UAVSoil - UAV borne spectrometers for high resolution soil and crop monitoring

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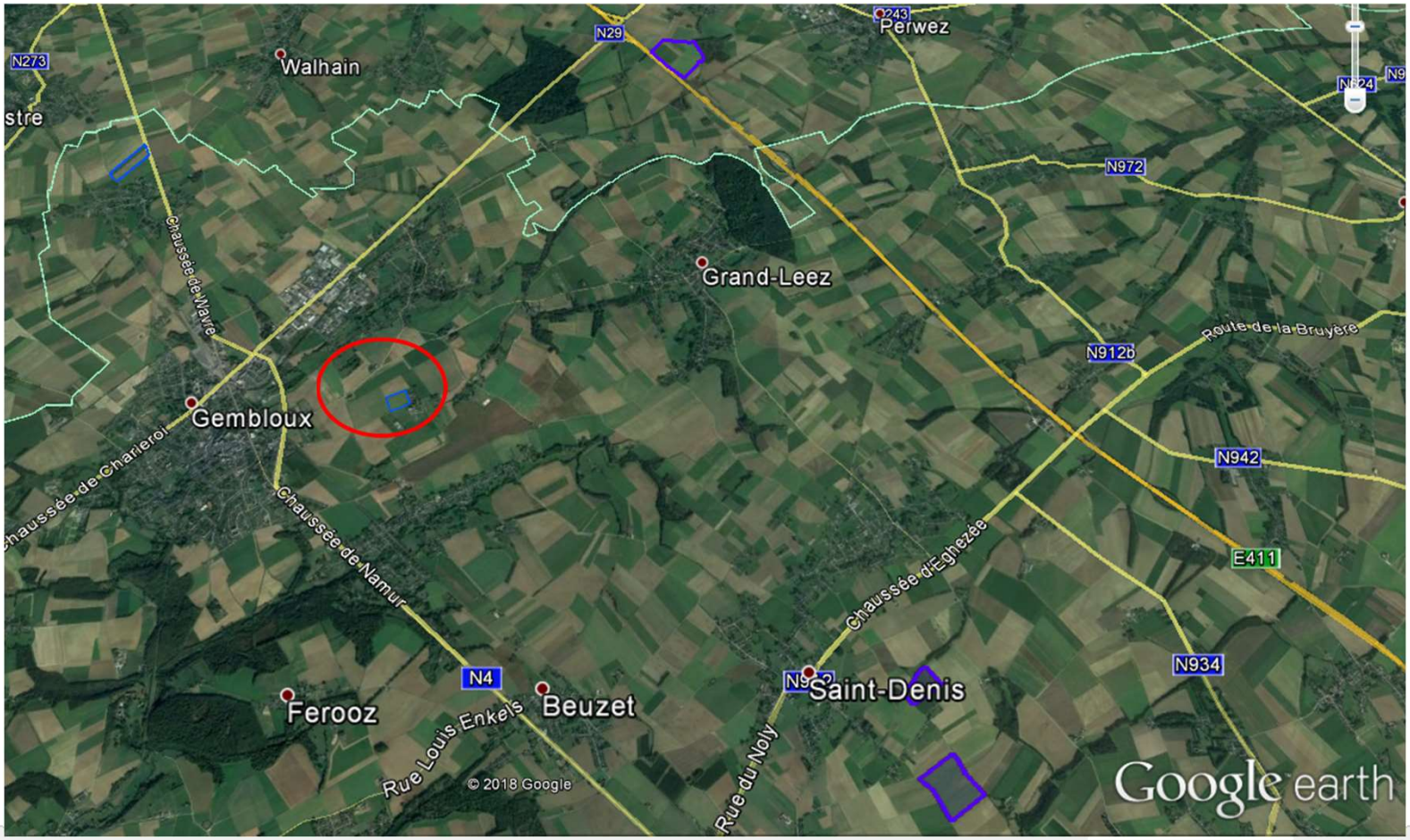
Objectives

Testing the potential of UAV- borne spectral sensors to produce parameters for explaining yield variations through input of up-to-date and high resolution soil variables with a perspective to improve yield prediction and optimization.

Specific objectives:

- Develop **soil** and **crop** parameter **maps** for individual fields using (as far as possible) **UAV borne instruments**
- **Spatial analysis of the crop and soil patterns**
- Evaluate the potential of high resolution **soil property maps** in providing input data for **nitrogen balance models** such as REQUAFERTI .

WP 1 - Data collection - Belgium site

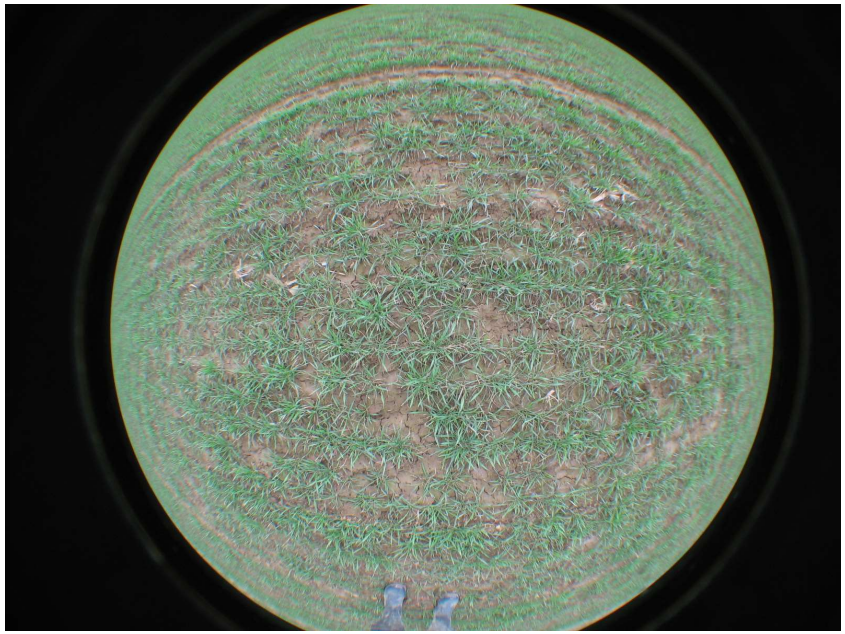


SICY site in Gembloux

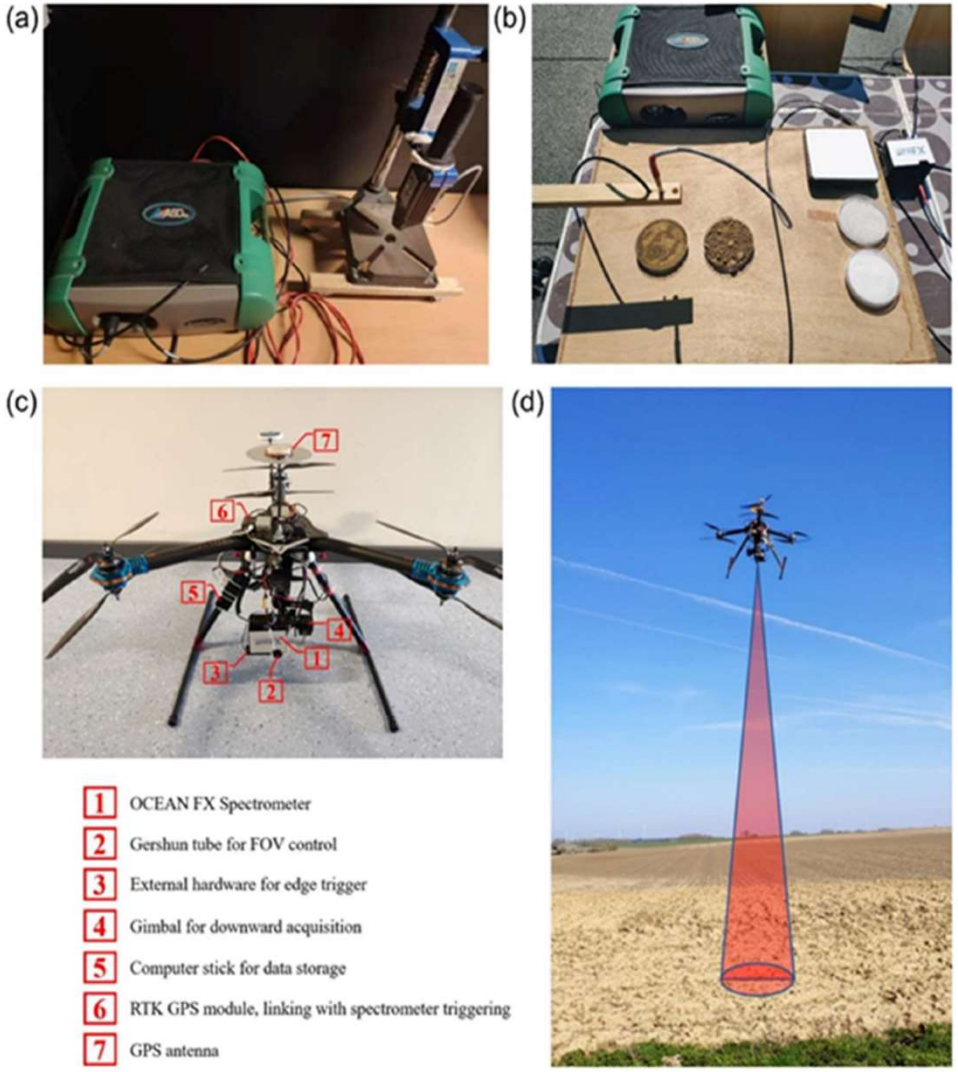
- 17 ha field
- Winter wheat in 2018, maize in 2017
- Conventional farming
- 4 fields before 2017

Data collection: Red Edge Normalized Difference Vegetation Index in March, April and May 2018

UAV fights with Micasense: 5 cameras : 475 nm - 840 nm : blue, green, red, red-edge, NIR.



Digital hemispherical photos for relating RENDVI to PAI



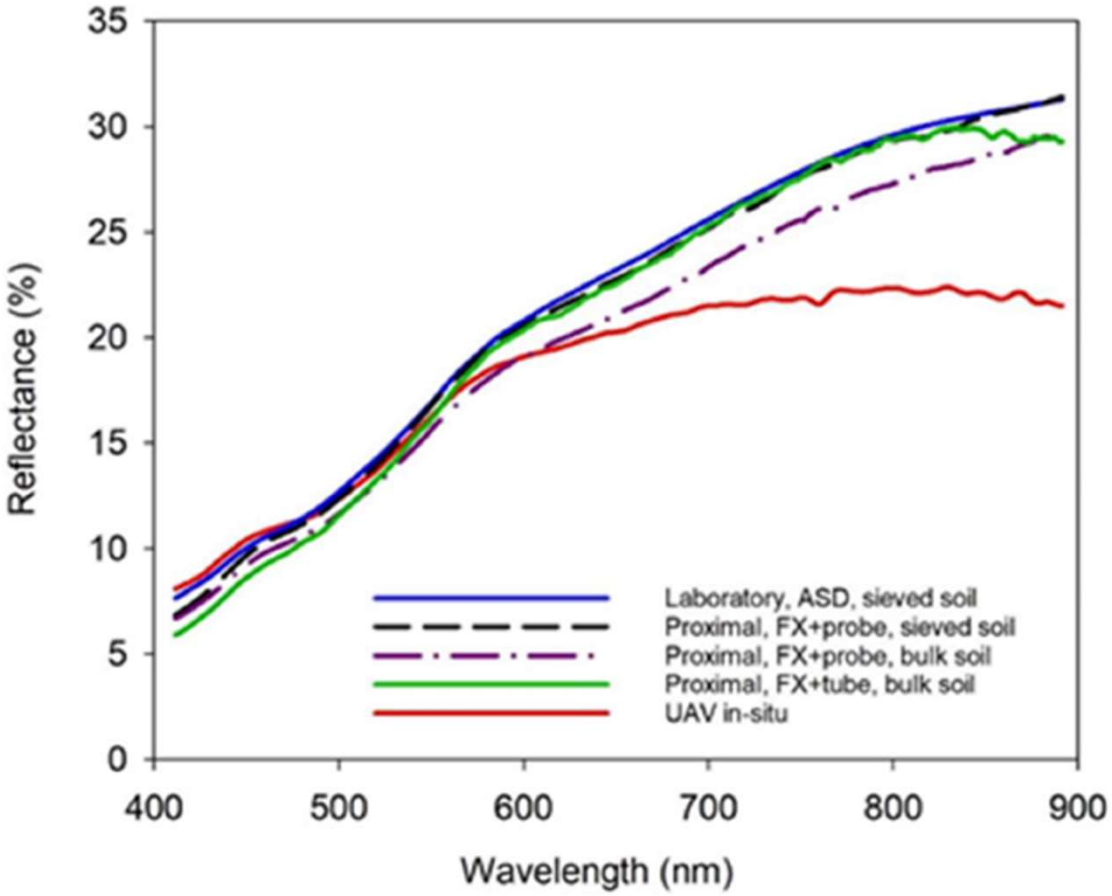
Data collection: soil organic carbon

Three steps for SOC prediction with UAV borne Ocean Optics FX spectrometer (400-900 nm)

a) Laboratory spectral library

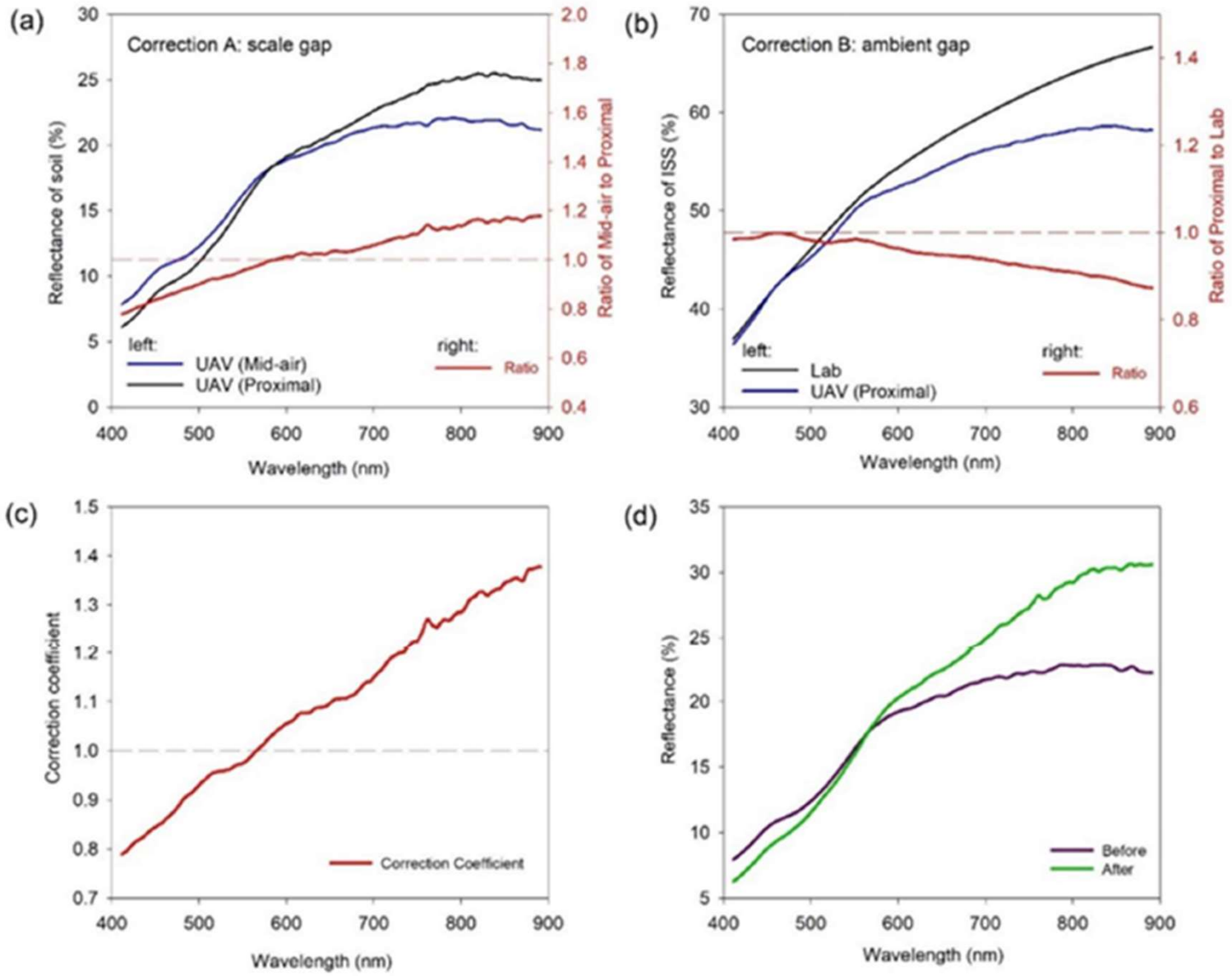
b) Proximal sensing outdoor

d) UAV borne sensing



Comparison of spectra from same soil sample under different conditions

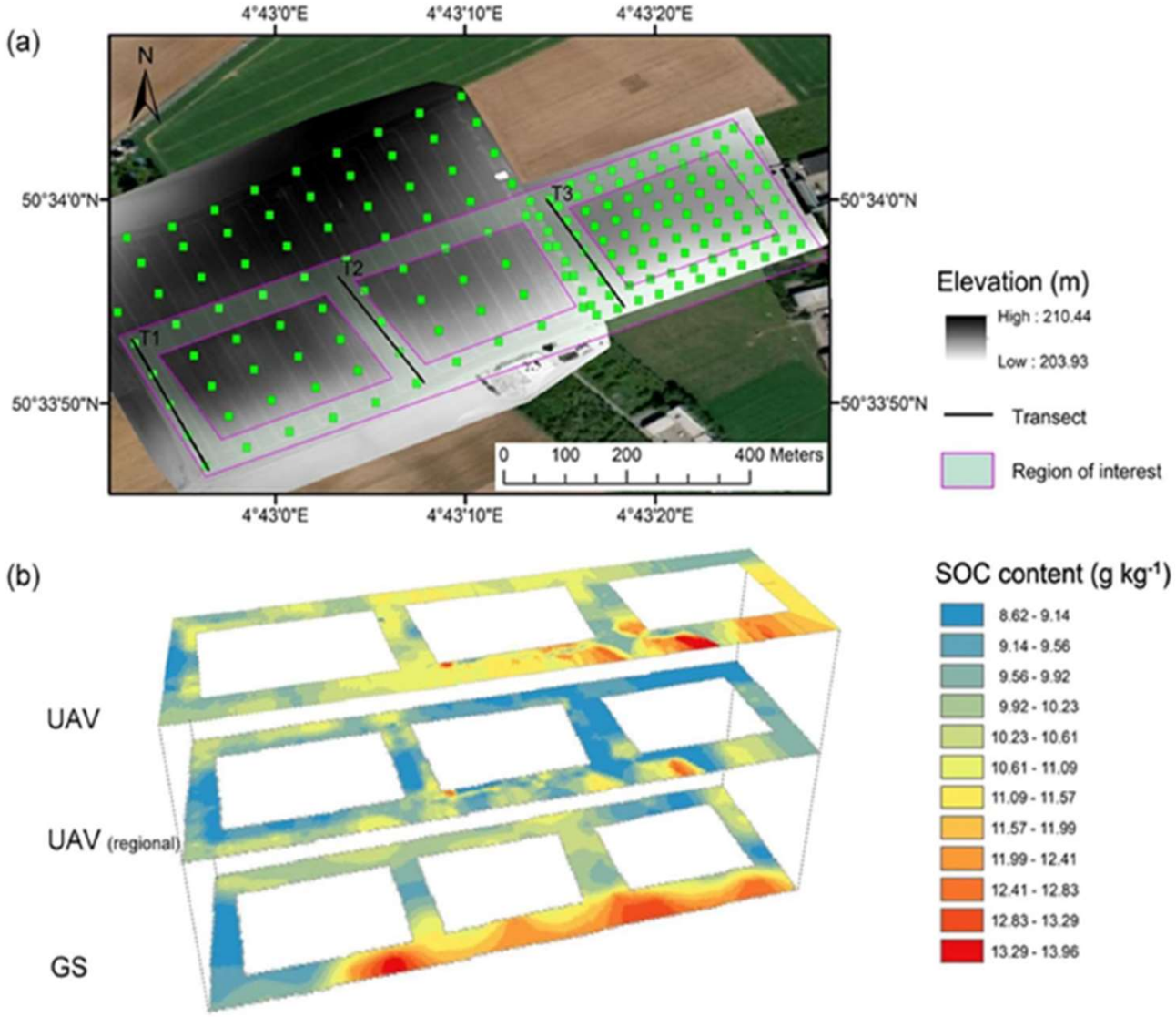
- Laboratory ASD
- Proximal FX (dashed)
- Proximal FX with fore-optic
- UAV borne FX

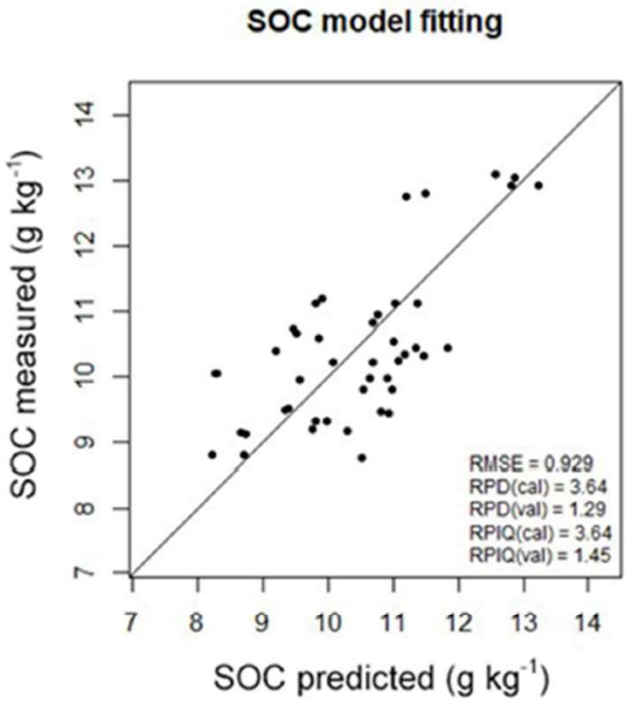


Correction in two steps

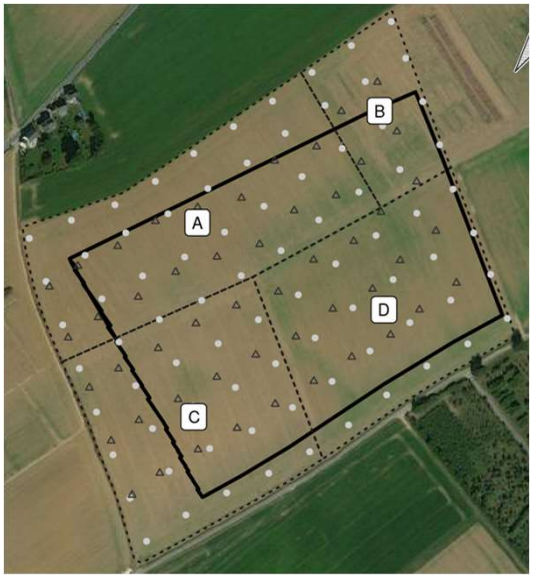
a) mid air to proximal
b) proximal to lab
c) overall correction
d) before and after correction

SOC mapping for Sicy and Hostellerie





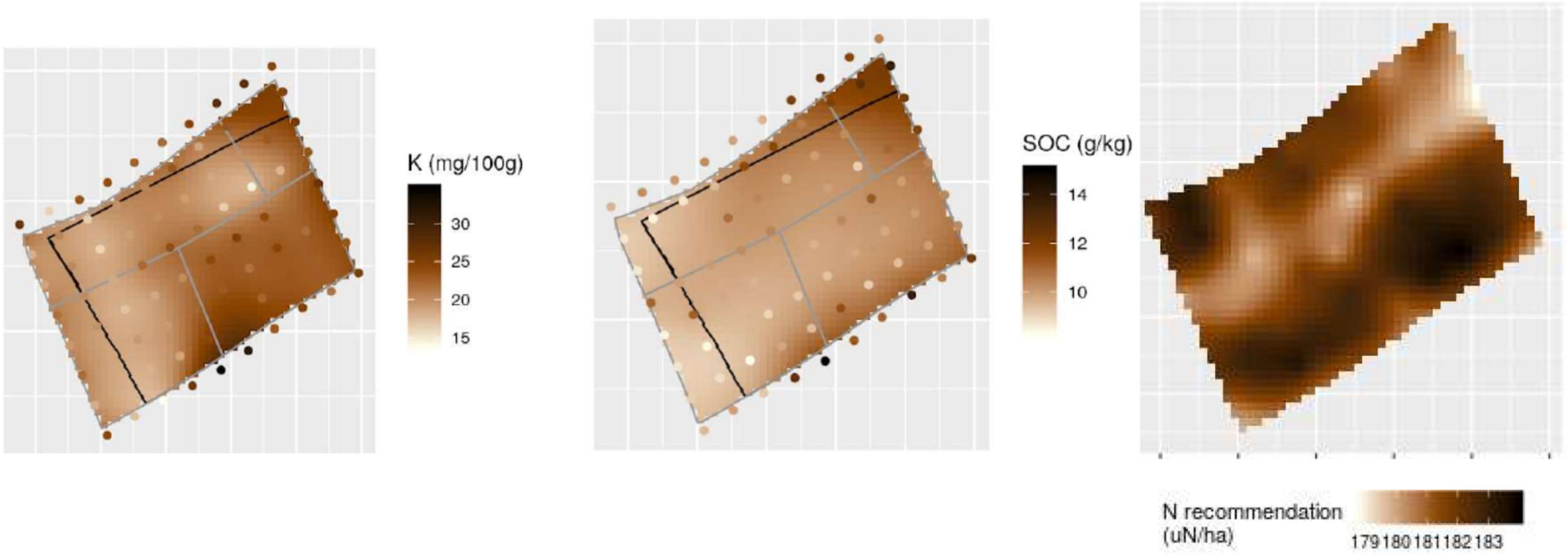
Historical management analysis



- **Main conclusion** : distinction between management of former parcels A - C and B - D.

- More organic amendments on B and D former parcels, higher frequency of residues restitution on D ⇒ more SOC expected

- Balance between import and export of P, K, Mg and Ca :
  - Higher on B and D
  - Higher pH expected on B and D



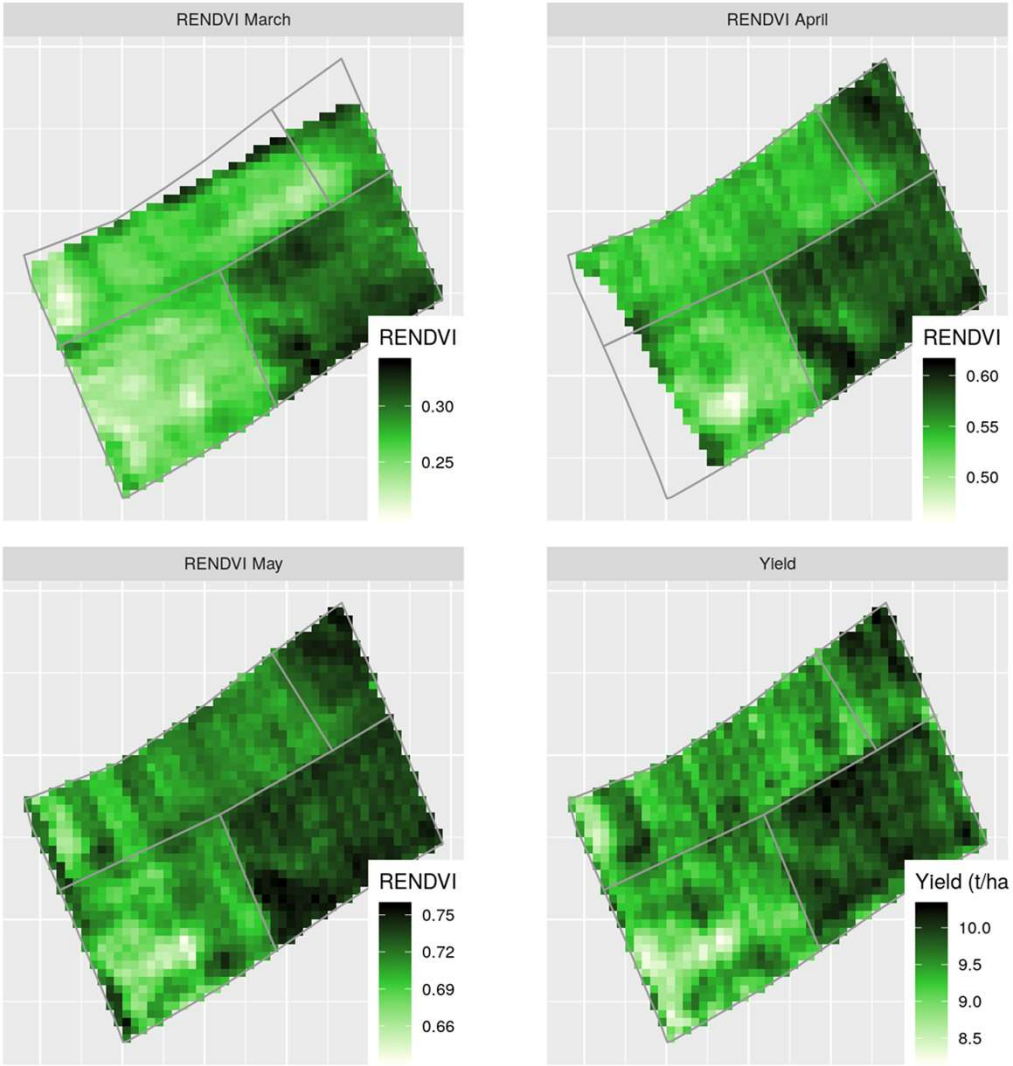
Limited variability in SOC: no effect on N recommendation (179-183 units N)

Crop maps

- Clear effect of former field lay-out

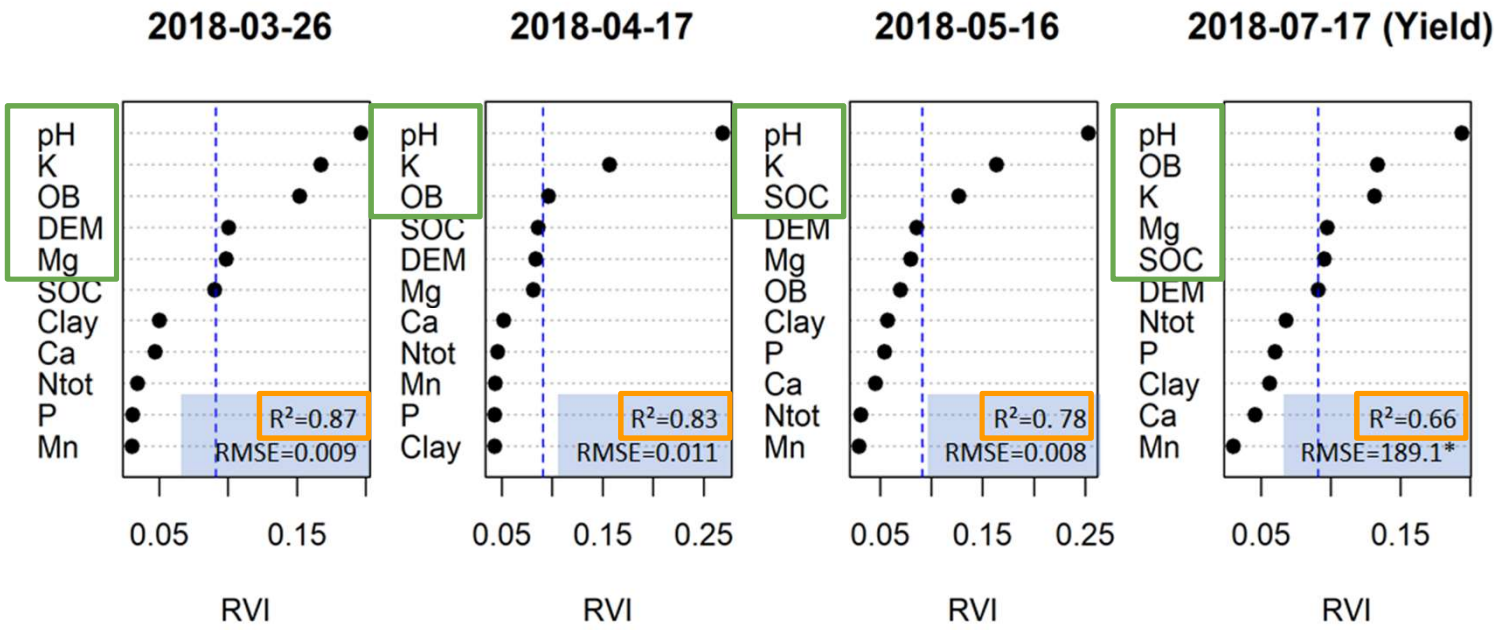
  ⇒ higher biomass and yield in B and D parcels

- Temporal stability of the patterns



Contribution of soil variables to crop growth heterogeneity

- Model performance decreases over time → annual variability
- K and pH are the most important variables
- Not important = not limiting growth because not inducing heterogeneity



Conclusions

- In case of land consolidation, the historical management determines the heterogeneity of several soil properties
- Crop growth is well characterized by UAV RENDVI and is well correlated with final grain yield
- SOC (= Nitrogen from mineralization) was not really driving crop growth heterogeneity as expected, probably because Nitrogen application was more sufficient than needed
- pH and K were the more important factor explaining crop growth heterogeneity