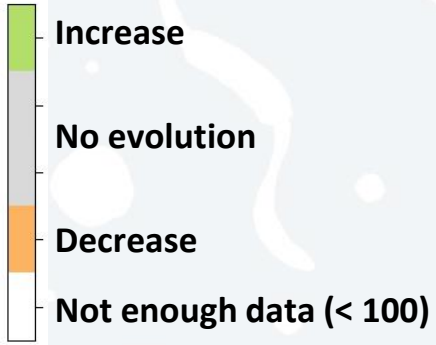


Variation in %: **high** fertility class'

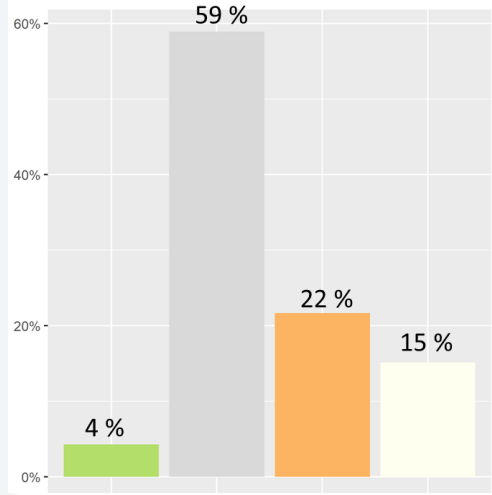


Significance and trend of the fertility evolution





% of agricultural surfaces in each class



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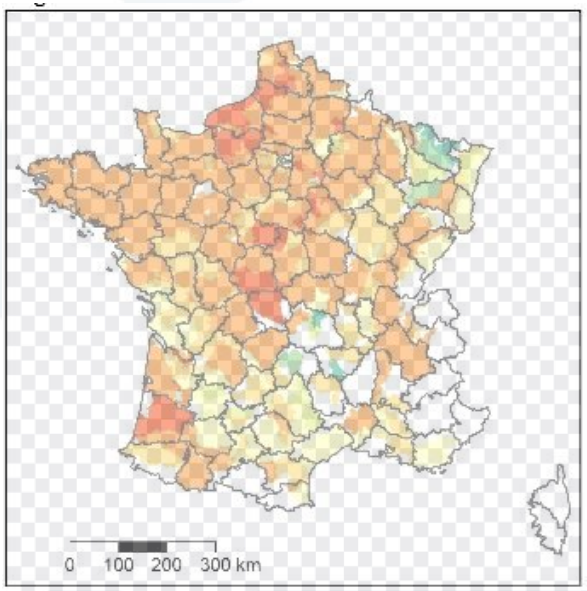
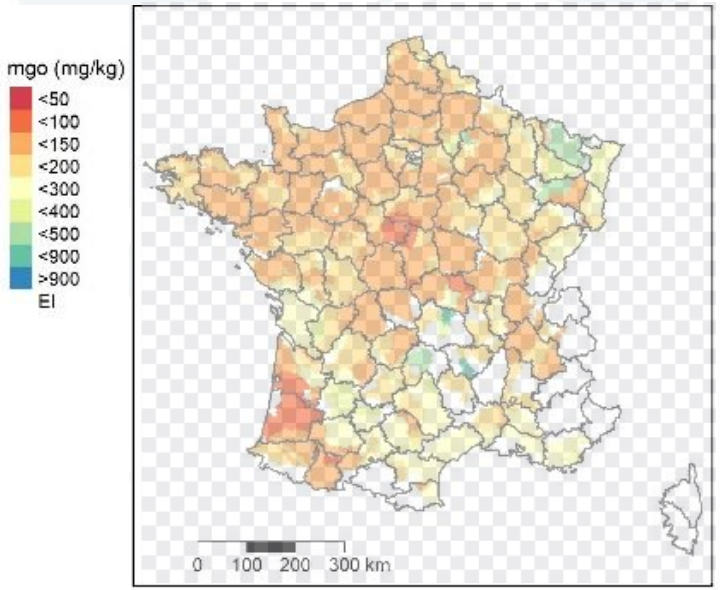
Results Evolution of MgO

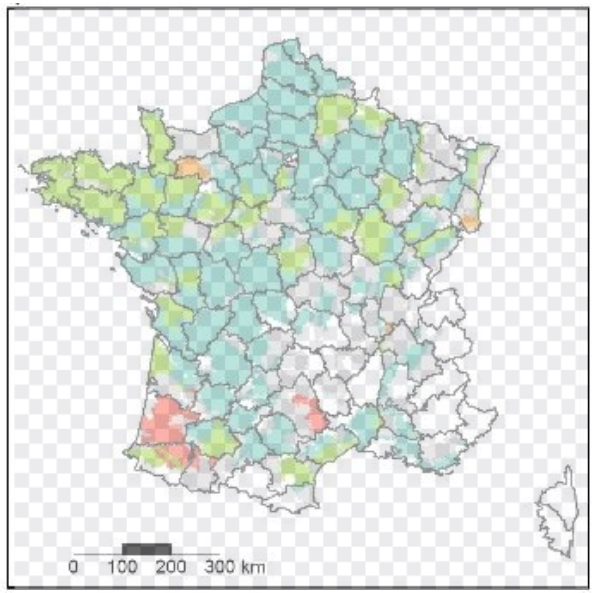
Median of MgO ($mg.kg^{-1}$)
1994-2002

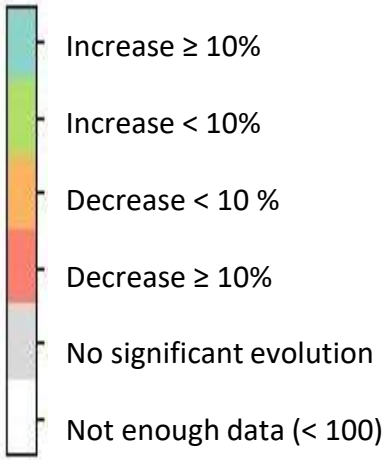


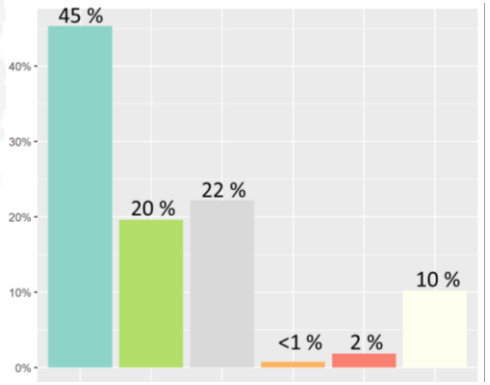
Median of MgO ($mg.kg^{-1}$)
2012-2019



Evolution of MgO content



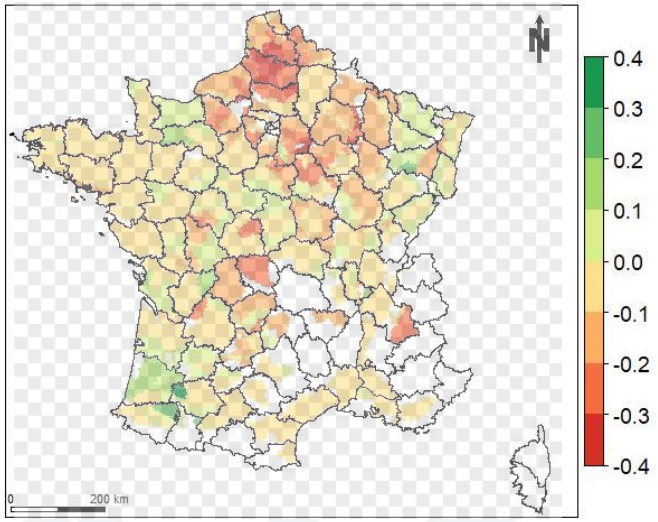




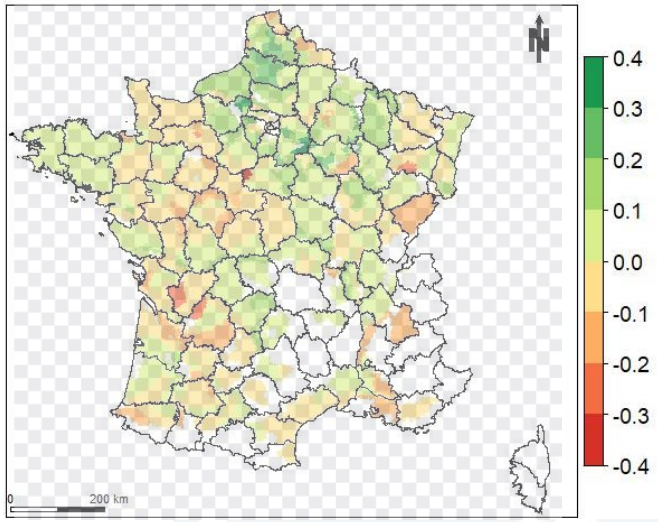
Results

Evolution of MgO : agronomic diagnosis

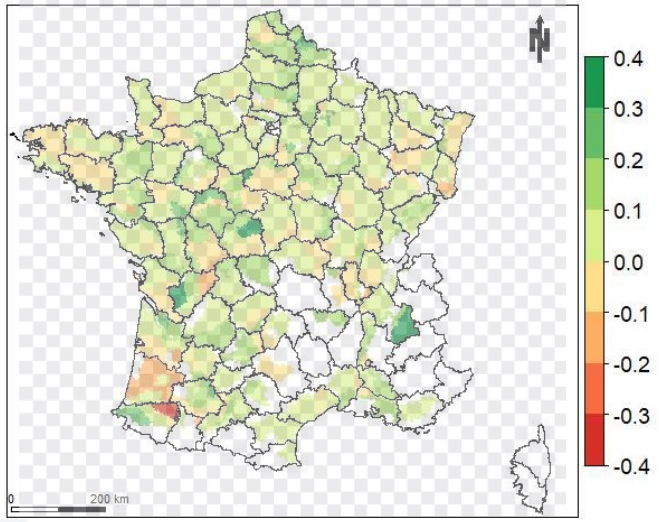
Variation in %: **low** fertility class'



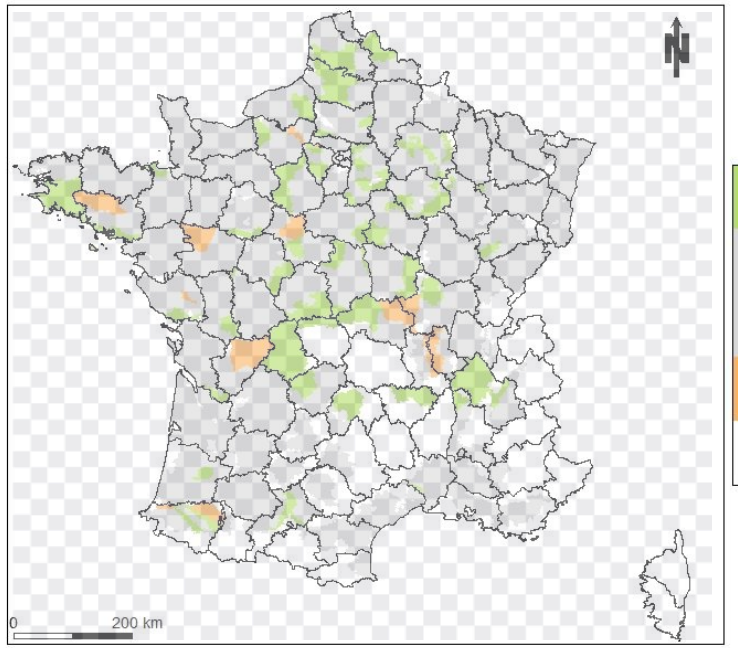
Variation in %: **medium** fertility class'



Variation in %: **high** fertility class'



Significance and trend of the fertility evolution



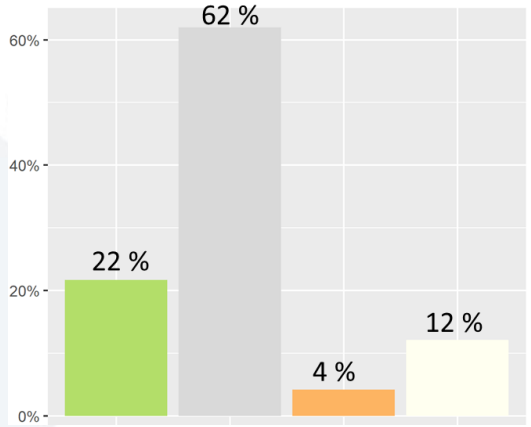
Increase

No evolution

Decrease

Not enough data (< 100)

% of agricultural surfaces in each class



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Take home messages

- **Upcycling** of soil tests for soil fertility monitoring is efficient to show general **trends in nutrients content :**

P_2O_5  K_2O  MgO 

- Globally, the soil fertility level in France remains high even if it may hide situations of deficiency

- The general decline of nutrient availability in soils calls for vigilance and soil monitoring through regular soil tests, in order to anticipate evolutions before their impact on soil fertility becomes critical

Thank you !

Bibliography :

Denoroy P., Dubrulle P., Villette C., Colomb B., Fayet G., Schoeser M., Marin-Laflèche A., Pellerin F., Pellerin S., Boiffin J. (2004)
RegiFert - Interpréter les résultats des analyses in : INRA - Techniques et pratiques (Ed.), 129 p.

Hu, B., Bourennane, H., Arrouays, D., Denoroy, P., Lemercier, B., &Saby, N. P. (2021).
Developing pedotransfer functions to harmonizeextractable soil phosphorus content measured with different methods:A case study across the mainland of France. Geoderma, 381 (15)