The 4 per 1000 initiative. Scientific rationale

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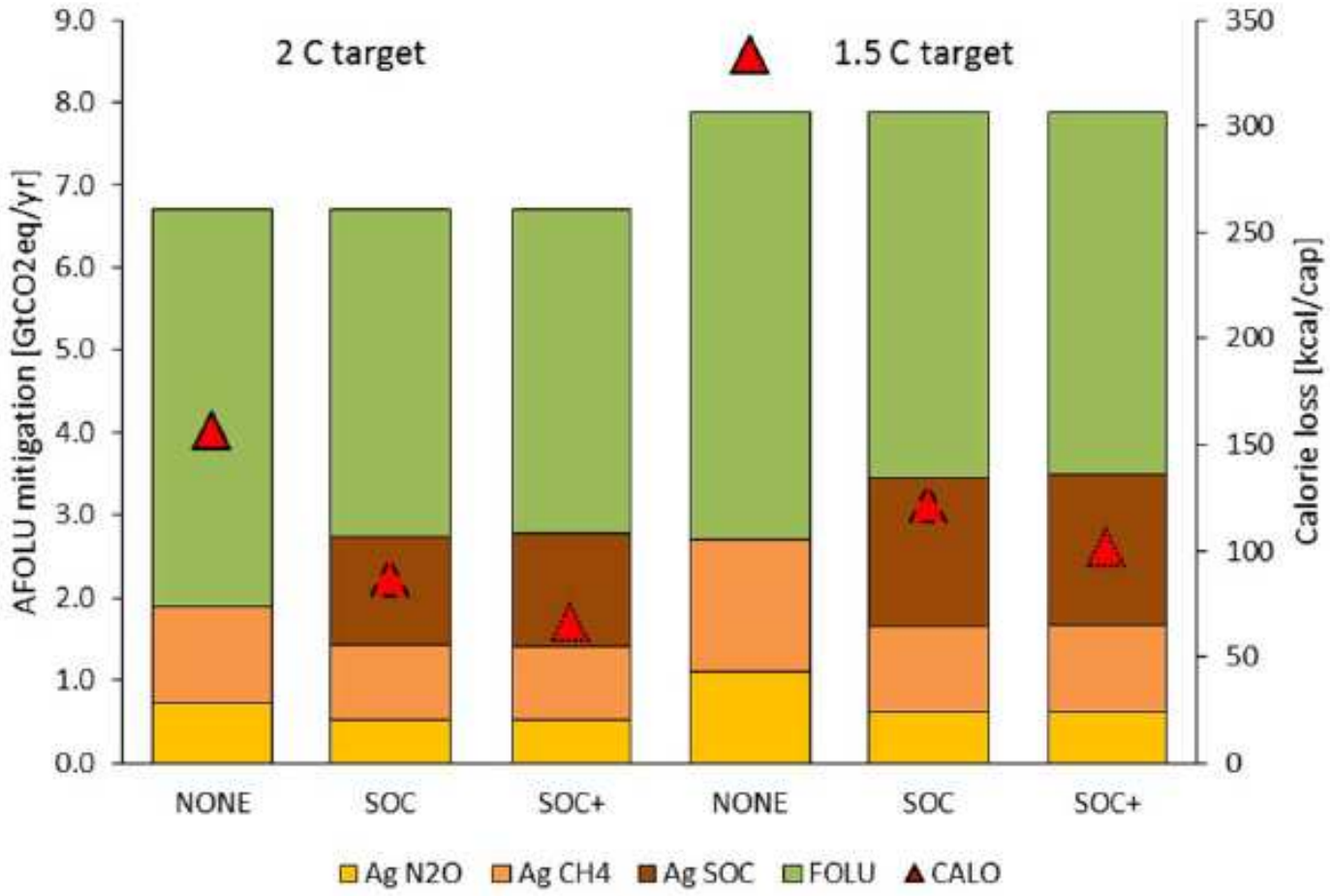
Research challenges for soil organic carbon
October 4, 2017, Tallinn

With soil carbon sequestration, food security is not threathened, even for a 1.5° C global warming target



SOC, soil organic C sequestration; SOC+, including its benefits for yields

(Frank et al., Env. Res. Lett., 2017)

Agricultural practices for soil carbon sequestration

Conservation tillage

Integrated soil fertility management

Rangeland Management

Water management

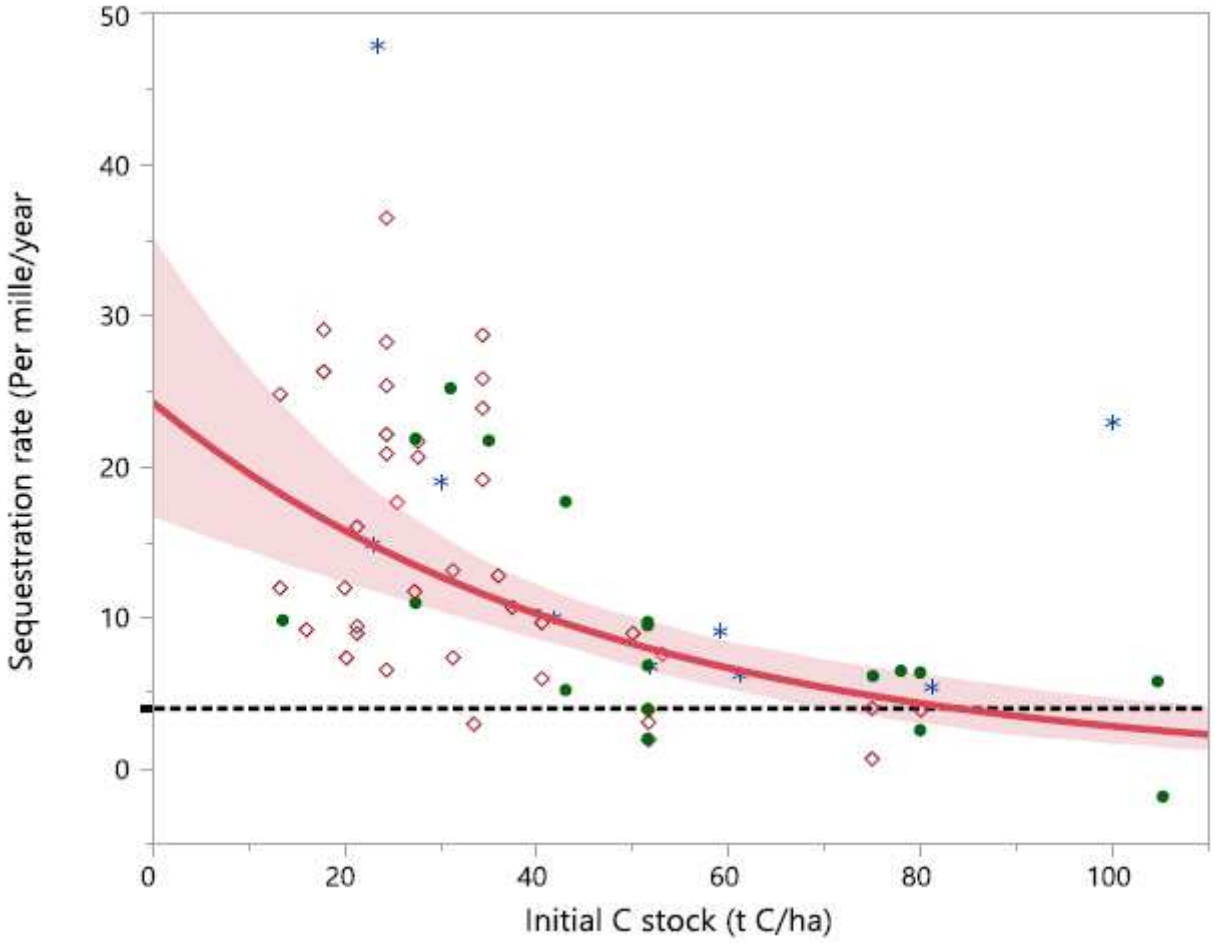
Agroecology

Agroforestry

Organic fertilizers

A 4 per 1000 SOC sequestration rate has often been exceeded in long-term arable field trials

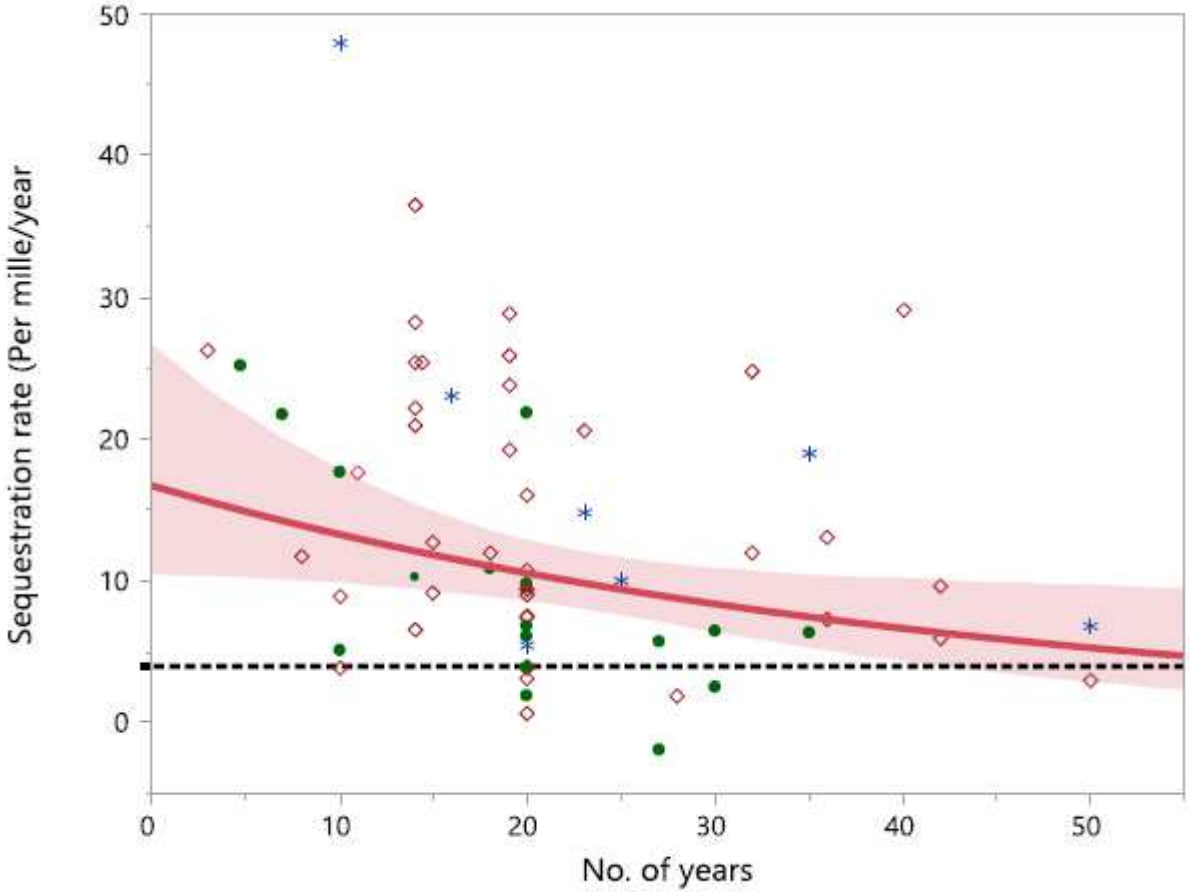
..but the rate declines with initial SOC stock



(Minasny et al., 2016, Geoderma)

A 4 per 1000 SOC sequestration rate has often been exceeded in long-term arable field trials

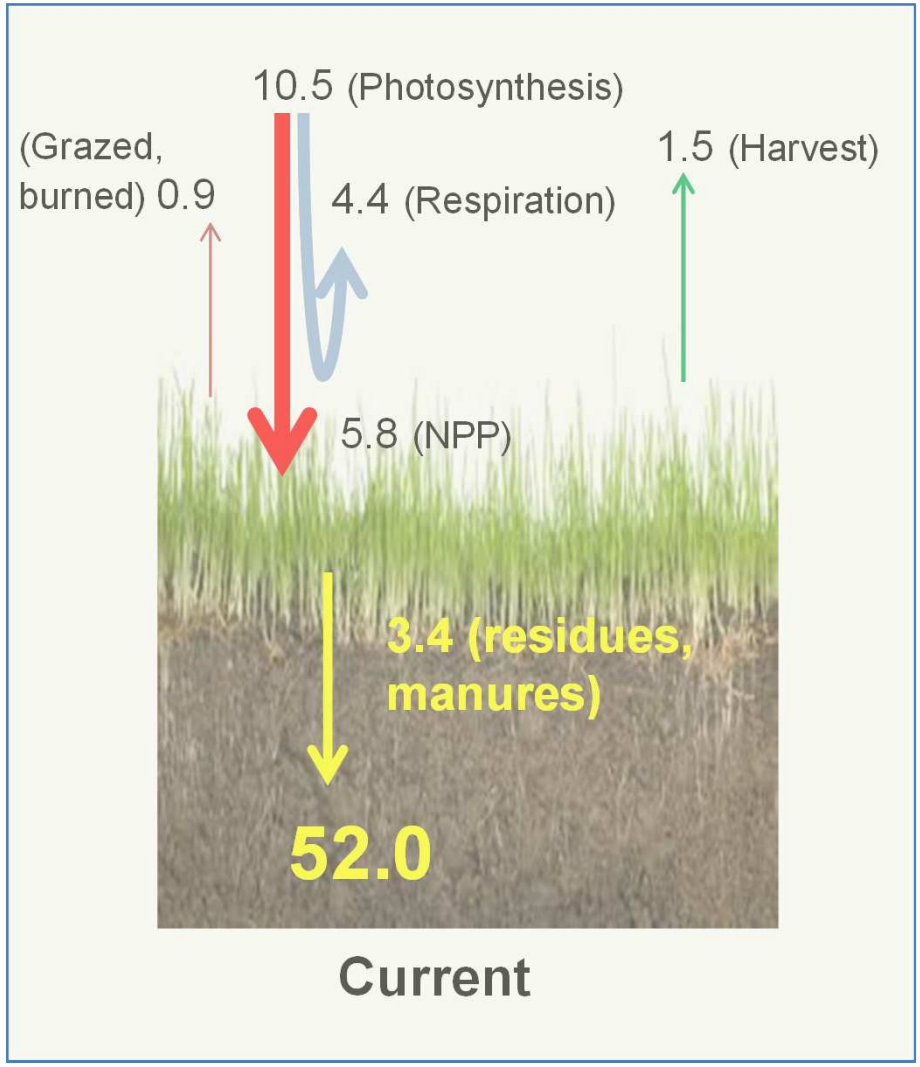
(over up to 50 yrs)

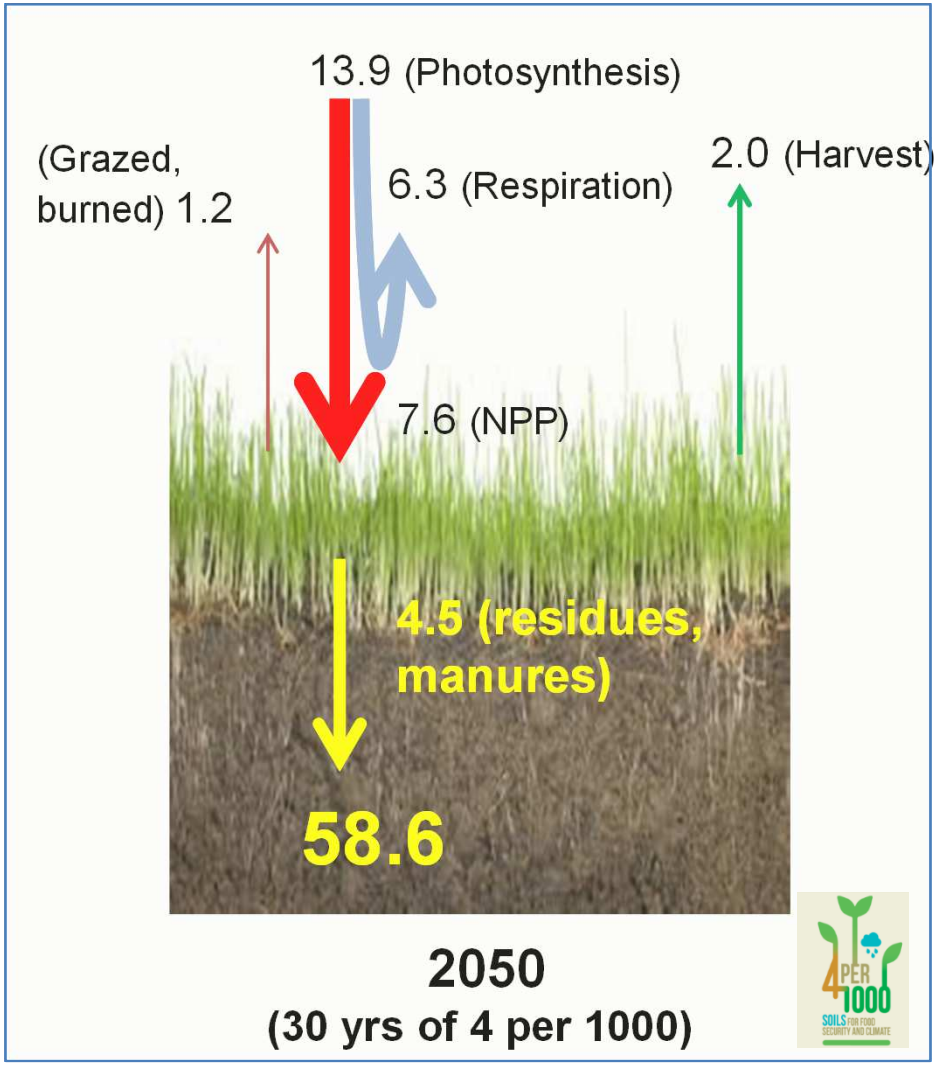


(Minasny et al., 2016, Geoderma)

Mean crop carbon cycle change during 30 yrs under 4 per 1000

(Global means, tC/ha)





A scenario adding a 1% annual increase to yield increases

Limits of soil carbon sequestration

- Adoption of SOC sequestration measures will take time,
- SOC will increase only **over a finite period (30-50 yrs locally)**, up to the point when a new SOC equilibrium is approached,
- The **additional SOC stock will need to be monitored** and preserved by adapting land management practices to climate change,
- Soil phosphorus (P) and nitrogen (N) should be available (root symbioses could help) as well as organic carbon recycling
- Soil and water management need to be combined, especially in dry regions

Adoption and permanence of improved practices

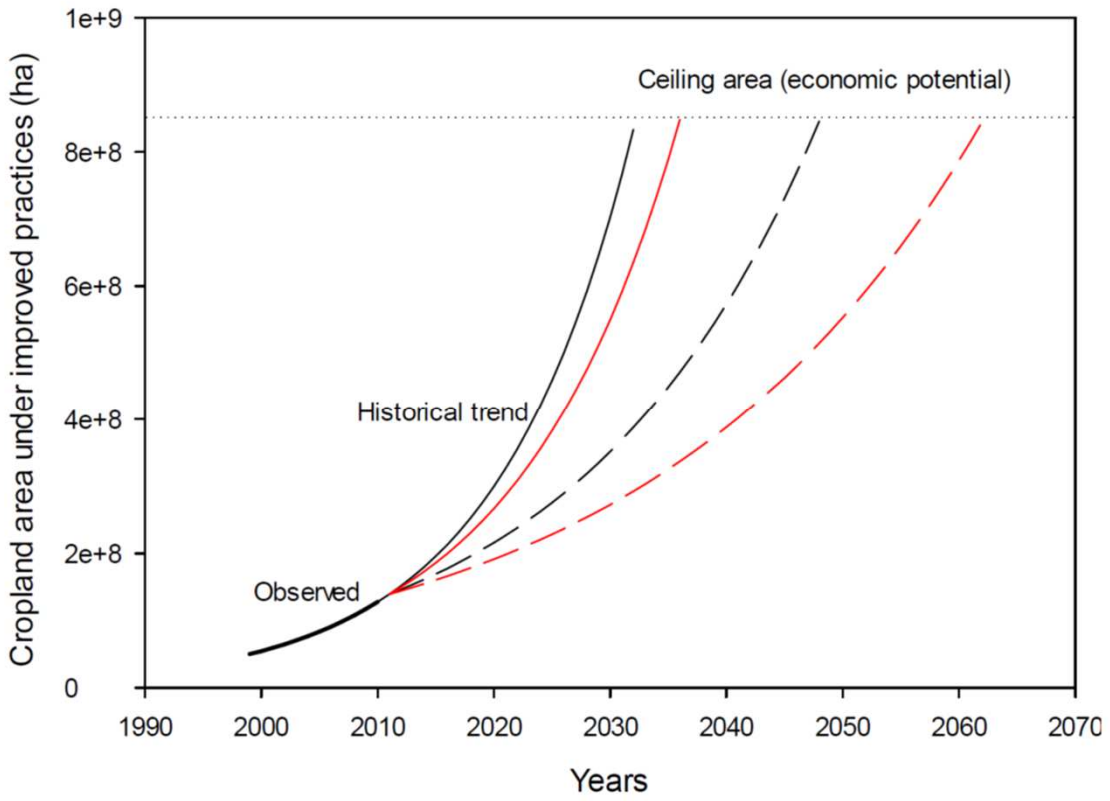
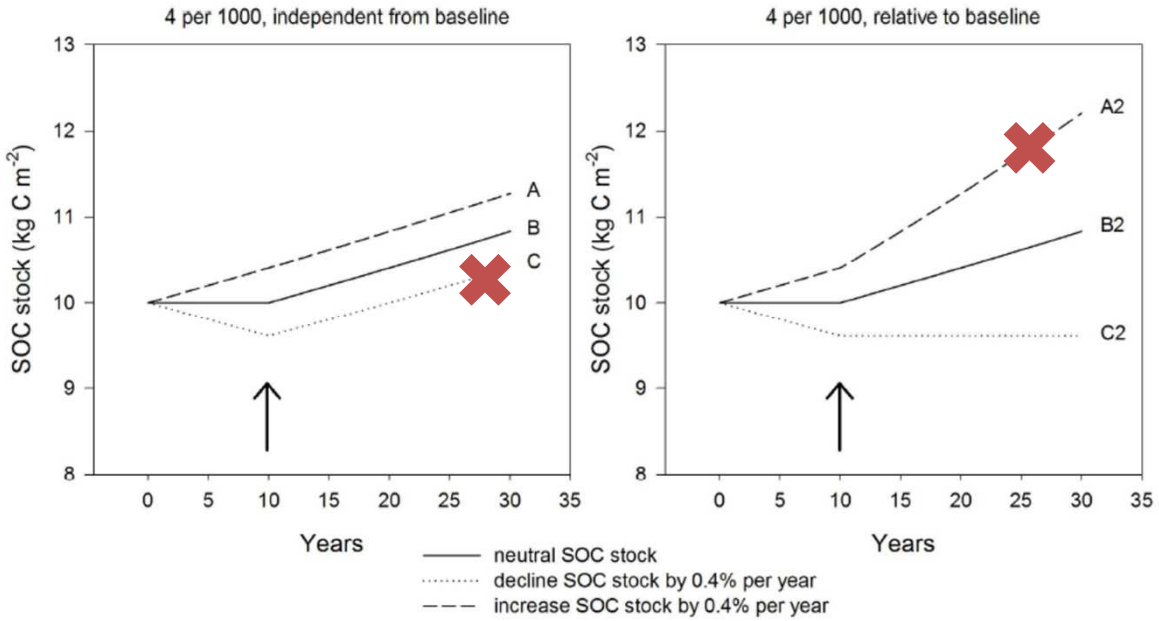


Figure 3. Historical trend in the expansion of cropland area under conservation agriculture (1999-2011) and projected trends assuming the same (solid lines, 8.9%) or a reduced (dashed lines, 5%) annual relative adoption rate with permanent improved practices (black) and with (red) an average 50 years duration of the improved practices before drop-out (i.e. 1.4% annual relative drop-out rate).

(Soussana et al., STILL, in press)

Baseline issues for SOC sequestration



(Soussana et al., STILL in press)

- Three contrasted theoretical baselines:
  - A, increasing SOC baseline (e.g. > 0.4% per yr), no changes required
  - B, constant SOC baseline, target a moderate increase (e.g. +0.4% / yr)
  - C, declining SOC baseline, target restoration (e.g. change relative to baseline by +0.4% per yr)

CIRCASA

Coordination of International Research Cooperation
on soil CArbon Sequestration in Agriculture

Thank you for your attention….