



Faculty of Science



Variation of Carbon Stocks in Danish Forest Soils

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Material

NFI: (National Forest Inventory) (2x2Km Grid) | KN: (Kvadratnettet) (7x7Km Grid)

Forest oriented

278 randomly selected plots from
the permanent NFI plots

=> Soil cores for a 1m soil depth

Soil oriented

124 data collected from forest soils

In total: 402 plots, in the entire region of Denmark.

- Data merged and analyzed with common variables.



Hypothesis:

The variation of the amount of C stored in the Danish forest soils can be explained by site variables.

Objectives:

- Explain these variations in the forest floor and the mineral soil over different soil depths.
- Create a model able to adequately predict the amount of forest floor carbon in Danish forest soils.



Variables

Classes

Classification criteria

Soil type

Sandy
Loamy
OrganicNFI: geo-referenced by
GEUS200

KN: DM, F.A.O. 1998

| | Jord type | Code | Class | DJF | | | | | | | | |
|-----------------------|--------------------------|----------------------------|-------|-----|--------------------------|--|--|-----------------------------------|--------------------------|-----------------|-------------------|--|
| C S | Postglaciale aflejringer | Flyvesand Saltvandssand | Sandy | | | | | | | | | |
| | S S | Senglaciale aflejringer | | | | | Ferskvandsgrus Ferskvandssand Ferskvands snad og grus Saltvandssand | | | | | |
| F C F | | Glaciale aflejringer | | | | | Smeltevandsgrus Smeltevandssand Morænegrus Morænesand | | | | | |
| | | F C F | | | | | Glaciale aflejringer | Smeltevandsler Moræneler | | | | |
| | | | | | | | Postglaciale aflejringer | Ferskvandsgytje Ferskvandstørv | Humic | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | Jordtype | JB nr. | Teksturdefinition | |
| | | | | | | | | 1 | 1 | Grovsandet jord | | |
| | | | | | | | | 2 | 2 | Finsandet jord | | |
| | | | | | | | 3 | 3 | Grov lerblandet sandjord | | | |
| | | | 4 | 4 | Fin lerblandet sandjord | | | | | | | |
| | | | 5 | 5 | Grov sandblandet lerjord | | | | | | | |
| | | | 6 | 6 | Fin sandblandet lerjord | | | | | | | |
| | | | 7 | 7 | Lerjord | | | | | | | |
| | | | 8 | 8 | Svær lerjord | | | | | | | |
| | | | 9 | 9 | Meget svær lerjord | | | | | | | |
| | | | 10 | 10 | siltjord | | | | | | | |
| | | | 11 | 11 | Humus | | | | | | | |
| | | | 12 | 12 | | | | | | | | |

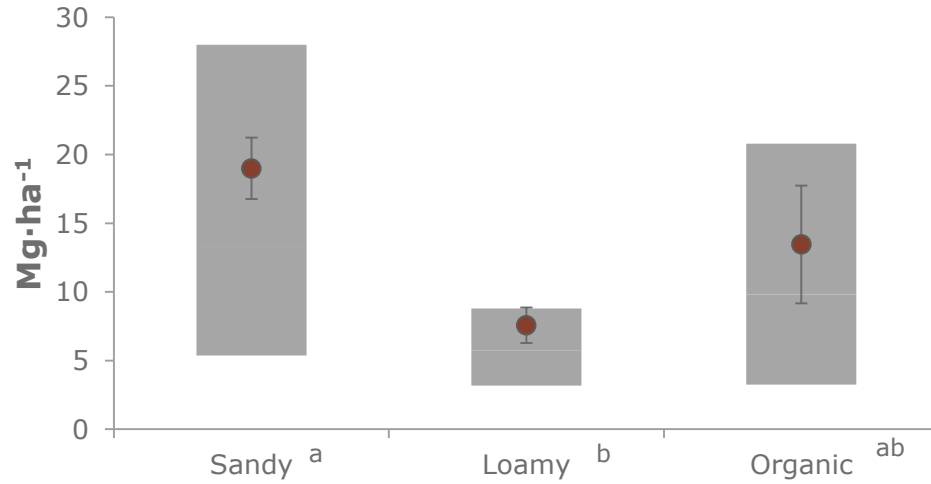


| Variables | Classes | Classification criteria |
|-------------------------------|-----------------------------------|---|
| Soil type | Sandy Loamy Organic | NFI: Est. G.I.S., GEUS200 input data KN: DM, F.A.O. 1998 |
| Tree species group | Brlf Con Mix | Est. 60% dominancy of Basal Area (TSU level) |
| Stand age | 0-10 10-30 30-60 >60 | NFI: DM, tree-rings KN: Field observation |
| Soil moisture | Dry Moist | NFI: Est. by field observations KN: Est. by field observations |
| Previous Land use (plu) | FRF, AFF, HTF | G.I.S., 1954-2010 Orthophoto check |
| Precipitation | Continuous (mm·yr ⁻¹) | G.I.S., DMI_2010 input data |

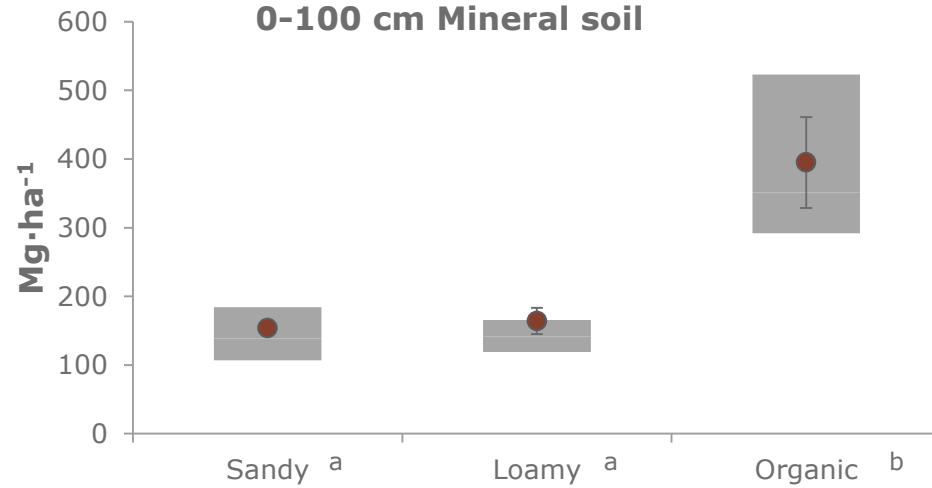


Soil Type

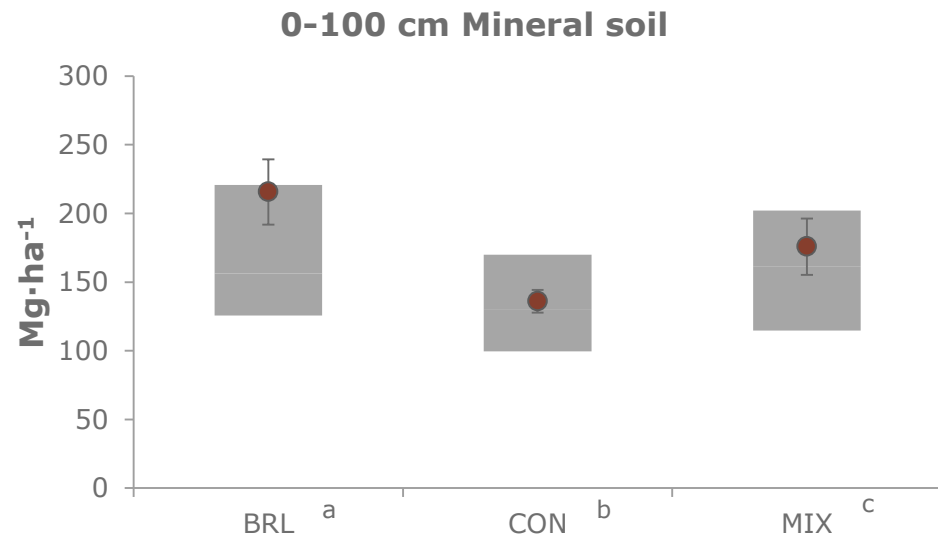
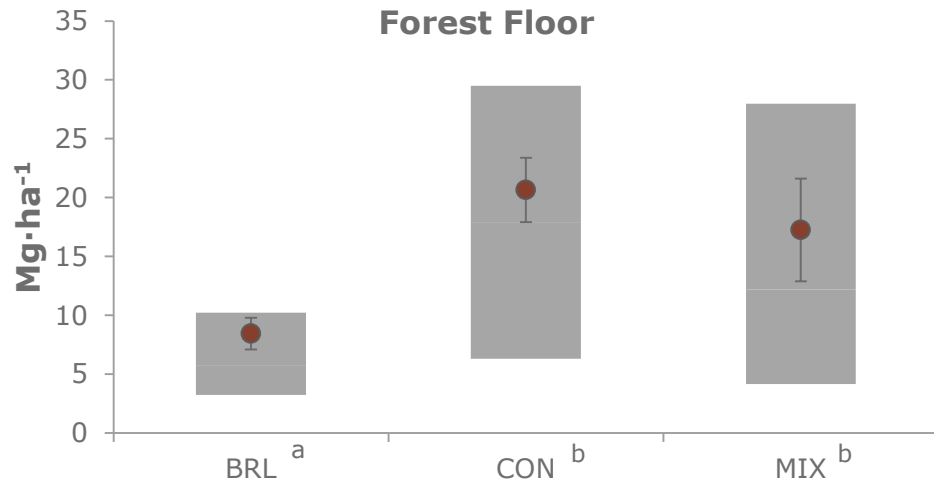
Forest Floor



0-100 cm Mineral soil

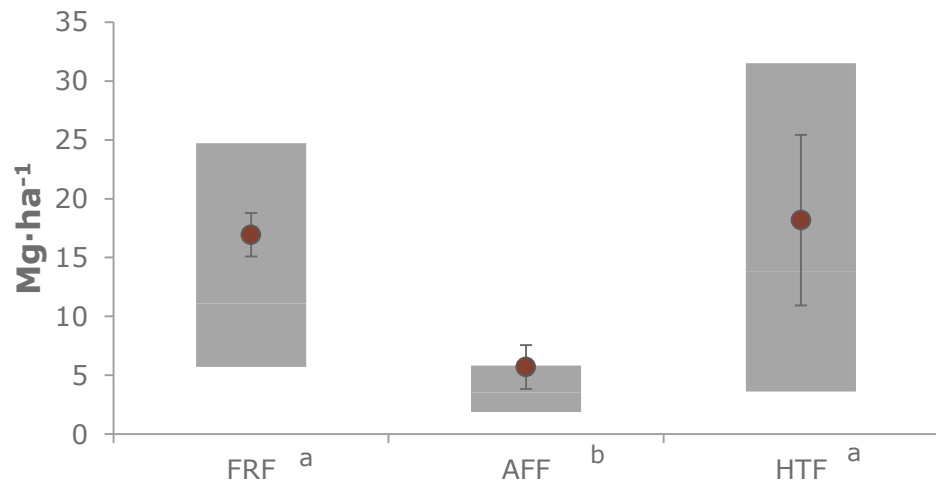


Tree species

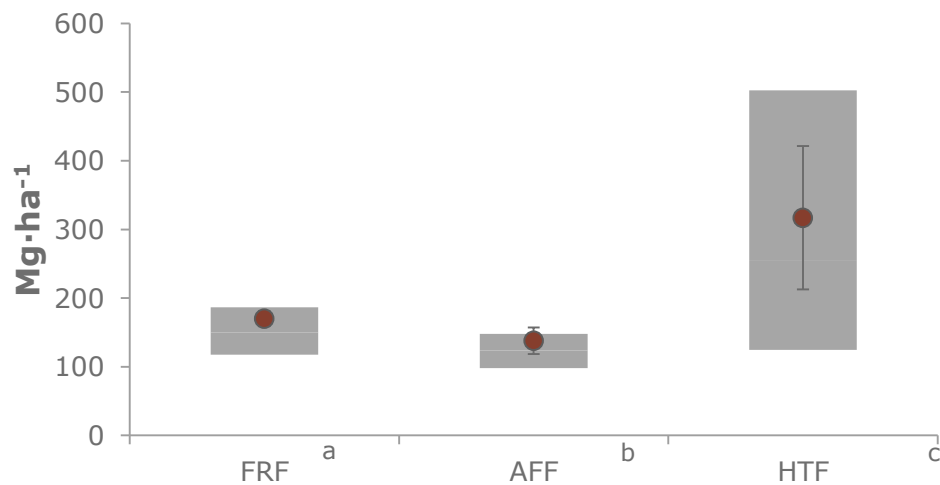


Previous Land Use

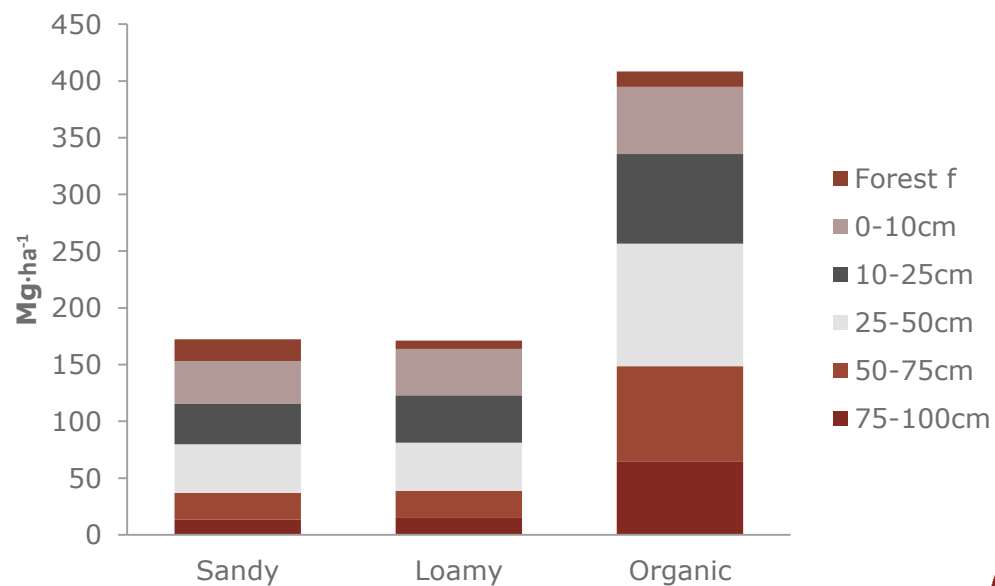
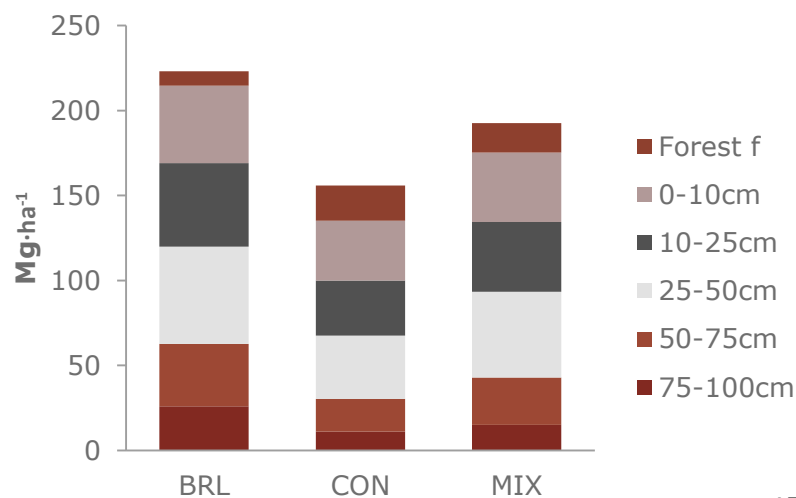
Forest Floor



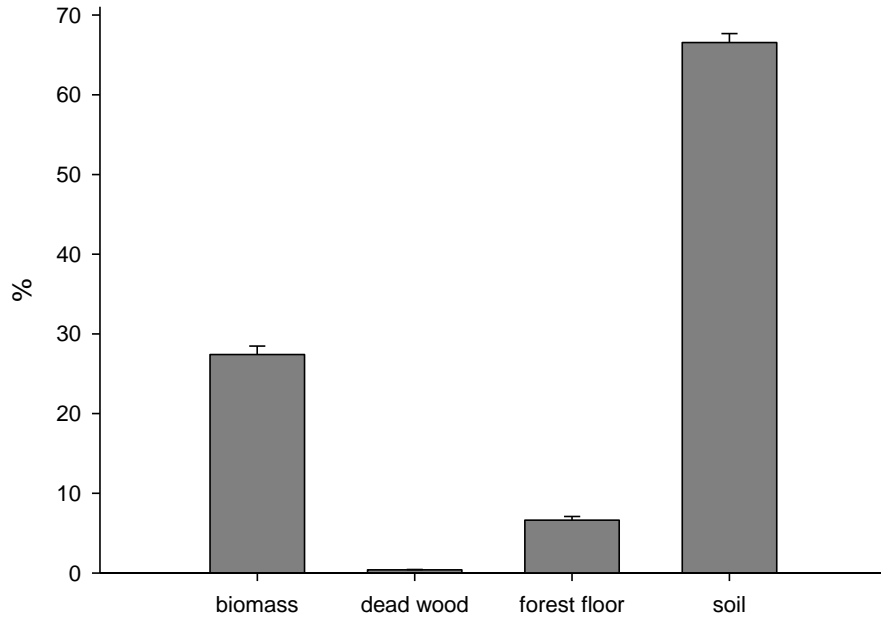
0-100 cm Mineral soil



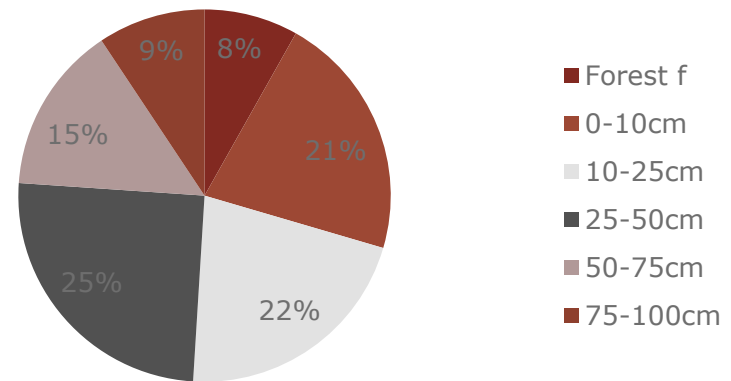
Soil C distribution in the soil layers

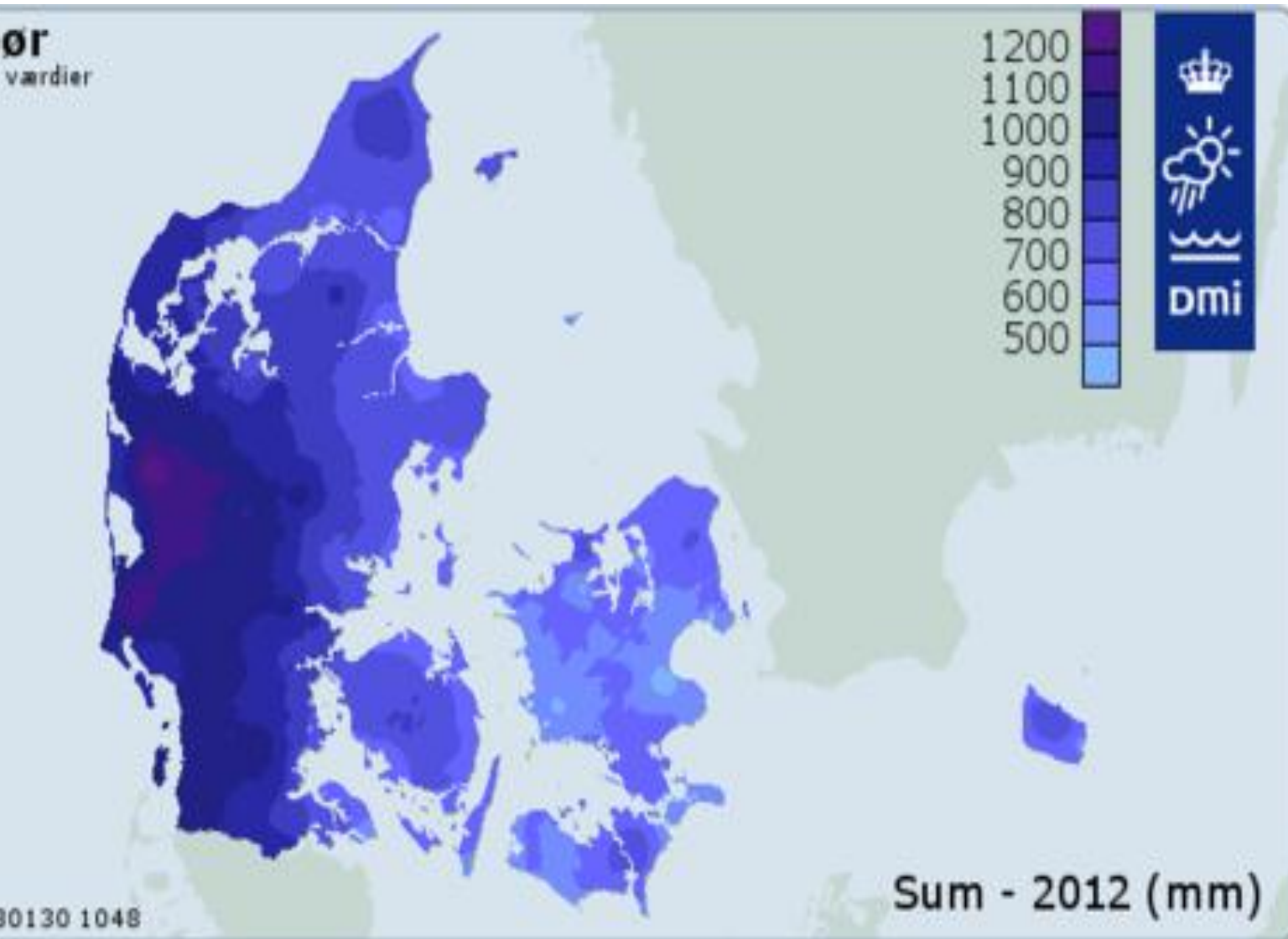


Relative C stocks



Relative Soil C Stock





01
værdier

and overlaps:

ls on east

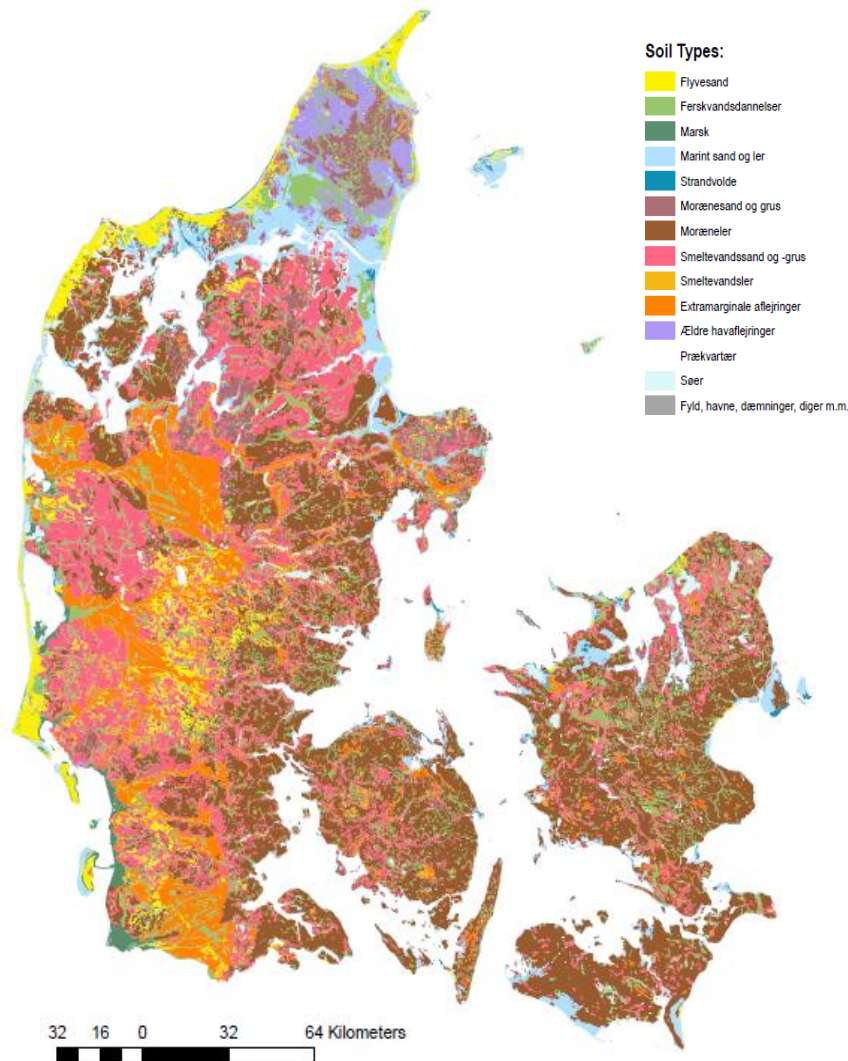
est

sandy soils

ated by

ars





Co-variation and overlaps:

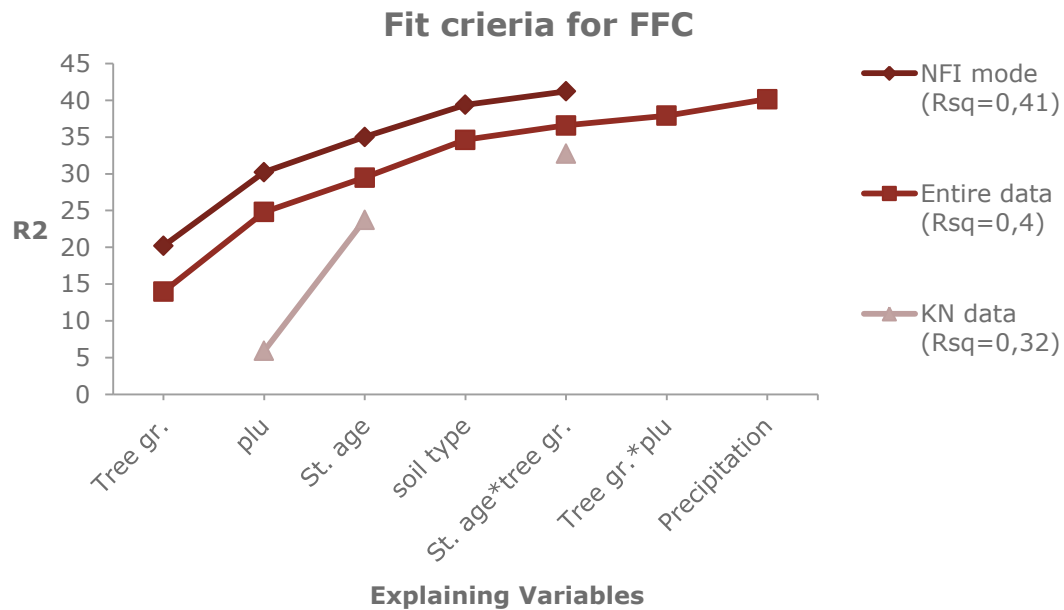
Sandy soils on West, clay soils on east

Higher Precipitation on the west

85% of Conifers are found in sandy soils

70% of Moist sites are dominated by Broadleaves

Forest Floor - Explanatory model

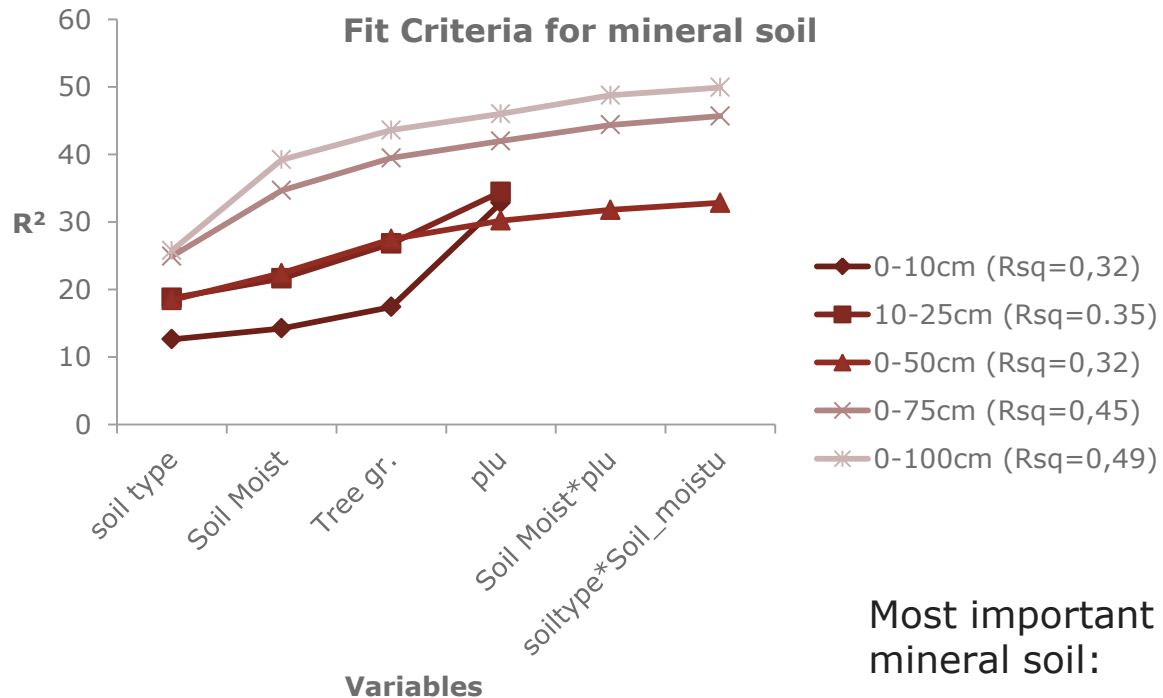


=> Explaining variables:

- *Tree species group*
- *Previous land use (plu)*
- *Stand age*
- *Soil type*



Mineral soil - Explanatory model



Most important explaining variables in the mineral soil:

Soil type

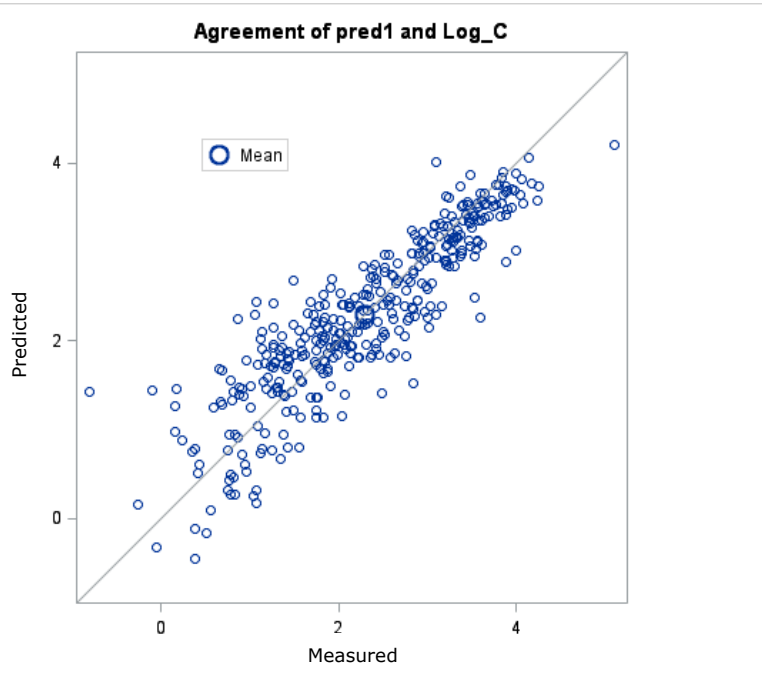
Moisture

Previous land use (plu)

Tree group



Forest Floor - Predictive model



NFI model ($R^2=0,78$)

KN fit ($R^2 =0,82$)

Entire dataset:

Substitution of precipitation with Soil type

Final Model:

$\text{Log}(C) = \text{log_FF_thick} * \text{soiltype} * \text{Tree_species}$
Tree species group

$R^2 = 0,79$; $P > .0001$



Conclusions

Although the 2 dataset have been designed for different purposes, the results are closely in line for both.

Site and soil variables can indeed explain the variation of C stocks in the forest

Forest floor:

More dependent on the tree composition and the age of the stands

Mineral soil:

Mainly dependent on the soil type and the moisture



Thank you!

