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Digging into the bulk density and coarse fragment data of the French soil quality monitoring network (RMQS)

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Context and problem description

- Bulk density (BD) and coarse fragments (CF) are needed to calculate stocks, e.g. SOC stocks.
- Often missing in soil monitoring networks because of time, labor and budget constraints.
- In RMQS BD and CF have been measured in both campaigns by two methods.
- Calculate stock changes based on equivalent soil mass.
- It is not clear the validity of these measurements and the nature of the BD changes.

What makes BD change?

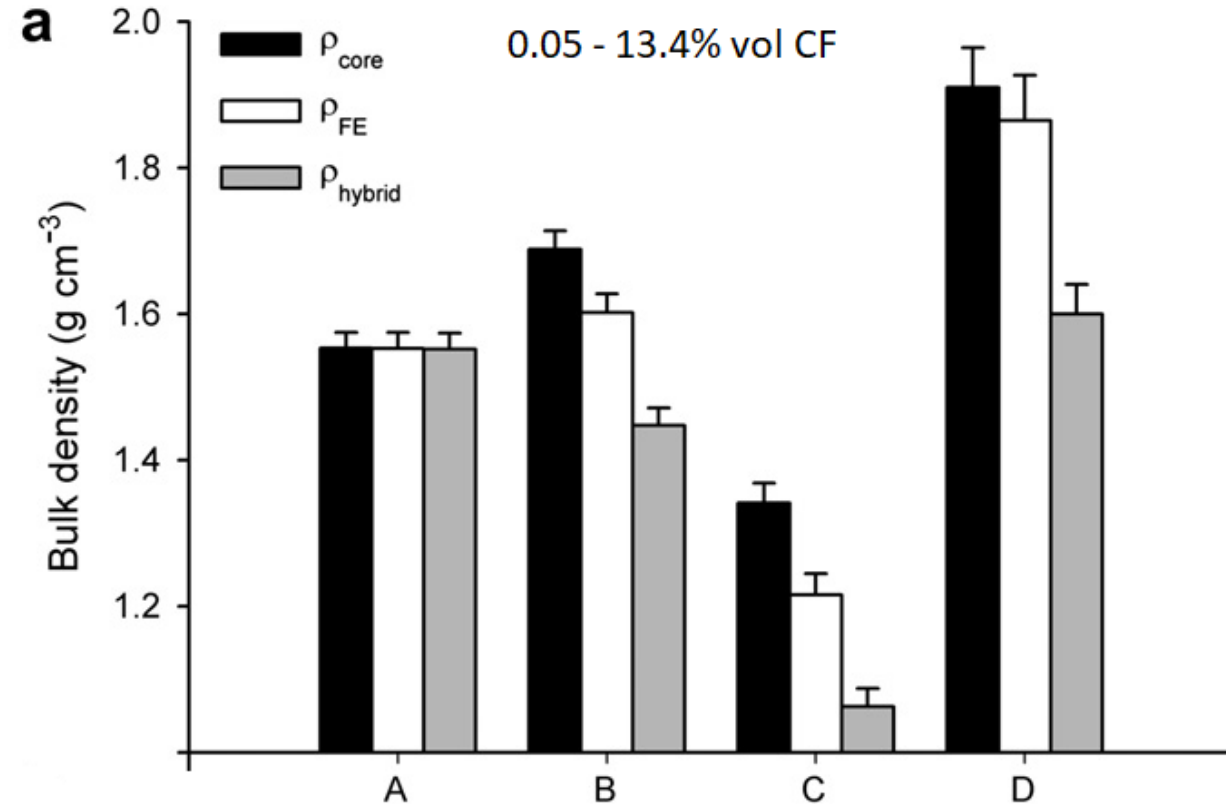


Bulk density and coarse fragments

$$\text{BD (g.cm}^{-3}\text{)} = \frac{\text{Fine soil+coarse fragments}}{\text{Sample Volume}}$$

$$\text{Fine soil (g.cm}^{-3}\text{)} = \frac{\text{Fine soil}}{\text{Sample Volume}}$$

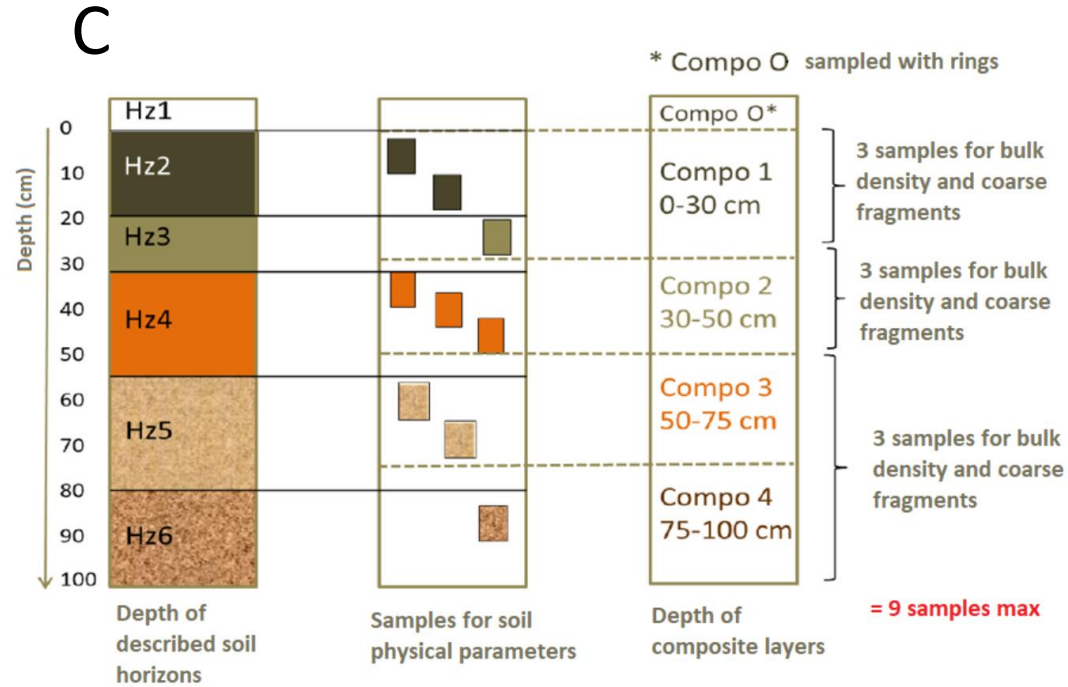
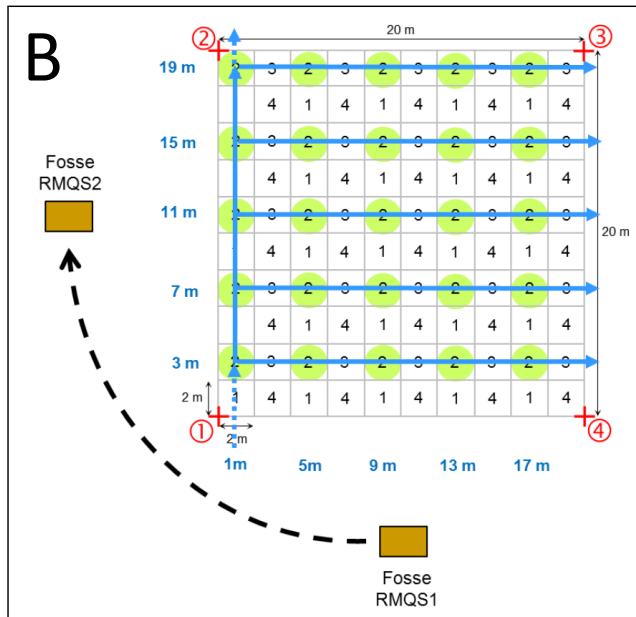
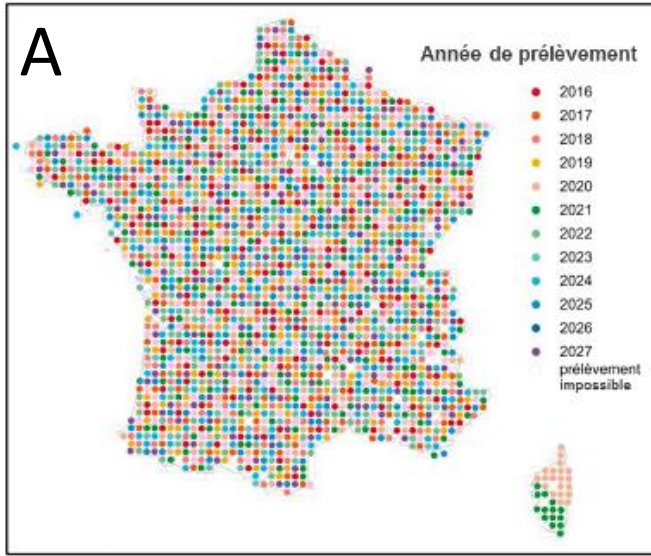
$$\text{Coarse fragments (\%)} = \frac{\text{CF mass}}{\text{Sample mass}} * 100$$



Objectives

- Which soil physical data should be used for estimating changes of SOC stocks in RMQS ?
- How does land use affect the changes of bulk and fine soil density between campaigns?

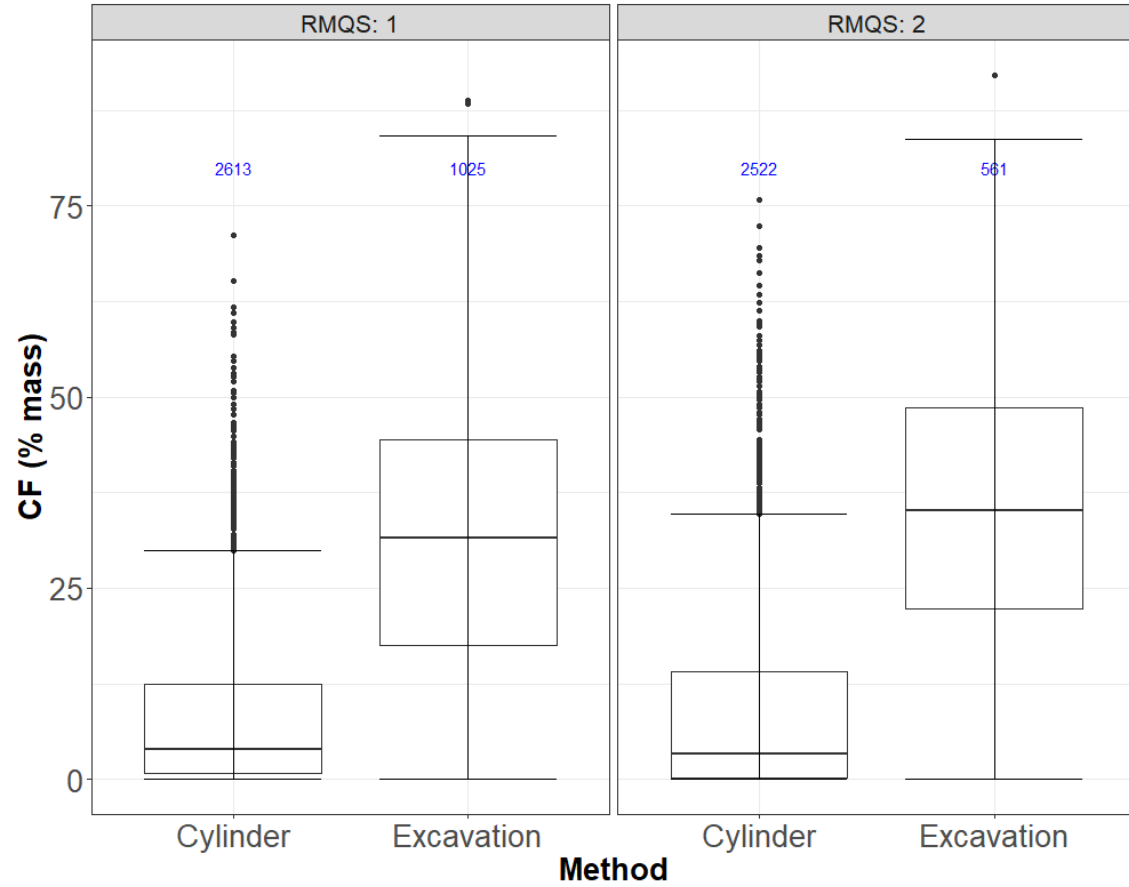
Sampling design



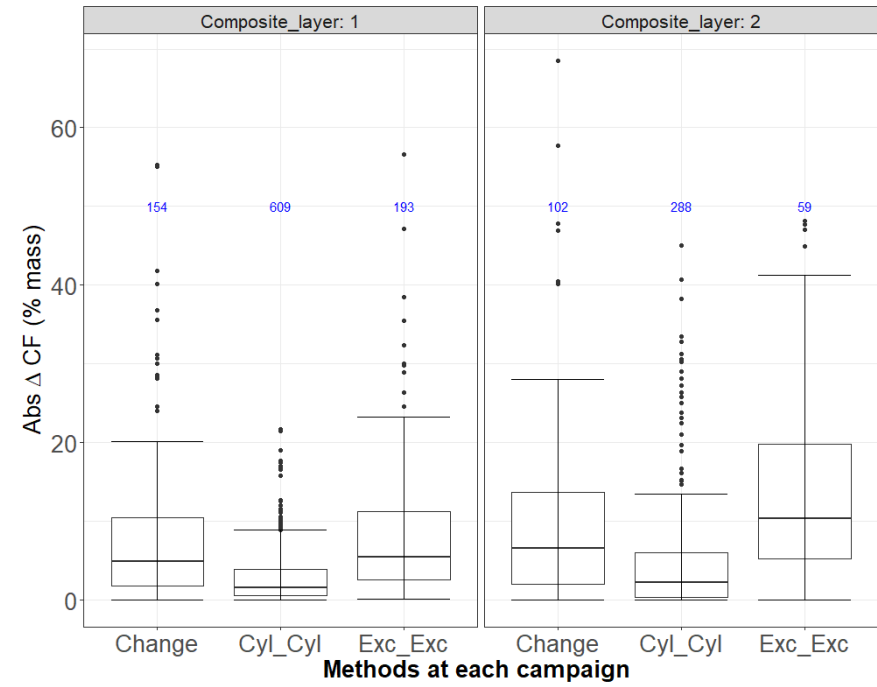
Jolivet et al. 2018

Coarse fragments

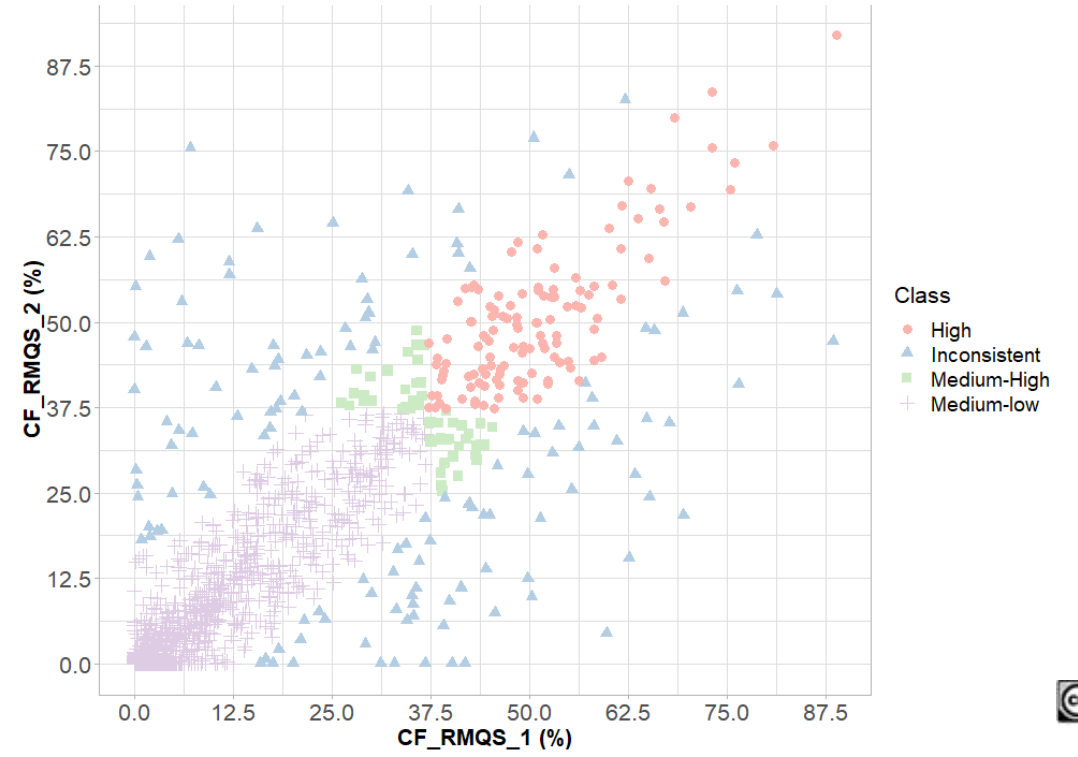
A



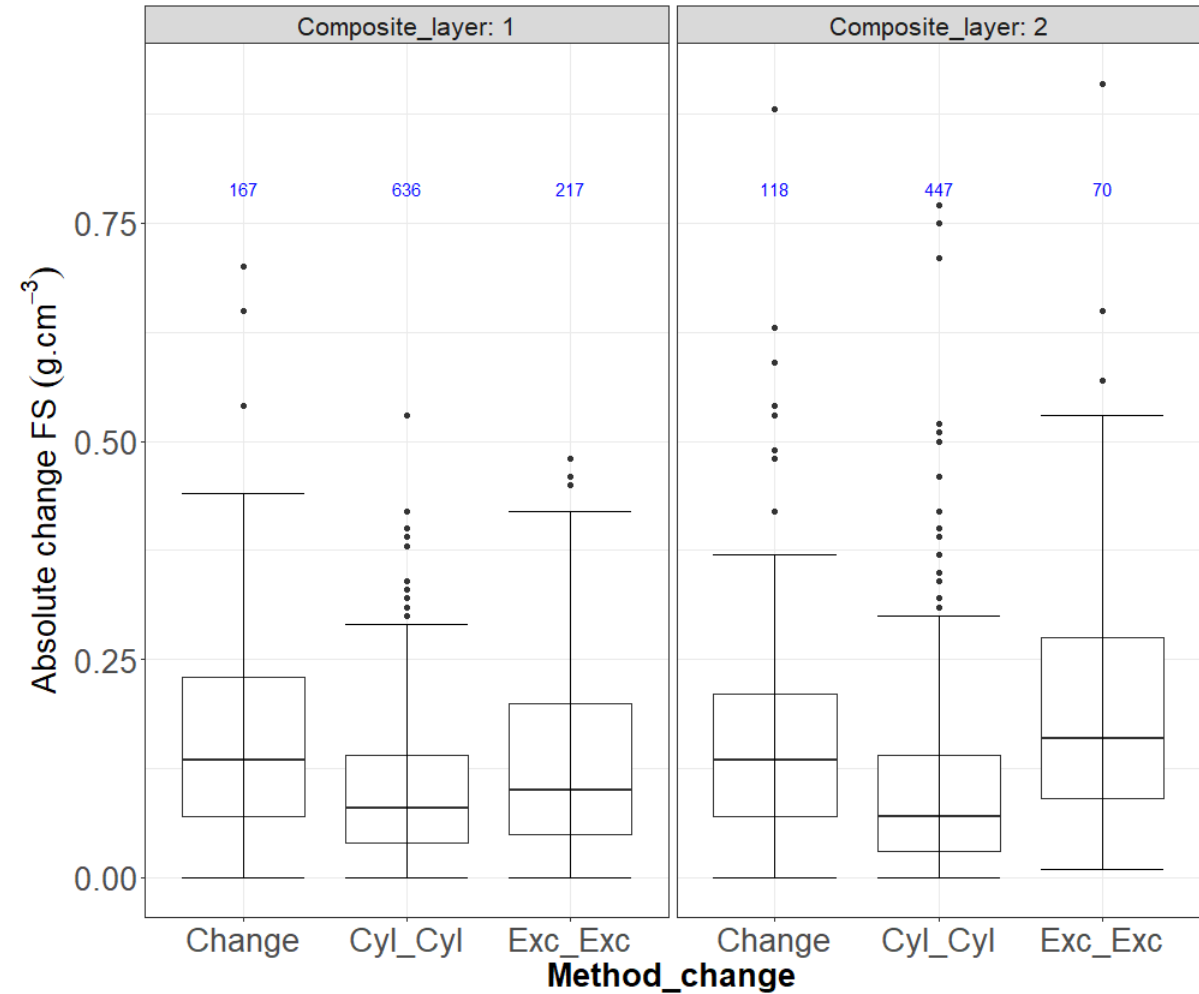
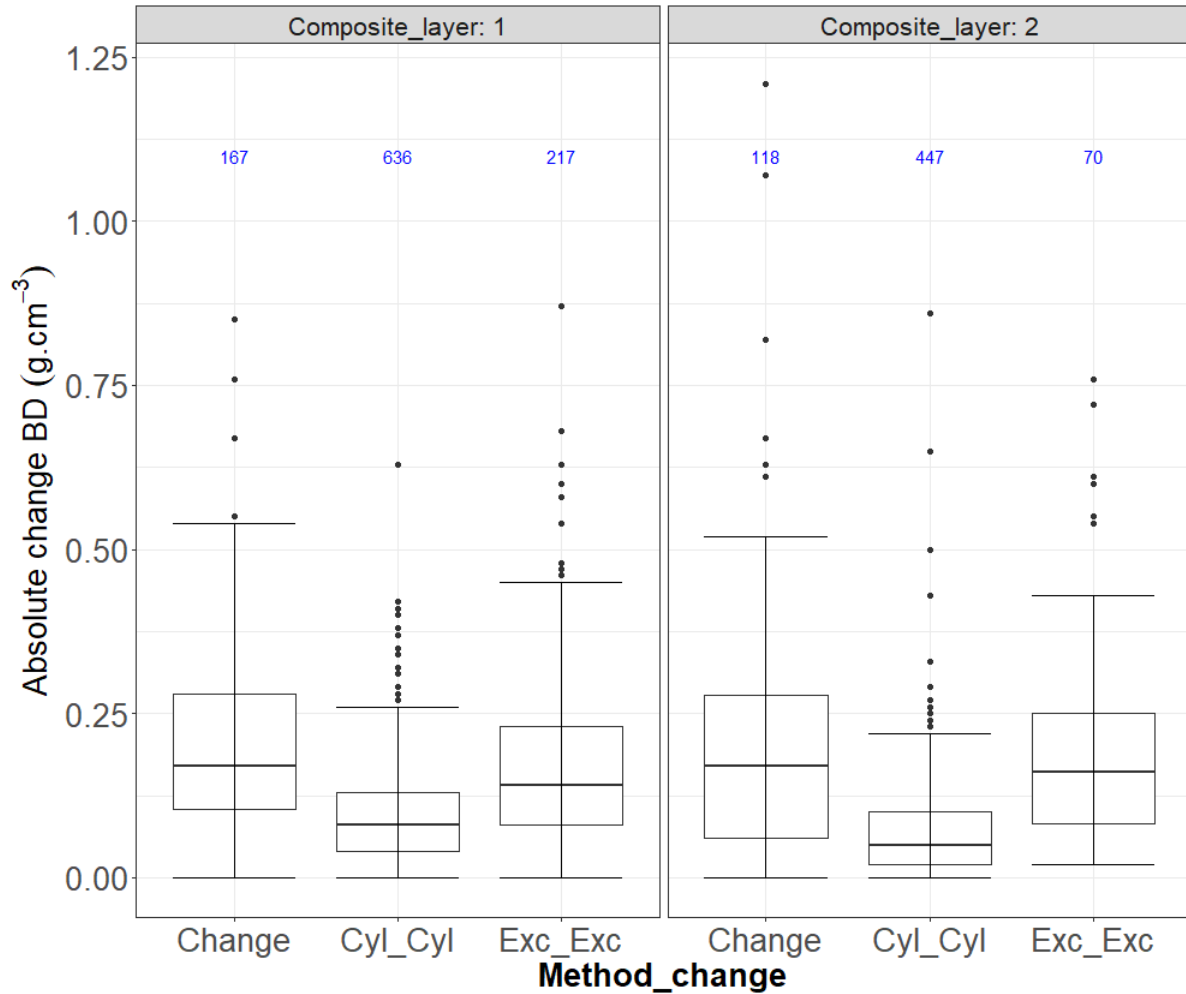
B



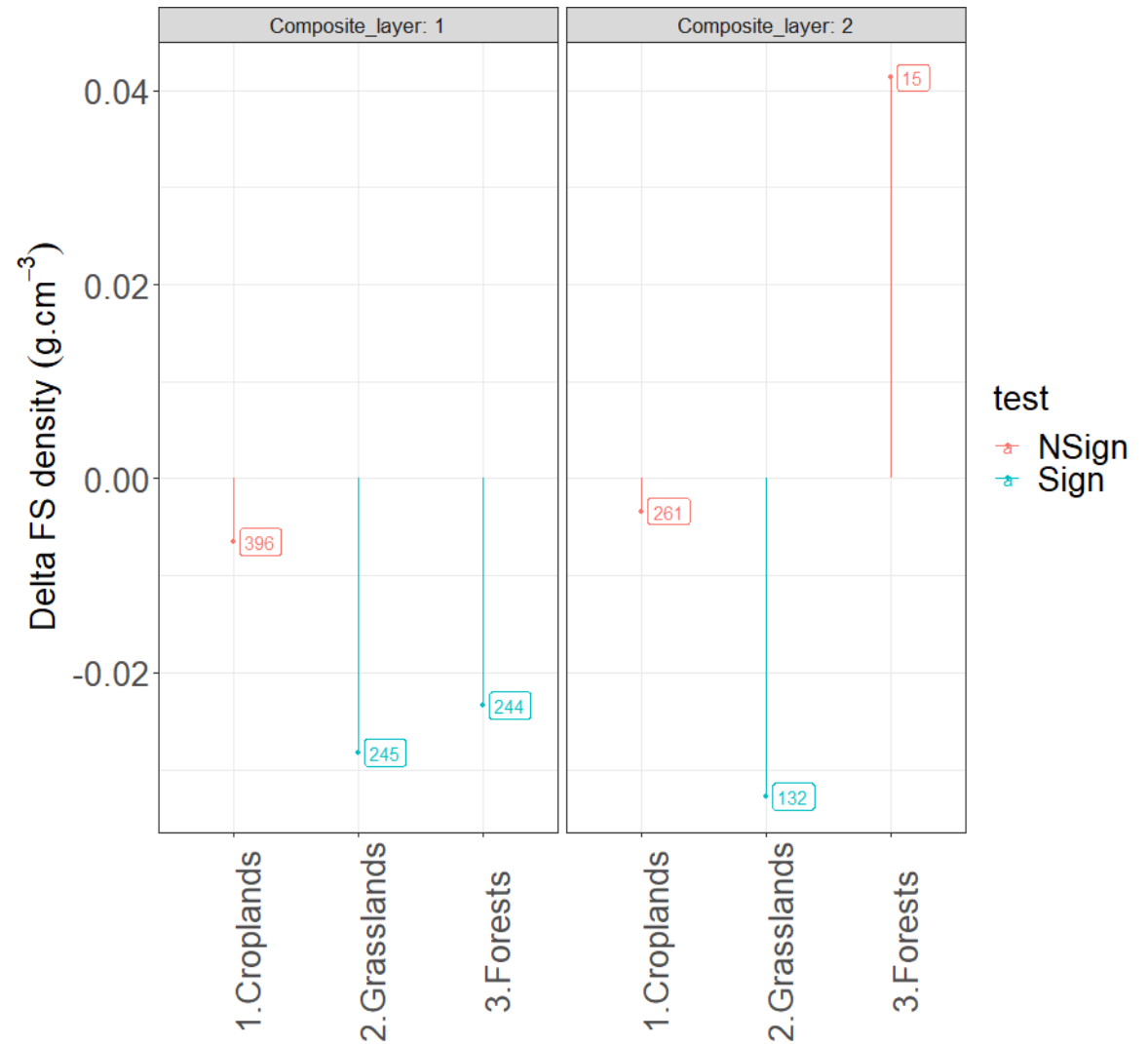
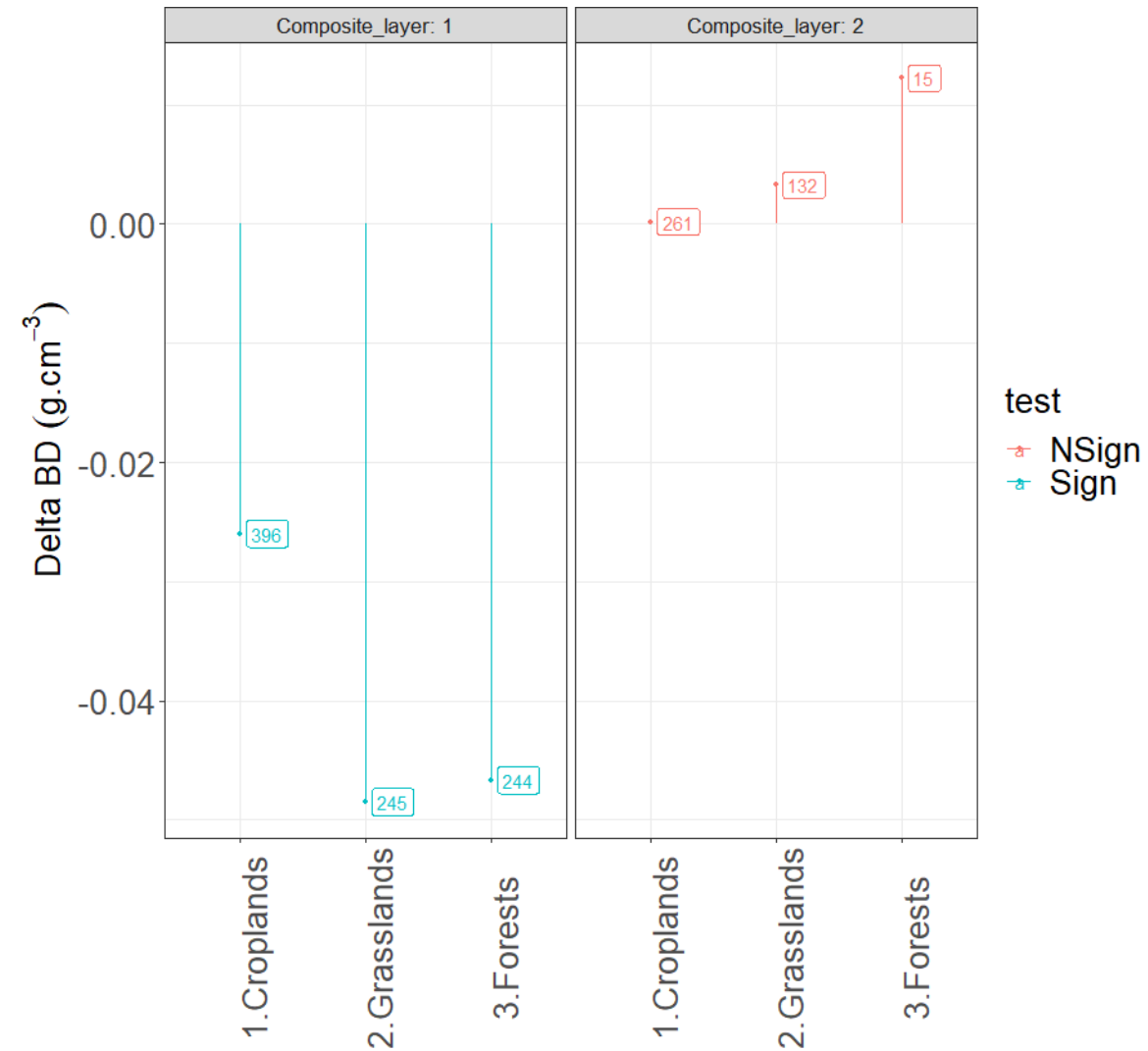
C



Δ Bulk density & Fine soil

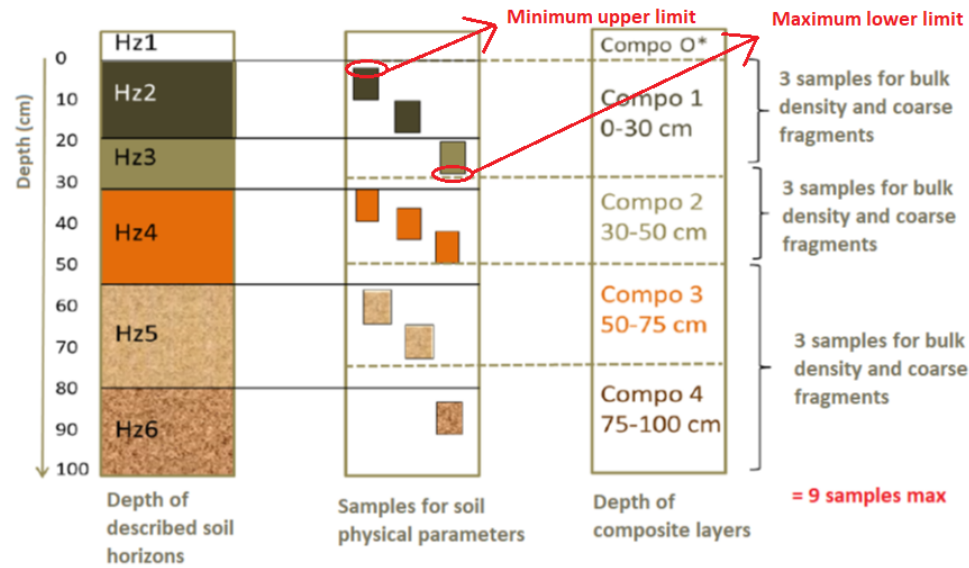


Effect of land use

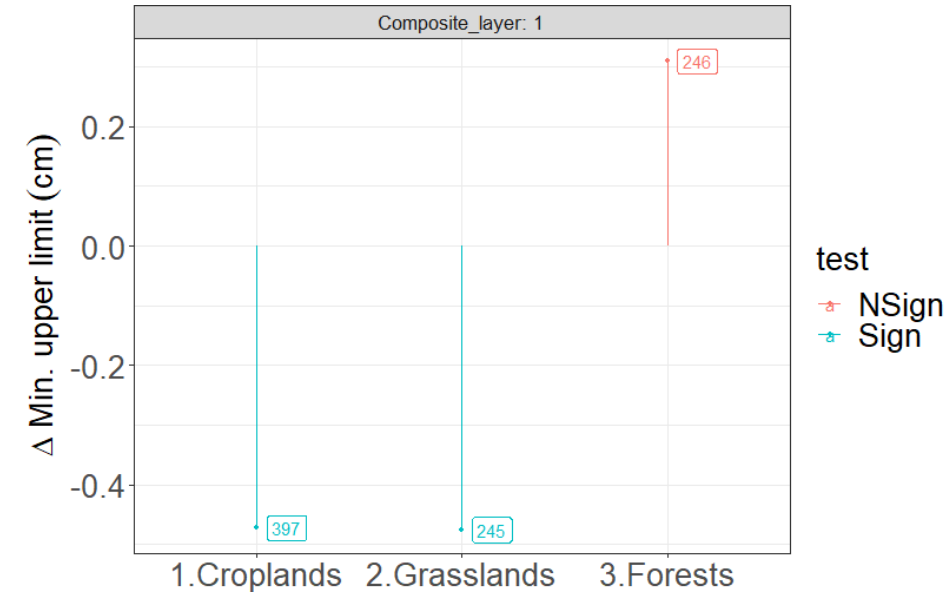


Distribution of samples within the soil pits To be confirmed

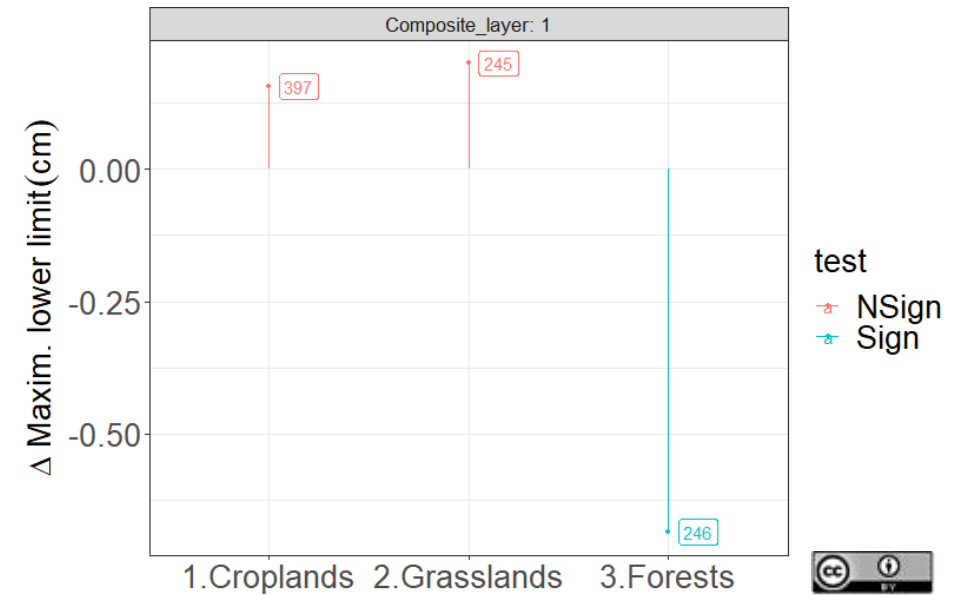
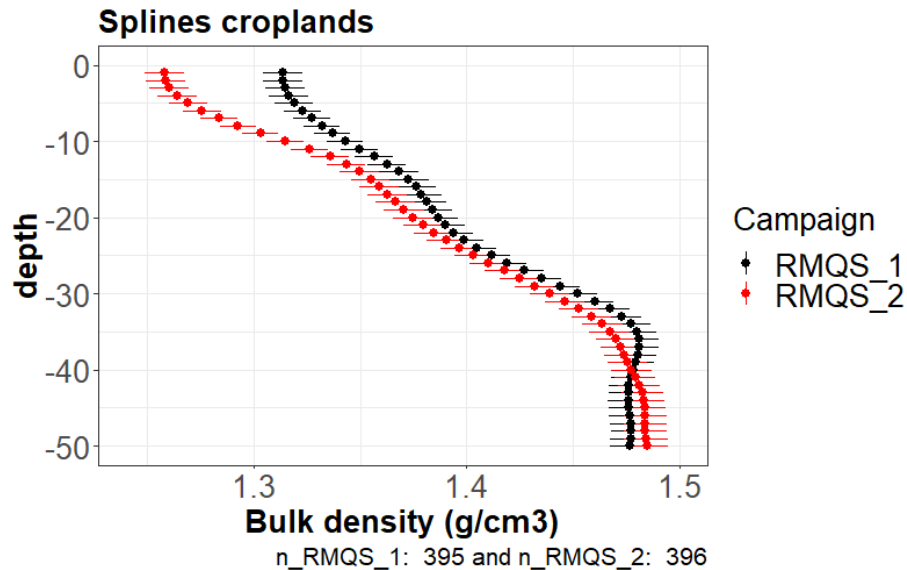
A



B



C



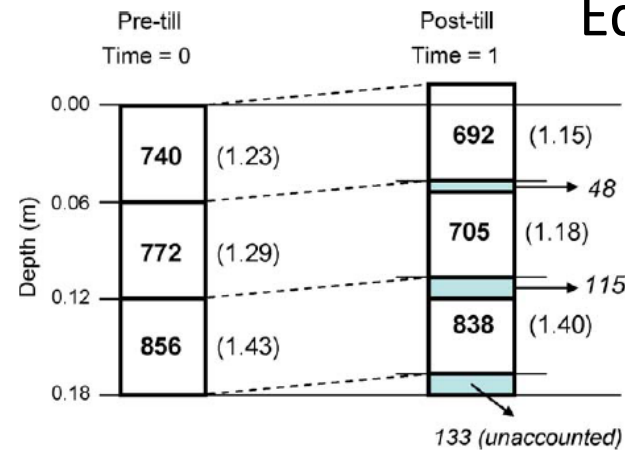
Discussion

- Uncertainty in CF content complicates the assessment of the temporal evolution of BD: decision tree.
- Variability of CF content is not necessarily related to measurement problems.
- Decrease of BD and FS in RMQS 2 in the main land use categories. Not entirely explained so far but there is a chance that this is linked to a change of distribution of samples within the soil profile. Average BD and CF?

Conclusions

- Scenarios for C stock changes:

Fixed depth



Equivalent soil mass

Lee et al., 2009

All data

Decision tree

Average of 2 campaigns:
BD constant

Pedotransfer?

- Significant decrease of BD in croplands, grasslands, and forests in horizon 1 but the reason is not fully understood yet.

The end

Thanks for your attention!



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