GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

Integrative Research Group

Brian Mc Conkey, Jean-François Soussana, Lee Nelson

Rationale

GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

- **Former Cross-Cutting Groups (C&N Cycling and Inventories and Monitoring) each had an assigned mandate that lacked flexibility to take on activities that involve aspects of both mandates**
  - Example: Grasslands
- **Single "Integrative Research Group" provides flexibility and efficiency**
  - Integrative Research Group (co-chairs + member representatives):
    - Fosters networks based on needs identified by members and other RGs
    - Provides coordination between its networks and for work intersections with the other RGs
  - Issue-focused scientific leadership is within the networks within the IRG
  - IRG networks assemble necessary expertise and resources to accomplish their goals
  - Only one Group with cross cutting functions for members to participate in

IRG vision and scope

GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

Vision

- Collaborative work to develop the knowledge and capabilities for *estimation*, *monitoring*, and *projection* of GHG emissions within and across agricultural systems

Scope: Address identified ***Research, Development, and Knowledge Transfer*** *(R-D-KT)* opportunities

- Integration of scales (local, subnational, national, and supranational scales)
- Applying, reporting, monitoring, and/or verifying greenhouse gas emission estimates across farming systems
- Communicate and coordinate
- Foster the building of capability of member countries.

Implications

GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

- **Active participation from members is essential for success**
  - Work areas too diverse for a few people to address adequately
  - Each network must have determined leadership
- **The member representatives to the Integrative Research Group have a vital, but very challenging, role**
  - Broad knowledge of agricultural GHG emissions and removals and agricultural systems
  - Commitment to connect diverse country expertise and resources to the Group networks doing work important for their country
  - Identify and prioritize research and knowledge needs
  - Support the funding of research networks and IRG activities

Climate negotiations & Agriculture

GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

Renewed interest in agricultural mitigation options (e.g. 120 countries include the land sector in their INDCs)

INDCs also include adaptation for developing countries

Soil carbon sequestration initiative (4/1000) in the Lima-Paris Action Agenda

Integrative knowledge required

GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

Estimating the technical potential for farms, sub-regions, industries to mitigate and adapt?

What is the economic potential for a given CO_2 price?

Which practices can be combined at farm/landscape scales?

How to monitor, report and verify?

How to help countries/industries in developing strategic plans and inventories?

Where is the potential for countries, for sectors?

GLOBAL RESEARCH ALLIANCE ON AGRICULTURAL GREENHOUSE GASES

Potential for soil C sequestration?

Potential for non-CO_2 mitigation?

Co-benefits with adaptation?

With agricultural productivity?

This requires upscaling mitigation options to the regional scale (e.g. pilot regions within countries)

How to integrate?

GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

Best practices with known potential?

Modeling with known uncertainties

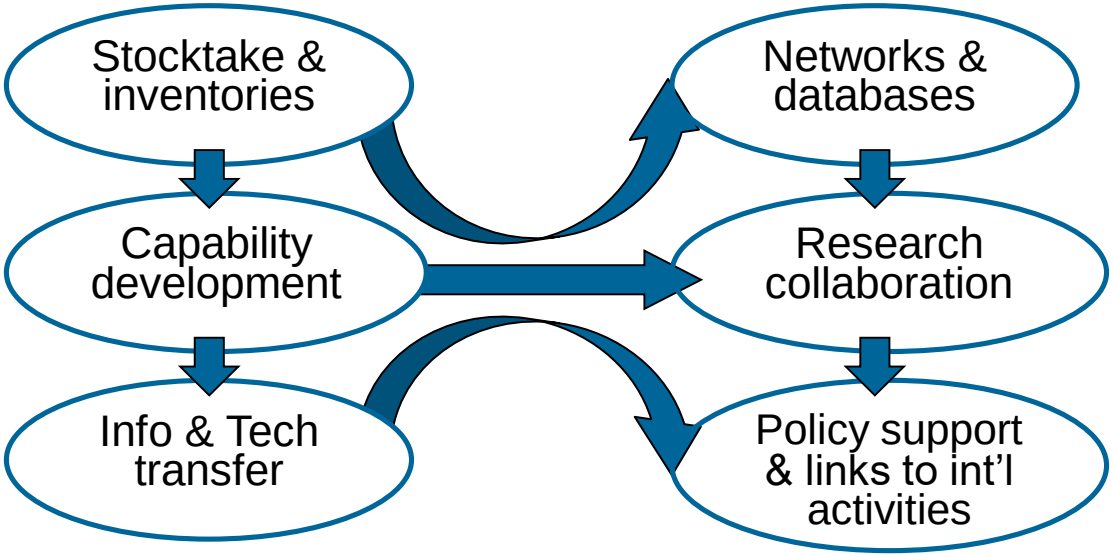
Learning loops with support of research groups and research users

Use existing modeling resources in collaboration with agencies, (e.g. GLEAM LCA model, FAO)

Partners and others with shared interests: CCAFS, FAO, SAI platform, farmers…

From stocktake toward scientific support to policies

GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES



Networks within IRG

GLOBAL RESEARCH ALLIANCE ON AGRICULTURAL GREENHOUSE GASES

1. **Grasslands network** *(transfers and builds on existing Livestock Group network)*
2. **Soil carbon sequestration network** *(**NEW**, but builds on work started across the GRA)*
3. **Field scale modeling network** *(builds on former C&N Cross-Cutting Group work)*
4. **Regional scale modeling network** *(**NEW**, but builds on work started across the GRA)*
5. **GHG inventories network** *(builds on former Inventories and Monitoring Cross-Cutting Group work)*

This list is not final, but will be used to start the IRG

Audiences

GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

- Governments
- Policy makers
- GHG Inventory practitioners
- Agriculture sectors/farmers
- International agencies

Questions

GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

Who is the audience?

What is the outcome for IRG?

- What is success?

What are low-hanging fruits to influence a target audience?

- What are the outputs?

What are the game-changing investments?

What adds value?

GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

Grasslands network - ideas

GLOBAL RESEARCH ALLIANCE ON AGRICULTURAL GREENHOUSE GASES

- Provides data and best management practices for grasslands to other networks
  - Productivity, quality, soil carbon, N_2O emissions…
  - By region and by practice
- Integrates grassland management and livestock management options (with LRG)
- ?

Questions

GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

Who is the audience?

What is the desired outcome for network?

- What is success?

What are low-hanging fruits to influence a target audience?

- 6 months, 1 year, etc.
- What are the outputs?

What are the game-changing investments?

What adds value?

Who?

GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

Field scale modeling network-ideas

GLOBAL RESEARCH ALLIANCE ON AGRICULTURAL GREENHOUSE GASES

Improved assessment methods (integrating models and data) of field scale:

- baseline GHG emissions and productivity,
- climate sensitivity
- mitigation options,
- adaptation options.

Including grasslands, crops and mixed systems, with inputs from LRG, CRG and PRG

Questions

GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

Who is the audience?

What is the desired outcome for network?

- What is success?

What are low-hanging fruits to influence a target audience?

- 6 months, 1 year, etc.
- What are the outputs?

What are the game-changing investments?

What adds value?

Who?

Soil C sequestration network-ideas

GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

- Estimating potential soil carbon sequestration across spatial and temporal scales and developing reliable and low-cost monitoring and verification methods,
- Understanding trade-offs and synergies with non-CO_2 GHG emissions and with yields, as well as costs and barriers to adoption.

Questions

GLOBAL RESEARCH ALLIANCE ON AGRICULTURAL GREENHOUSE GASES

Who is the audience?

What is the desirred outcome for network?

- What is success?

What are low-hanging fruits to influence a target audience?

- 6 months, 1 year, etc.

-What are the outputs?

What are the game-changing investments?

What adds value?

Who?

GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

GHG inventories network-ideas

GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

Aims at improving national GHG inventories, also integrating soil carbon stock changes when possible

Will consider options for improved activity description, for Tier 2 and Tier 3 in sub-sectors, mobilizing GRA activities

Questions

GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

Who is the audience?

What is the desired outcome for network?

- What is success?

What are low-hanging fruits to influence a target audience?

- 6 months, 1 year, etc.
- What are the outputs?

What are the game-changing investments?

What adds value?

Who?

Regional scale modeling network-ideas

GLOBAL RESEARCH ALLIANCE ON AGRICULTURAL GREENHOUSE GASES

Aims at developing generic and robust methods for assessing the balance between GHG emissions and removals in agriculture and at testing best practices at landscape, sub-regional to regional scales

This integrates methods from best-practices, from field-scale modeling, from soil C, from activities within inventories…

Questions

GLOBAL RESEARCH ALLIANCE ON AGRICULTURAL GREENHOUSE GASES

Who is the audience?

What is the desired outcome for network?

- What is success?

What are low-hanging fruits to influence a target audience?

- 6 months, 1 year, etc.

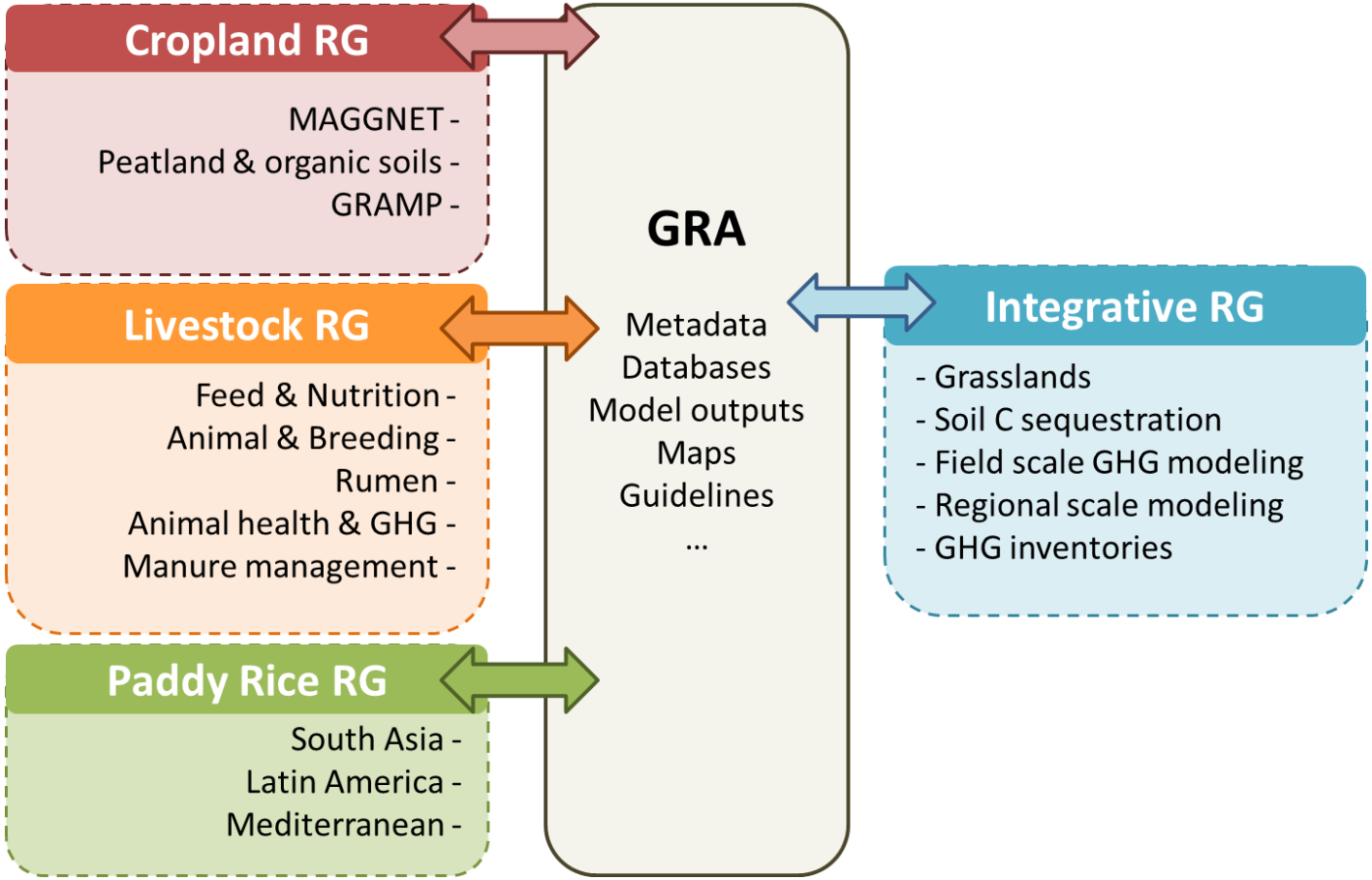
-What are the outputs?

What are the game-changing investments?

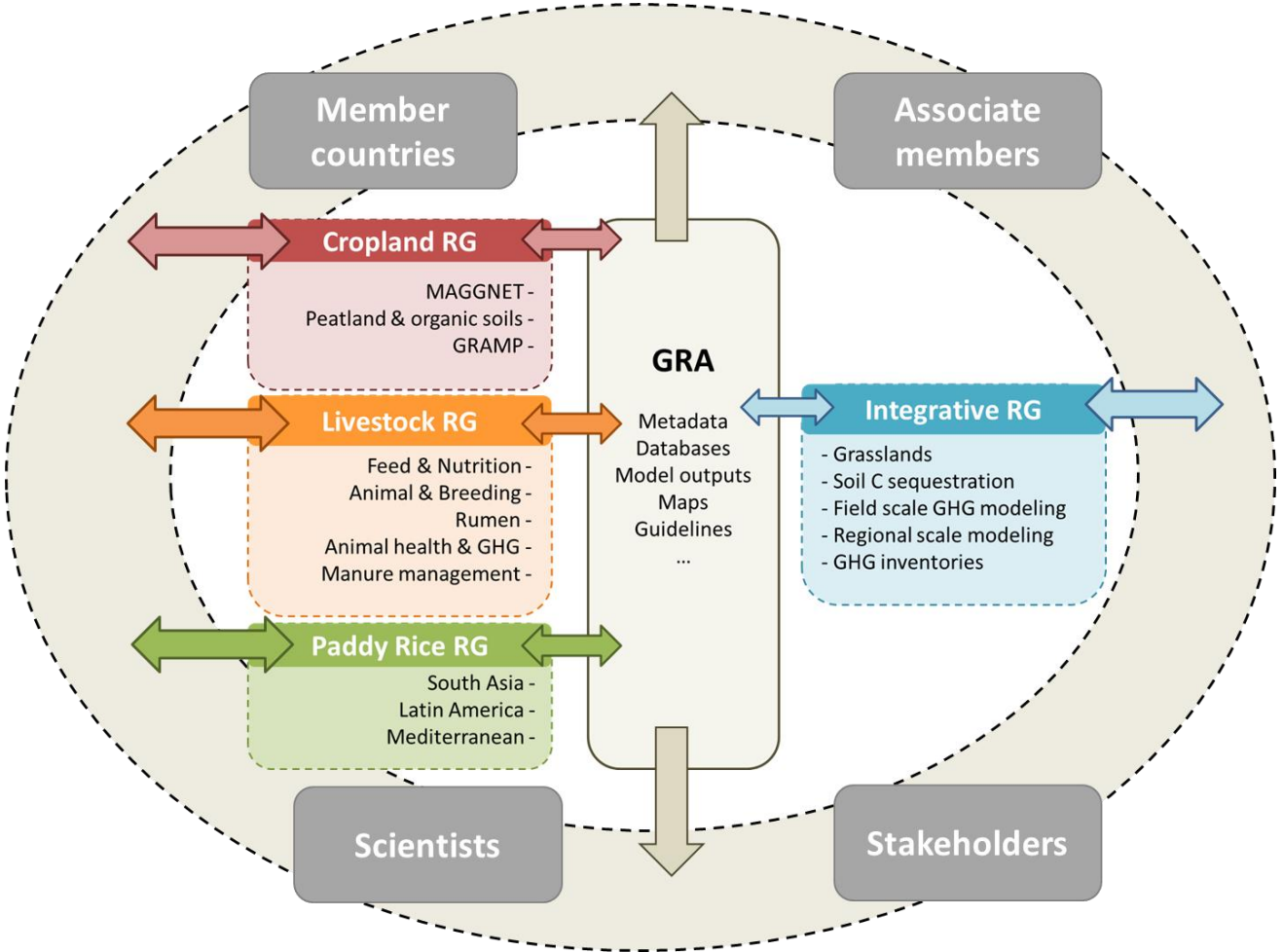
What adds value?

Who?

Integration of knowledge within GRA



Suggested integration of GRA functioning



Funding strategy

GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

Linked to current and developing initiatives:

Examples

- FACCE & other countries call on GHGs (ERA-GAS)
- Funding for 4/1000 program (support from France)
- International Research Consortium
  - Soil health
- International agencies?
- NAMAs and INDCs
- Other?

Agriculture and agricultural soils facing climate change and food security challenges: public policies and practices

Paris, Sept. 16, 2015

Carbon sequestration in soils: the 4 per mil concept

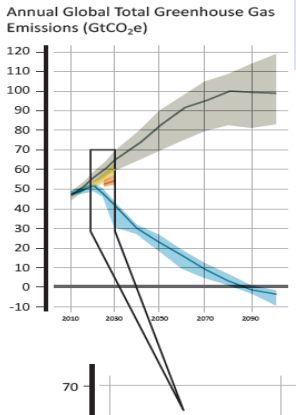
Jean-François Soussana[1], Hervé Saint-Macary[2], Jean-Luc Chotte[3]

1. INRA, Paris, France
2. CIRAD, Montpellier, France
3. IRD, Montpellier, France

A large gap
in emission's reduction by 2030

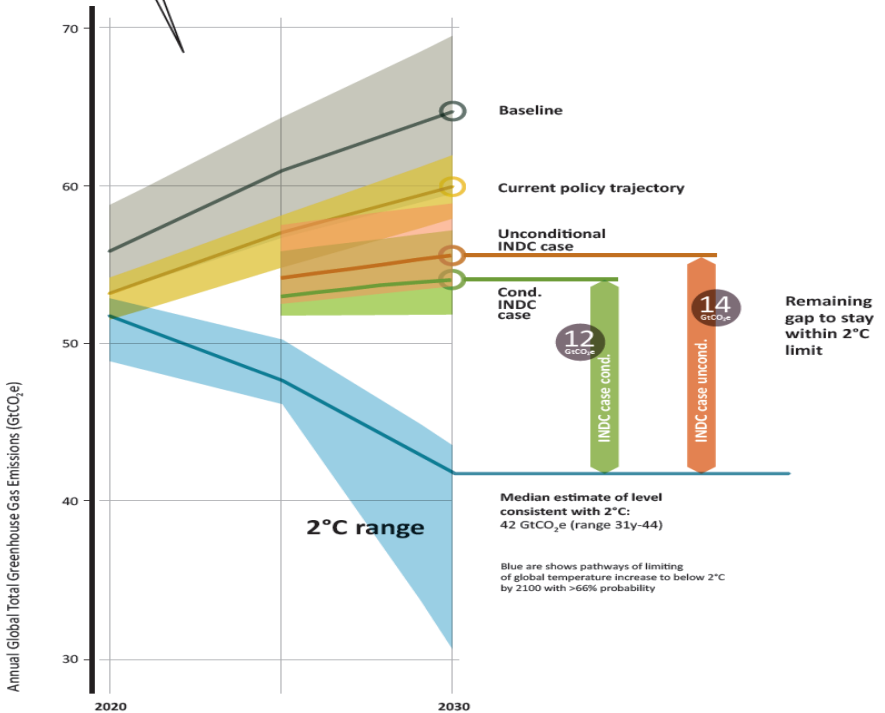
- By 2030, a gap of 12 Gt CO_{2e} with conditional INDCs prevents reaching the targeted +2℃ maximum global warming threshold

- Could this gap be matched by the 4/1000 initiative?
- While contributing to food security?
- And to climate change adaptation?



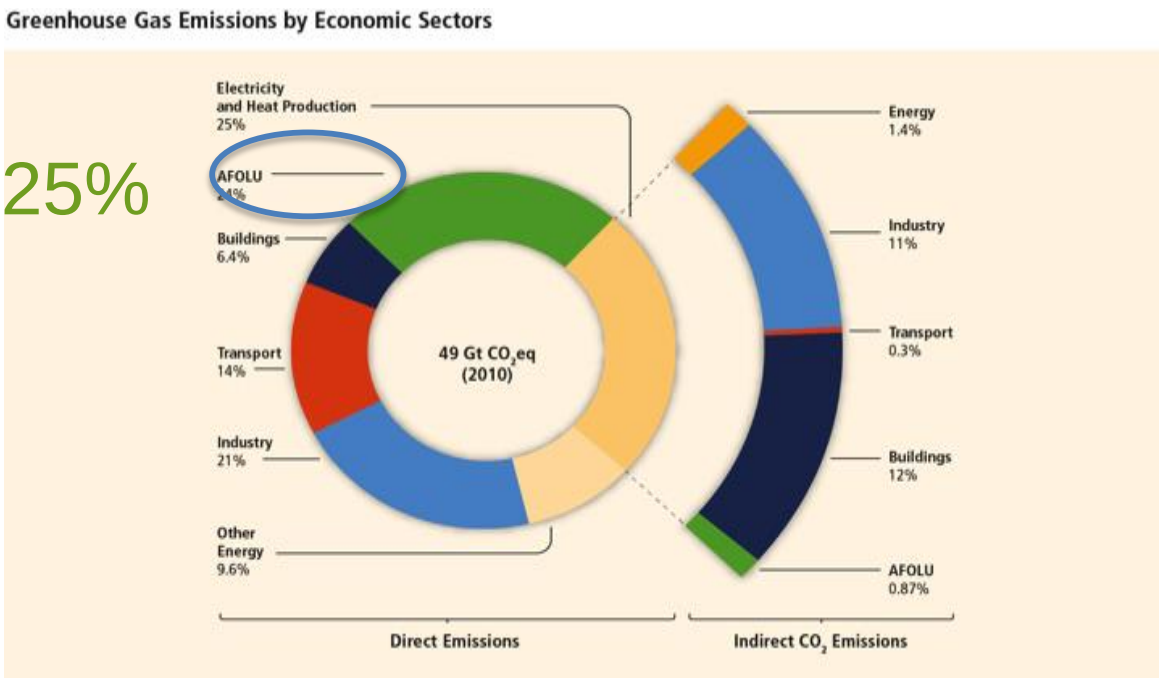
The Emissions Gap Report 2015 – Executive Summary

[UNEP]



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

25%



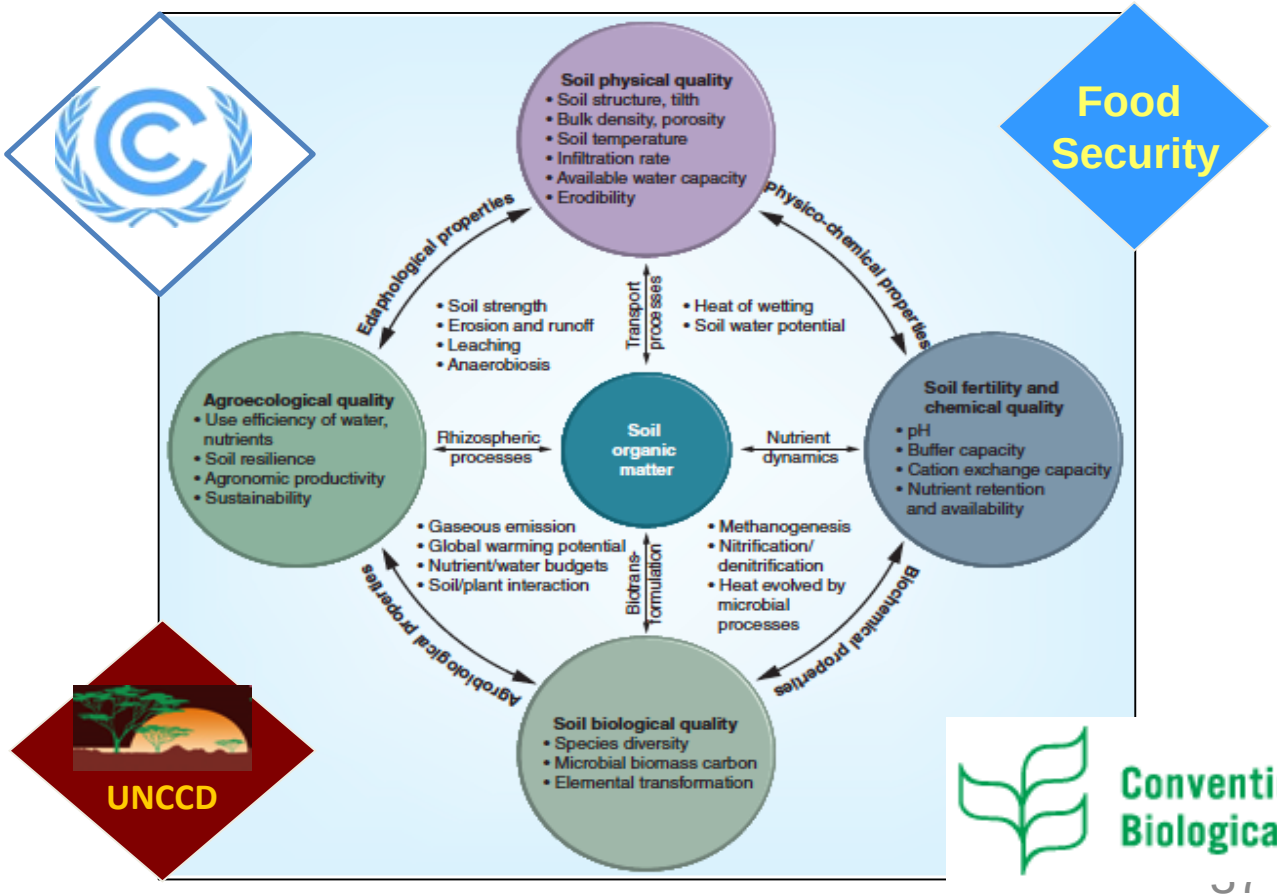
IPCC WGIII AR5

- 92 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

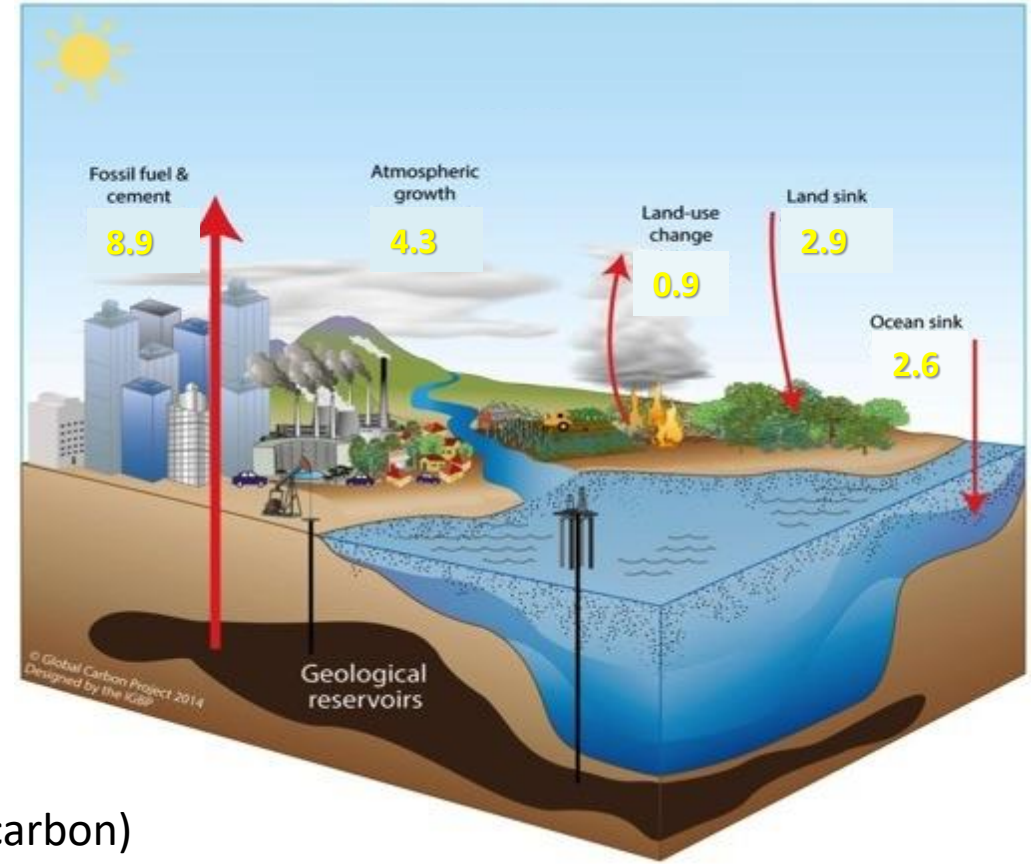


Food Security

UNCCD

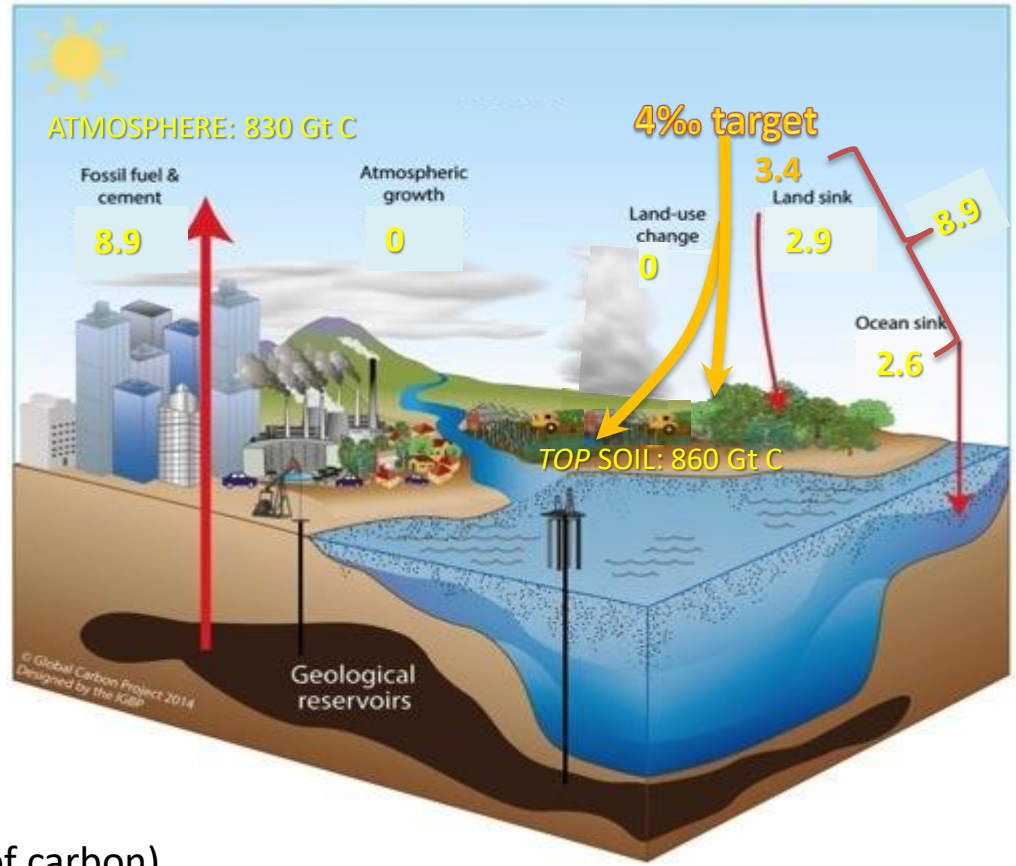
Convention on Biological Diversity

Why 4/1000?



Gt C (billion metric tons of carbon)

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 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℃ 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 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