Potential of different management options for soil carbon sequestration

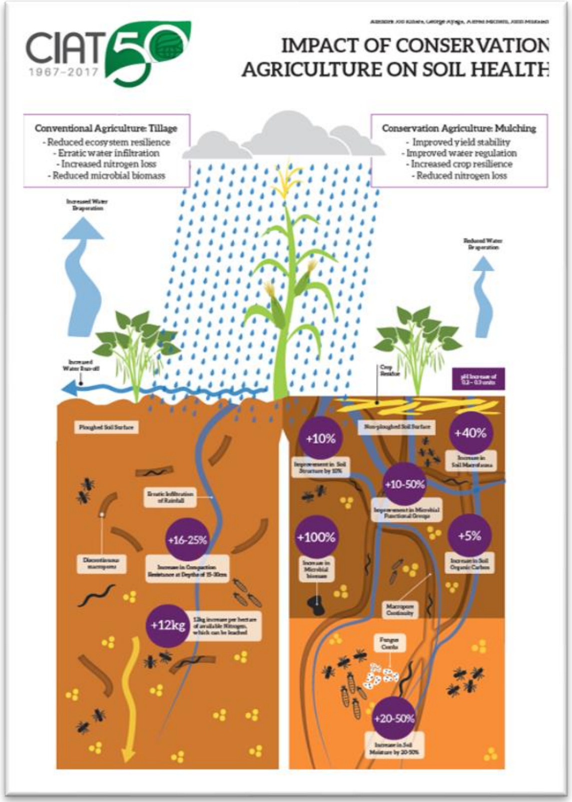
…regarding climate change mitigation as well as adaptation and food security in SSA and what I feel could be a promising way forward

4p1000 Climate-Soil Community of Practice, 24 March 2022

Rolf Sommer, WWF-Germany (rolf.sommer@wwf.de)

Triple-win of increasing soil organic carbon

Enhancing soil organic matter improves soil fertility, soil health, helps increasing **agricultural productivity** and **resilience**, and - by its very nature - constitutes a **carbon sink**!



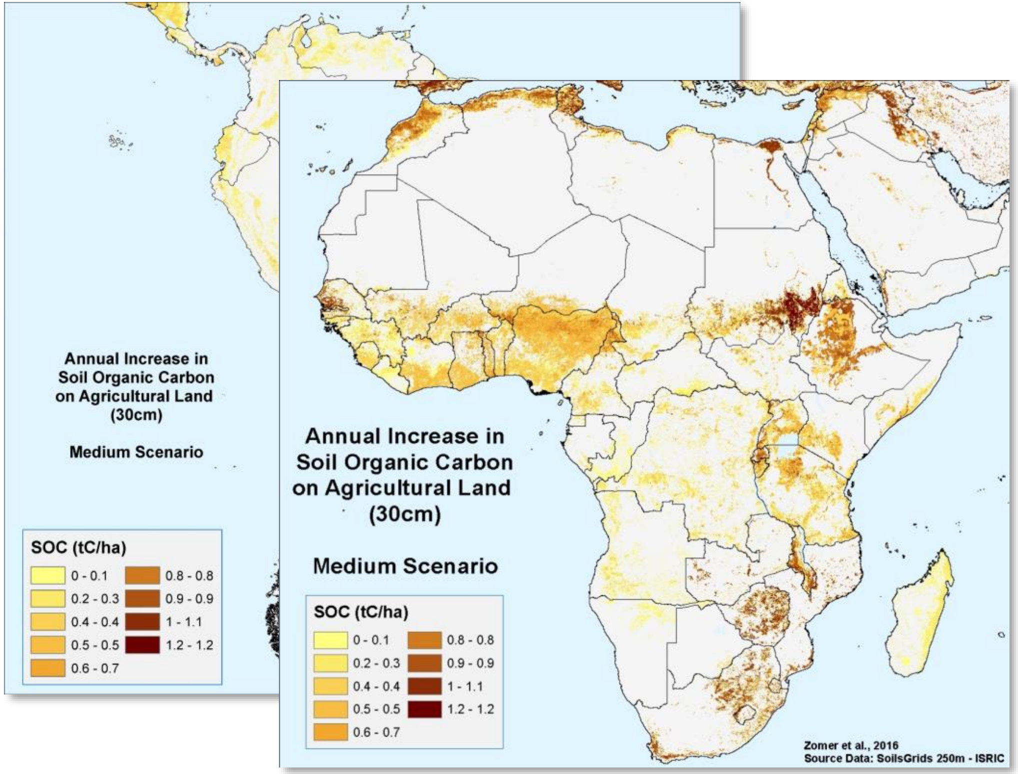
Manage expectations of CC mitigation through C-sequestration in soils!

"The point we are making is that the rate of carbon accumulation in soil that is suggested, 0.4 per cent per year every year for 20 years, is almost certainly unattainable … It would therefore be unwise for policy-makers to rely on this rate of carbon sequestration across the globe.
… However, no-one wishes to criticise the positive and laudable aims of the initiative."

David Powlson, Rothamsted Research, UK

Geospatial estimation of the global sequestration potential of increased organic carbon in cropland

Zomer, Bossio, Sommer, Verchot (2017) Nature Scientific Reports, doi:10.1038/s41598-017-15794-8



Worldwide croplands could sequester between **0.90 and 1.85 Gt C/yr,**

= 26–53 % of the target of 4p1000

But, unlikely to happen that way…!

Dynamics and climate change mitigation potential of SOC sequestration

(Sommer & Bossio, 2014)

SOC sequestration follows a saturation curve

+

Uptake of improved practices does take time

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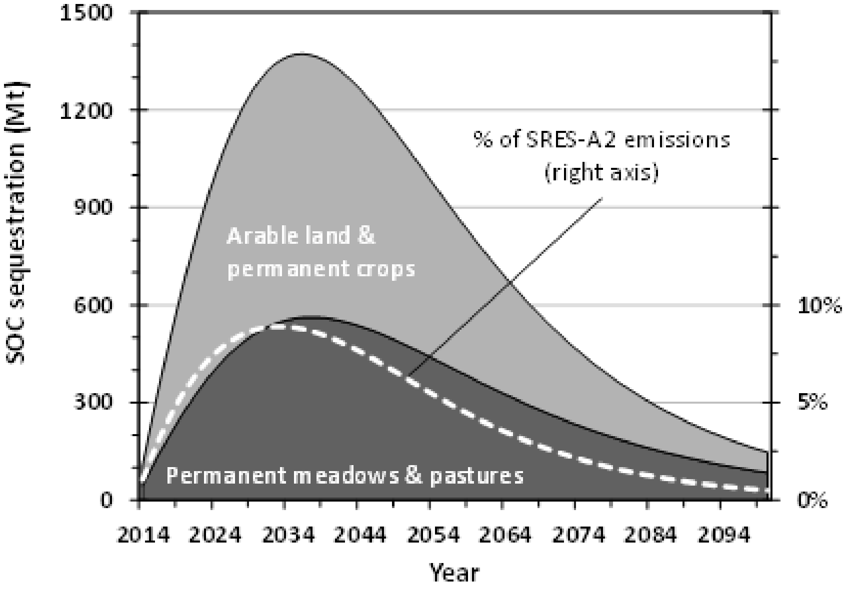
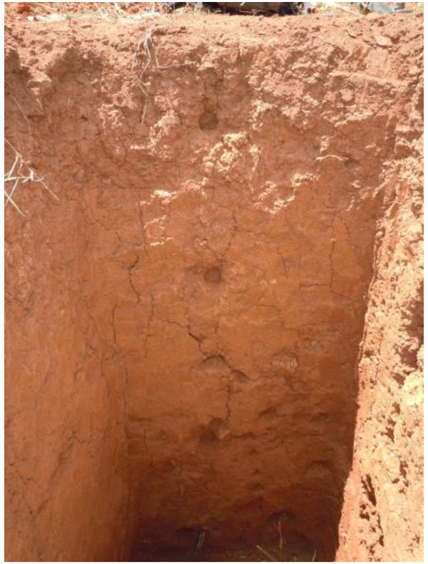


- The projected 87-year (2014-2100) **global** SOC seq. potential of agricultural land ranged between 31 and 64 Gt. **(0.36 to 0.74 Gt/yr)**
- Global climate change mitigation potential:
  - 1.9-3.9 % of the SRES-A2 projected 87-year anthropogenic emissions
  - 10-21 % of 4p1000 target

Agricultural management options

- "Most of the enthusiasm centres on agricultural practices like reducing tillage intensity, planting cover crops, and improving grazing management.
- These practices have the potential to simultaneously increase soil health, reduce greenhouse gas emissions, and enhance carbon sinks — a seemingly win-win solution.
- … But determining when certain agricultural practices actually increase carbon stocks, and how to measure and credit their gains, remains exceedingly complex.
- The efficacy of soil carbon interventions depends on local climate conditions, land management history, and soil characteristics.
- Soil carbon, meanwhile, varies substantially over time, space, and depth.
- On top of that, any changes in soil carbon occur slowly, which makes it difficult to reliably track changes once new practices are implemented."

Source: https://carbonplan.org/research/soil-protocols-explainer

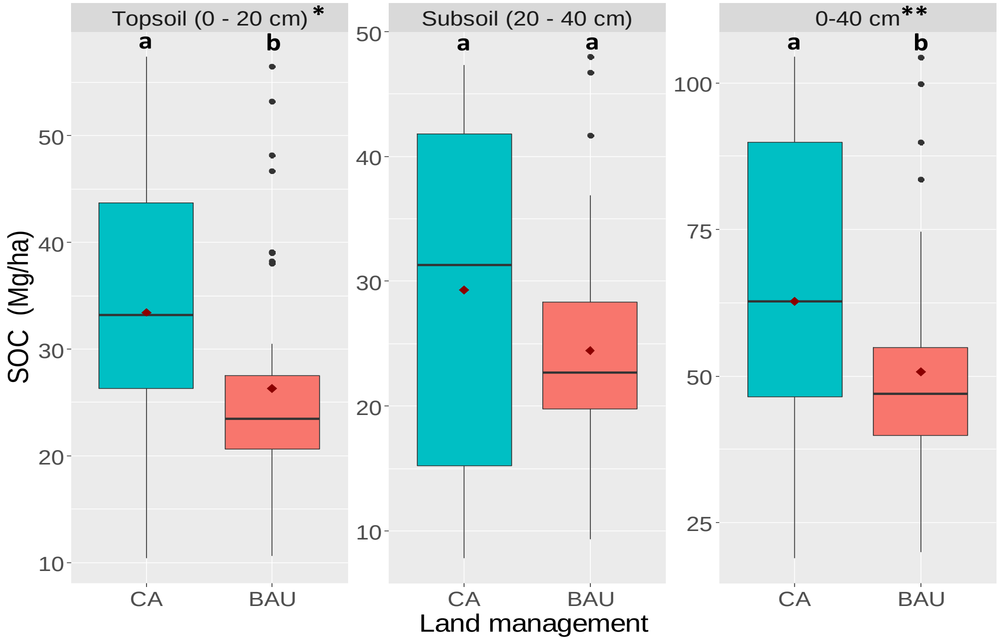


"If you torture the data long enough, it will confess to anything!“

Ronald Coase, Economist, Nobel Price laureate 1991 (Economics)

The impact of Conservation Agriculture

Western Kenya, Bungoma County



*Different letters indicate statistically significant differences: * at P < 0.05; ** at P < 0.10*

(Sommer et al. 2018)

- Significant differences between CA and business-as-usual (BAU) in the top 20 cm:

  ~7.5 t C/ha

- CA practiced between 8-15 years, i.e. avoided SOC loss or sequestration rates:

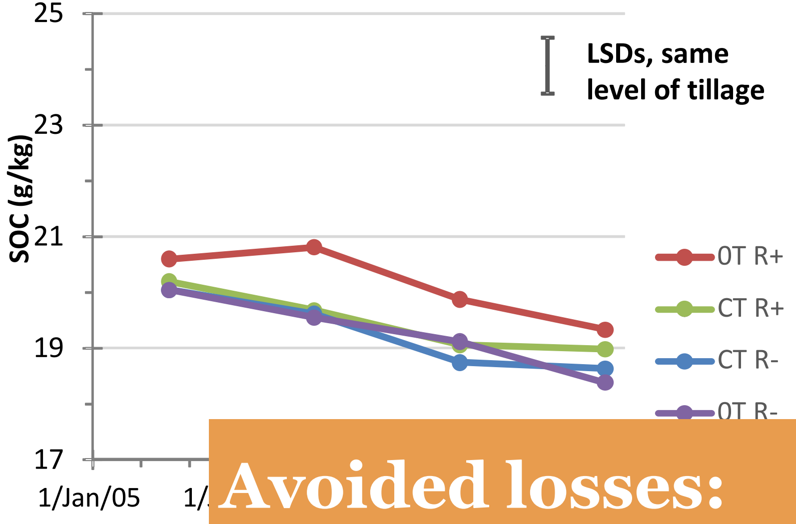
  ~0-5 – 0.9 t C/ha/yr

Avoiding C-losses but failing to sequester…!

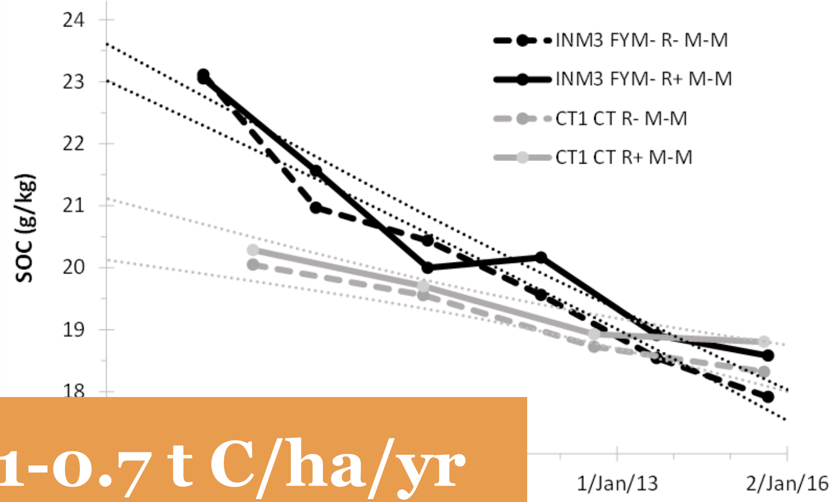
CIAT long-term trials, Western Kenya – observed SOC changes over time under improved land use

1. Instead of C-sequestration, we detect losses!

Conservation Agriculture



2. Land use history seems the major driver of losses!



Avoided losses: ~0.1-0.7 t C/ha/yr

Source: Sommer et al. 2018

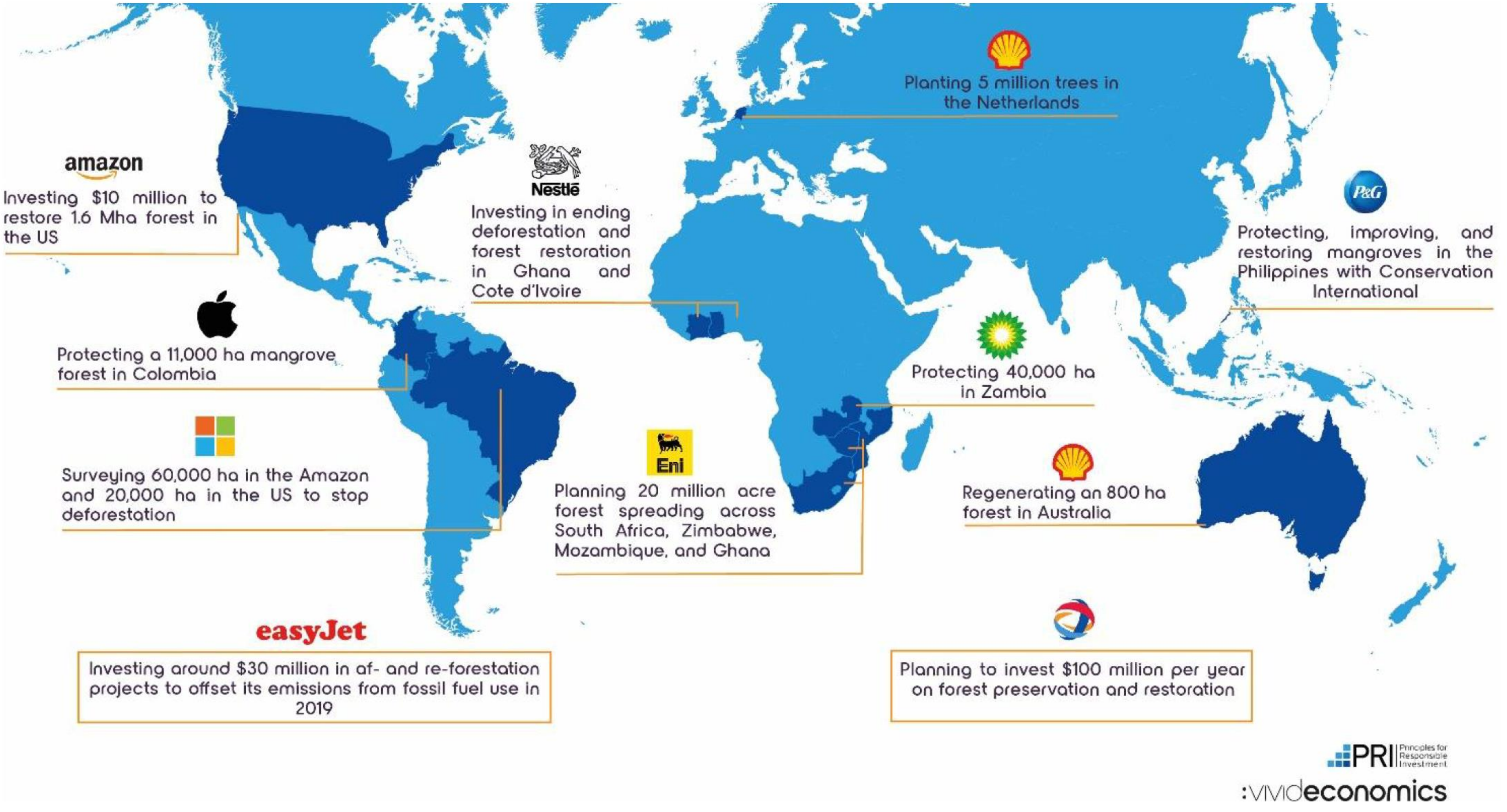
Avoid detrimental „co-evolutions“ (leakages)

- At WWF we are very concerned that – once again – an offsetting via C-certificates could undermine independent mitigation or CO_2-reduction efforts ;
- rather then doing everything possible for reducing CO_2 emissions, companies may want to buy their way out cheaply;
- there is serious risk of leakage effects, and of double claiming or even double counting;
- thorough corresponding adjustment would be required, which has rarely been done so far.

“Our findings reveal that robust crediting of soil carbon is hard and that none of the existing protocols is doing enough to guarantee good outcomes.”

Source: https://carbonplan.org/research/soil-protocols-explainer

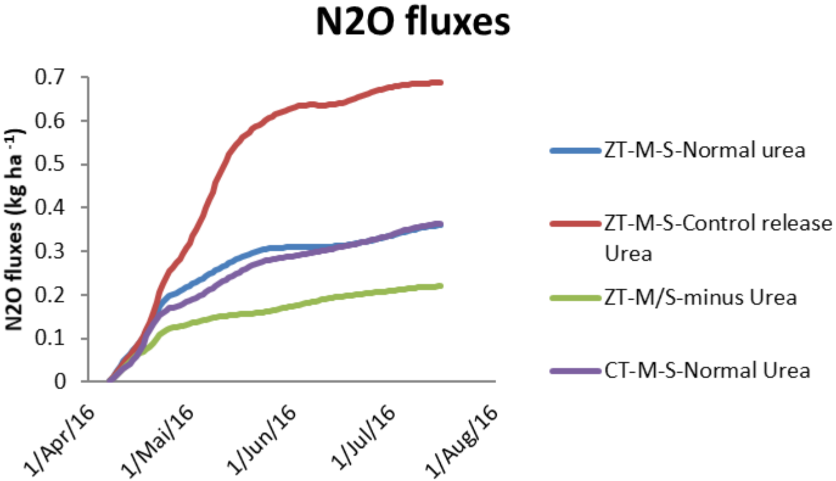
Figure 2 Companies have already started to channel their resources to forest-related NBS projects



Source: *Vivideconomics 2020: An investor guide to negative emission technologies and the importance of land use* Link

Tradeoffs, on-farm and broader

- increased "co-emissions" of other GHGs e.g., N_2O (right figure) or methane
- very high labor demand for managing organic matter
- current farm economics work against organic matter retention (competition with livestock feed)
- lack of water in dryer areas e.g., for growing cover crops
- managing organic matter and diversifying farming systems is knowledge-intensive and may come with additional risks



Source: Karanja, 2021

Promising ways forward

- Strong support for an **agroecological transformation**
  - …while avoiding mistakes of the 70ths
  - Stakeholder engagement from the beginning is paramount!
- Payments for management practices rather than C-sequestration in soils
- Payments for environmental services not merely carbon sinks
- Avoid detrimental subsidies at all cost
- Mineral fertilizers where required
  - must leap-frog the mistakes of the past
  - include a long-term strategy (vision) to phase out mineral N fertilizer
  - must investigate rural-urban nutrient cycling (options)
- Manage systems rather than a mere promotion of (single) technologies …promoted by the north to the south…


THANK YOU!