International Soil Research, pre-event, January 27, 2016, Brussels

Soils for Food Security and Climate
The 4‰ Initiative

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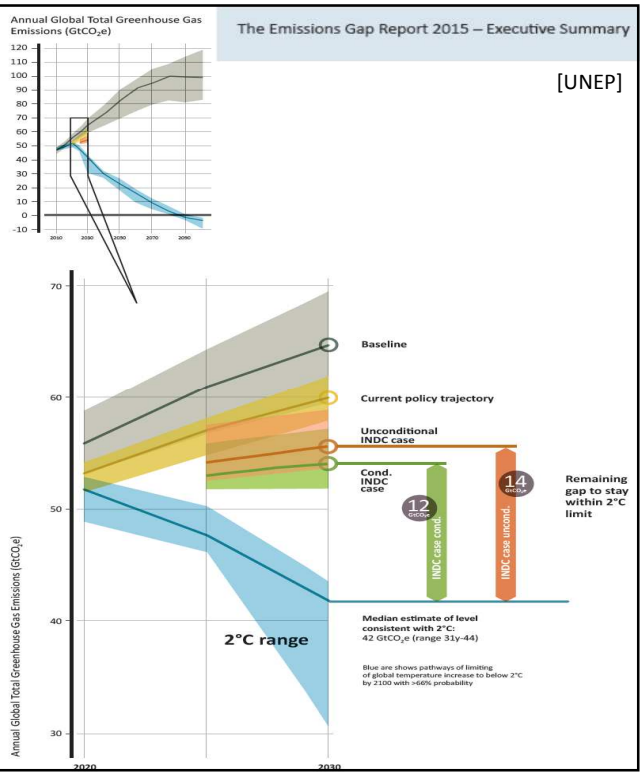
on behalf of CGIAR, CIRAD, INRA and IRD

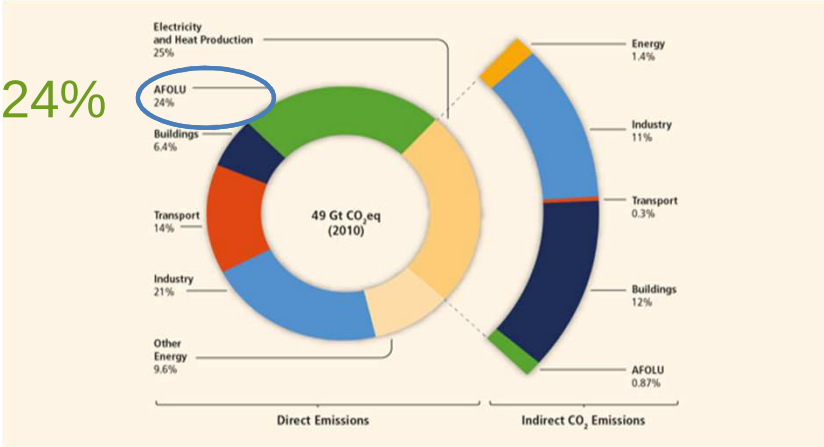
A large gap in emission's reduction by 2030

- By 2030, a gap of 12 Gt CO_{2e} with conditional INDCs prevents reaching the targeted +2°C maximum global warming threshold
- Could this gap be matched by the 4/1000 initiative?
- While contributing to food security?
- And to climate change adaptation?



Agriculture, forest and land use (AFOLU) in global GHG emissions

24%



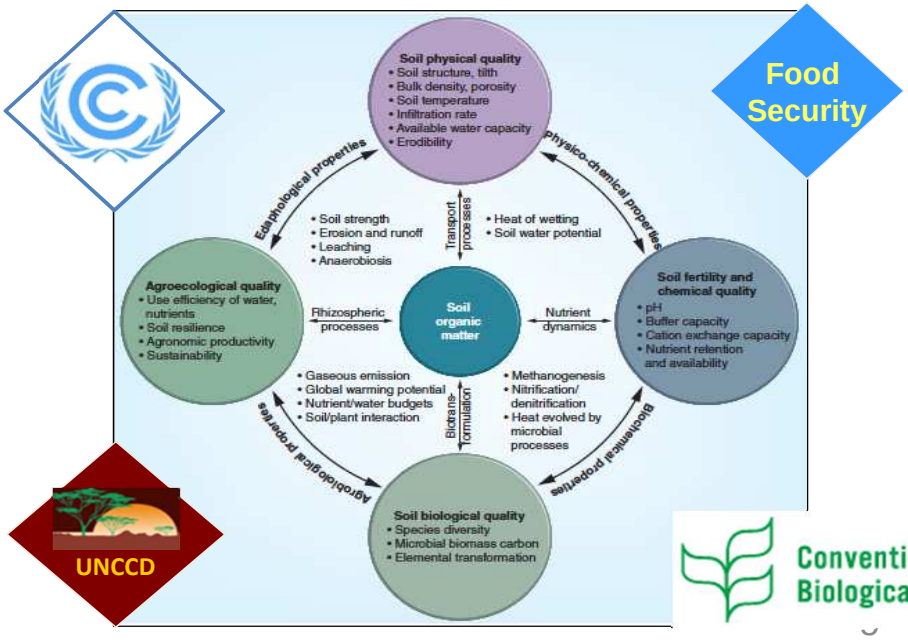
IPCC WGIII AR5

- 128 countries include the AFOLU sector in their INDCs (Intended Nationally Determined Contributions)
  - **At least 25% of total committed GHG mitigation**
    [as estimated by the International Institute for Applied Systems Analysis, IIASA]

Why Soil Carbon?
Key facts and figures

- 2-3 times more carbon in soil organic matter than in atmospheric CO_2 [IPCC, 2013]
- 1.4 billion metric tons carbon could be stored annually in agricultural soils, equivalent to a storage rate of 0.48%/year in top soil [after IPCC, 2007, 2014]
- Half of the agricultural soils are estimated to be degraded, leading to global grain losses estimated at $1.2 billion [FAO, 2006]
- 24-40 million metric tons additional grains could be produced in developing countries by storing an additional ton of carbon per ha in soil organic matter [Lal , 2006]
- Reduced yield variability after soil restoration leading to increased soil organic matter [Pan et al. , 2009]

Soil organic matter: multiple benefits



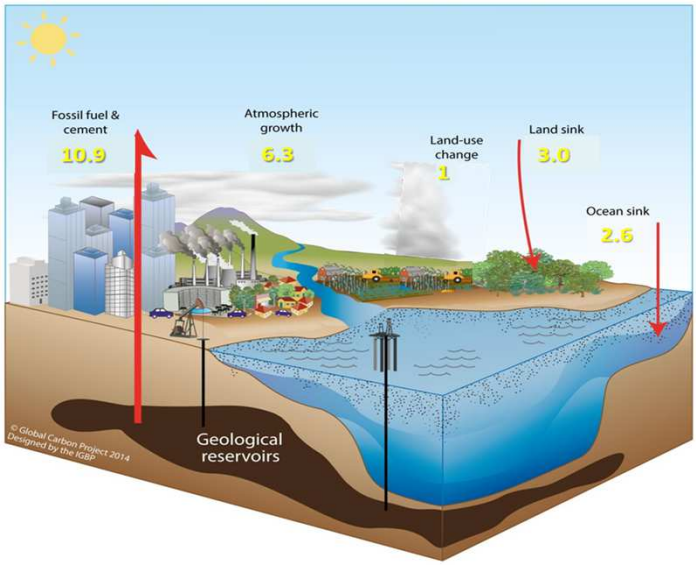
Food Security

UNCCD

Convention on Biological Diversity

Why 4/1000?

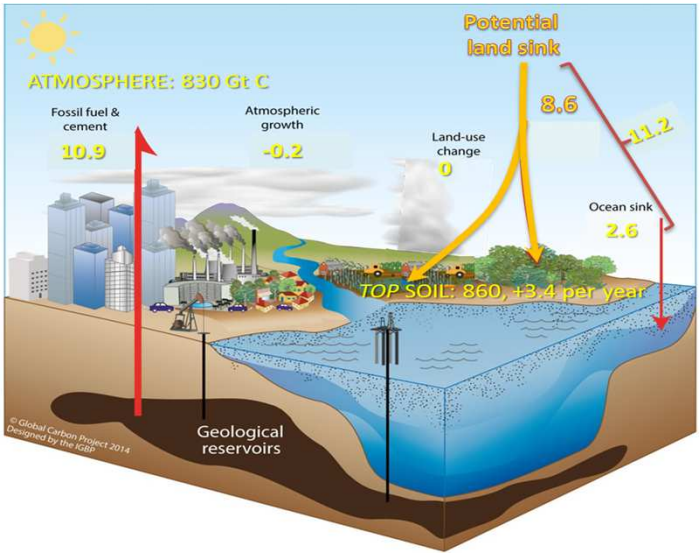
The global carbon cycle in 2030-2050
based on Paris Agreement (COP21) pledges



Gt C (billion metric tons of carbon)

Why 4/1000?

The global carbon cycle in 2030-2050
assuming full implementation of the 4/1000 initiative



Measures:

- halting deforestation & forest degradation,
- reforestation & agroforestry,
- soil carbon sequestration at 3.4 Gt C/yr, i.e. 0.4% of top soil C stock (860 GtC)

Gt C (billion metric tons of carbon)

Technical and economic potential

- There are technical uncertainties about the potential, but 3.4 GtC/yr in soils ('4/1000' target) is technically achievable
- Achieving that potential would double by 2030 the total mitigation encompassed by the currently published INDCs
- Economic potential is estimated at 1 Gt C/yr in agriculture
  - **For a price of $120 per metric ton of CO_2 (compatible with the 2°C warming target)**
  - **In addition, local studies in Asia, Latin America and Africa show that best practices providing a 4/1000 increase in soil carbon have a large co-benefit: on average, a 1.3% increase in crop yields**

Limits and co-benefits of soil carbon sequestration

- Adoption of SOC sequestration measures will take time,
- SOC will increase only over a finite period (20-30 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) deficiencies may also prevent SOC storage to be achieved

⇒Ecologically sound management strategies need to overcome nutrient limitations in some regions, while avoiding excess N fertilization leading to additional N_2O emissions

⇒ Large co-benefits are expected in terms of yields, yield stability (e.g. Pan et al., 2009 for China) and water resources.

Suggested themes for an international research program on soil carbon sequestration

- Improving estimates of current and potential changes in soil organic carbon stocks
- Design and co-construction of agronomic strategies and practices for soil carbon sequestration, including an assessment of their co-benefits for food security and climate change adaptation,
- Institutional arrangements and public policies, including financial mechanisms, that aim at promoting and rewarding relevant practices ; social dimensions and contribution to sustainable development,
- Metrics and methods for monitoring, reporting and verification (MRV) of soil carbon sequestration (farm, landscape, region, country) and of associated (social, economic, environmental) impacts

[As per the conclusions from a side-event to the 'Our Common Future under Climate Change' Science Conference, July 7, 2015]

Towards an international research programme

- An evidence based and policy relevant programme…
  - **Aimed at providing options for countries, stakeholders and the private sector and at supporting the multi-partner initiative**
- … nested in existing international programmes
  - **GRA – Integrative Research Group**
  - **CGIAR – CCAFS and WLE (Water, Land & Ecosystems) programmes**
- … well connected to other research & knowledge programmes
  - **e.g. GSP, Geoglam, ELD, AgMIP, EU FACCE JPI…**
- Seed funding provided by French Ministry for Research for 2016-2017