4 PER 1000. SOILS FOR FOOD SECURITY AND CLIMATE INTERNATIONAL PROGRAM

Marion GUILLOU

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And of the 4p1000 secretariat

Outline

- Why soil carbon?
- The 4 per 1000 aspirational target
- Agricultural practices and their potential
- Linking research and action to create solutions

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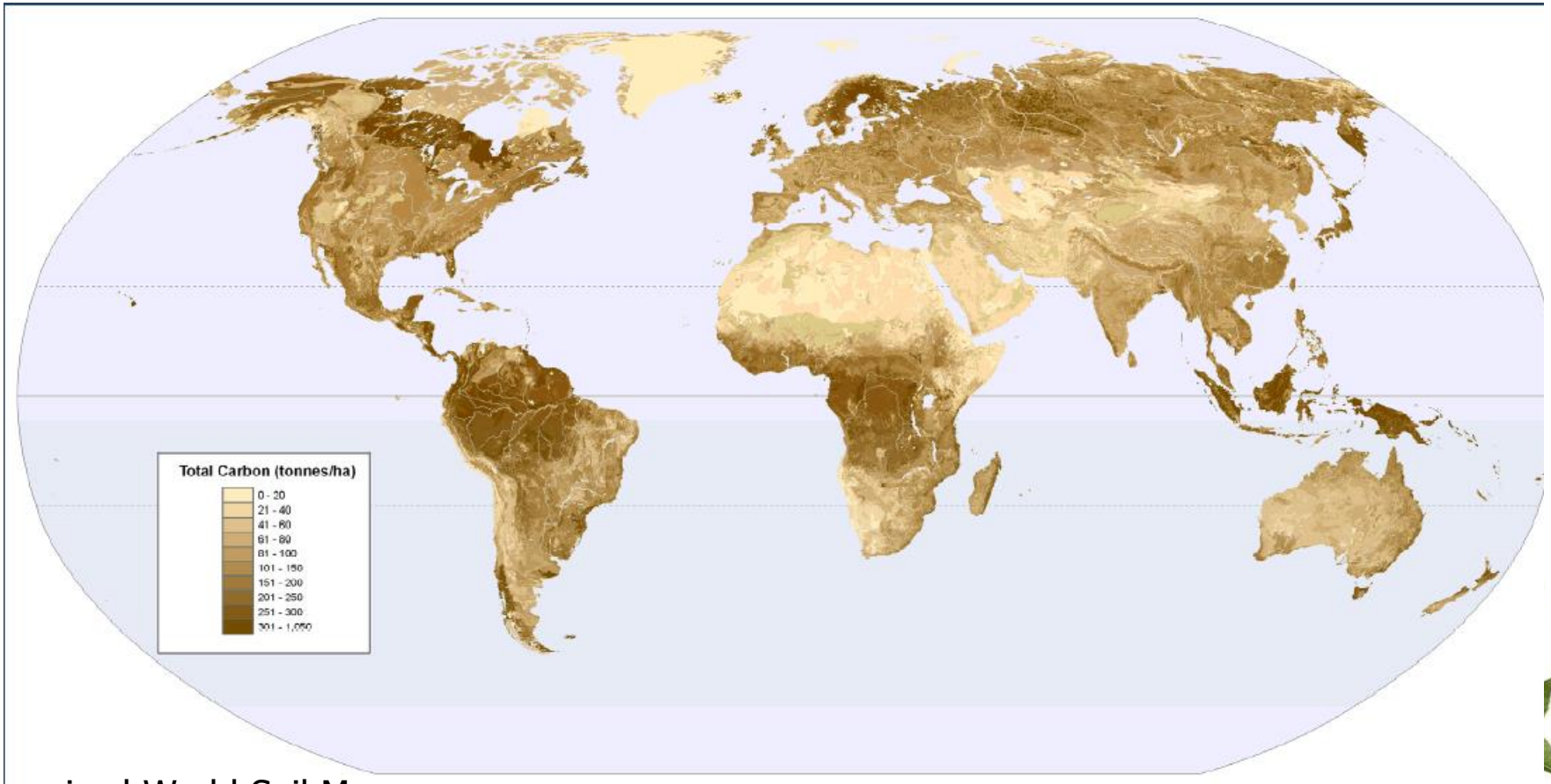
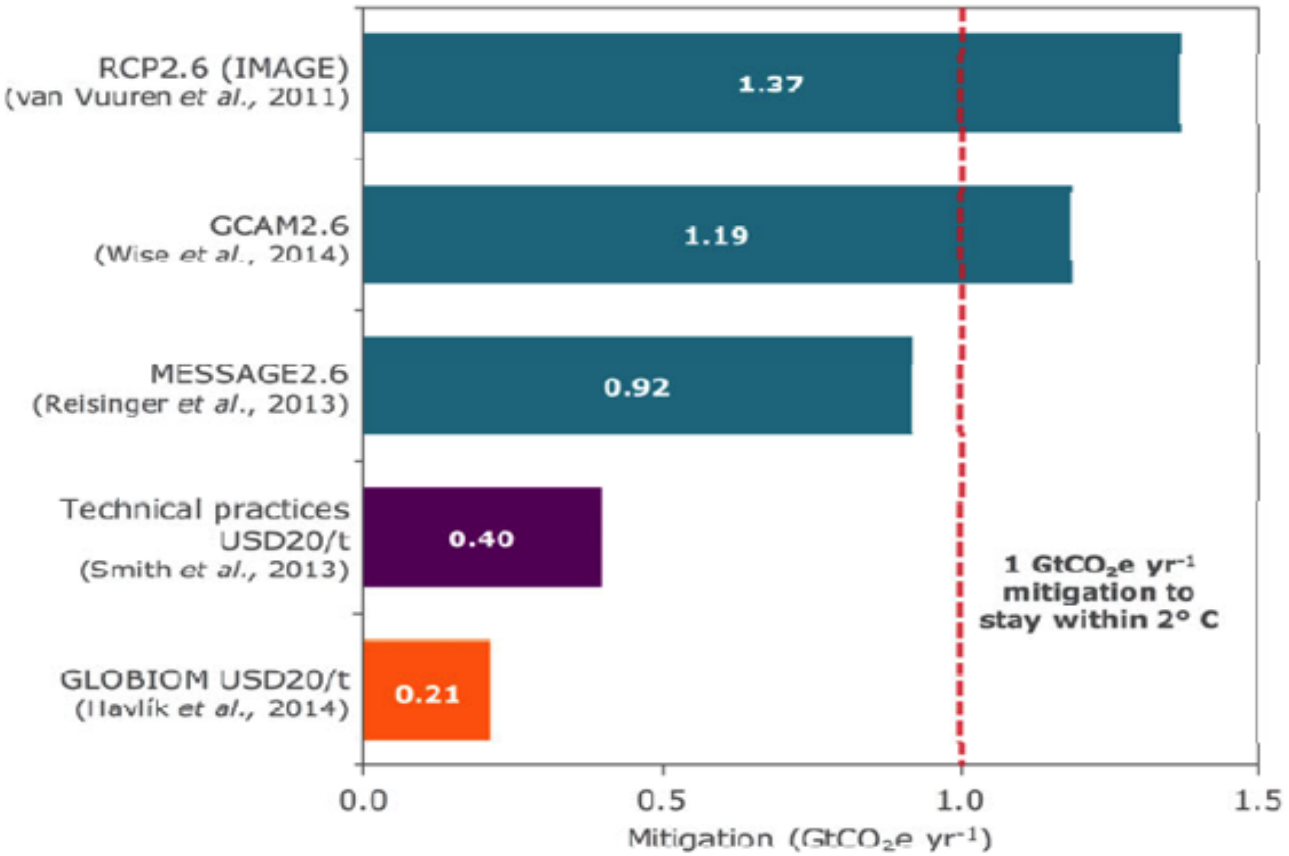
Soils contain two to three times more carbon than the atmosphere



(Harmonized World Soil Map, UNEP, FAO, JRC 2010)

Without soil carbon sequestration, staying withing 2°C cannot be achieved by the agriculture sector by 2030

N_2O and CH_4 mitigation



(Wollenberg et al., 2016, GCB)

Why Soil Carbon?
Co-benefits for adaptation, land degradation neutrality and food security

Half of the agricultural soils are estimated to be **degraded** [FAO, 2006]

The annual cost of **fertilizer to replace nutrients lost to erosion** is US $ 110 – US $ 200 billion (ITPS, 2016).

24-40 million metric tons **additional grains per ton C stored in soils OM** in developing countries [Lal , 2006]

Reduced yield variability after soil restoration leading to increased soil organic matter [Pan et al. , 2009]

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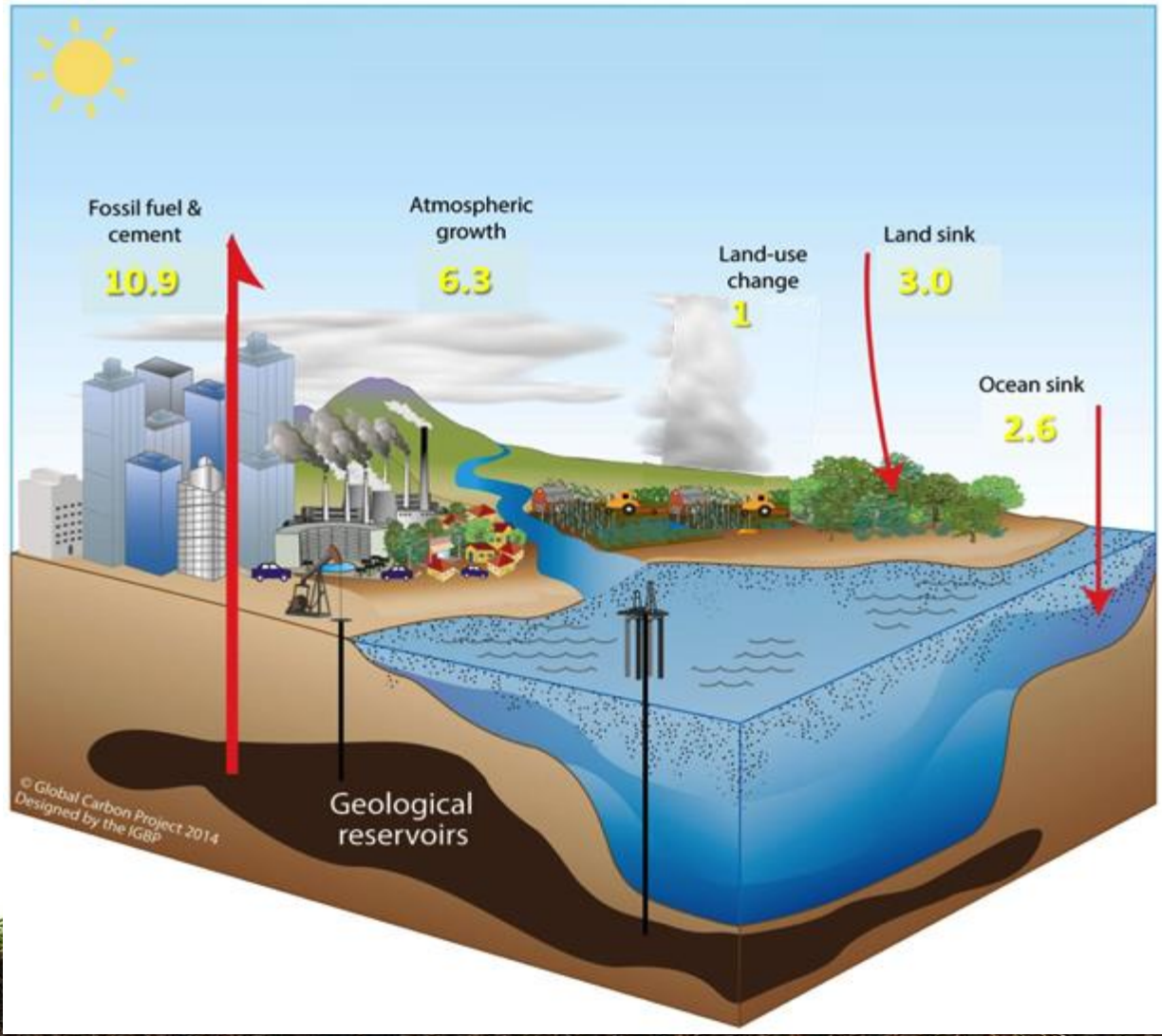
The global carbon cycle in the 2030's based on Paris Agreement NDCs

(assuming no changes in biosphere carbon sinks)

Why 4/1000?



Gt C (billion metric tons of carbon)

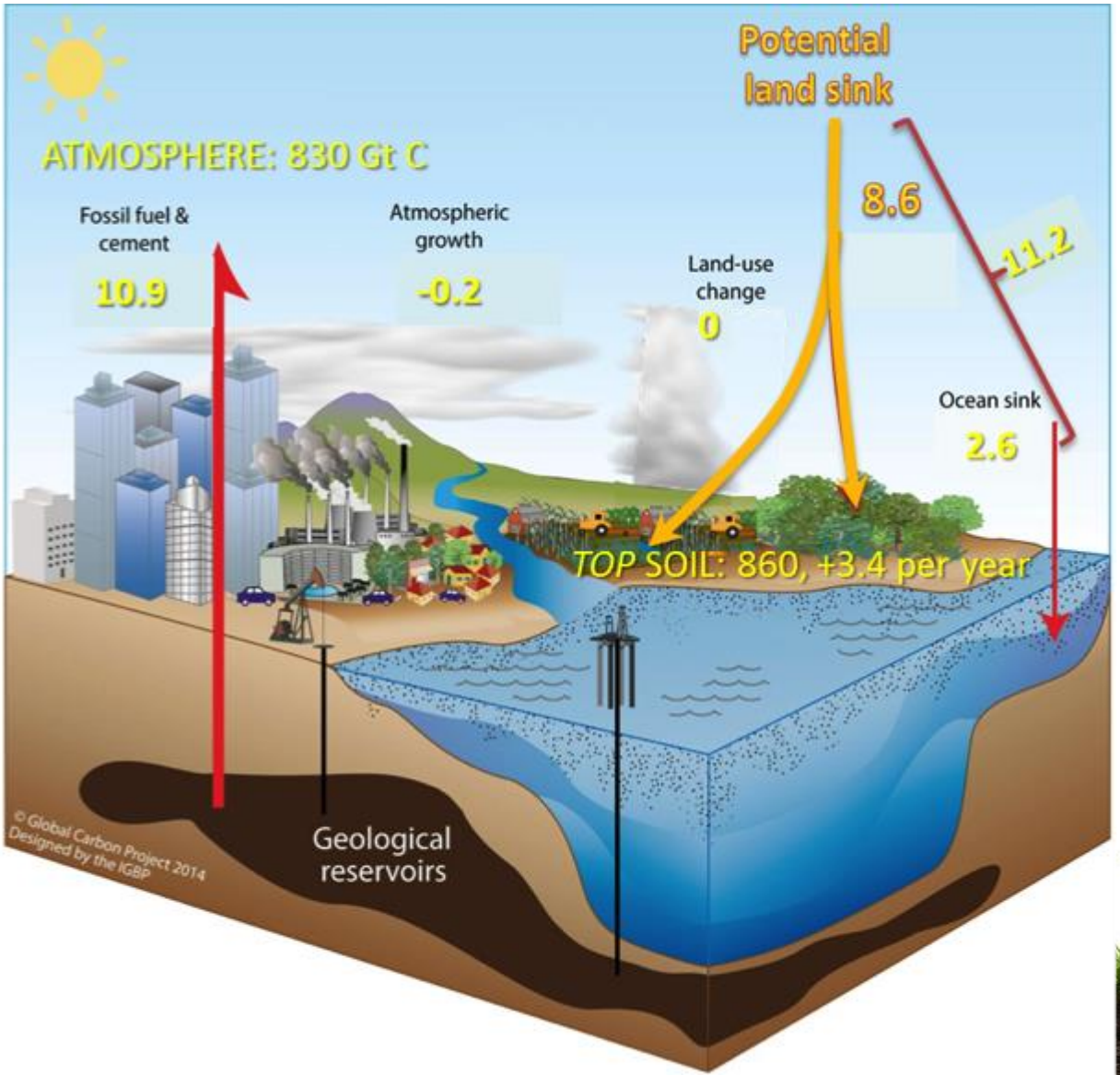
Combining global aspirations for soils and for tropical forests: potential for atmospheric CO_2 stabilization

Measures:

- **halting deforestation & forest degradation,**
- **reforestation & agroforestry,**
- **Agricultural soil management**
- **Desertified & salinized soil restoration**

Total 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)

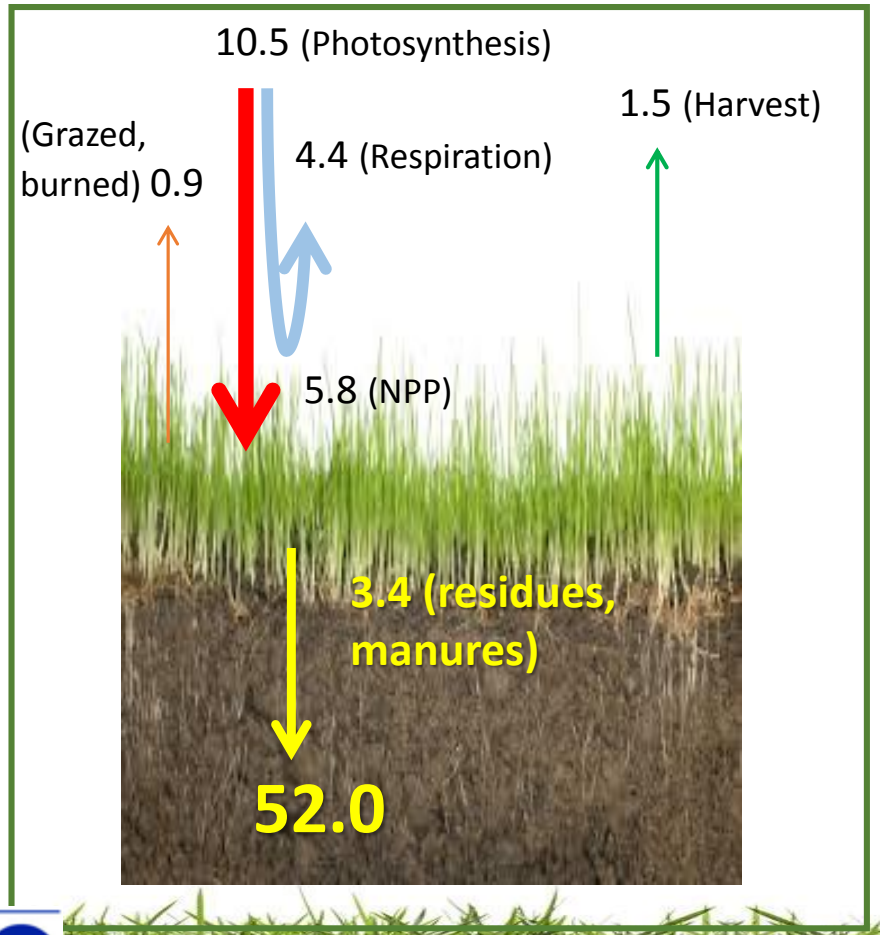


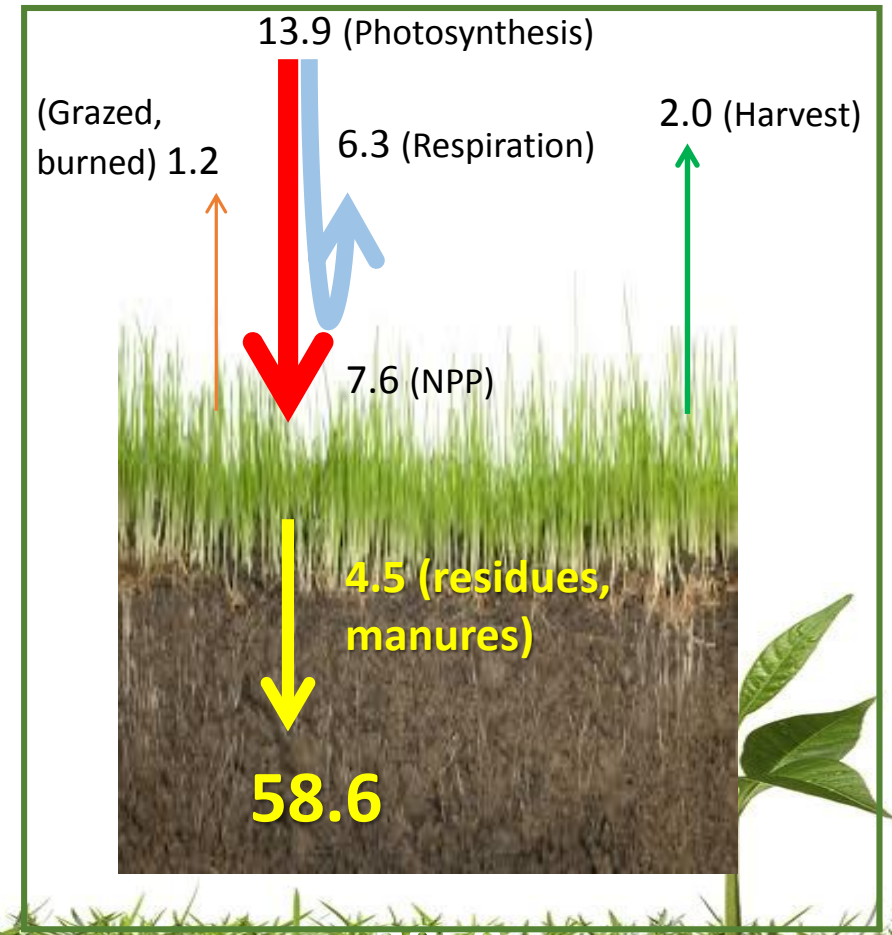
Limits of soil carbon sequestration

- 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 improved practices will need to be **maintained over several decades**,
- Soil phosphorus (P) and nitrogen (N) should be available (root symbioses could help),
- Soil and water management need to be combined, especially in dry regions.

Mean crop carbon cycle change during 30 yrs under 4 per 1000

(Global means, tC/ha)





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Agricultural practices for soil carbon storage

Conservation tillage

Integrated soil fertility management

Rangeland Management

Water management

Agroecology

Agroforestry

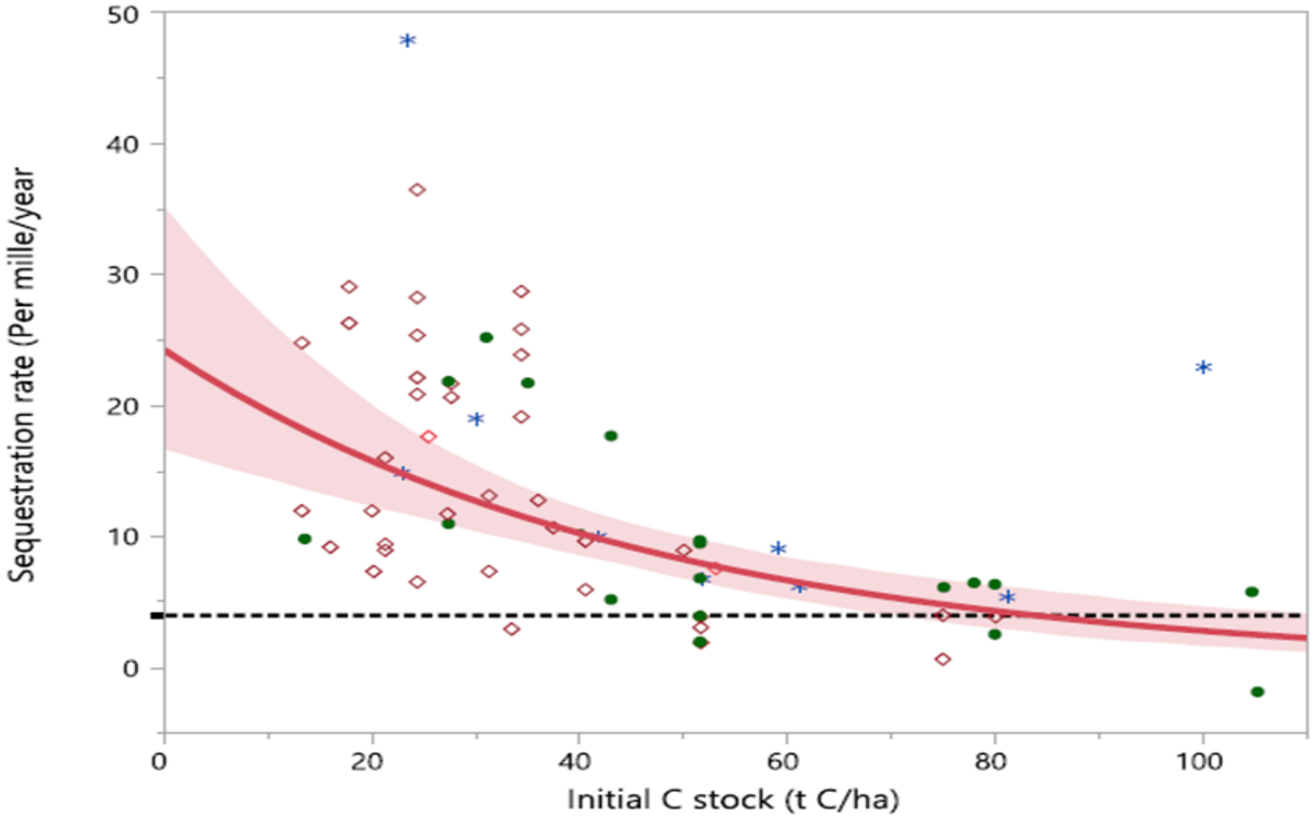
Organic fertilizers

Country	Practice	Impact on soil C (‰ year^{-1})	Reference
Benin	Crop residues incorporation	6 to 8	Kenne et al. 2016
Ivory Coast	Compost 10 t ha^{-1} yr^{-1}	21 to 23 (after 23 years)	Kenne et al. 2016
Cameroon	*Acacia senegal* improved fallow	15 (after 15 years)	D'Andouss Kissi et al. 2013
D. R. Congo	*Acacia auriculiformis* improved fallow	5.6 (after 22 years)	Bisiaux et al. 2009; Gond et al. 2016
France, Région méditerranéenne	Agroforestry : walnut tree and wheat	7 (after 18 years)	Cardinael et al. 2015a, b; 2017

(E. Torquebiau and al., CIRAD)

A 4 per 1000 SOC sequestration rate has often been observed or has been exceeded in long-term arable field trials

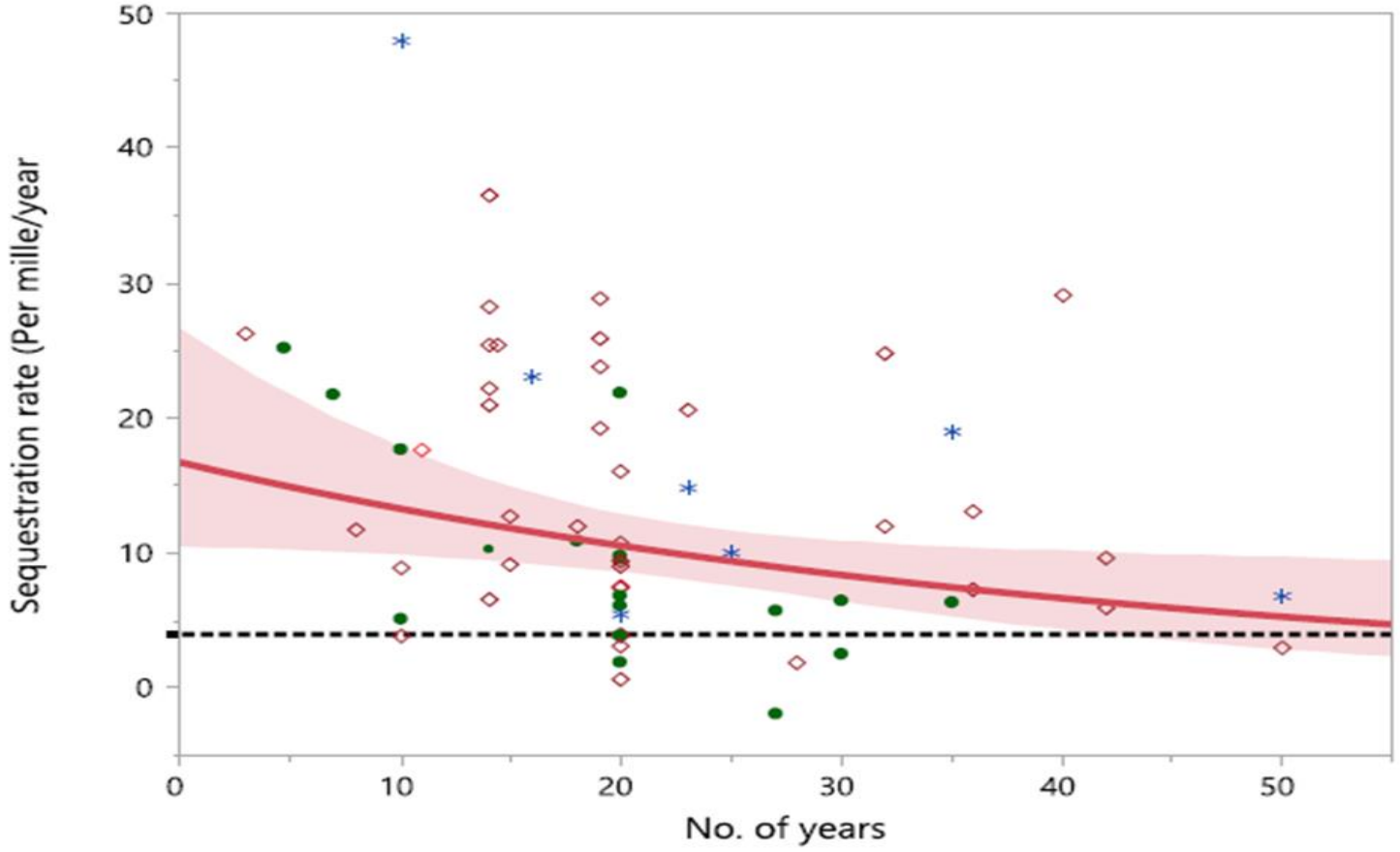
..but the rate declines with initial SOC stock



(Minasny et al., 2016, Geoderma)

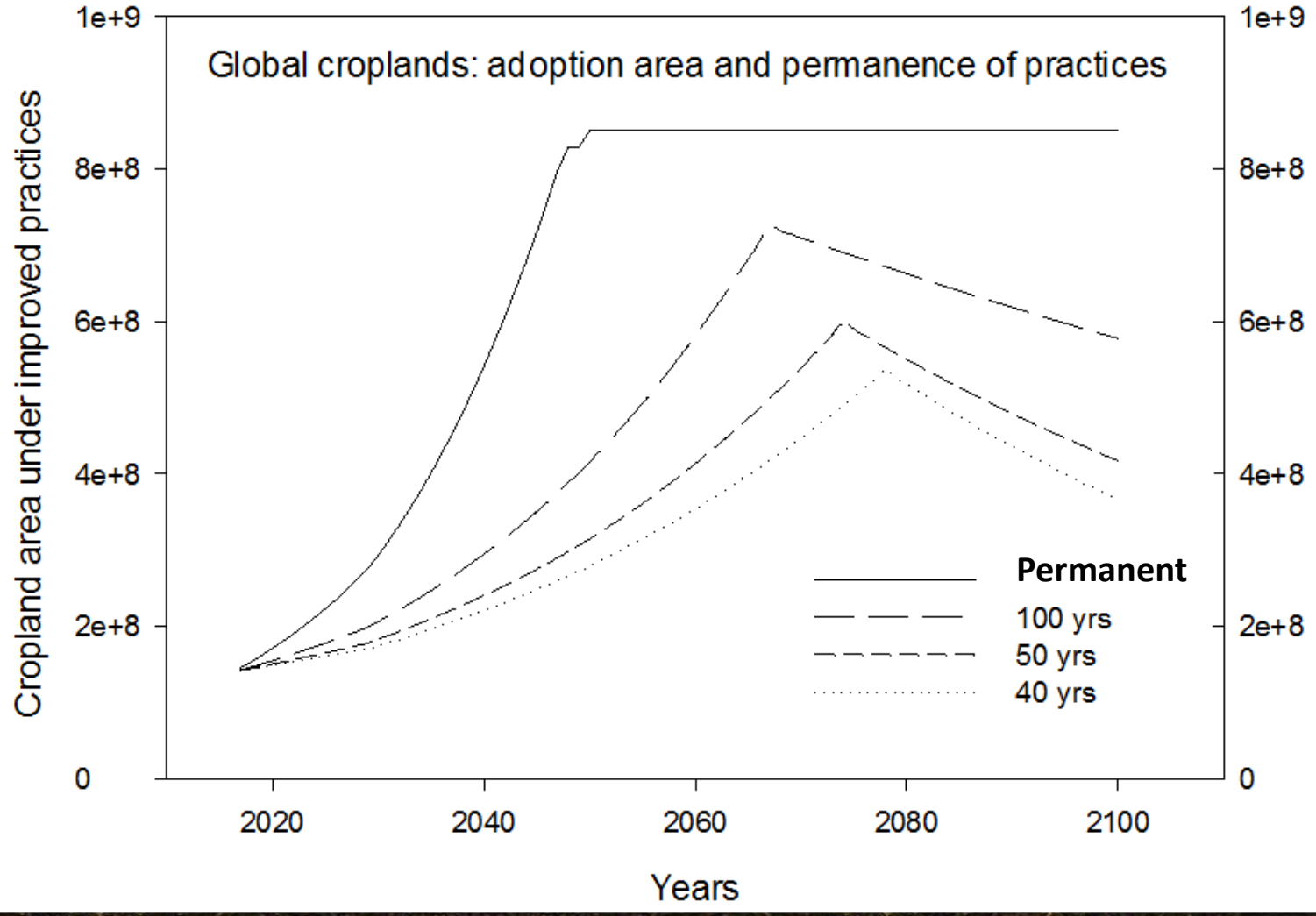
A 4 per 1000 SOC sequestration rate has often been observed or has been exceeded in long-term arable field trials

(over up to 50 yrs)



(Minasny et al., 2016, Geoderma)

Permanence of improved practices is key to achieving soil C sequestration potential



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An integrated research and implementation platform

A Scientific and Technical Committee in charge of supervisity

RESEARCH PERSPECTIVE

Science and technology

Basic research on soil–plant processes

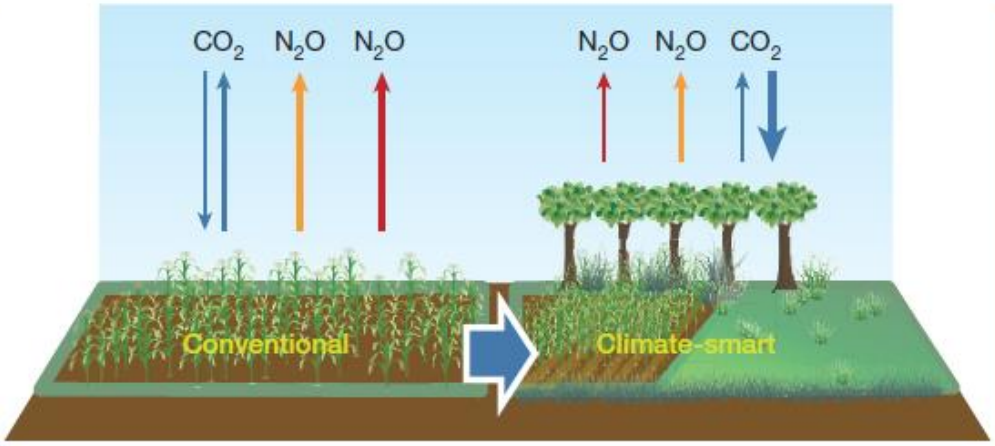
Research measurement networks

Soil monitoring networks

Advanced greenhouse gas networks

Remote sensing

Spatial databases and model integration



Practices

Reduced tillage

Biochar

Land restoration

Improved crop rotations

Organic amendments

Nutrient management

Cover crops

Agroforestry

Implementation

National and international greenhouse gas mitigation programme

Greenhouse gas offset and ecosystem service markets

Agricultural product supply chain management

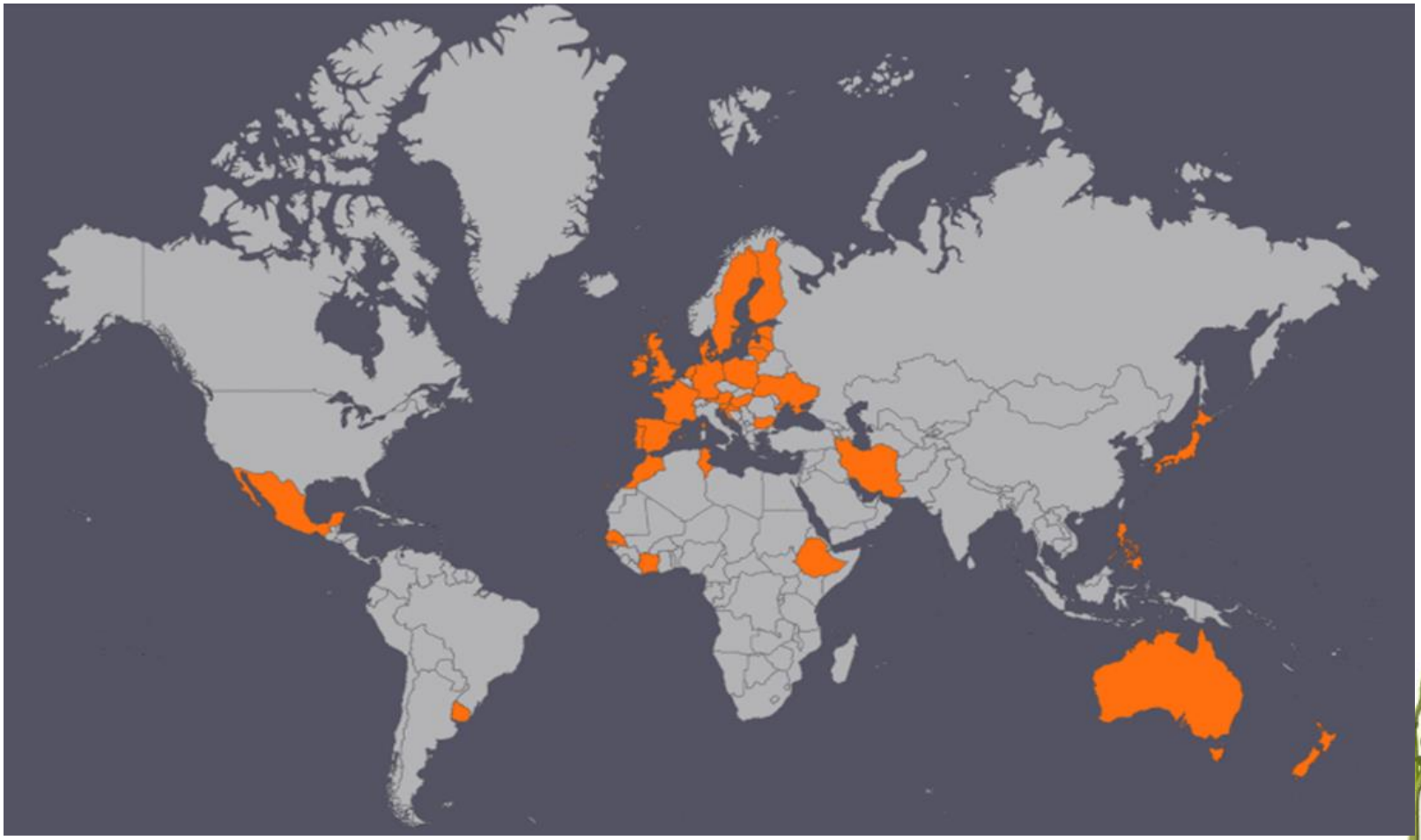
Decision-support systems

Land-user engagement

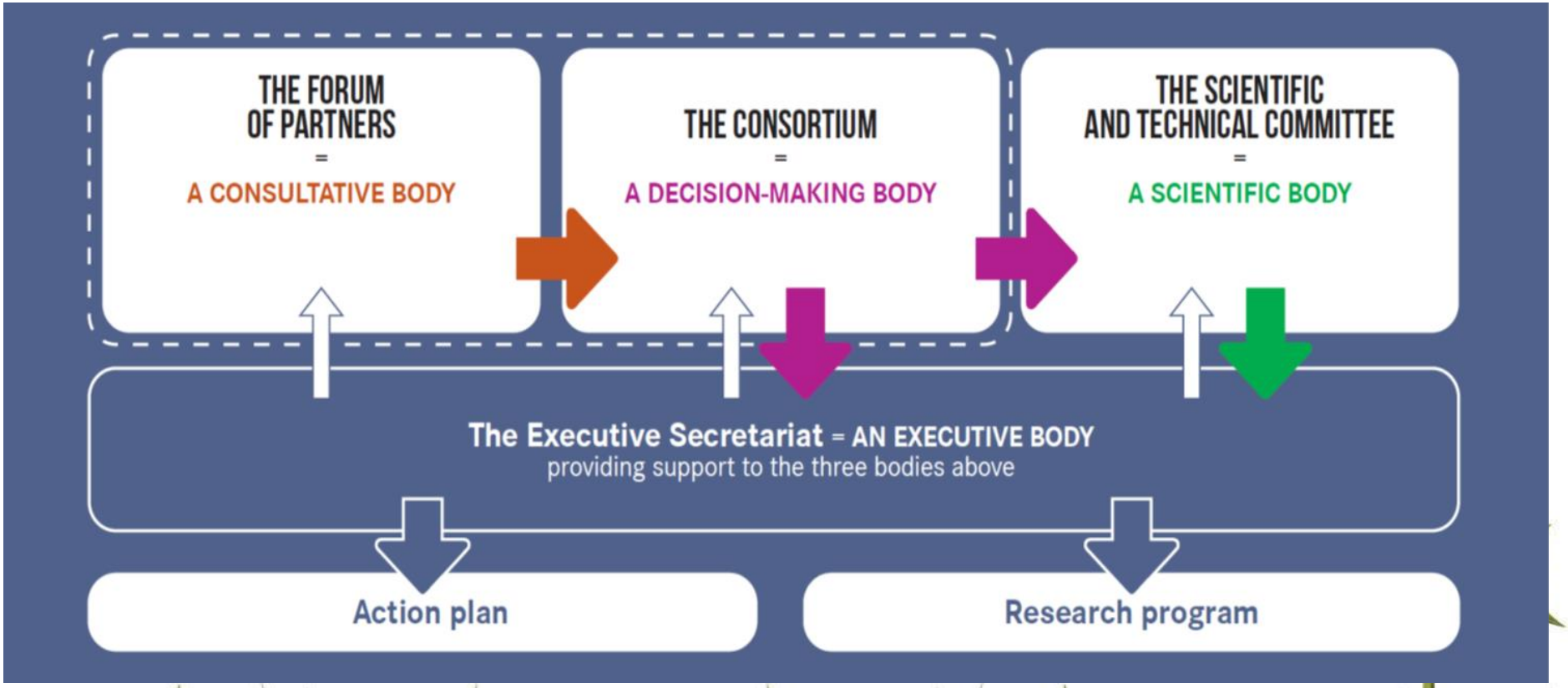
(Paustian et al., 2016, Nature)

4 per 1000 Soils for Food Security and Climate

Countries members of the Forum



Governance bodies



Thank you for your attention

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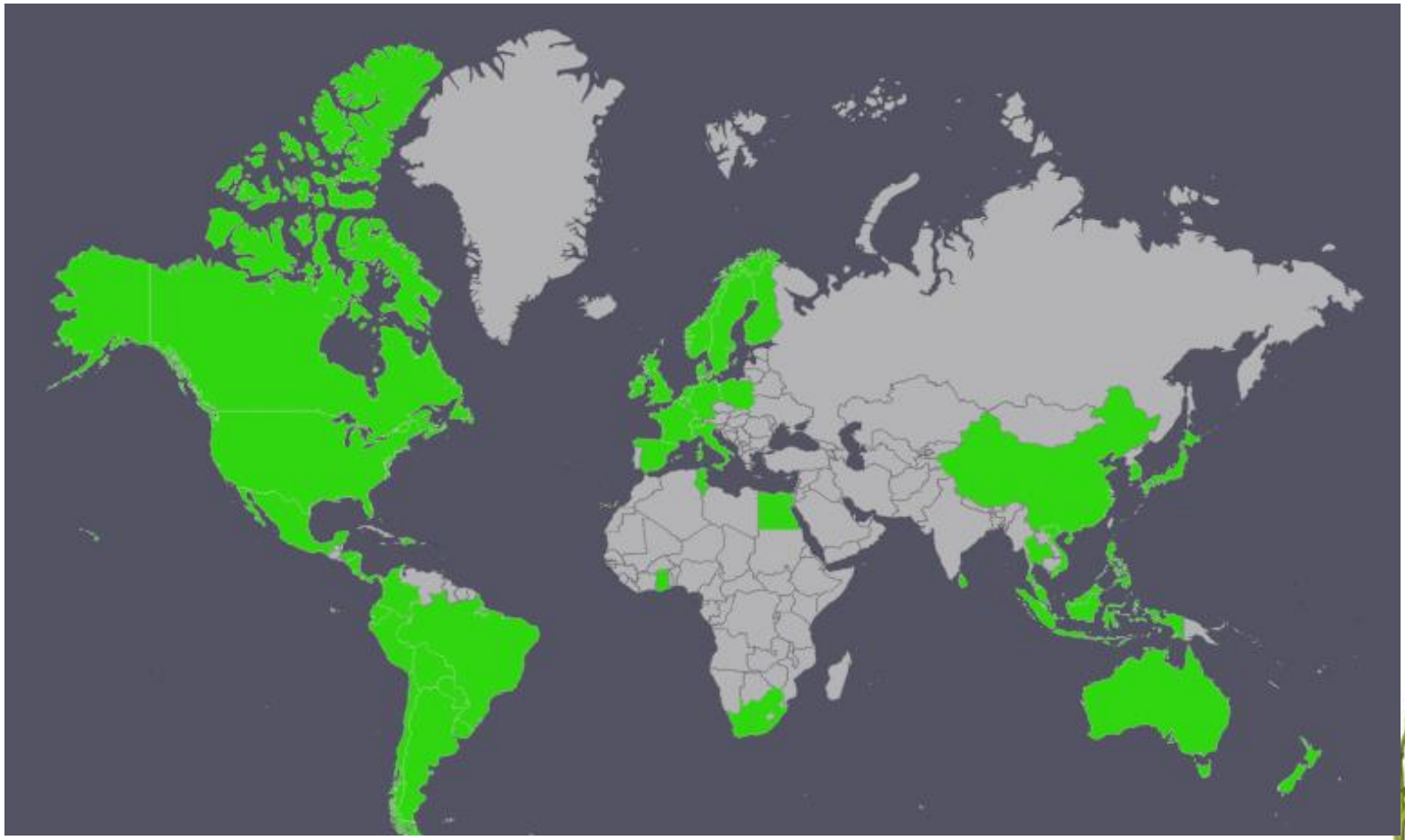
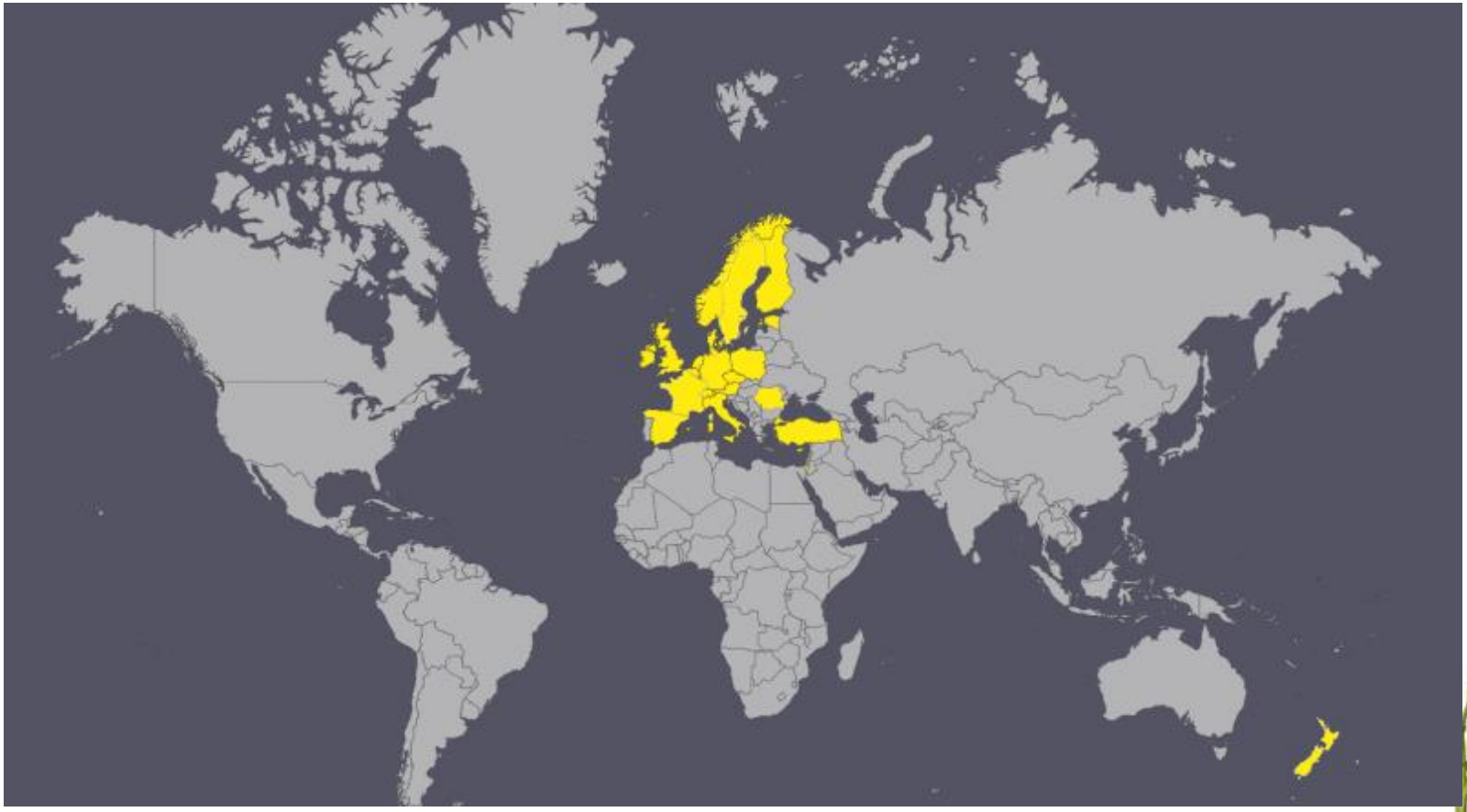
Global Research Alliance on Agricultural Greenhouse Gases



GRA – Member countries

Agriculture, Food Security and Climate Change
Joint Programing of Research

TAP Soil : Thematic Annual Programing: refers to 4 per 1000



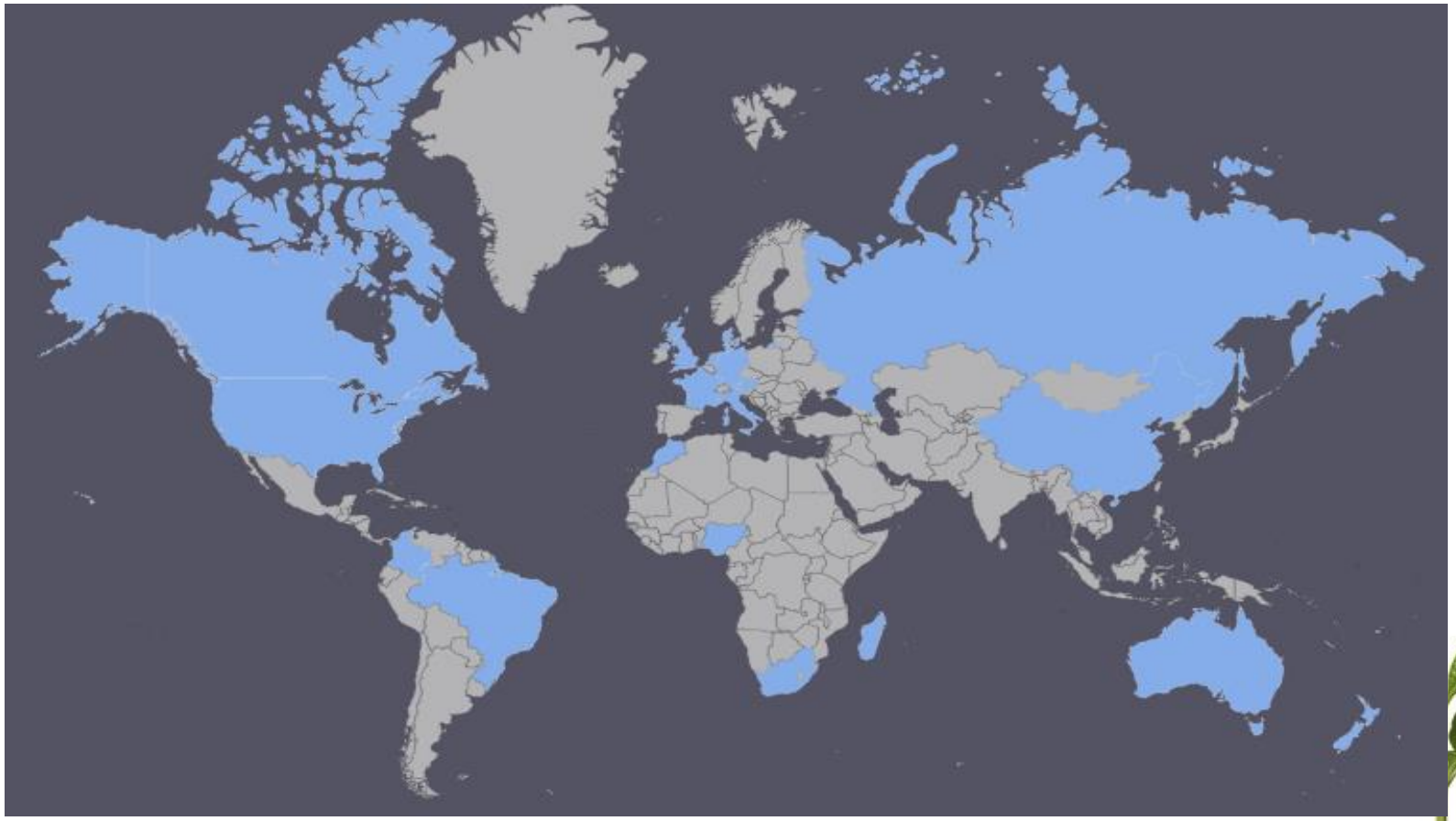
FACCE – JPI members states

Climate Change Agriculture and Food Security

A CGIAR program contributing to 4 per 1000 research

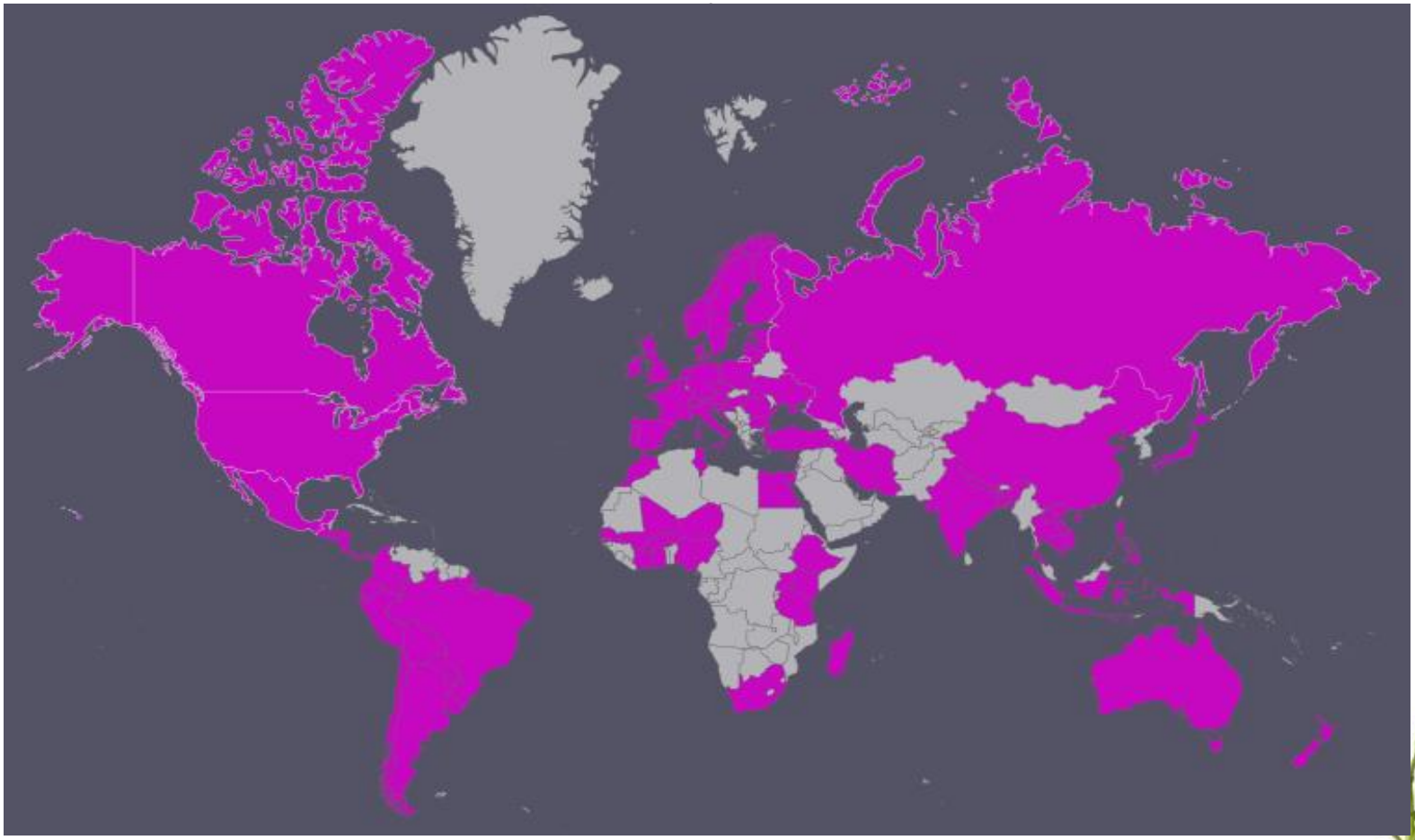
Horizon 2020 – SFS50 (2017) call for a research

Coordination and Support Action will include 4 per 1000, GRA and FACCE JPI: CIRCASA proposal



CIRCASA partners (proposal to be submitted in Feb. 2017)

Our vision: a better coordinated research on agricultural soil carbon sequestration spanning at least 82 countries and 85% of global



Total countries
including 4 per 1000, GRA, FACCE JPI, CCAFS & CIRCASA