PARIS2015
LA RECHERCHE SE MOBILISE POUR LE CLIMAT

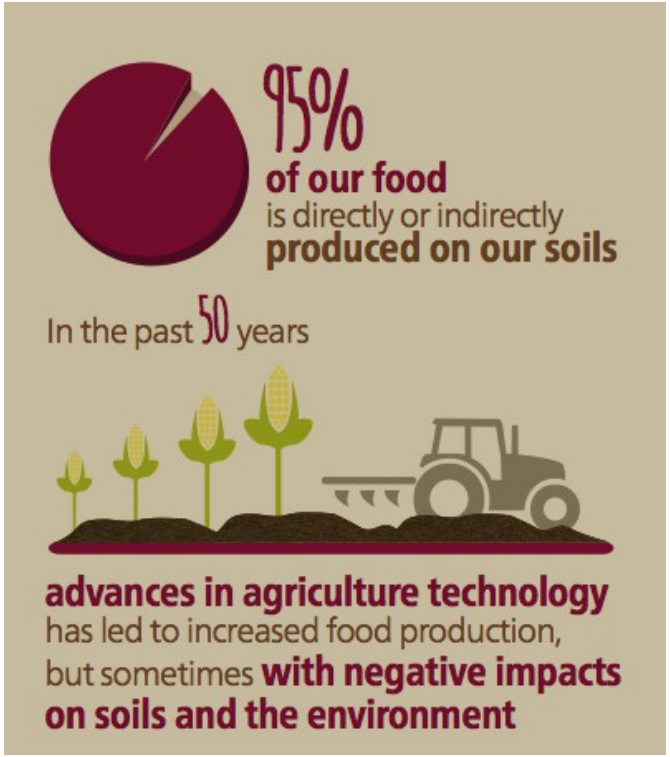
Soils for Food Security and Climate

The 4‰ Initiative

François Houllier, CEO of INRA
(based on contributions by CGIAR, CIRAD and IRD)

Why Soil Carbon?
Soil, food security & nutrition. Key facts and figures (1/2)

2015 International Year of Soils



[FAO, April 2015. Healthy soils are the basis for healthy food production]

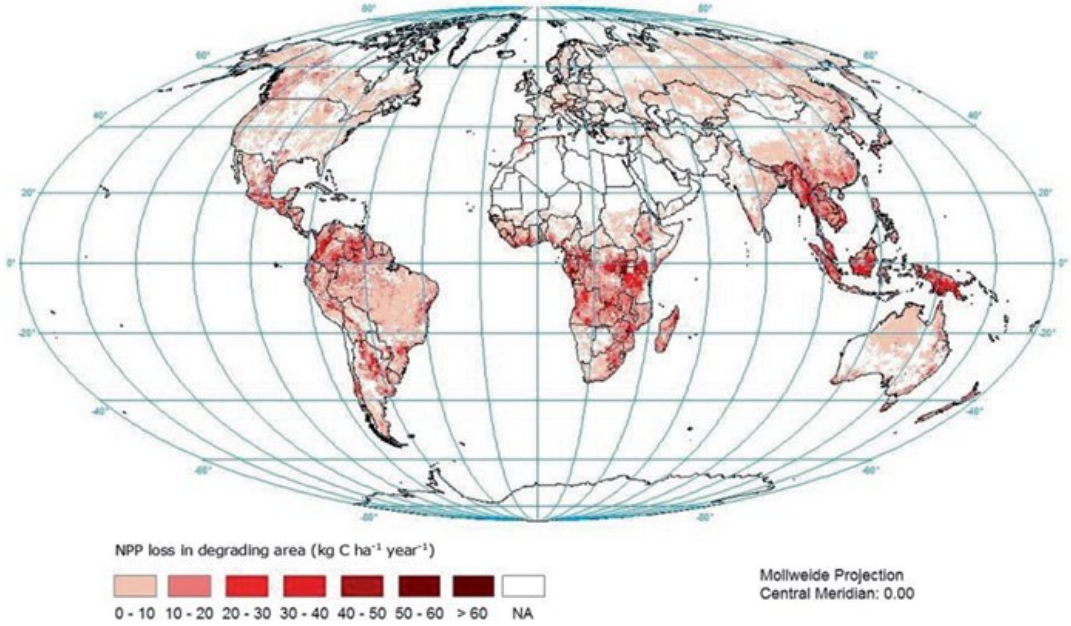


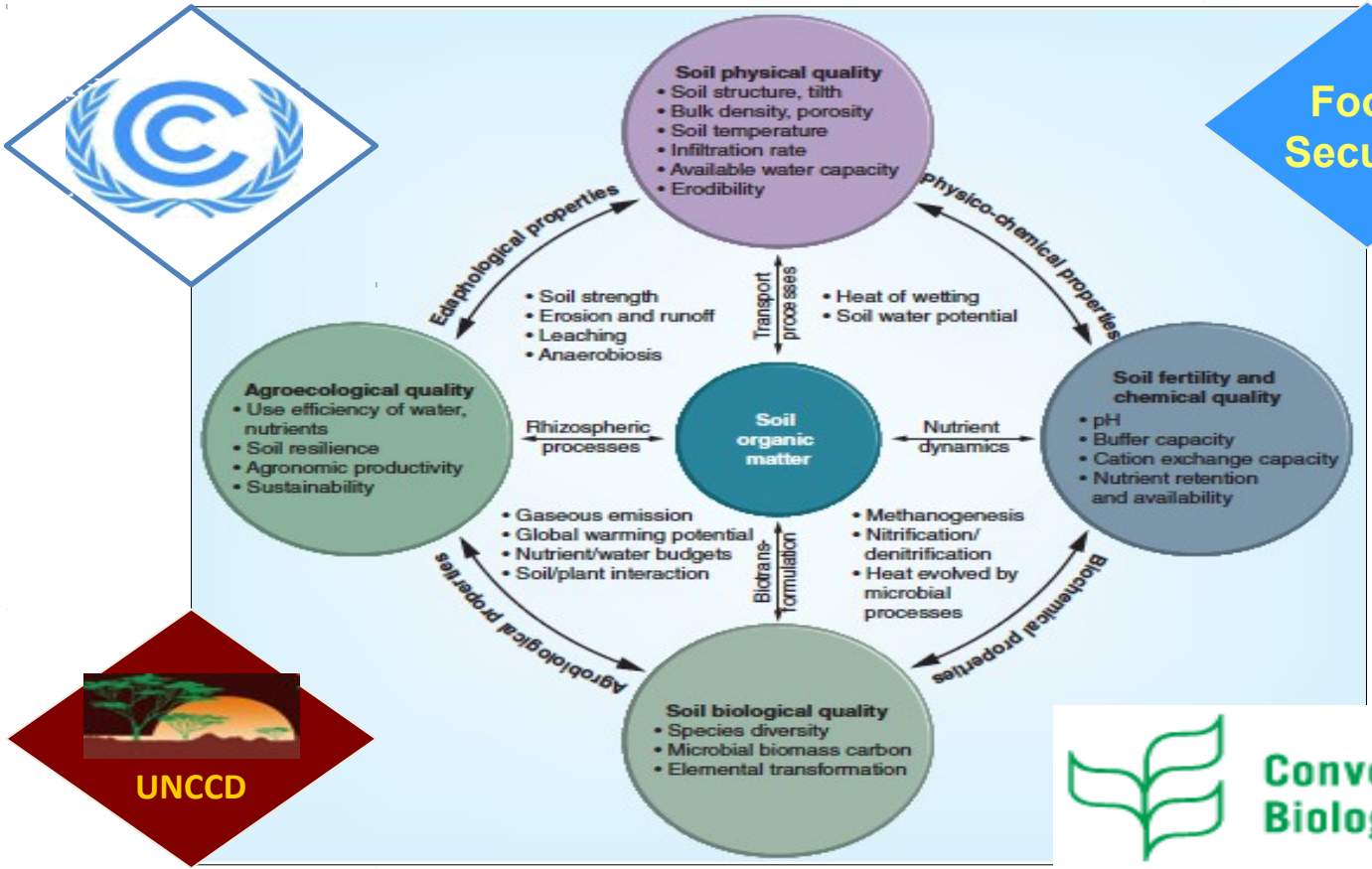
Fig. 15.5 NPP loss in the degrading areas 1981–2006

BAI Z, 2013. Land degradation and ecosystem services DOI 10.1007:978-94-007-6455-2_15

Why Soil Carbon?
Soil, food security & nutrition. Key facts and figures (2/2)

- Increased production
  - **24-40 million metric tons additional grains could be produced in developing countries by storing one additional ton of carbon per ha in soil organic matter** *[Lal, 2006]*
  - **Local studies in Asia, Latin America and Africa show that best practices generating a 4/1000 increase in soil carbon may have co-benefits: e.g. on average, a 1.3% increase in crop yields**
- Better climate resilience
  - **Reduced yield variability after soil restoration, leading to increased soil organic matter** *[Pan et al., 2009]*

Soil organic matter: multiple benefits

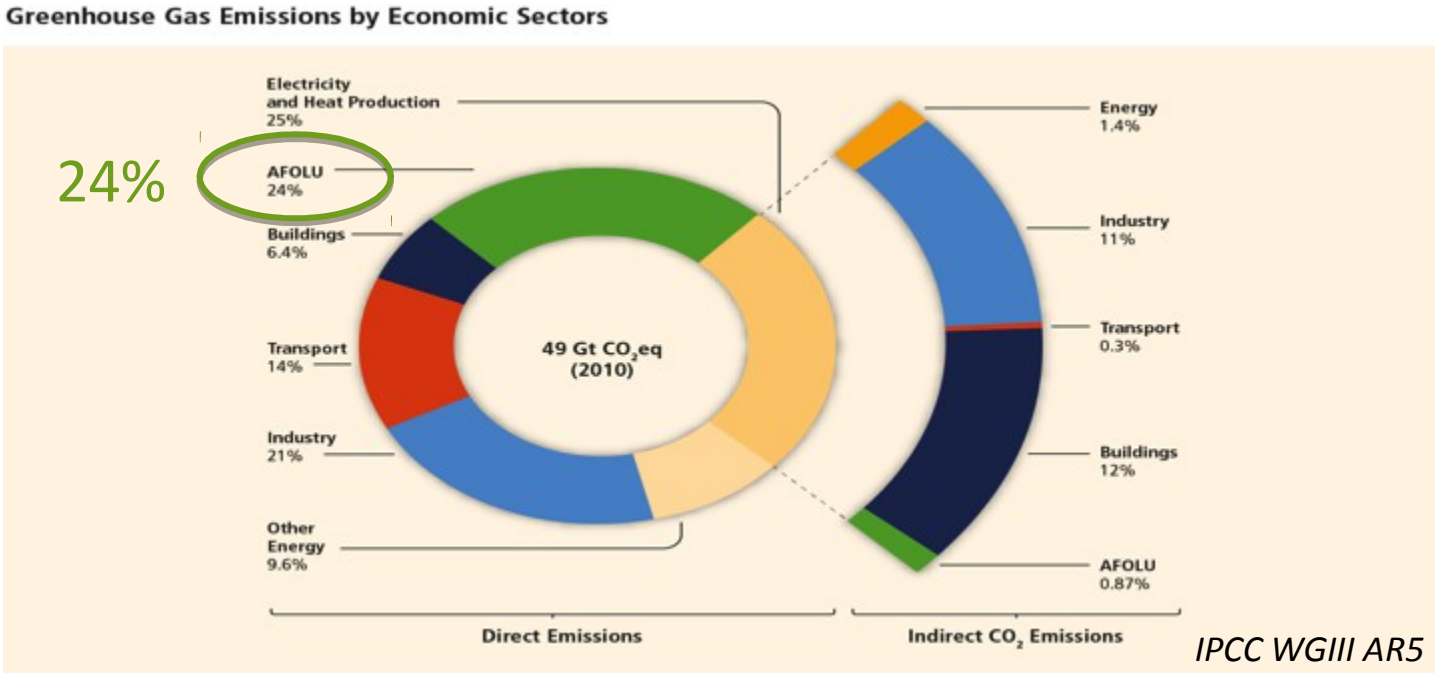


Food Security

UNCCD

Convention on Biological Diversity

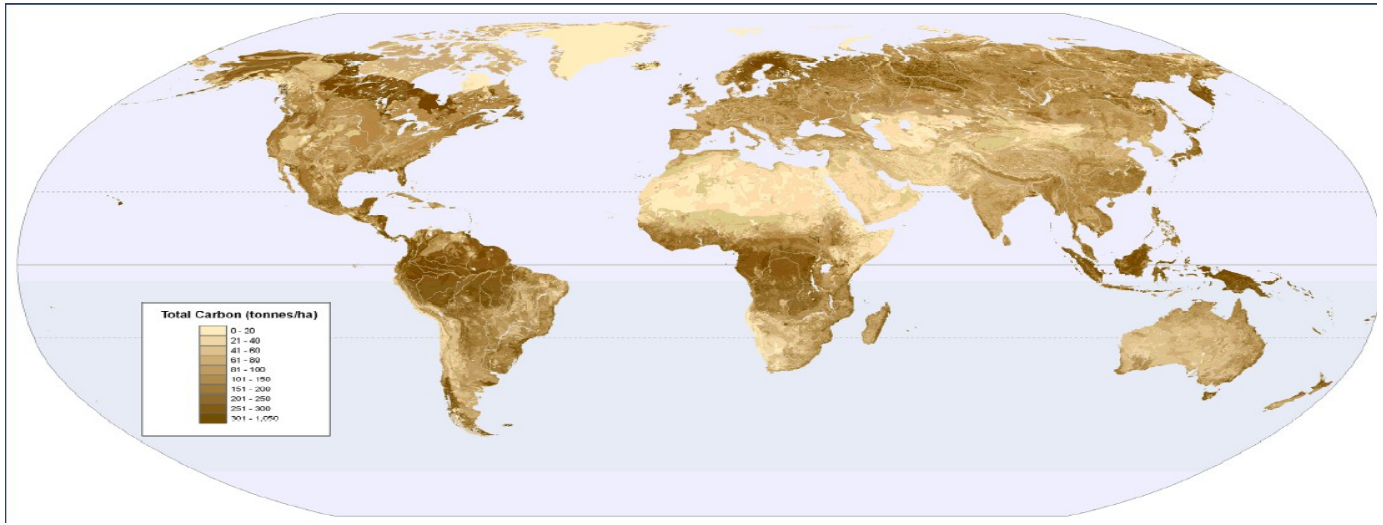
Agriculture, forest and land use in global GHG emissions



IPCC WGIII AR5

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

Soils contain 2 to 3 times more carbon than the atmosphere



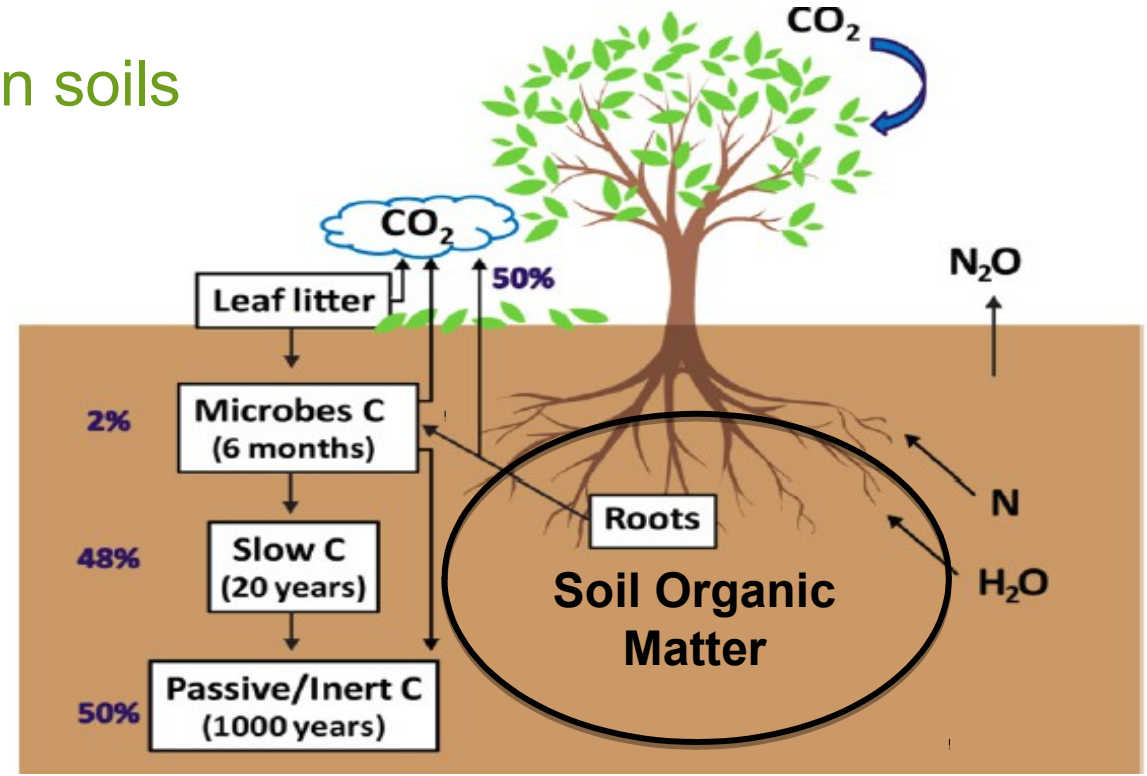
(UNEP, FAO, JRC 2010)

- Could soil carbon sequestration offset, within a few decades, the current atmospheric rise in CO_2?

Carbon residence time in soils

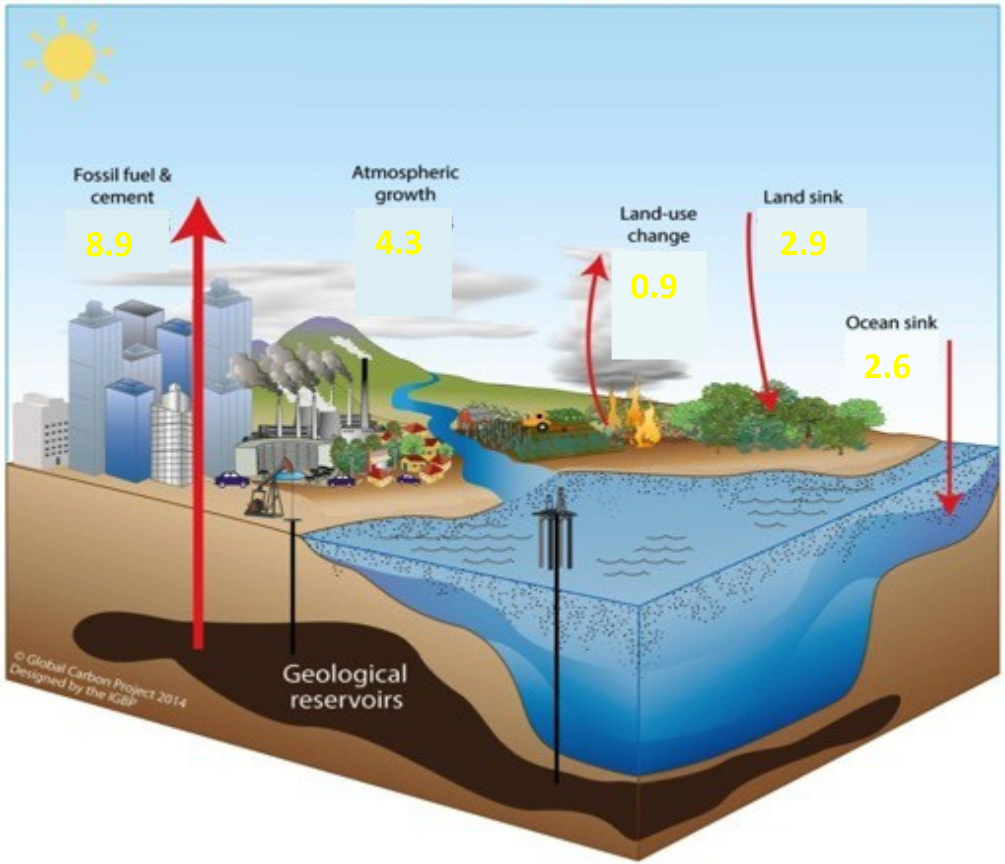
Top soil (0-30, or 0-40 cm)

Deep soil (below 50 cm)



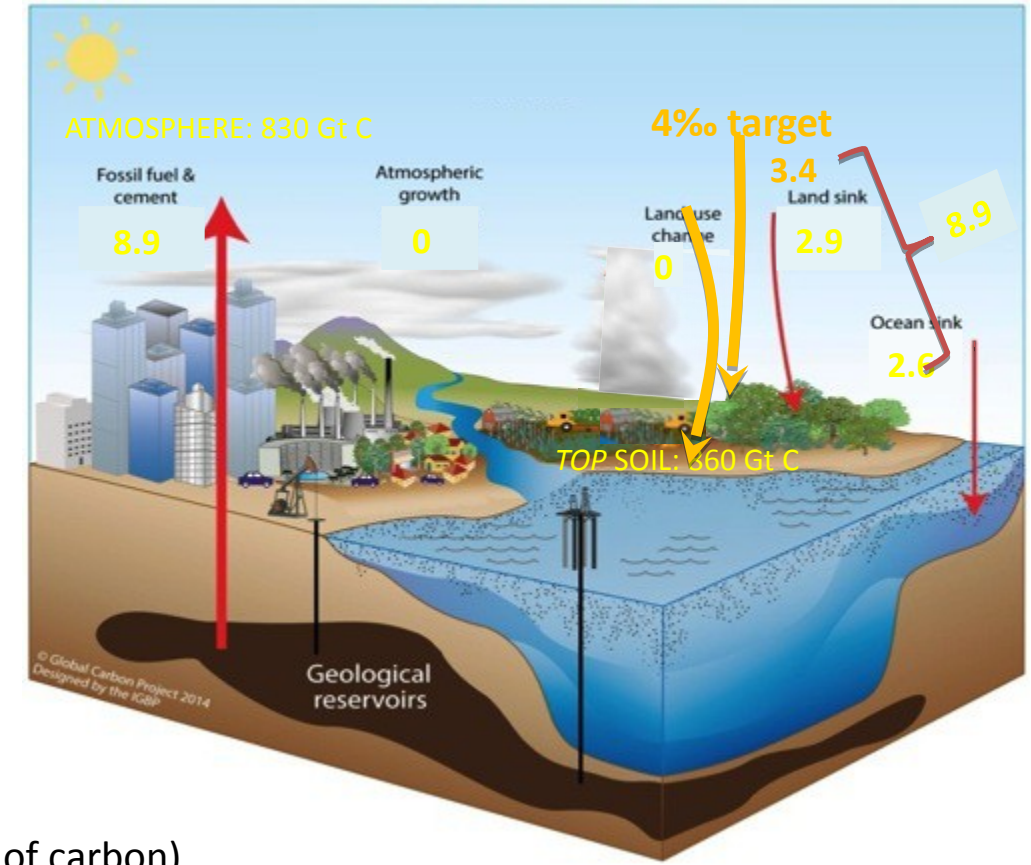
- Top soil carbon responds to changes in soil management and use within a few decades, while long-term buildup of deep soil carbon can lead to increased permanence of stock

Why 4/1000?



Gt C (billion metric tons of carbon) *[after GCP 2014]*

Why 4/1000?



Gt C (billion metric tons of carbon)

Anthropogenic CO_2 budget as if all land-based sequestration could be implemented within one year.

Technical potential

- There are scientific uncertainties about the potential, but achieving +3.4 GtC/yr in soils (*ie*, '4/1000' target) is technically feasible *[after IPCC 2000, 2007, 2014]*
  - **Agricultural soils: 1.4 GtC/yr** (ca. +0.48%/yr of top soil organic C stock)
  - **Forests and agroforestry soils: 1.3 GtC/yr** (and +2.7 Gt C/yr in biomass)
  - **Salt affected and desertified soils: +0.5-1.4 GtC/yr**
- Ecologically sound practices that can be used to store carbon in soils include conservation agriculture, crop – livestock integration, agroforestry, water management in arid areas
- Reaching the '4/1000' target would double by 2030 the total mitigation encompassed by the currently published INDCs

Technical and economic potential

- There are scientific uncertainties about the potential, but achieving +3.4 GtC/yr in soils (*ie*, '4/1000' target) is technically feasible *[after IPCC 2000, 2007, 2014]*
- Reaching the '4/1000' target would double by 2030 the total mitigation encompassed by the currently published INDCs
- Economic potential is estimated at +1 Gt C/yr in agriculture *[after GLOBIOM, IIASA, unpublished]*
  - **For a price of $120 per metric ton of CO_2 (compatible with the less-than-+2°C warming threshold)**

Suggested themes for an international research program

- **As per the conclusions from a side-event to #CFCC15 Science Conference, updated by the outcome of the scientific workshop organized yesterday …**
  - 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 that aim at promoting and rewarding relevant practices, including financial mechanisms, 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 to be further worked out in coming months**

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 and well connected to other research & knowledge partnerships and initiatives
  - **GRA – Integrative Research Group**
  - **CGIAR – CCAFS and WLE (Water, Land & Ecosystems) programmes**
  - **GSP, GACSA, Geoglam, ELD, AgMIP, EU FACCE JPI, *etc.***
- … supported by seed funding provided by the French Ministry for Research for 2016-2017