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

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Munera-Echeverri JL [1], Martin M [1], Boulonne L[1], Saby N[1], Arrouays D[1].
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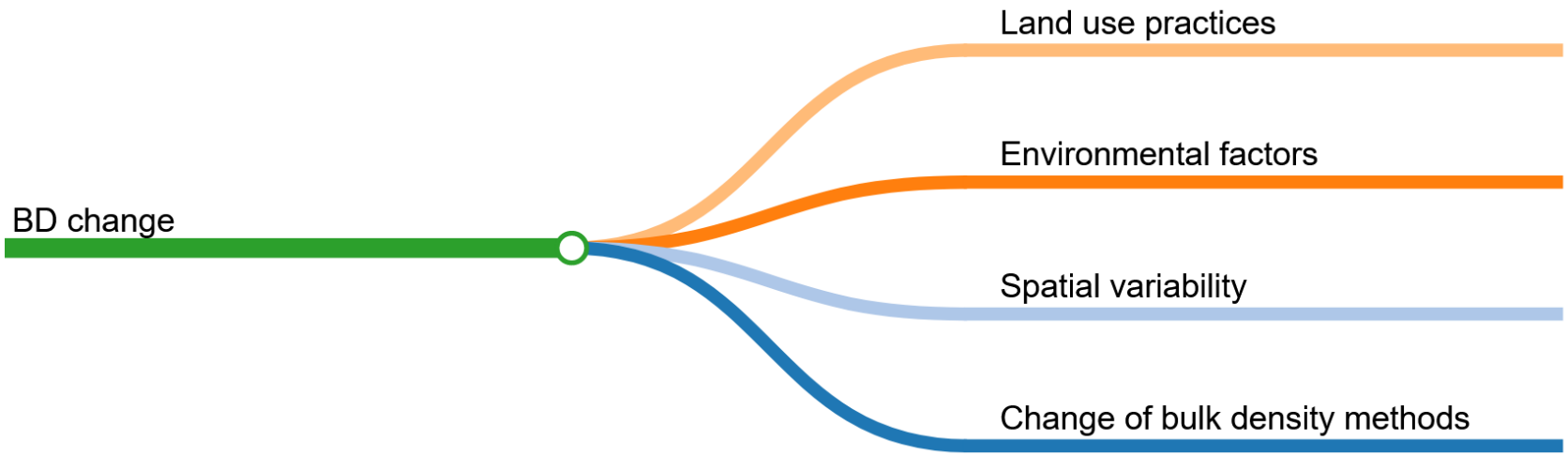
Context and problem description

- 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?



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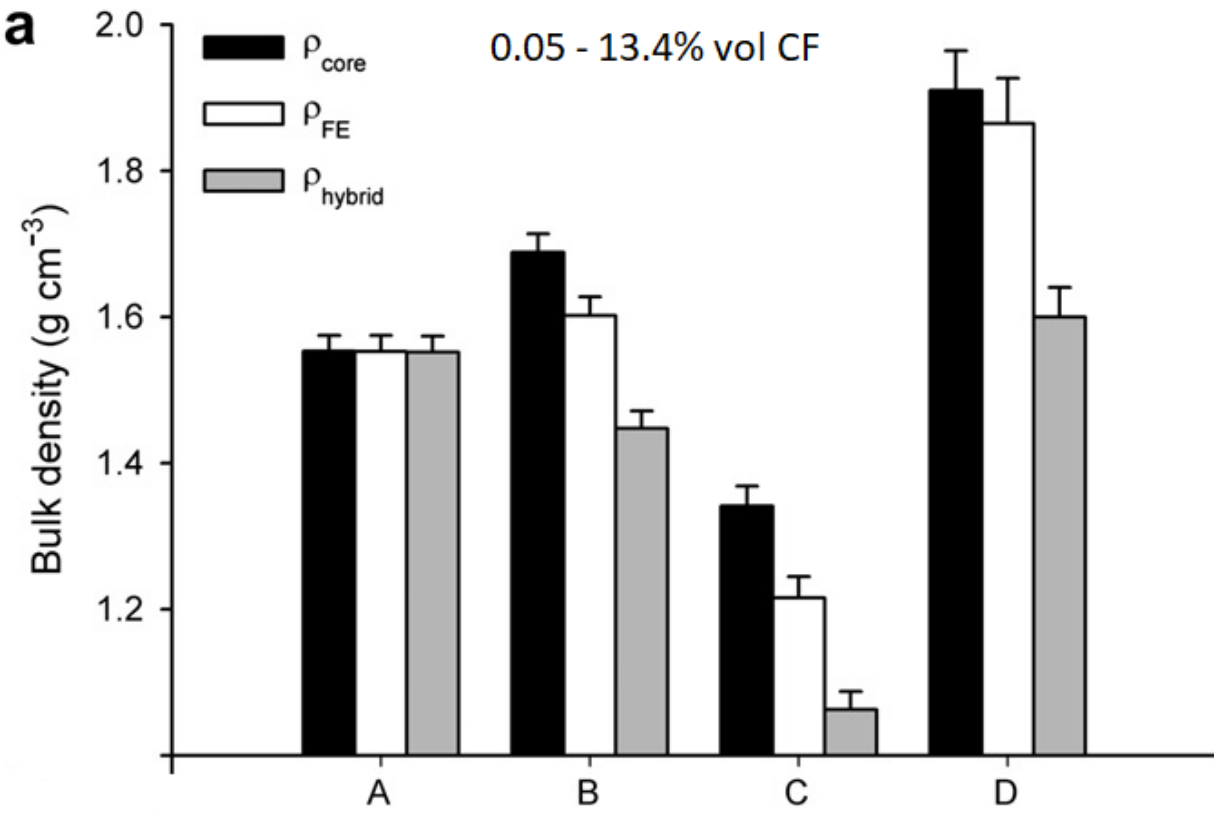
Bulk density and coarse fragments

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

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

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



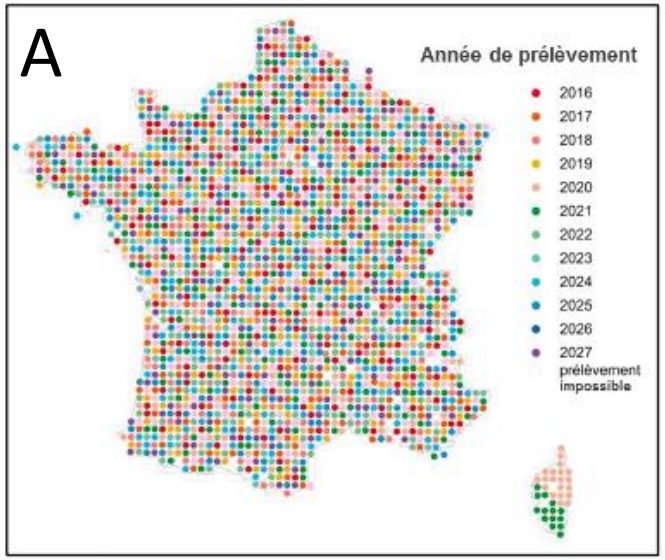
Throop et al. 2012

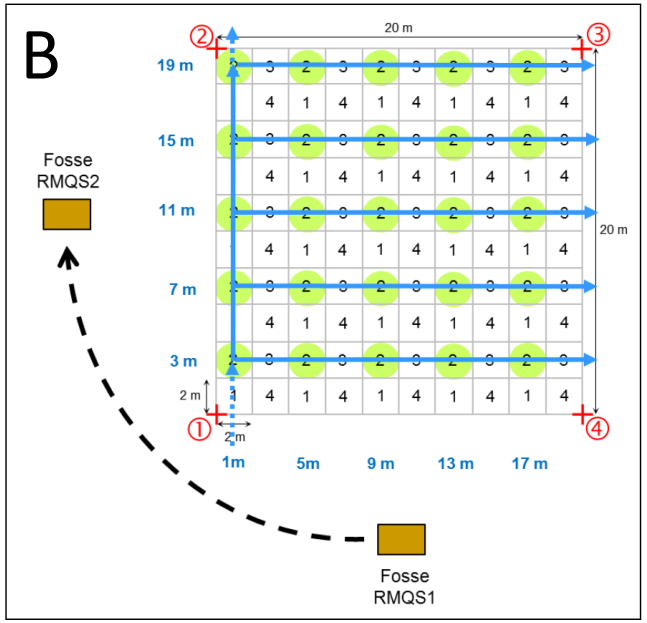
Objectives

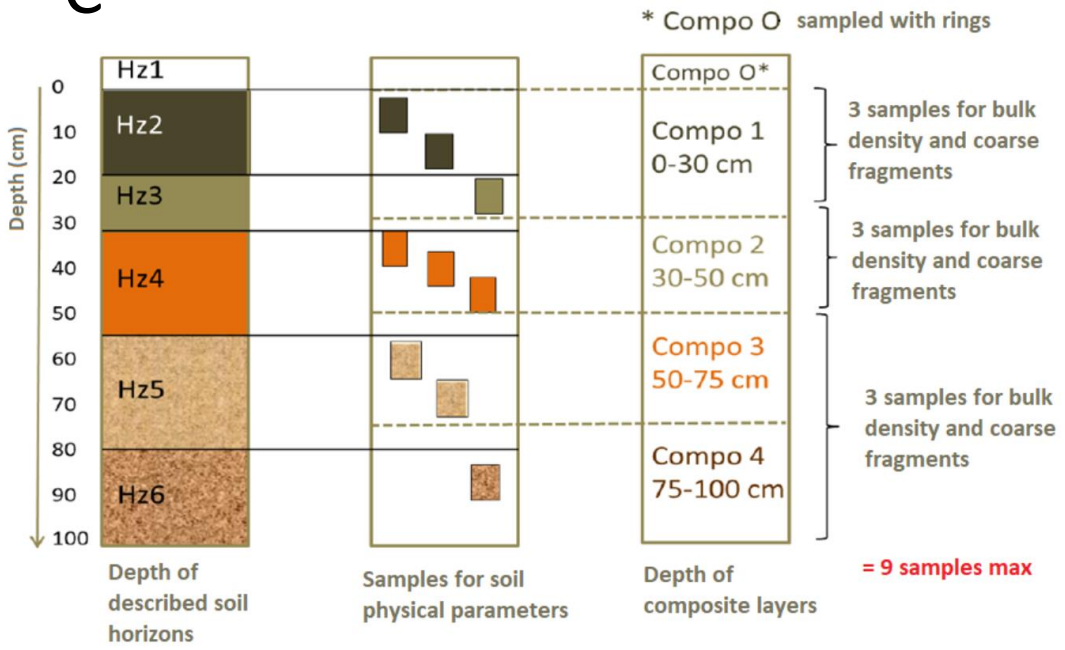
- Which soil physical data should be used for estimating changes of SOC stocks in RMQS ?

- How does land use affect the changes of bulk and fine soil density between campaigns?

Sampling design



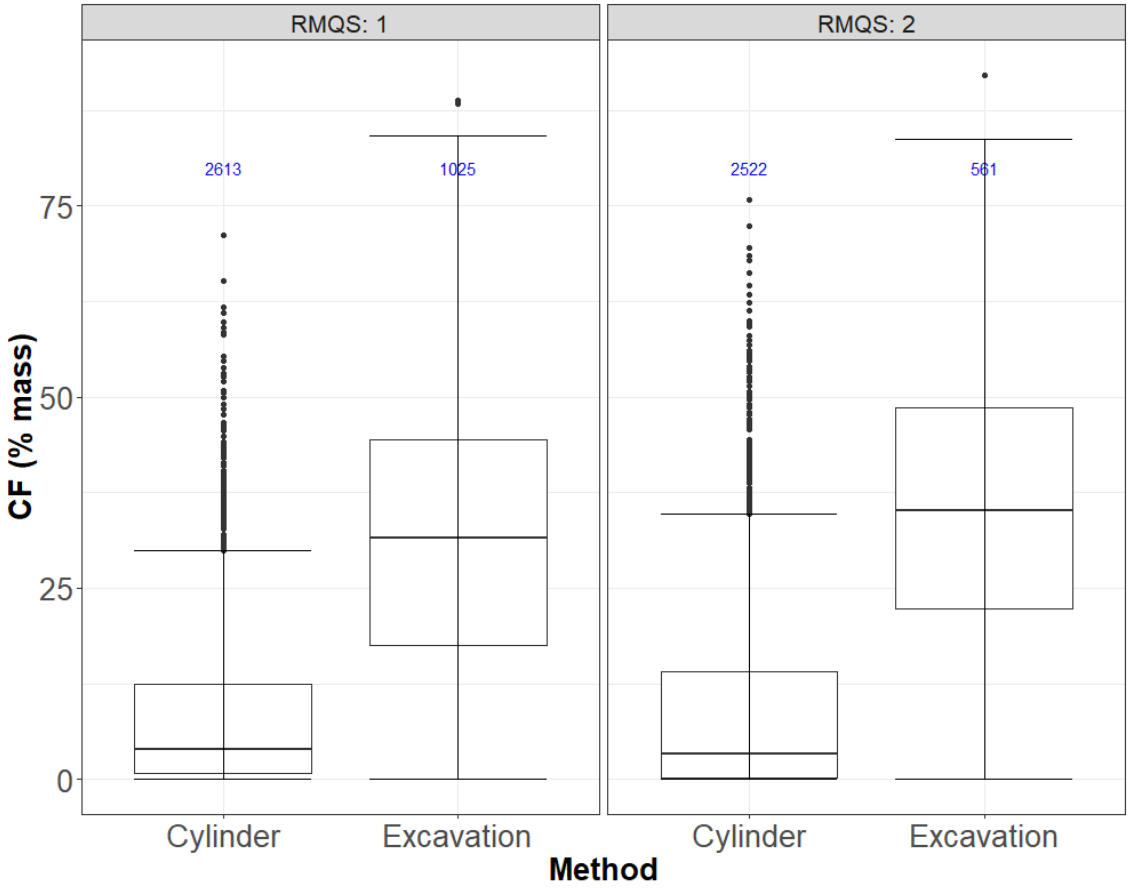




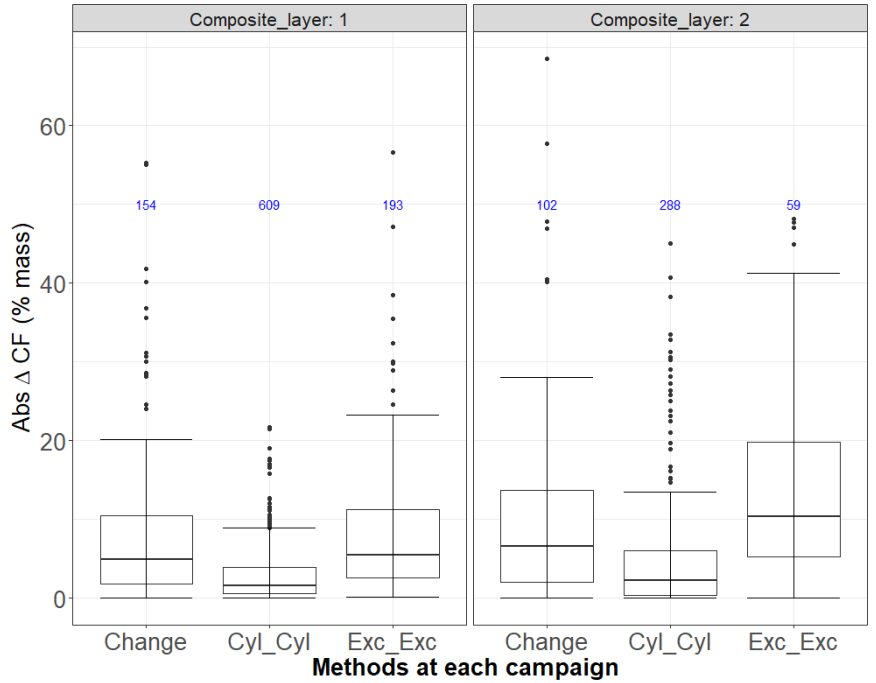
Jolivet et al. 2018

Coarse fragments

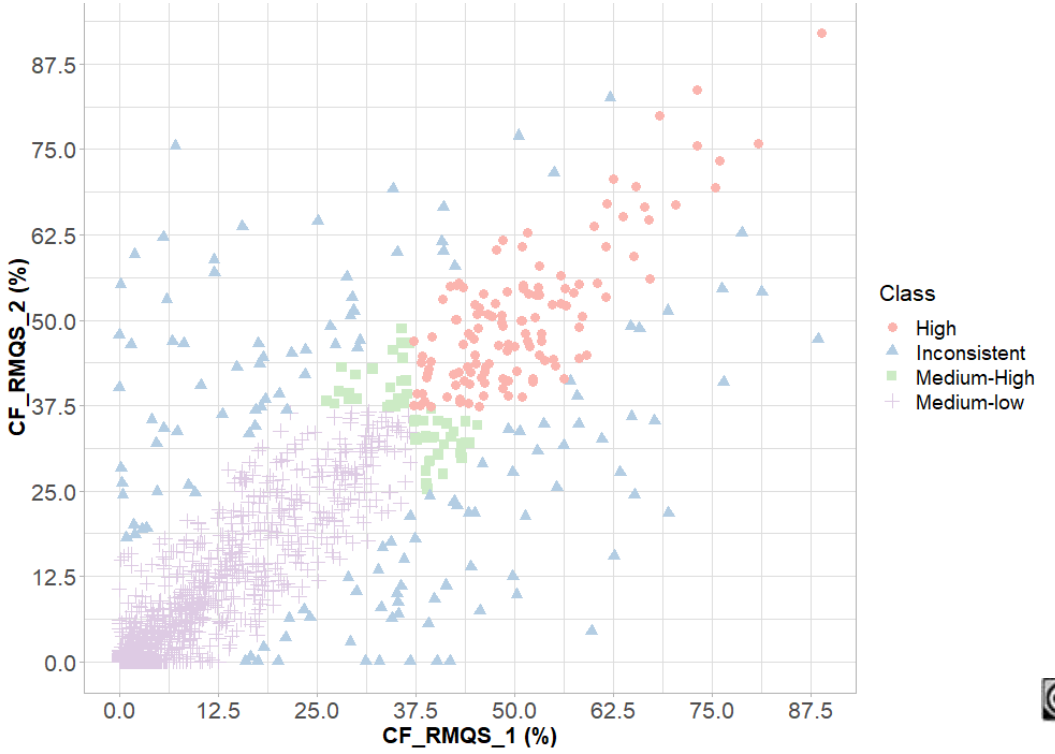
A



B



C



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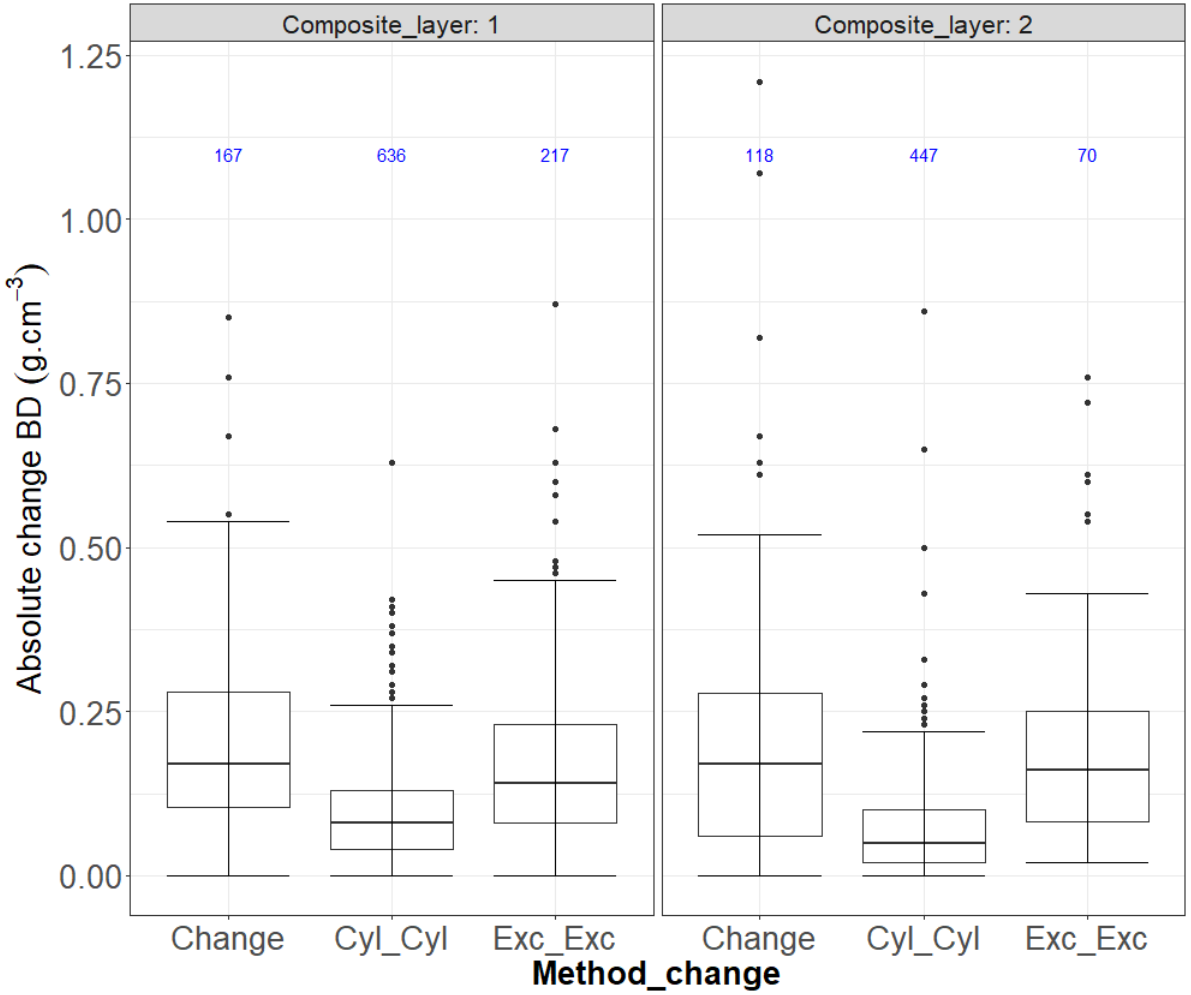
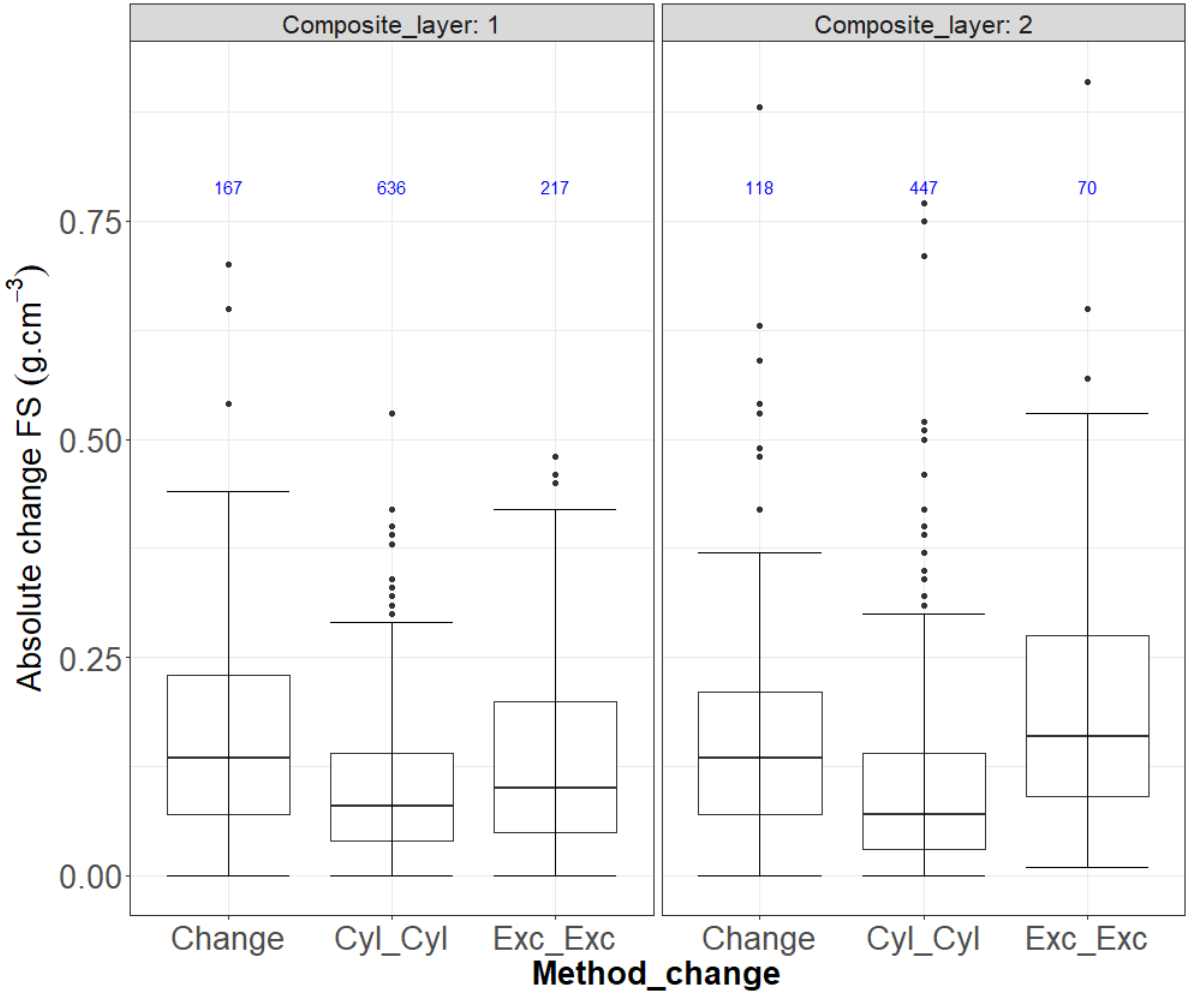
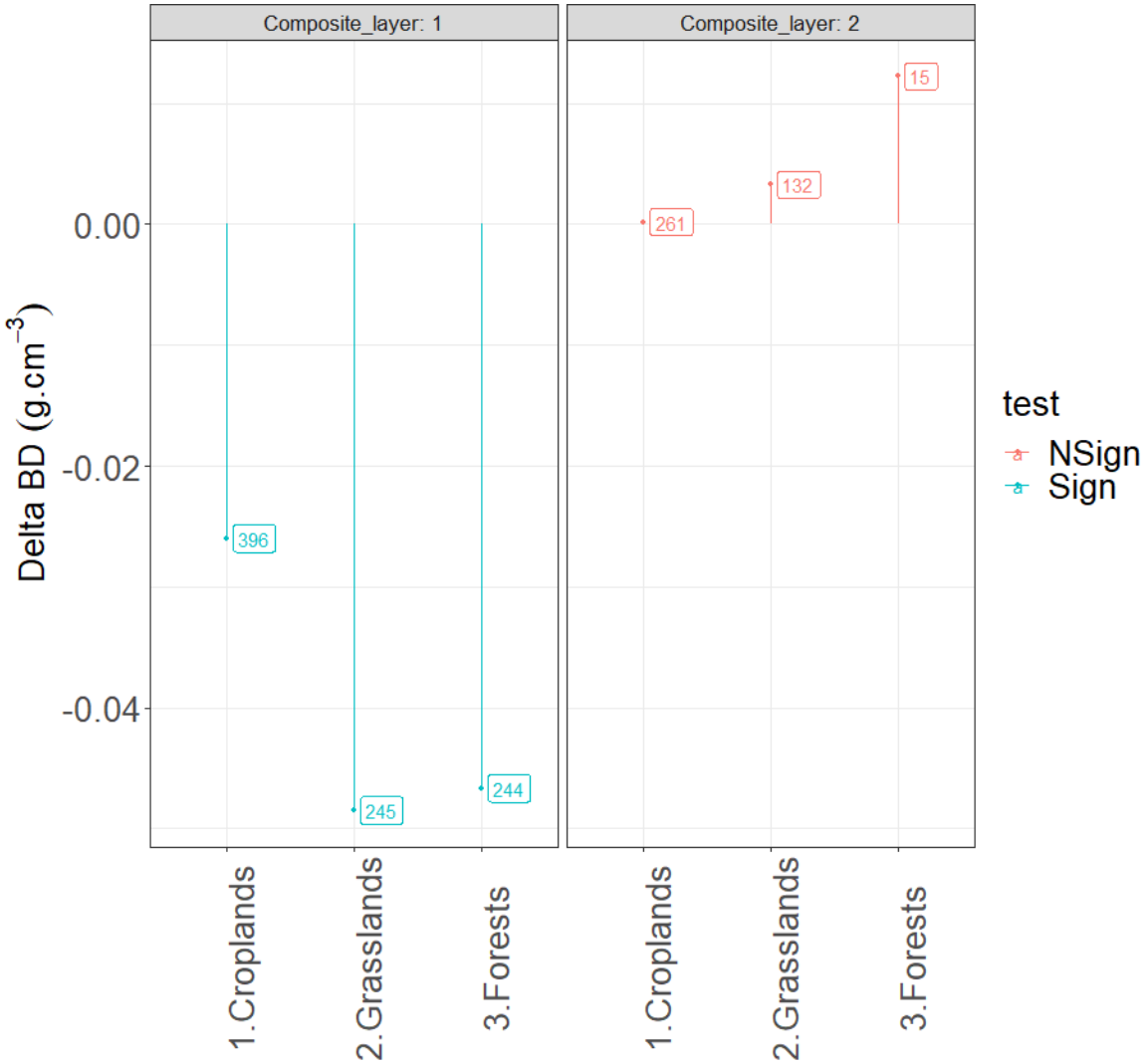
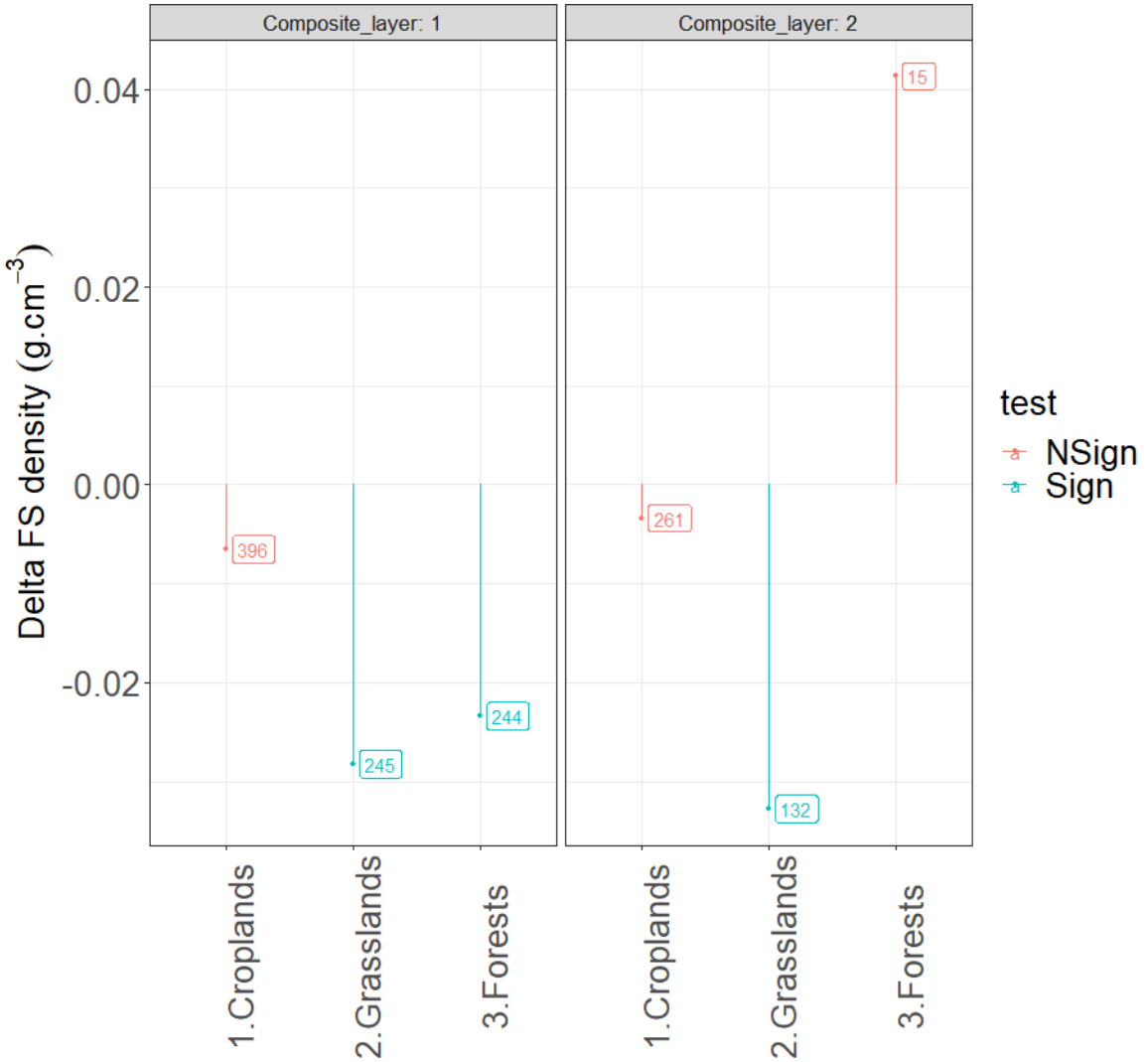
Δ Bulk density & Fine soil





Effect of land use

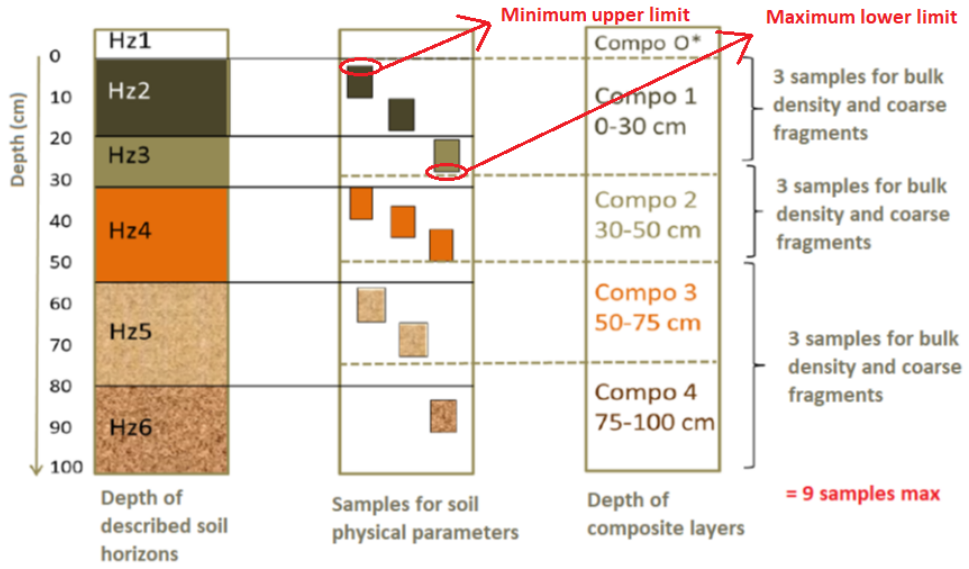




Distribution of samples within the soil pits

To be confirmed

A



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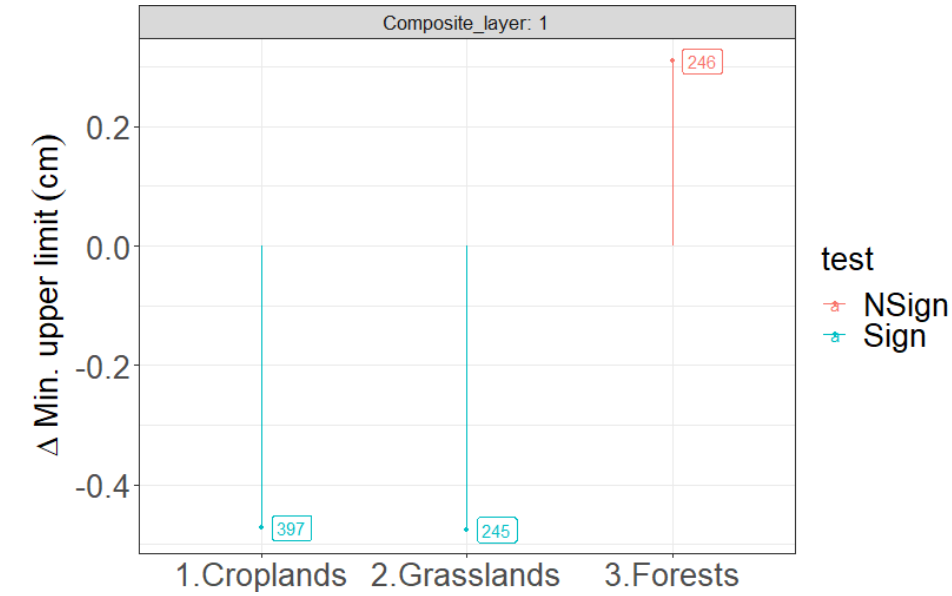

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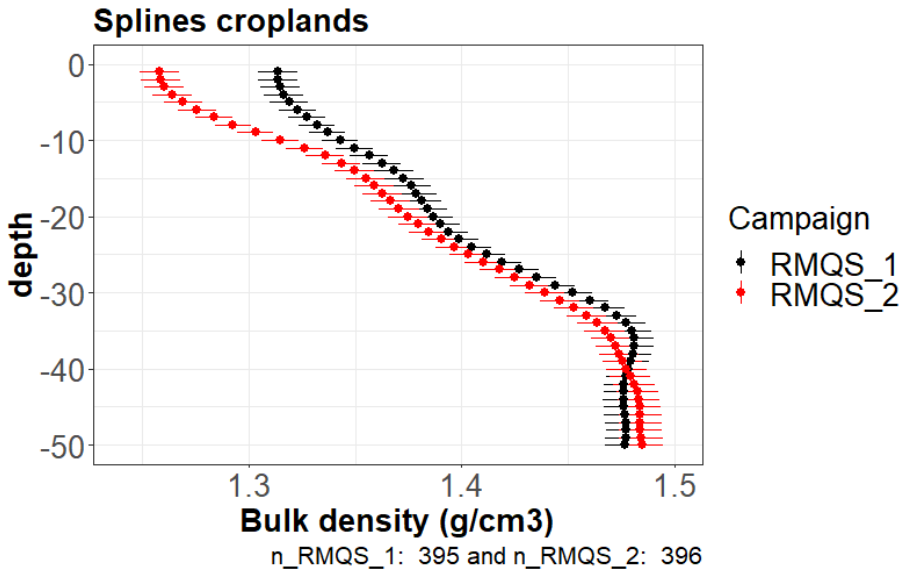
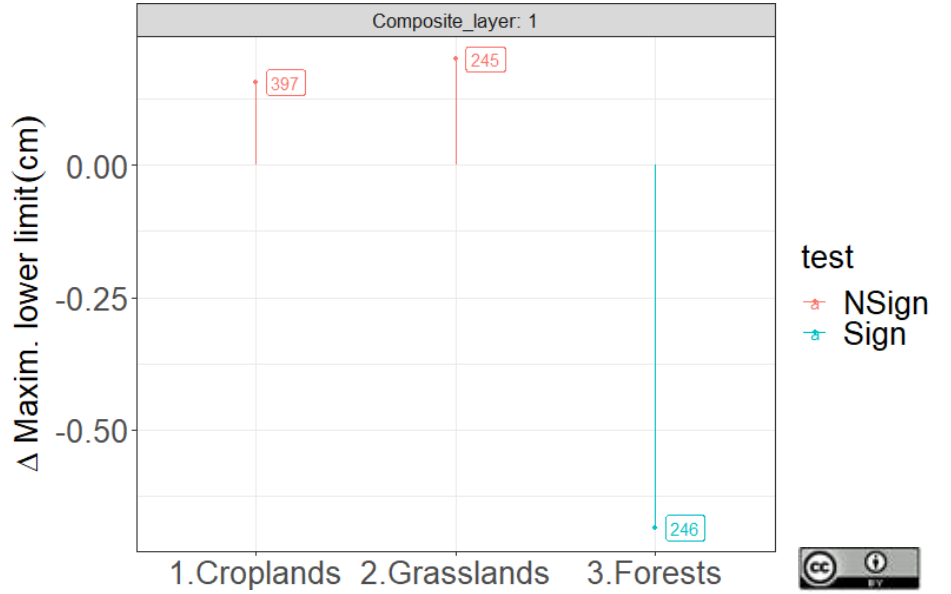




Discussion

- Uncertainty in CF content complicates the assessment of the temporal evolution of BD: decision tree.

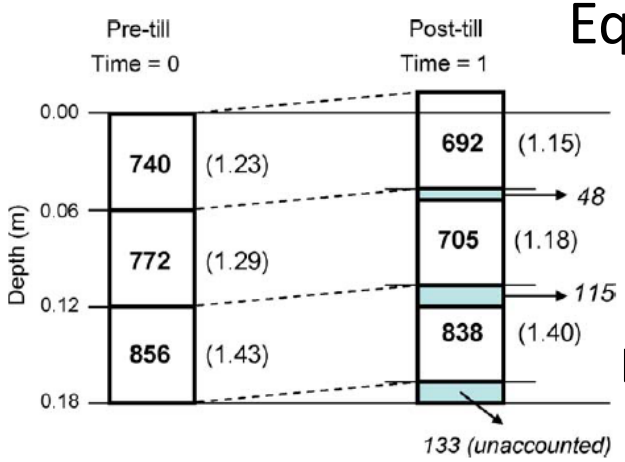
- Variability of CF content is not necessarily related to measurement problems.

- 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.

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The end

Thanks for your attention!

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References

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