

Ignoring changes in soil bulk density overestimates the C sequestration potential under reduced and no tillage

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Overview

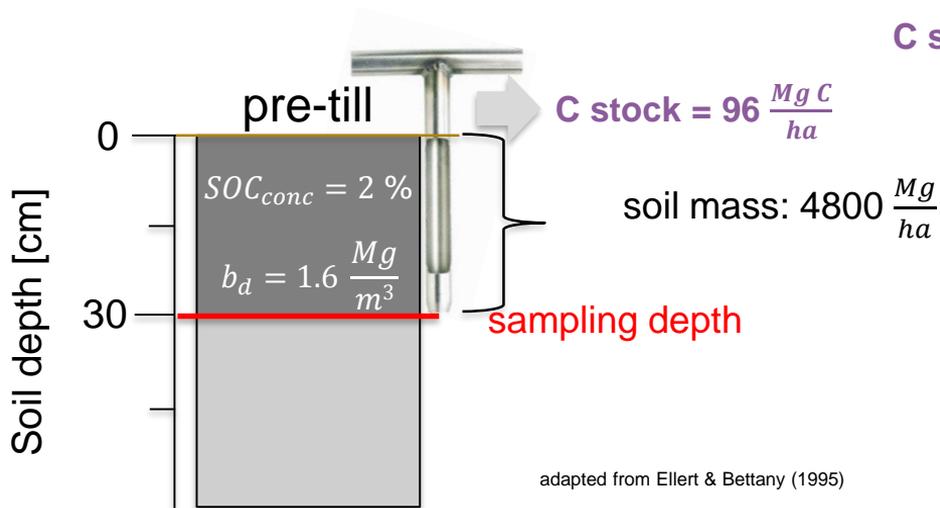
- several studies comparing tillage intensities
 - both beneficial and null effects on SOC
- Limitations:
 - reported stocks mostly limited to 0 – 30 cm soil depth
 - differences in soil mass not considered (fixed depth)
 - definition of tillage intensities not consistent (especially “reduced tillage”)

Approach

$$C \text{ stock} = b_d * SOC_{conc} * depth$$

“Fixed depth”

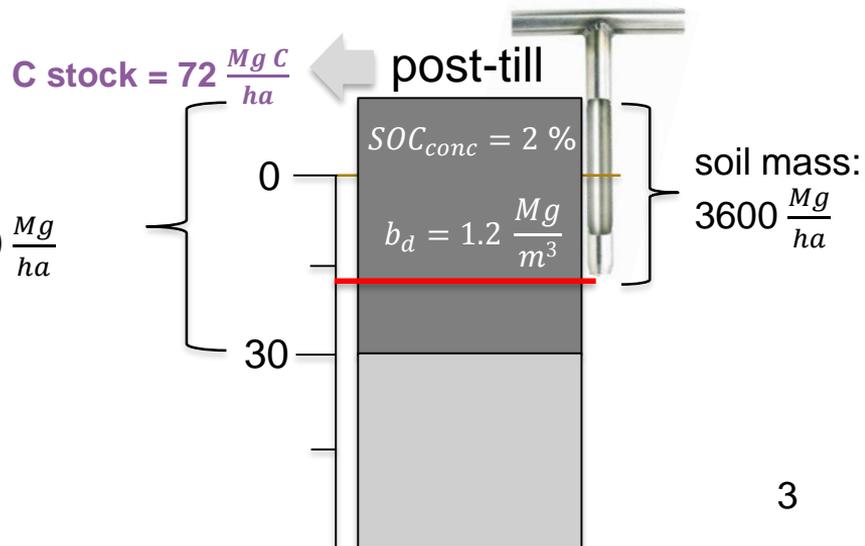
- treatment comparison based on same sampling depth, e.g. 0 – 30 cm
- b_d considered identical



$$C \text{ stock} = b_d * SOC_{conc} * depth_{eq}$$

“Equivalent Soil Mass (ESM)”

- C mass stored in the same soil mass
- considers changes in b_d among treatments



Outcomes

SOC stock changes (Mg/ha) (0 – 30 cm depth) after tillage conversion (*Meurer et al. 2018*)

Approach	high → intermediate	intermediate → no tillage	high → no tillage
<i>ESM</i>	3.22 (± 1.48)	2.18 (± 1.40)	4.19 (± 1.82)
<i>fixed depth</i>	3.71 (± 1.58)	3.20 (± 1.52)	6.12 (± 1.76)

values are presented as mean ± (standard error)

overestimation

15 %

47 %

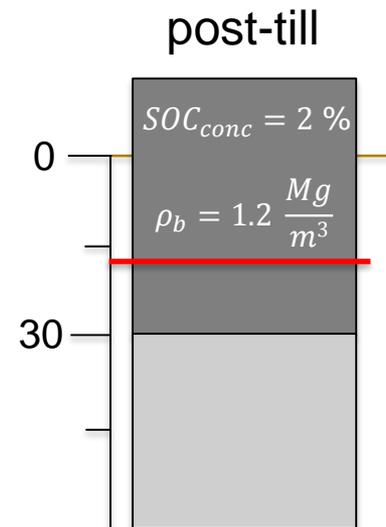
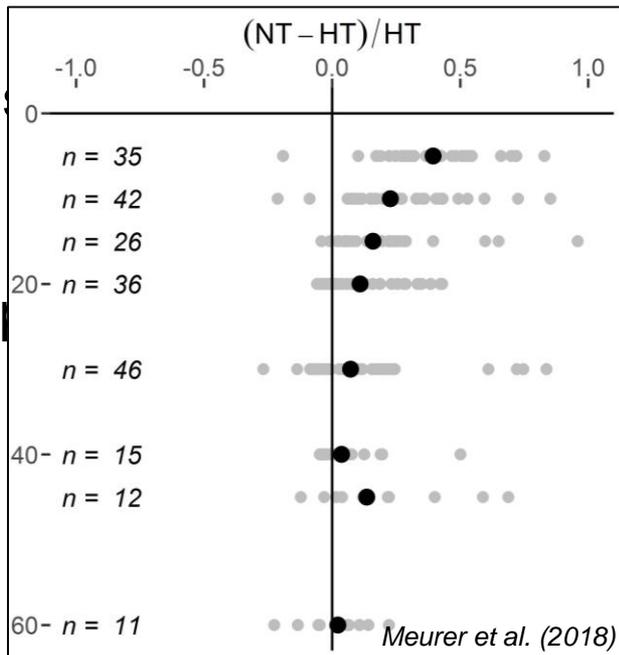
46 %

To summarise...

- positive effect of less intensive tillage on SOC stocks

BUT

- method to calculate SOC stocks
→ stocks might be underestimated
- sample as deep as possible



Thank you for your attention!

- Ellert BH, Bettany JR (1995): Calculation of organic matter and nutrients stored in soils under contrasting management regimes. *Can J Soil Sci* 75, 529 – 538
- Haddaway NR, Hedlund K, Jackson LE, Kätterer T, Lugato E, Thomsen IK, Bracht Jorgensen H, Söderström B (2015): What are the effects of agricultural management on soil organic carbon in boreo-temperate systems? *Environ Evid* 4:23. Doi: 10.1186/s13750-015-0049-0
- Meurer KHE, Haddaway NR, Bolinder MA, Kätterer T (2018): Tillage intensity affects total SOC stocks in boreo-temperate regions only in the topsoil – A systematic review using an ESM approach. *Earth-Science Reviews* 177, 613 – 622. Doi: 10.1016/j.earscirev.2017.12.015