

G20 MACS, November 14, 2017, Potsdam





The role of soils for the resilience of future food systems

Dr. Jean-Francois Soussana INRA, Paris, FRANCE





Pledges for the Paris agreement on climate

 128 countries include the Agriculture Forestry and Land Use sector in their pledges At least 25% of total committed mitigation [IIASA]

• A gap in emission reduction

By 2030, a gap of 12 billion tons CO_{2e} prevents reaching the targeted +2°C maximum global warming threshold



Soil carbon sequestration: a major option for climate and for food security

- 2-3 times more carbon in soil organic matter than in atmospheric CO₂ [IPCC, 2013]
- 1.4 billions metric tons (Gt C) could be stored annually in <u>agricultural</u> soils, equivalent to an annual storage rate of 0.4 - 0.6 % in top soil [after IPCC, 2007, 2014]
- 80 % of this potential could be reached for 100 USD per ton of CO₂, a price compatible with the 2° C global warming target (Smith et al., 2008, Frank et al., 2017)

Agricultural practices for soil carbon sequestration



Conservation tillage



Water management



Integrated soil fertility management





Rangeland Management



Agroecology

Agroforestry



Organic fertilizers

Co-benefits for adaptation, land degradation and food security

- Half of the agricultural soils are estimated to be degraded [FAO, 2006, 2011] The annual cost of fertilizer to replace nutrients lost to erosion is US \$ 110 US \$ 200 billion (ITPS FAO, 2016).
- Erosion causes annual losses of 0.3–1.0 billions tons carbon from arable land (Chappell et al., 2015, NCC)
- 24-40 million metric tons additional grains can be produced in developing countries per additional ton C per hectare stored in soils organic matter [Lal, 2006]
- Reduced yield variability after soil restoration leading to increased soil organic matter [Pan et al., 2009]

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)

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

What means « 4 per 1000 » ?

Data: CDIAC/NOAA-ESRL/GCP

Stabilizing atmospheric CO₂

by a **large** soil carbon sequestration rate calculated over **top** soil (0-40 cm)

Strengthening the current land carbon sink

The 4 per 1000 target of 3.5 GtC/ yr is compatible with literature estimates:

- Agricultural soils
- Forest soils
- Desertified and salinized soils

The goals of the "4 per 1000" Initiative

- Increase carbon storage in soils, with a view to:

- improving food security
- <u>adapting</u> agriculture to climate change
- <u>mitigating</u> climate change (1,5°C/ 2°C target)

supporting the:

- Sustainable Development Goals adopted by the United Nations,
- the Paris Agreement on Climate,
- the land degradation neutrality principle.

A multistake-holder Initiative with 2 pillars:

- Action plan
- International research and cooperation program

The members and partners as of 25 June 2017

| | Forum | Consortium |
|-----------------------------|-------|-------------|
| | | governance) |
| BANKS and DEVELOPMENT FUNDS | 4 | 3 |
| STATES and COMMUNITIES | 39 | 20 |
| FUNDATIONS | 5 | 2 |
| PROFIT-MAKING ORGANISATIONS | 32 | 0 |
| FARMERS ORGANISATIONS | 35 | 21 |
| INTERNATIONALE INSTITUTIONS | 11 | 11 |
| RESEARCH / UNIVERSITIES | 54 | 39 |
| CIVIL SOCIETY – NGOs | 78 | 34 |
| TOTAL | 258 | 130 |

🌄 📕 MINISTÈRE DE L'AGRICULTURE ET DE L'ALIMENTATION

On going work

- A set of reference criteria for the evaluation of projects and actions
- An international scientific research and cooperation
 programme
- A new website «4 per 1000» including the collaborative platform & the resources center

Upcoming events:

• Next meeting of the Forum / Consortium:

16th November 2017 in Bonn, Germany (COP23)

Themes of the international research program

- Improving estimates of the baseline of soil carbon change and of the potential for soil carbon sequestration;
- Co-constructing agricultural strategies and practices for soil carbon sequestration and assessing their co-benefits and trade-offs;
- Metrics and methods for monitoring, reporting and verifying (MRV) soil carbon sequestration at multiple scales (field to country);
- Public policies and financial mechanisms that aim at promoting and rewarding relevant practices

pour le développement

Soil Carbon Sequestration Flagship

| Online collaborative knowledge hub | | | |
|--|---|--|--|
| Developing solutions | Monitoring solutions | Adopting solutions | |
| Decision support toolbox Maps of SCS potential (e.g. to reach the 4 per 1000 aspirational target) Maps of crop and pasture practices suited to reach SCS targets Implications of SCS practices for yields, drought tolerance and climate change adaptation N₂O and CH₄ emissions, energy use Costs and benefits of transitioning to SCS practices | Methods to certify SCS Tiered methodologies for monitoring, reporting and verifying (MRV) soil organic carbon (SOC) stocks in crop and pasture systems Handbooks and guidelines for project scale MRV adapted to regional contexts and agricultural systems Technologies for rapid SOC stock verification Modelling of SOC stock change in crop and pasture systems | Enabling environment Regional stakeholder workshops on SCS Criteria for sustainable SCS projects supporting livelihoods Assessment of barriers to the adoption of SCS practices Value chains, business models and policy options Research funding strategy and international research cooperation | |
| Capacity building, knowledge transfer and training | | | |

CIRCASA

Coordination of International Research Cooperation on soil CArbon Sequestration in Agriculture

Goals of CIRCASA project (17 countries)

The overarching goal of CIRCASA is to develop **international synergies concerning research and knowledge transfer** on agricultural soil C sequestration at European Union (EU) and global levels.

- Strengthen the international research community on soil carbon sequestration in relation to climate change and food security;
- **Improve our understanding** of agricultural soil carbon sequestration and its potential for climate change mitigation and adaptation and for increasing food production;
- Co-design a strategic research agenda with stakeholders on soil carbon sequestration in agriculture;
- Create an International Research Consortium

Thank you for your attention!