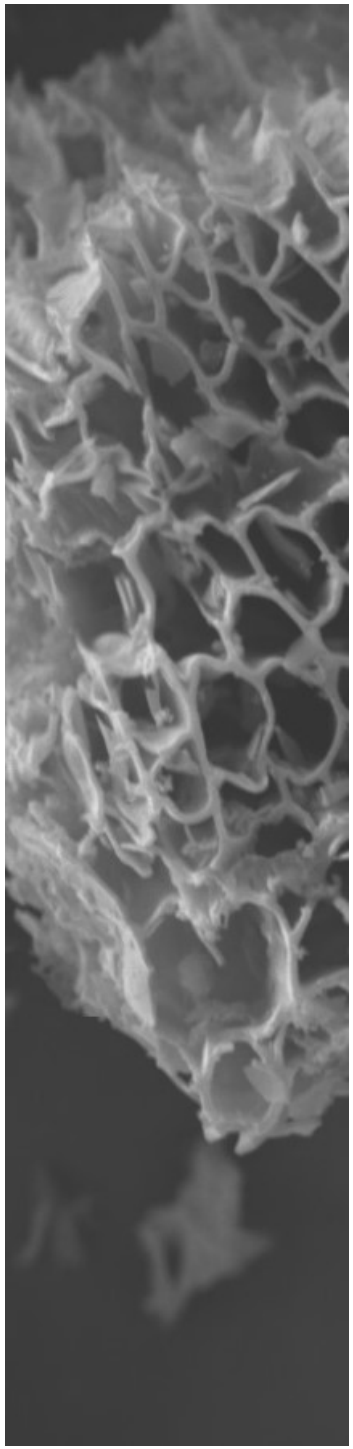


Stockage du carbone et propriétés du sol après l'apport de biochars et d'associations biochar-matières fertilisantes

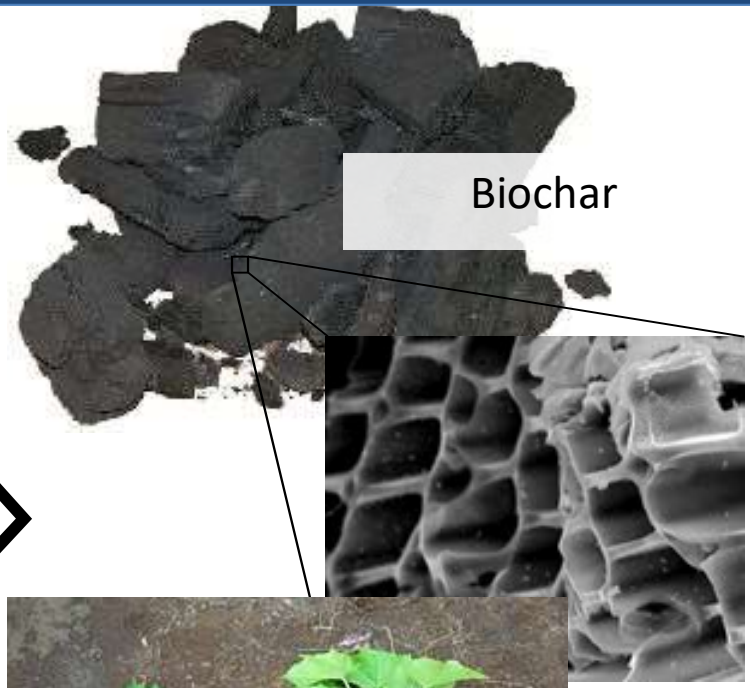
Samuel Abiven[1], Hans-Peter Schmidt[2]

1 Université de Zurich
2 Ithaka institute for carbon intelligence

Biochar systems: principles

Waste management

Pyrolyser

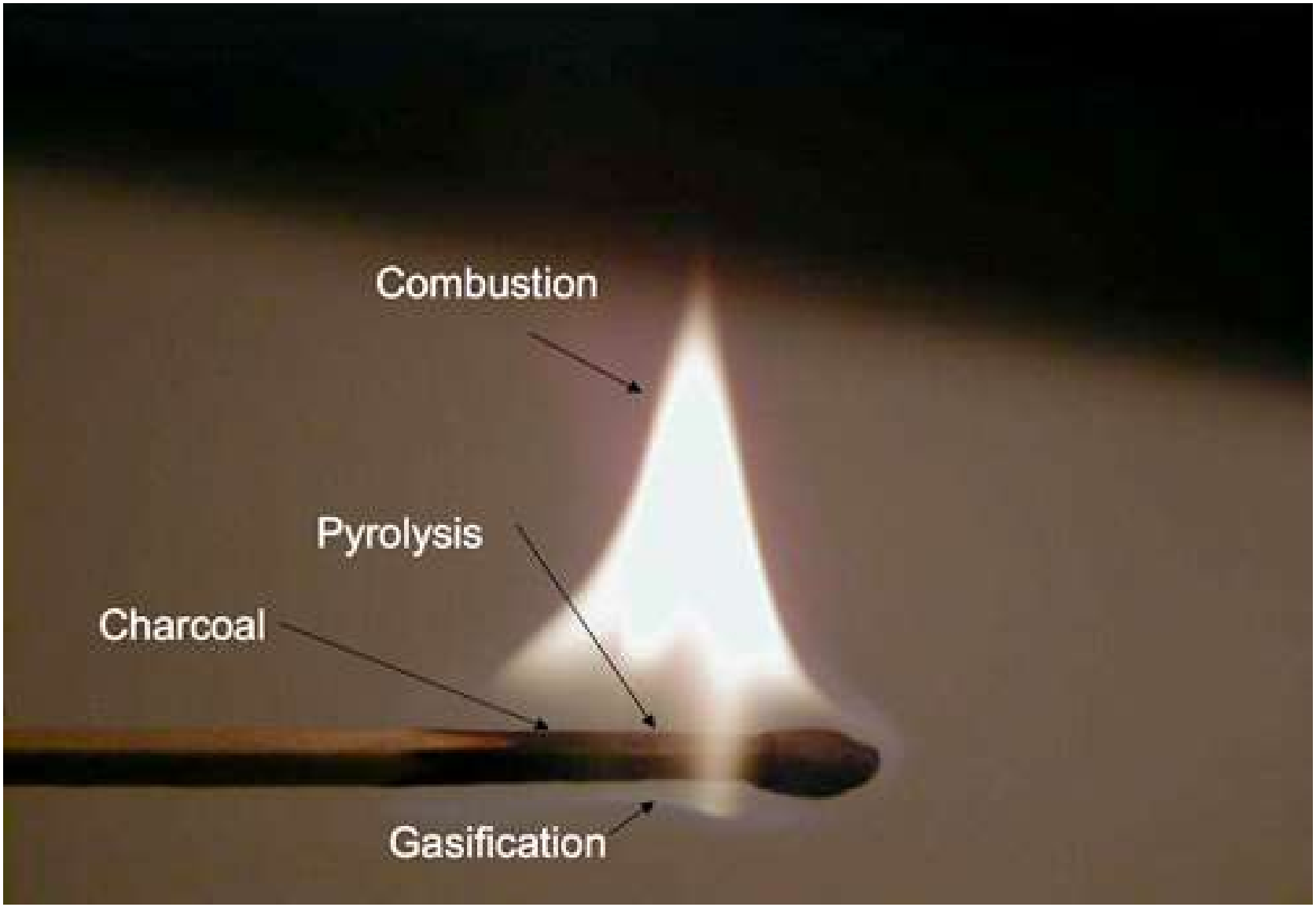


Biochar

Climate mitigation + water and nutrients retention

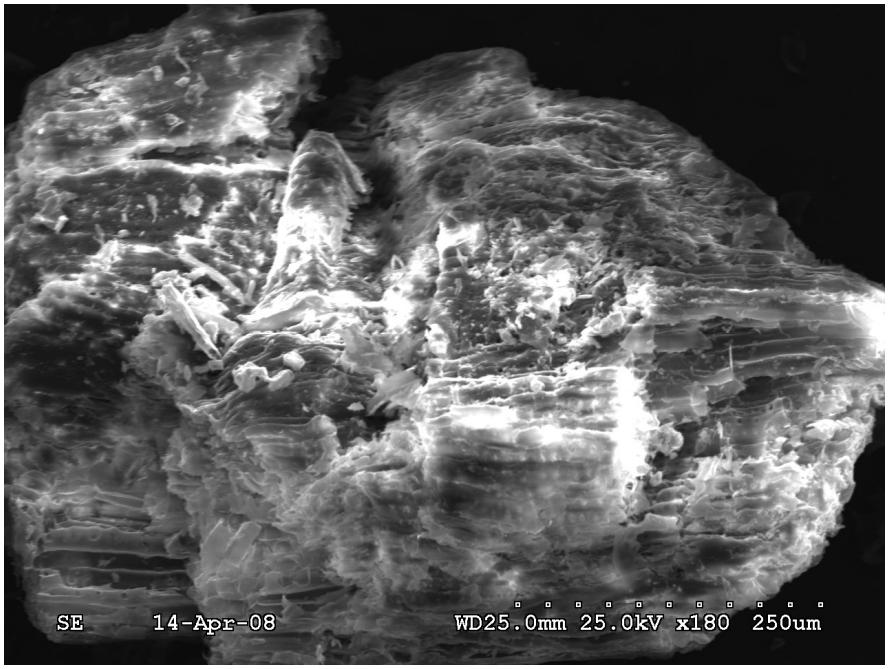
Energy biogas production

Pyrolysis

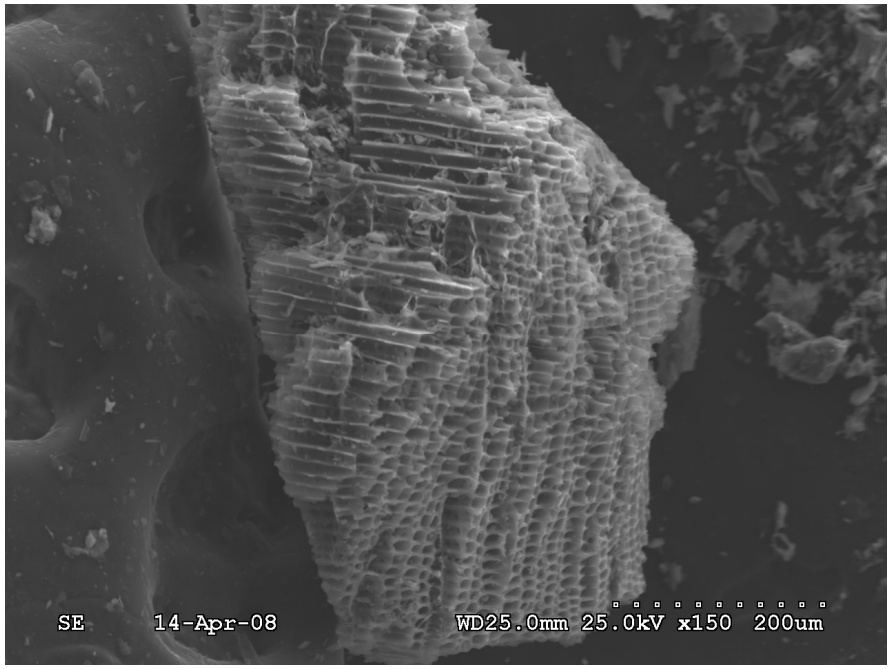


Physical characteristics

Wood



Biochar

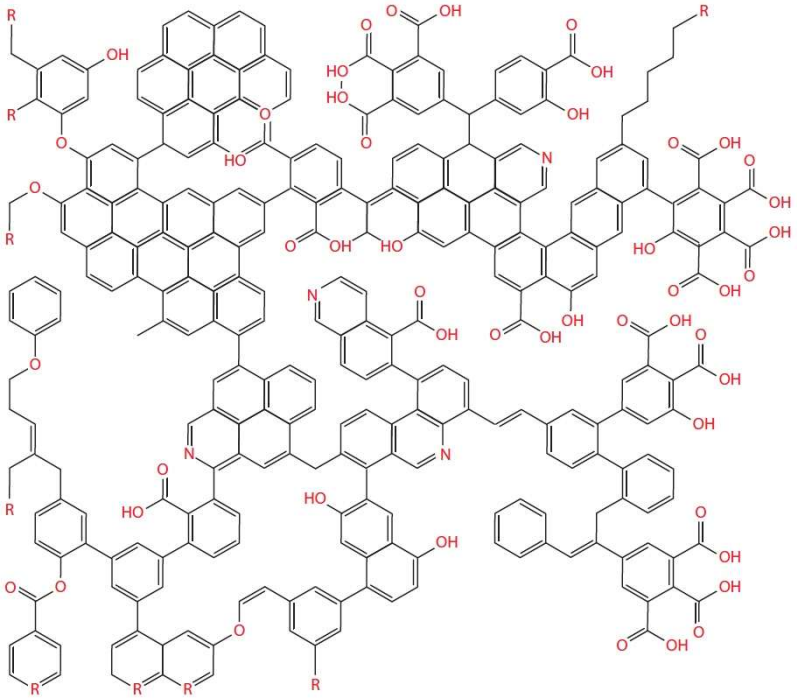


SEM pictures - Jeff Bird

- High porosity
- High specific surface area

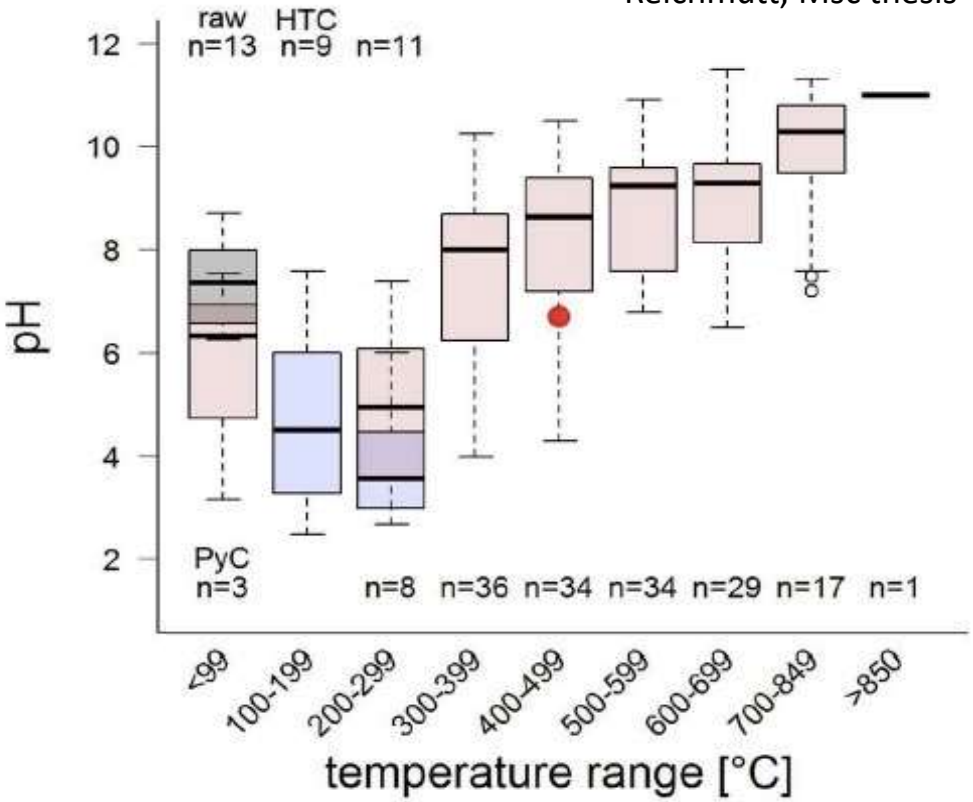
→ CEC, water retention, buffering capacity…

Chemical characteristics



Bird et al., 2015

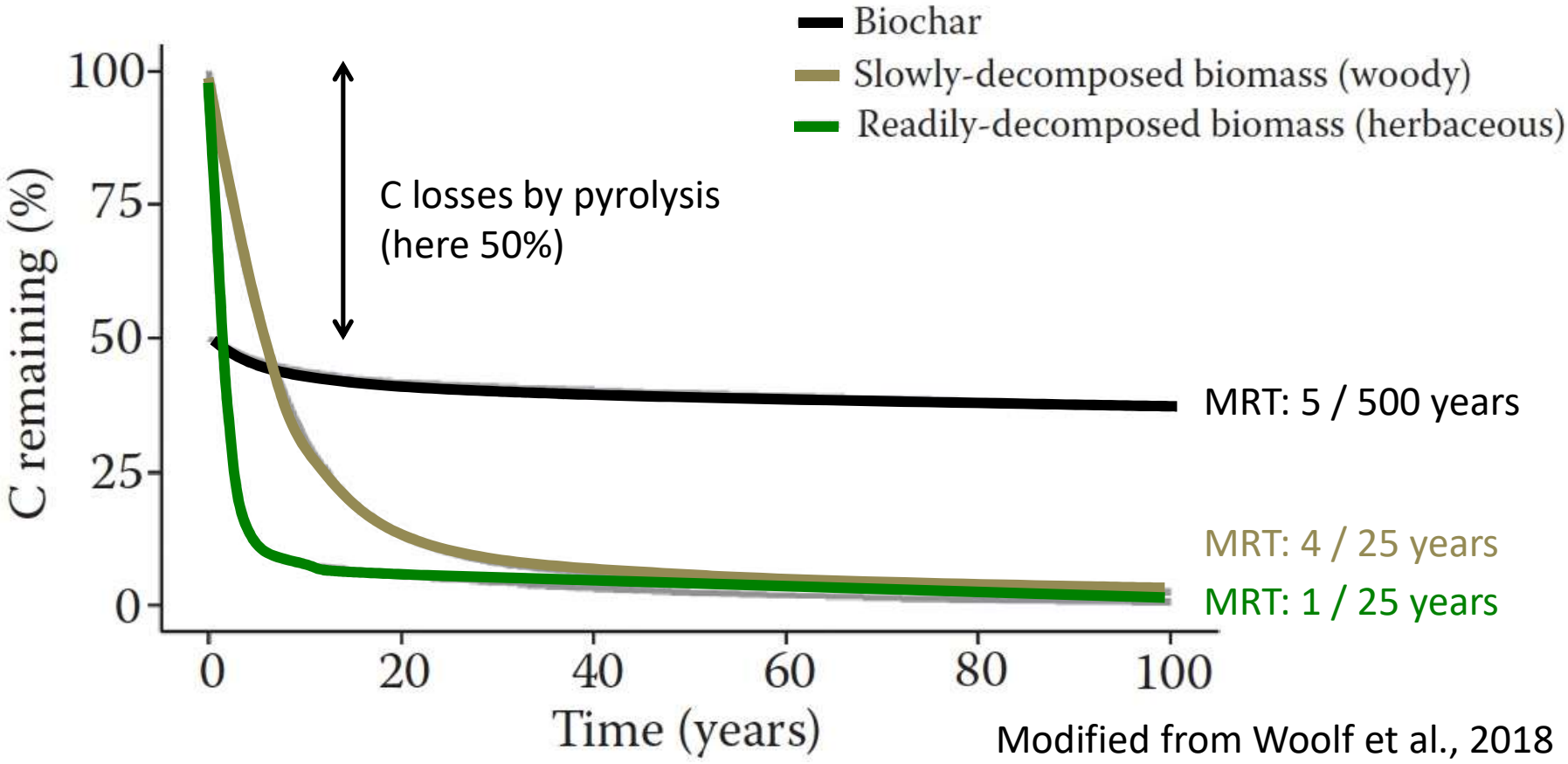
Reichmutt, Msc thesis



- Low C:O, C:H, C:N
- High pH

→ Low nutrient, high buffer, high chemical persistence

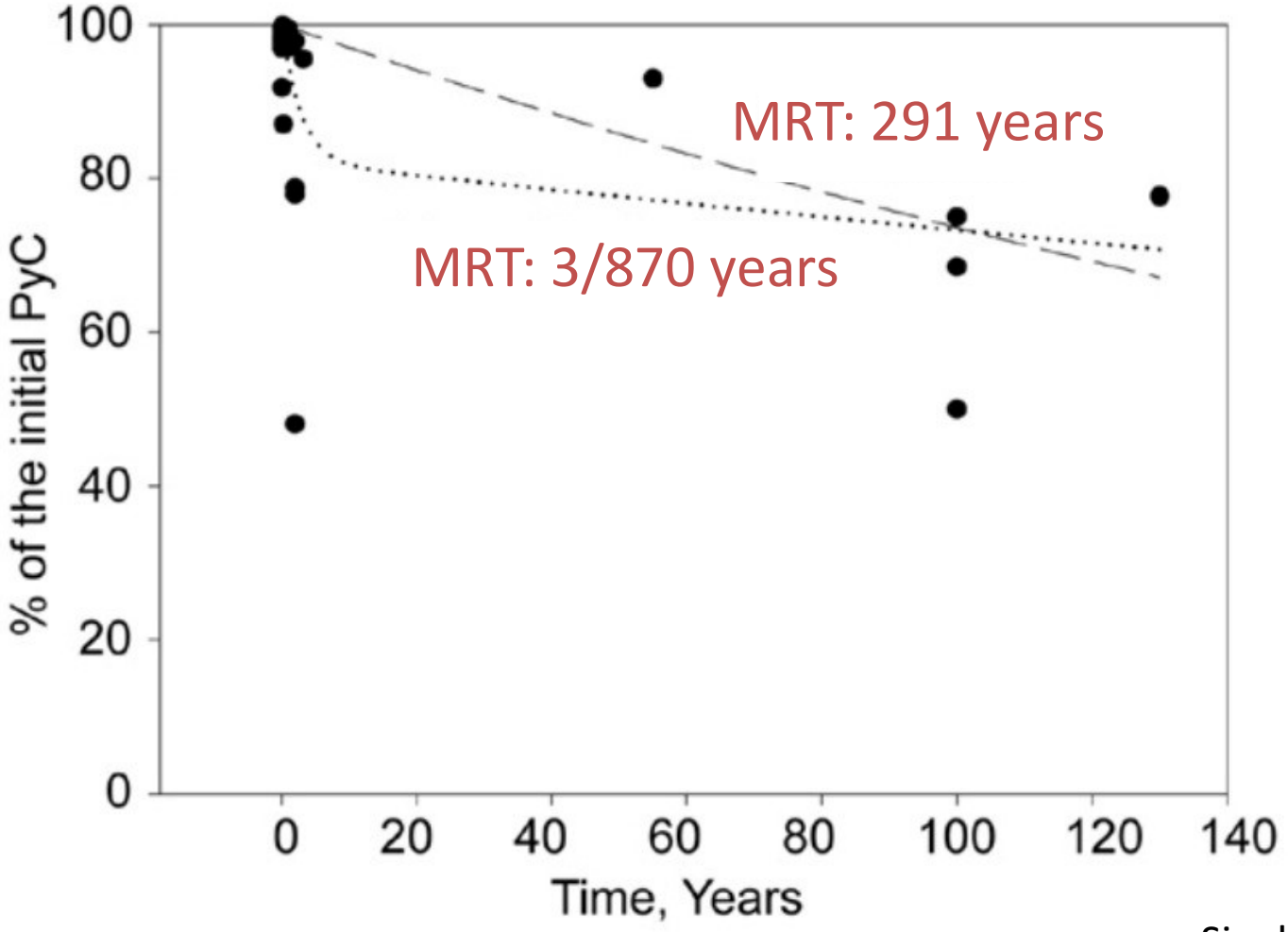
Carbon storage



Modified from Woolf et al., 2018

- Pyrolysis yield usually between 35 and 65 % recovery
- Use of the extra C to be taken into account

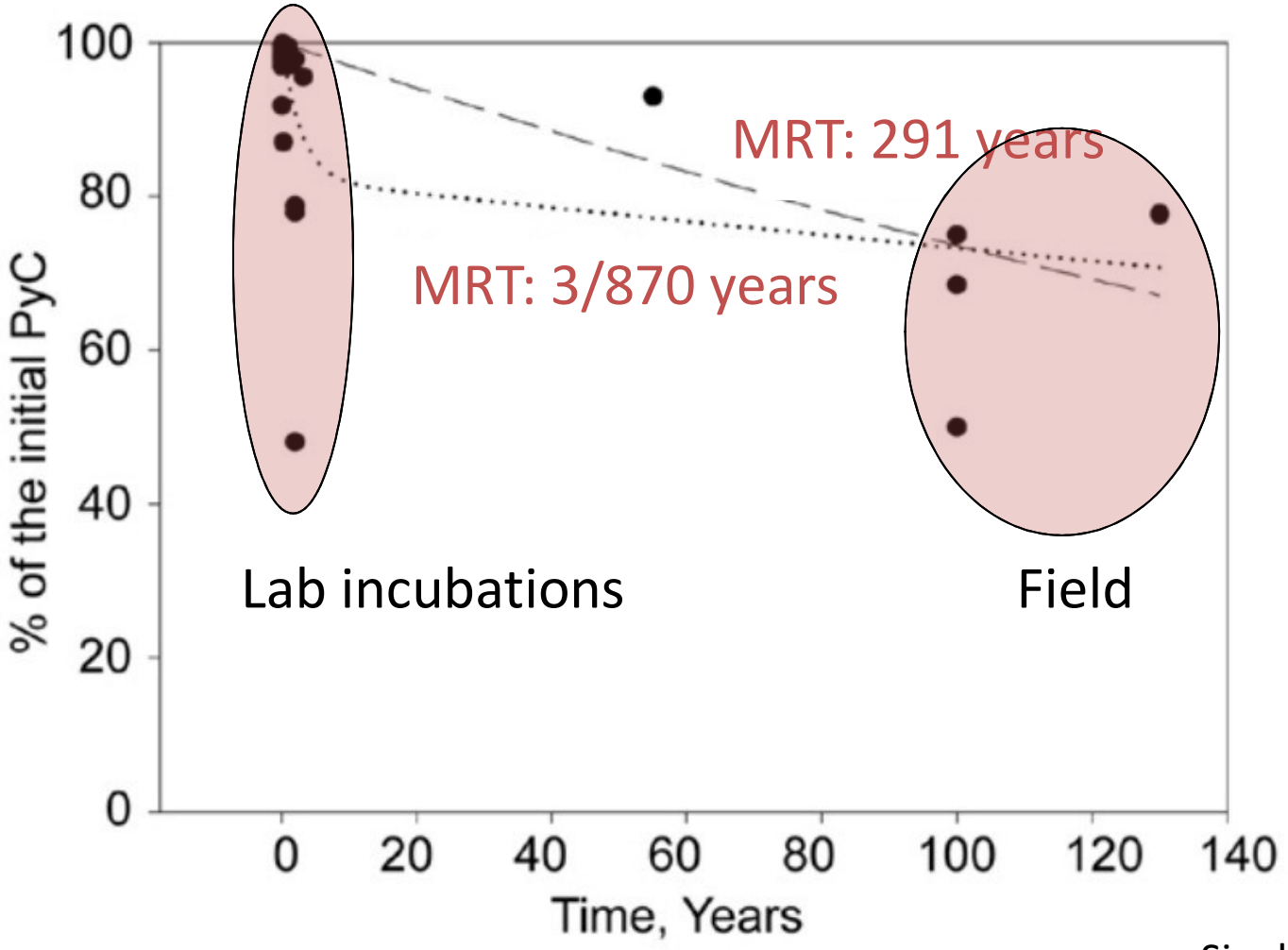
Carbon storage



Singh et al., 2012

Updated review (Lehman et., 2015): average MRT: 4/900 yrs

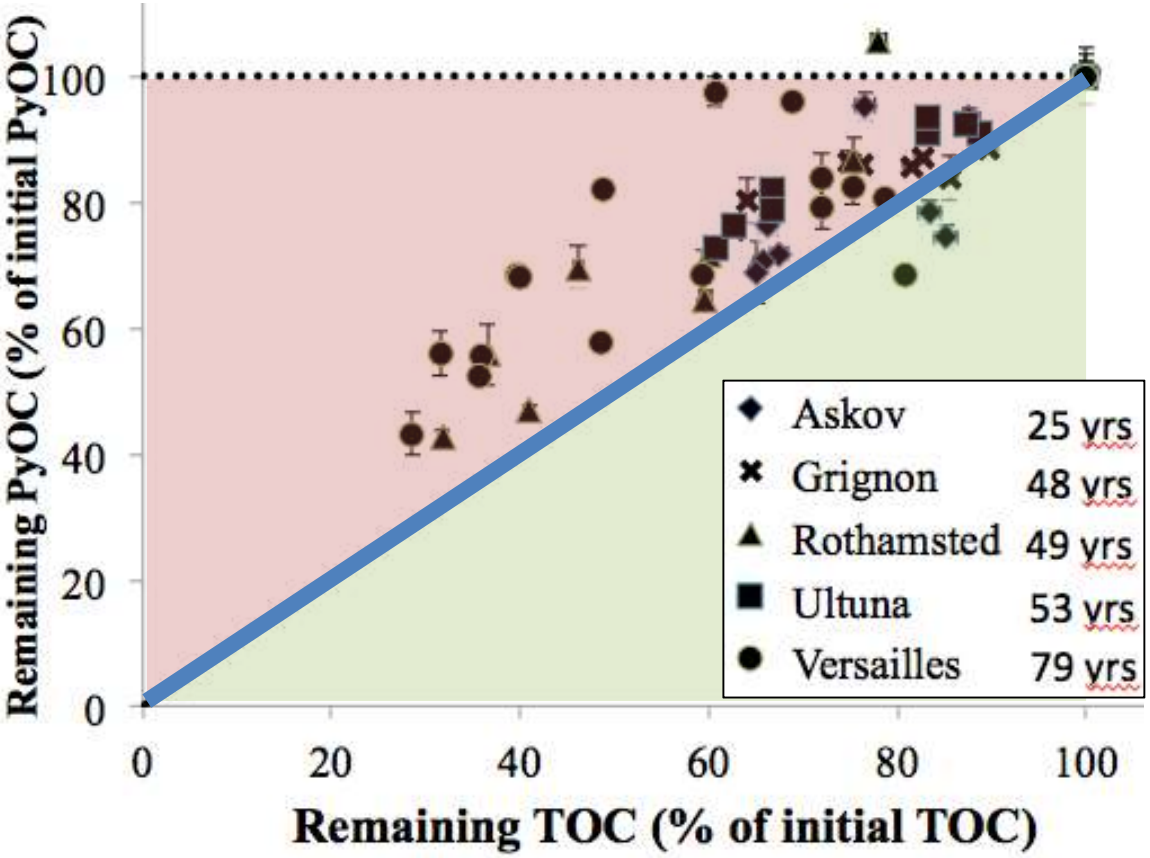
Carbon storage

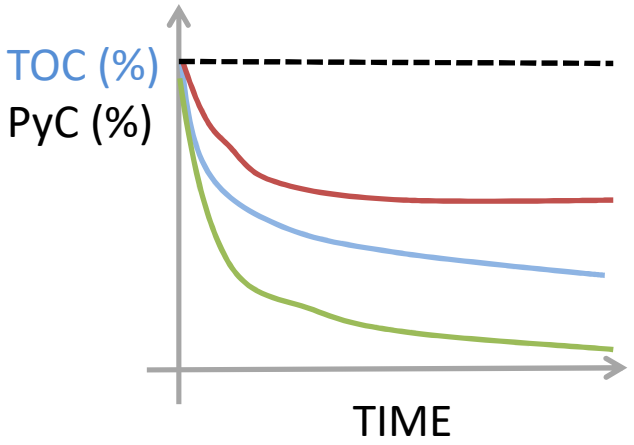


Singh et al., 2012

Updated review (Lehman et., 2015): average MRT: 4/900 yrs

MRT estimation with bare fallow





MRT: 70 to 200 years

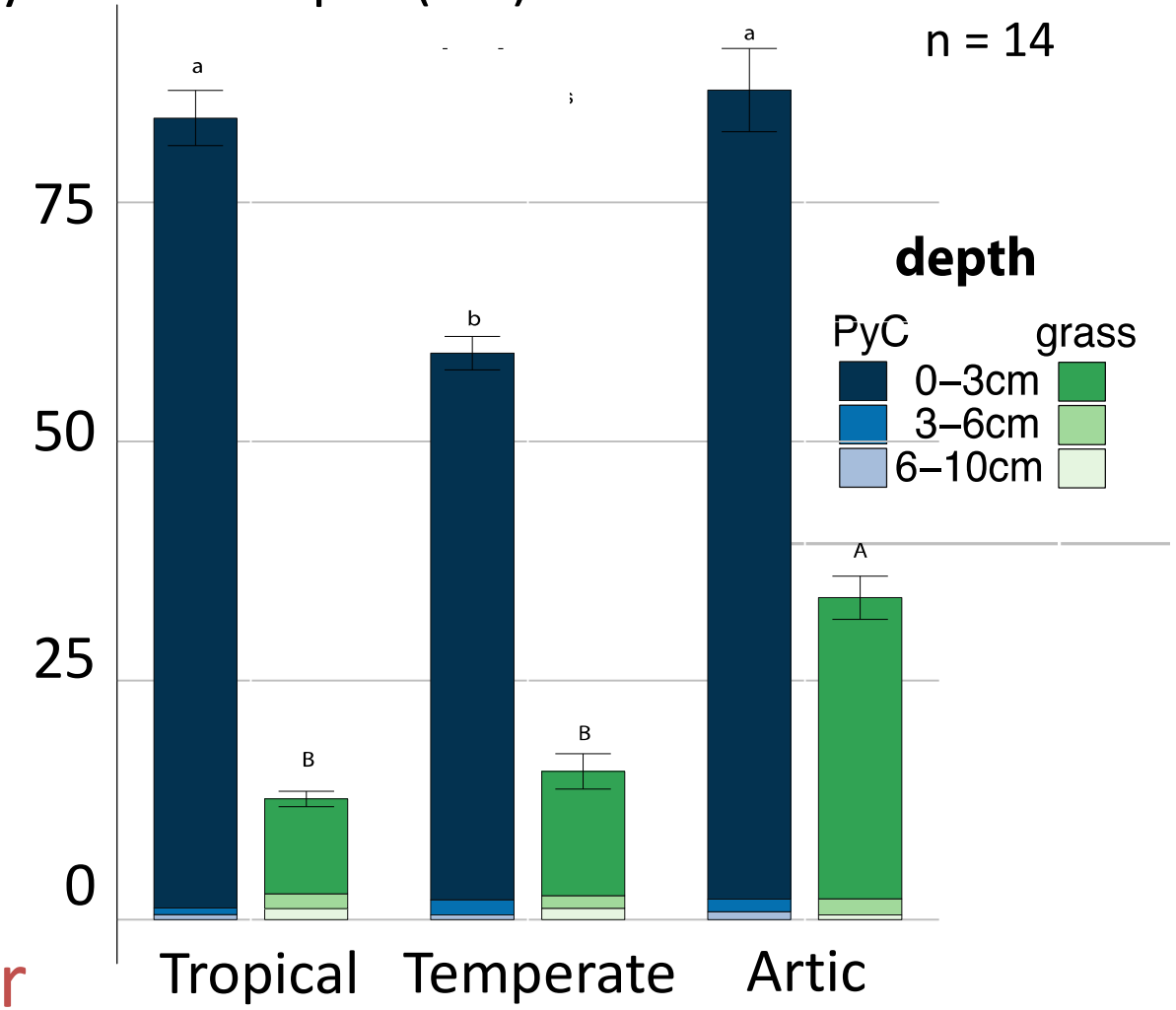
Lutfalla et al., 2017

Field incubations

13C labelled
~5’000 permil

Other degradation processes than other organic materials

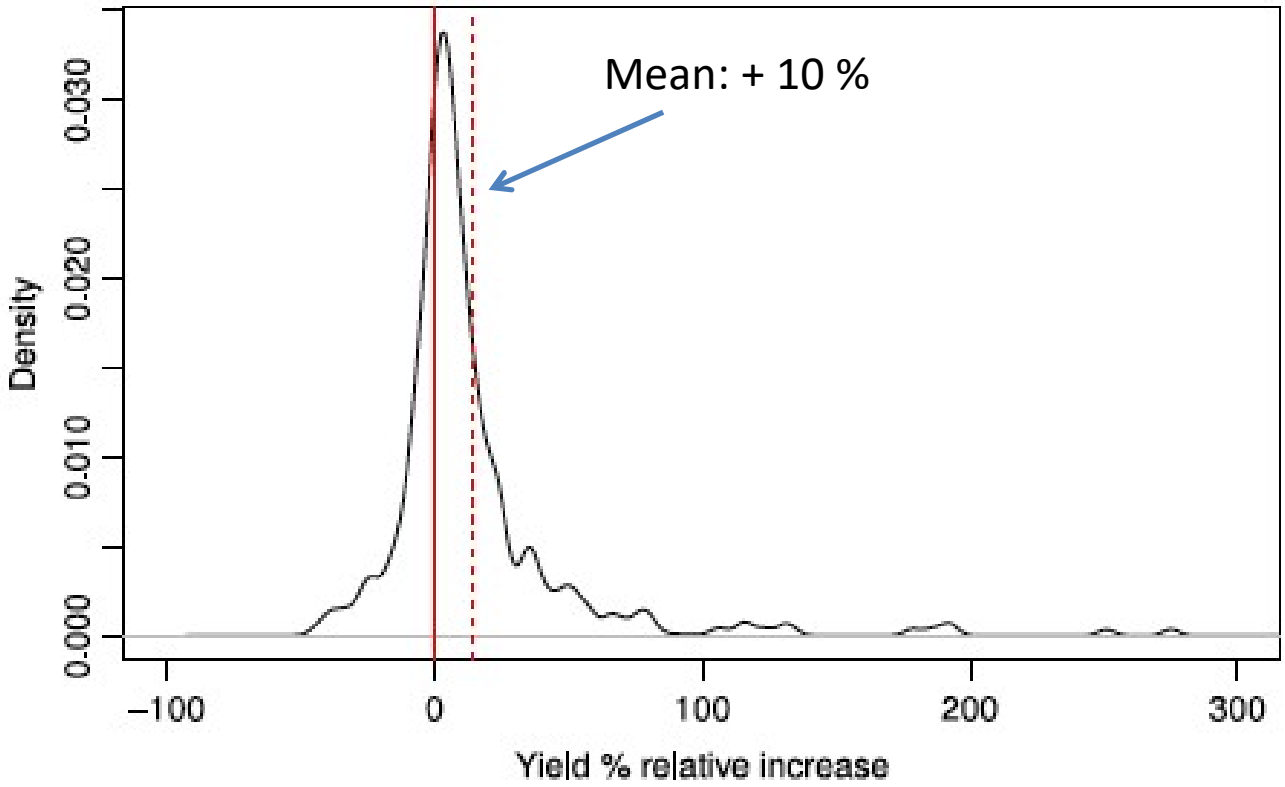
Recovery of initial input (%C)



Reisser et al. Sci. Rep.

Yield at the global level

Meta-analysis + modeling on field studies

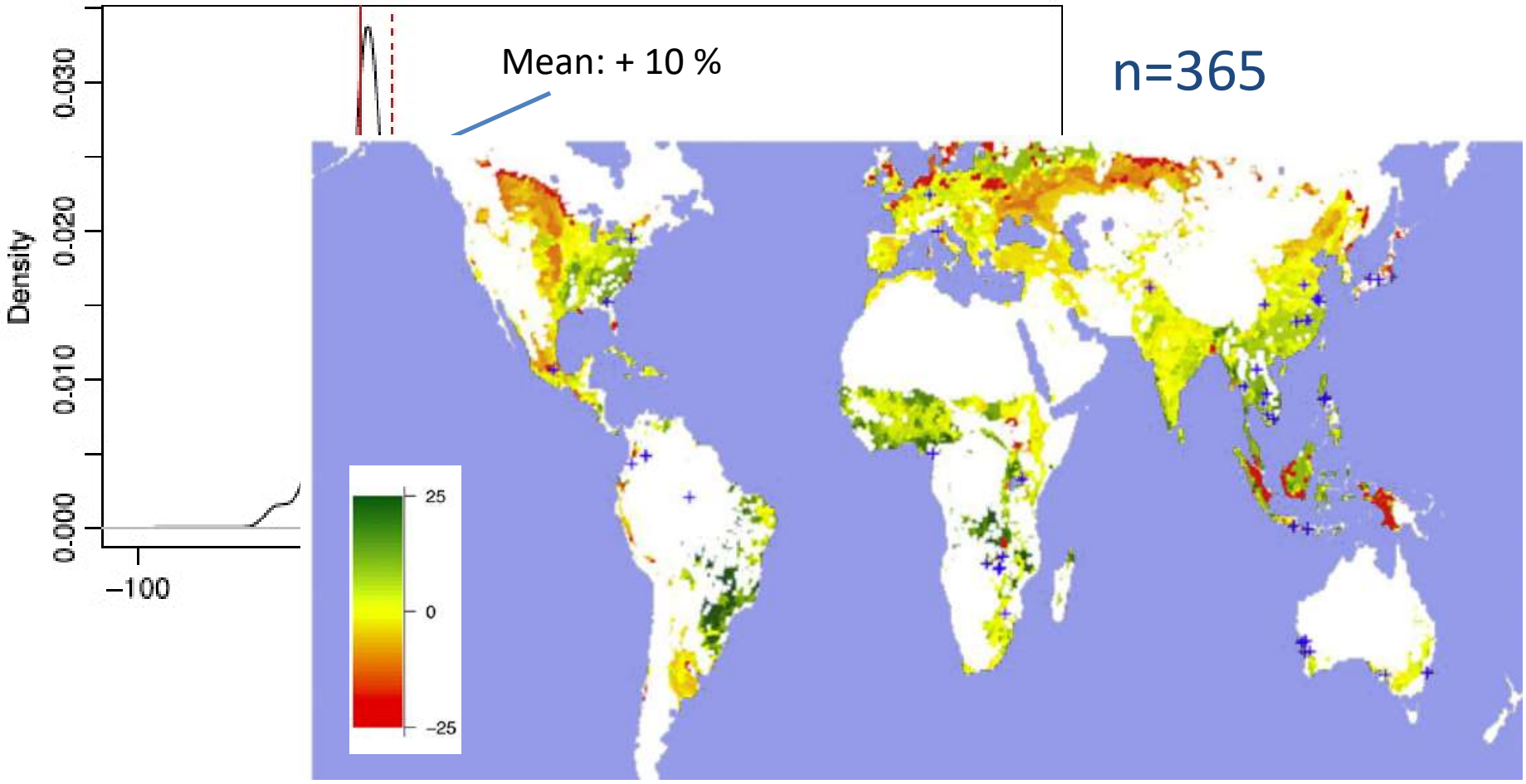


n=365

Crane-Droesch et al., 2013

Yield at the global level

Meta-analysis + modeling on field studies



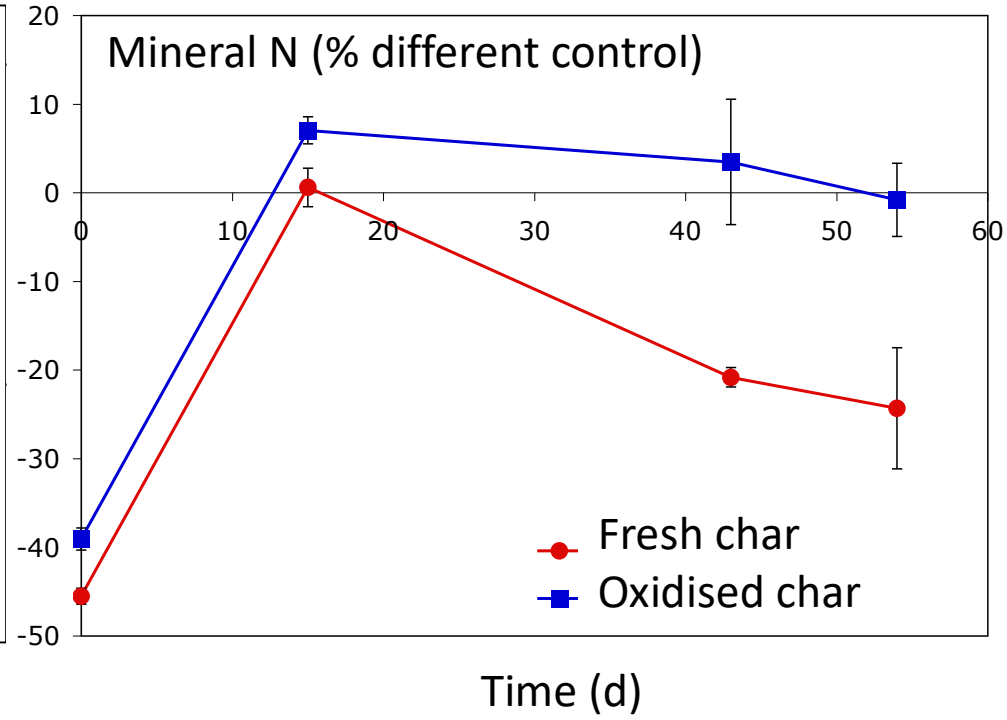
% difference
to control

Crane-Droesch et al., 2013

Field experiment Valais

- Established in 2009
- Vineyard Valais (Regosol)
- Combination of biochars and composts

	Fresh char	Oxidised char
C stocks	+60%	+50%
Water UE	+57%	+33%
NUE Cu, Zn, P	+ 10 to 30%	0 to + 20%
Grape quality	ns	ns

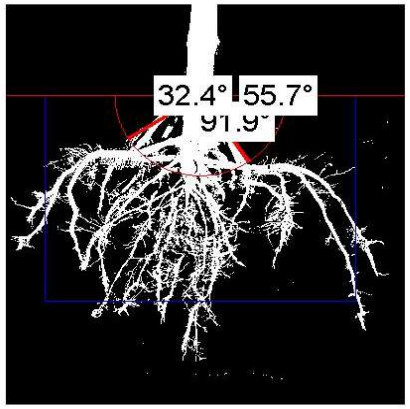


Schmidt et al., 2013 ; Msc thesis Pichler

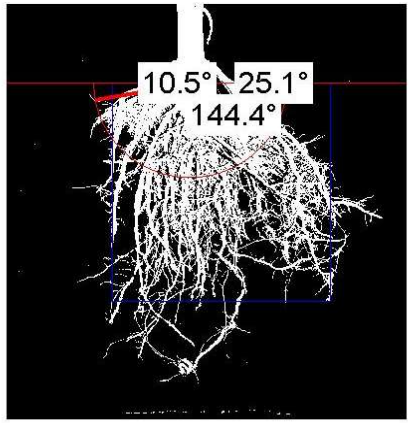
Field trial Zambia

- Maize trials by farmers
- Oxisols and sandy soils
- Root architecture (shovelomics)

Control



Biochar



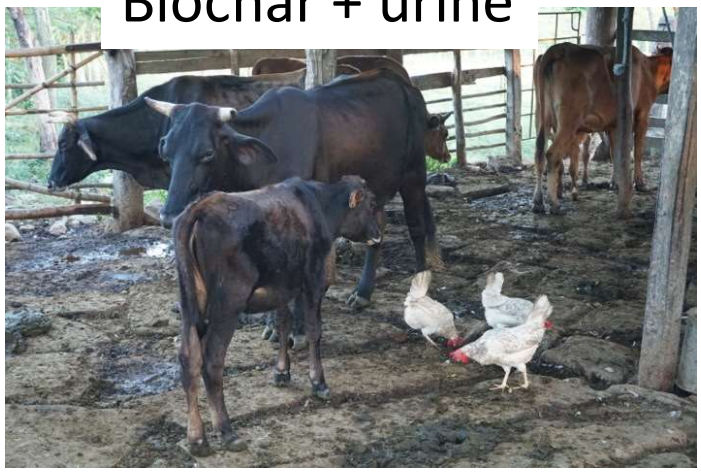
- Root / Shoot x2
- +75% root surface
- +10% yield

Abiven et al., 2015

Biochar-based fertilizers

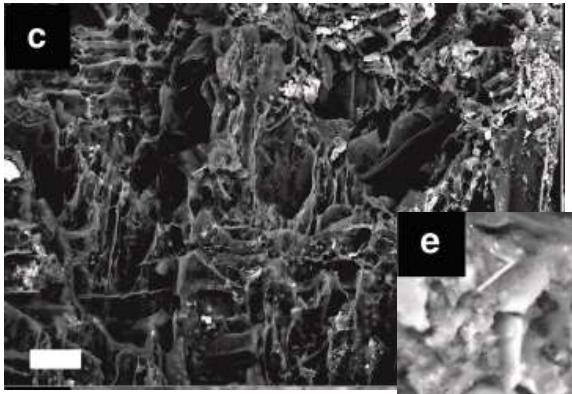
Biochar during composting

Biochar + urine



Biochar + organic N rich + labile C rich

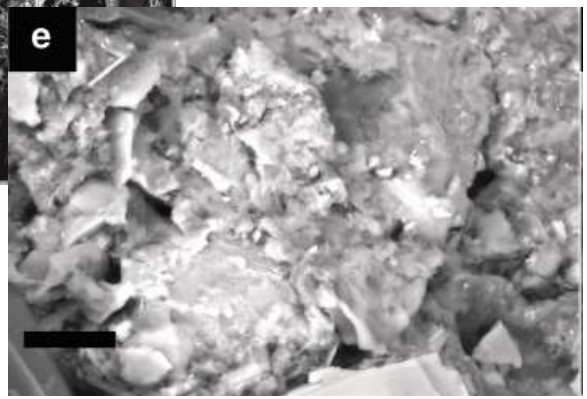
Pictures: H.P. Schmidt



Biochar

Co-composted

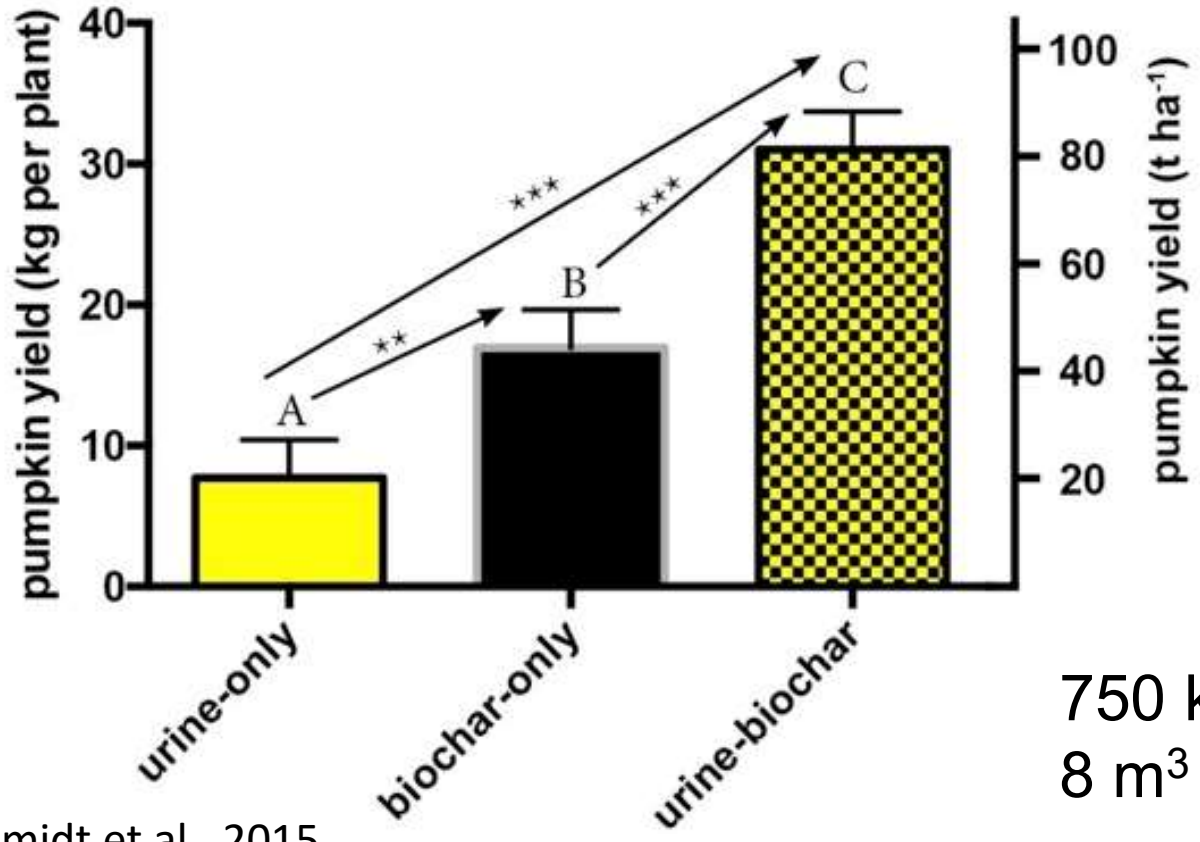
Coated



Hageman et al., 2018

Field trial Nepal

- Field trials in network of organic farmers
- Sub-tropical area, loamy soils



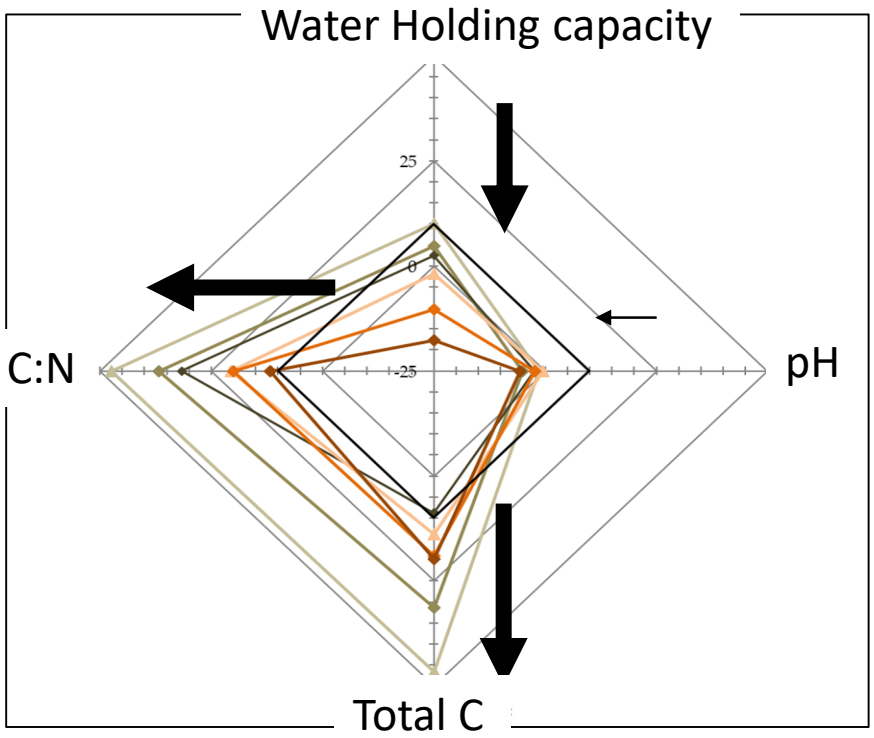
Schmidt et al., 2015

ITAB: 30 $t.ha^{-1}$

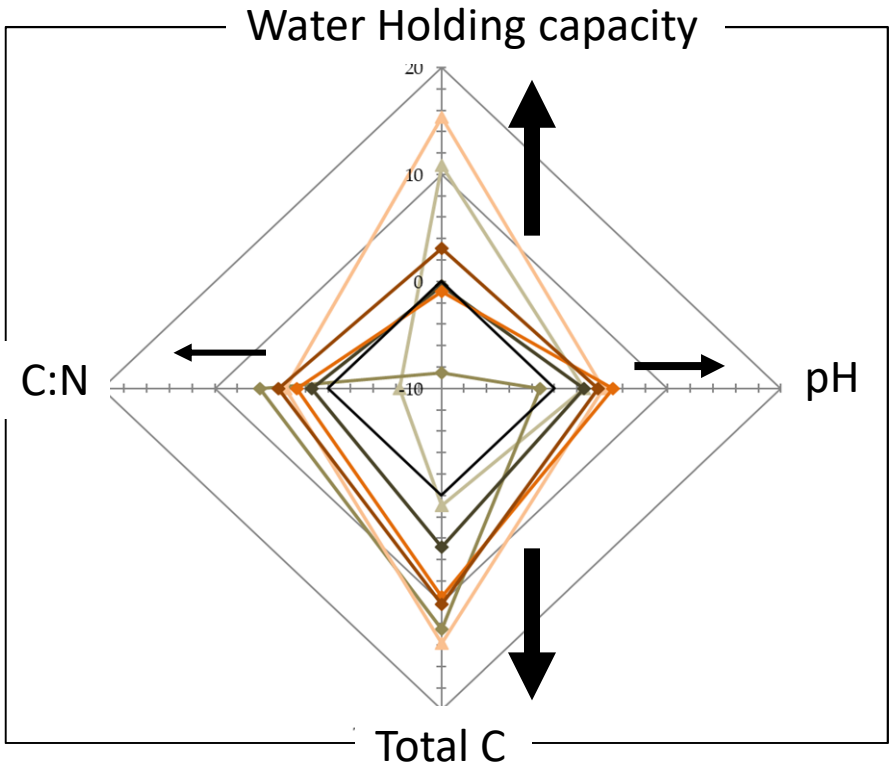
750 kg biochar / ha
8 m^3 cow urine / ha

Field Network - South India

- Trials in agronomic stations and farmers
- Large range of pedo-climatic conditions
- Physical + eco-sociological studies



Red soil (poor fertility), poor communities

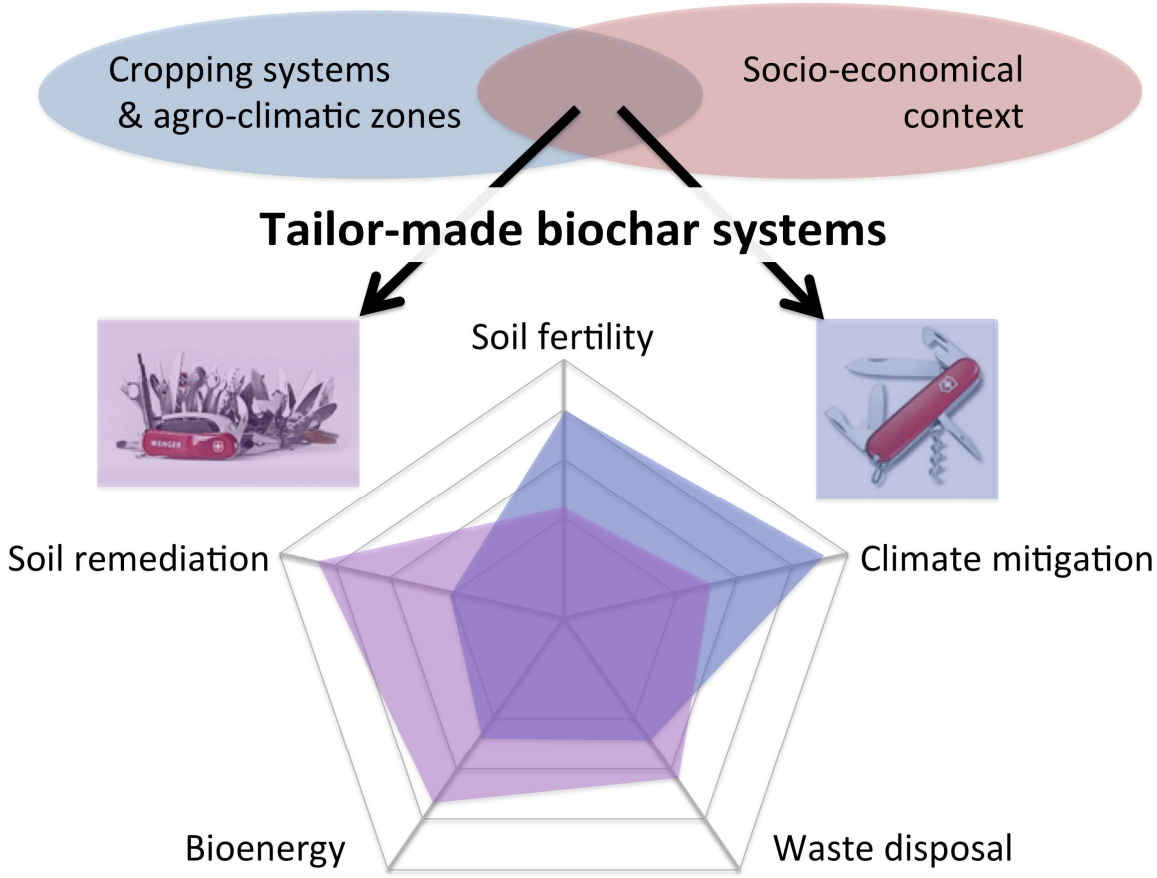


Black soil (high fertility), wealthy communities

Bellè et al., in prep.

Conclusions

- C storage potential depends on MRT
- Drivers leading to soil fertility improvement remain unclear
- Associations to other fertilizing matters beneficial




Thank you for your attention
Picture: MWI Schmidt