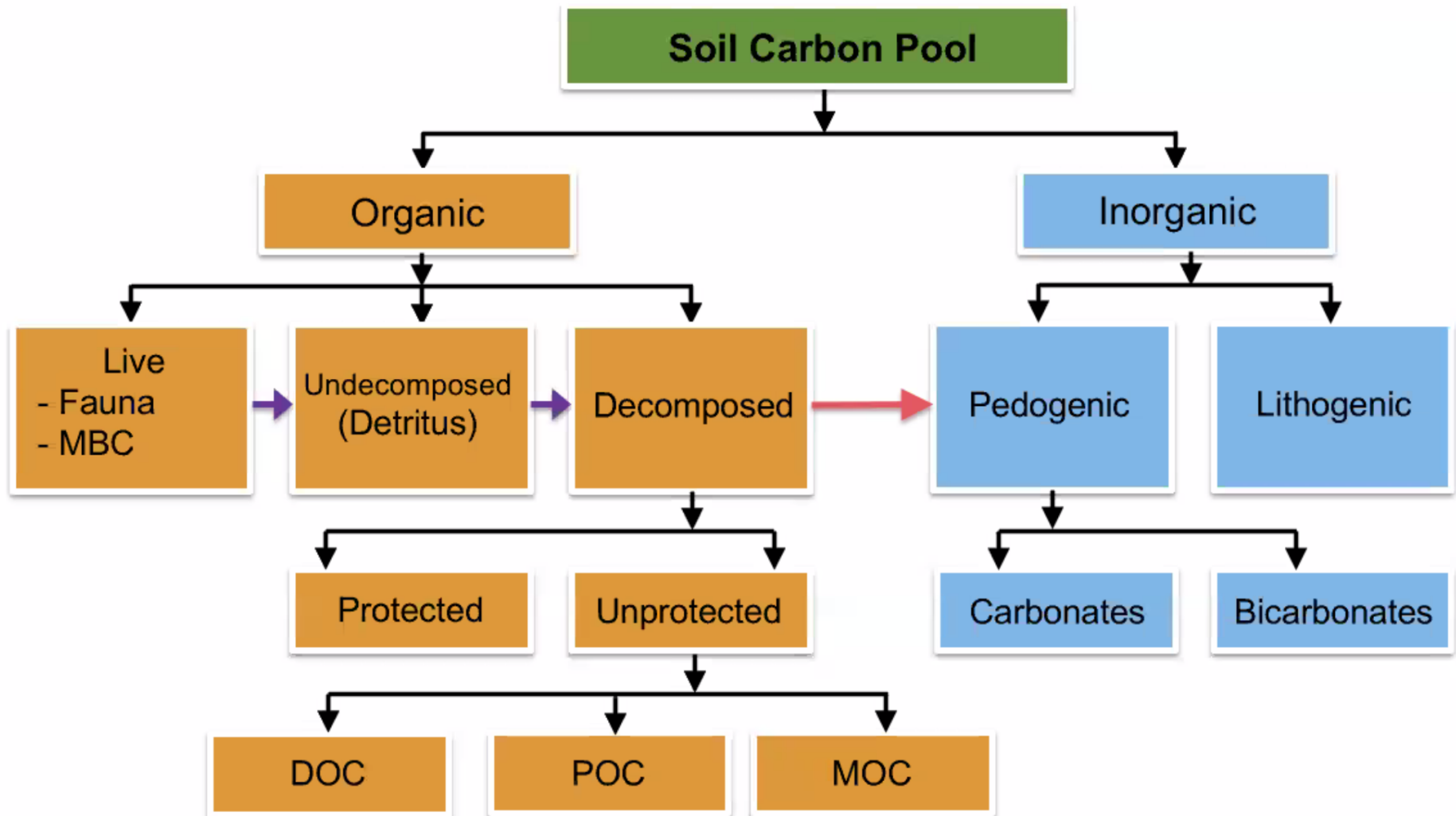




# COMPONENTS OF SOIL CARBON POOL





## TECHNICAL POTENTIAL OF C SEQUESTRATION

I. **Soils** ..... 1.45 – 3.44 Pg C/yr (2.45 Pg C/yr)

*Lal (2018)*

### II. Terrestrial Biosphere by 2100

- Soils ..... 178 Pg

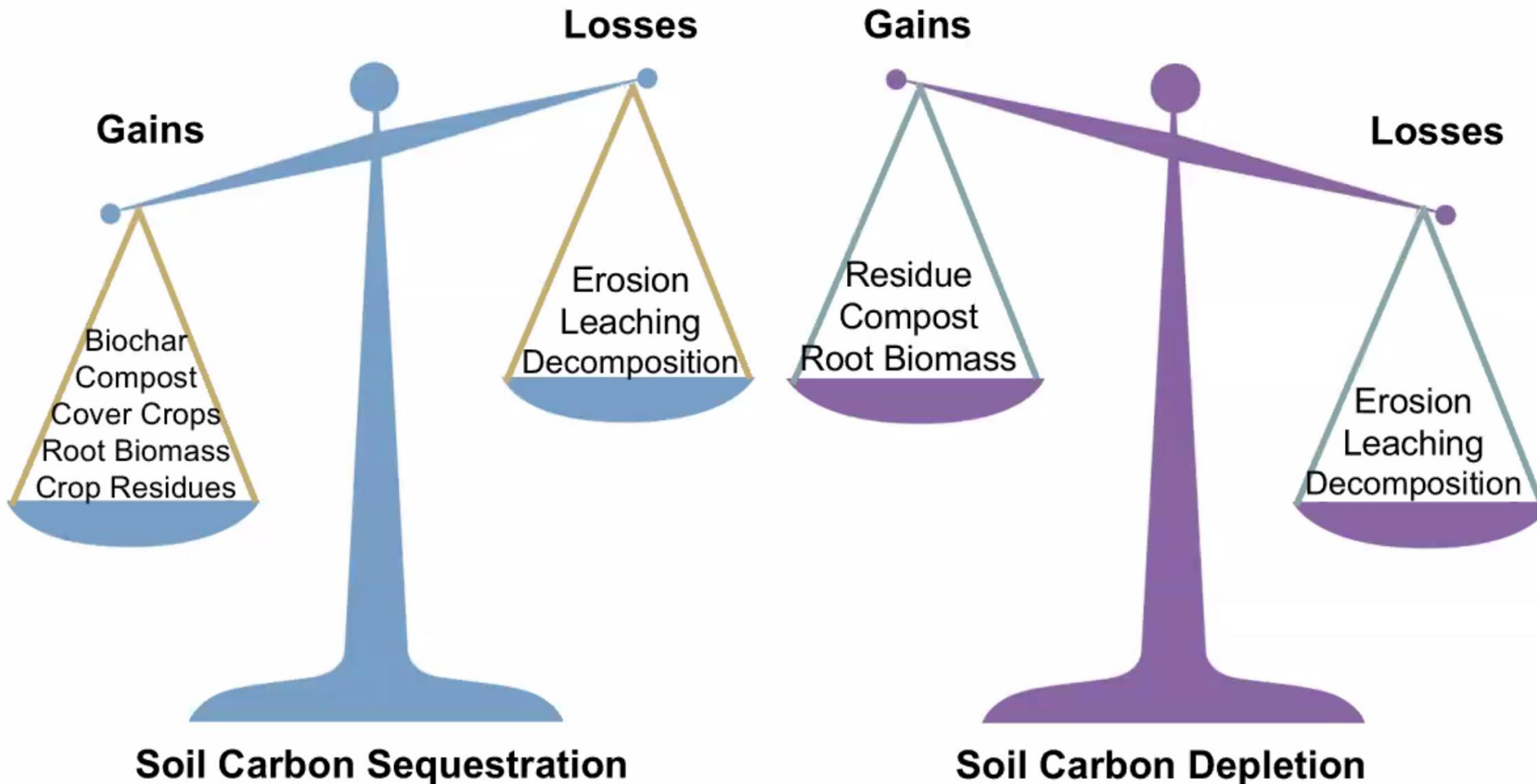
- Vegetation ..... 155 Pg

**Total** 333 Pg (157 ppm CO<sub>2</sub>)

*Lal et al. (2018)*



# CREATING POSITIVE C BUDGET





## SOC MEASUREMENT FOR TRADING CARBON CREDITS

<b><u>Quantity:</u></b>	SOC stock (Mg C/ha)
<b><u>Depth:</u></b>	1-m or more
<b><u>Frequency:</u></b>	1-5 yr. depending on land use
<b><u>Precision:</u></b>	Whole # in Mg/ha
<b><u>Scale:</u></b>	Landscape or farm scale

With the first measurement of SOC in 1850,  
there have been numerous advances since 2000  
(i.e., LIBS, INS)



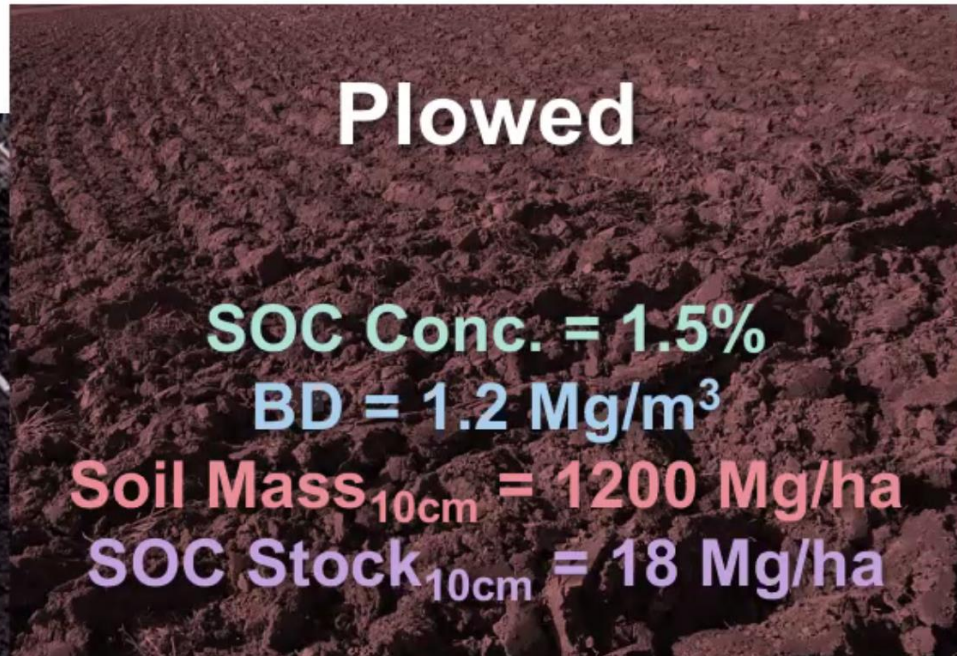
II. Suppose half of the land is plowed. Soil bulk density of the plowed half has decreased to 1.2 Mg/m<sup>3</sup> but SOC content is the same. If the SOC stock is calculated on an equal depth basis, it is lower in the plowed than in the unplowed field.



**No Till**

SOC Conc. = 1.5%  
BD = 1.4 Mg/m<sup>3</sup>

Soil Mass<sub>10cm</sub> = 1400 Mg/ha  
SOC Stock<sub>10cm</sub> = 21 Mg/ha



**Plowed**

SOC Conc. = 1.5%  
BD = 1.2 Mg/m<sup>3</sup>

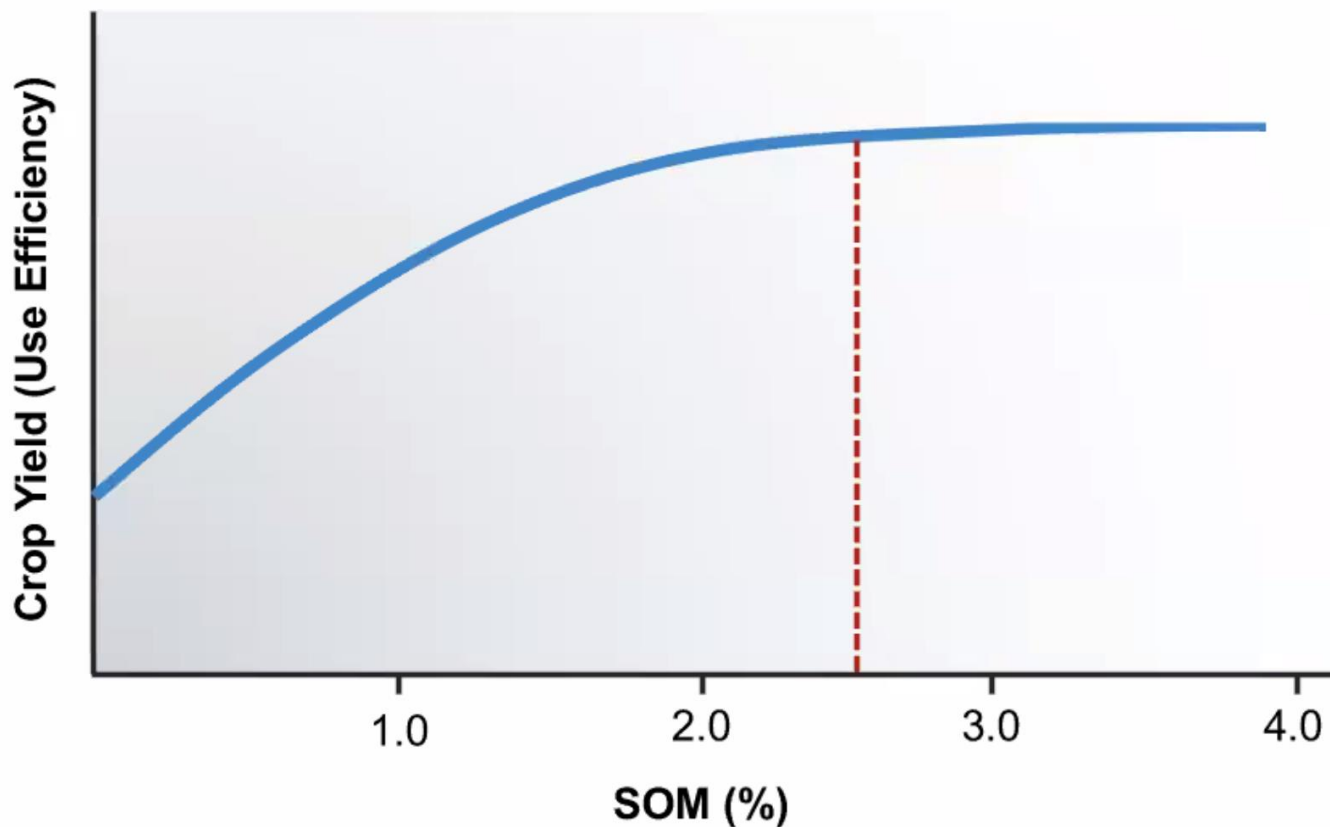
Soil Mass<sub>10cm</sub> = 1200 Mg/ha  
SOC Stock<sub>10cm</sub> = 18 Mg/ha



## THRESHOLD LEVEL OF SOIL ORGANIC MATTER IN 0-30CM LAYER

**SOM** : 2.5 - 3.5%

**SOC** : 1.5 - 2.0%





## PAUCITY OF SCIENTIFIC DATA

- Research data on rate of SOC and SIC sequestration, soil C sink capacity, effectiveness of RMPs for land use and soil/crop/animal management, and the magnitude of SOC sequestration and MRT are not widely available.
- While the importance of SOC pool to agronomic sustainability has long been recognized (Jenny 1941), the societal value of soil C needs to be determined (Lal 2014).
- **SOC effects on productivity and use efficiency must be determined for site-specific conditions.**
- **Global maps are needed for SOC and SIC stocks at 1:10,000 scale.**



Soil organic carbon sequestration is feasible and the potential is large...



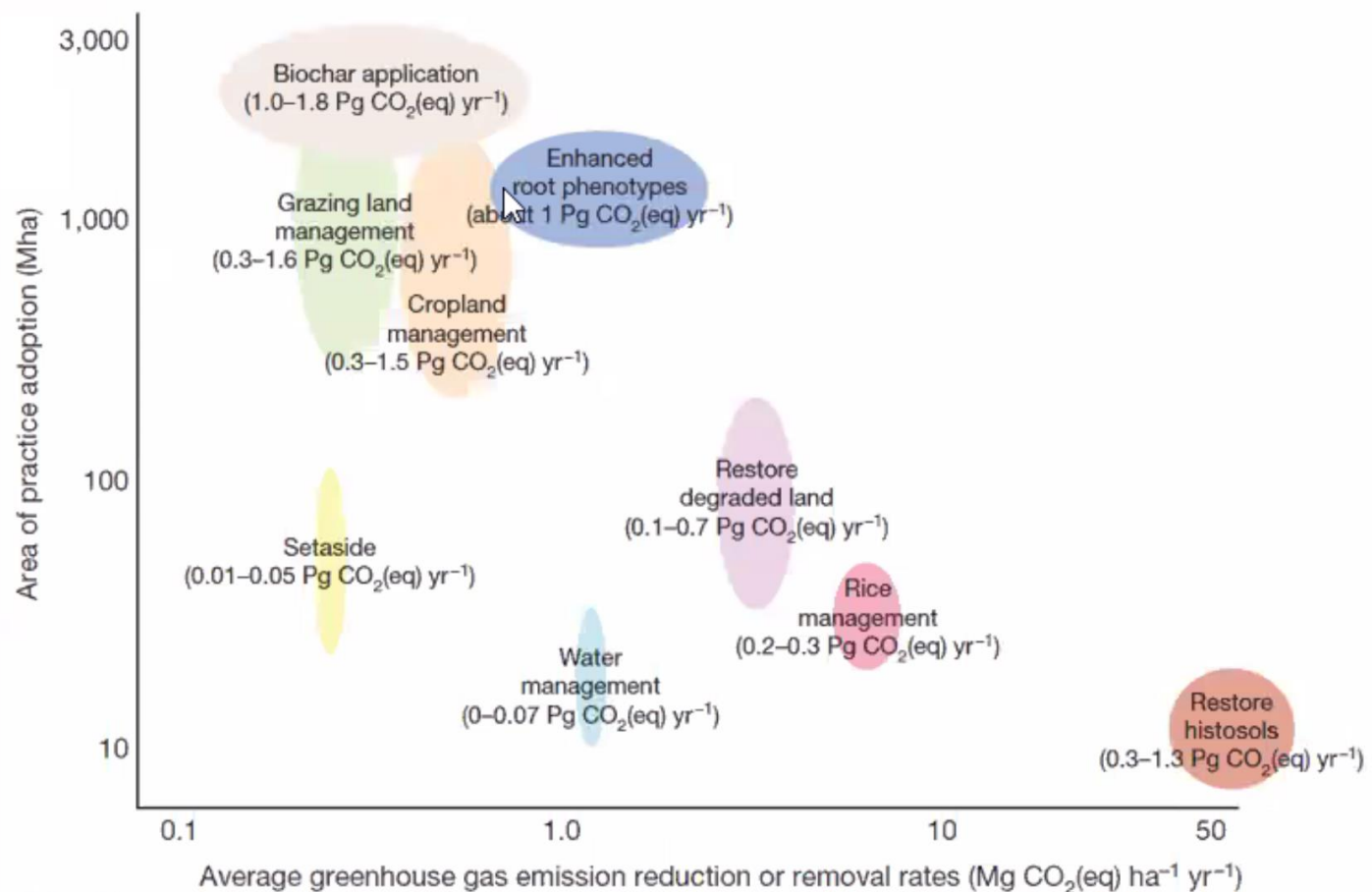
Prof. Pete Smith



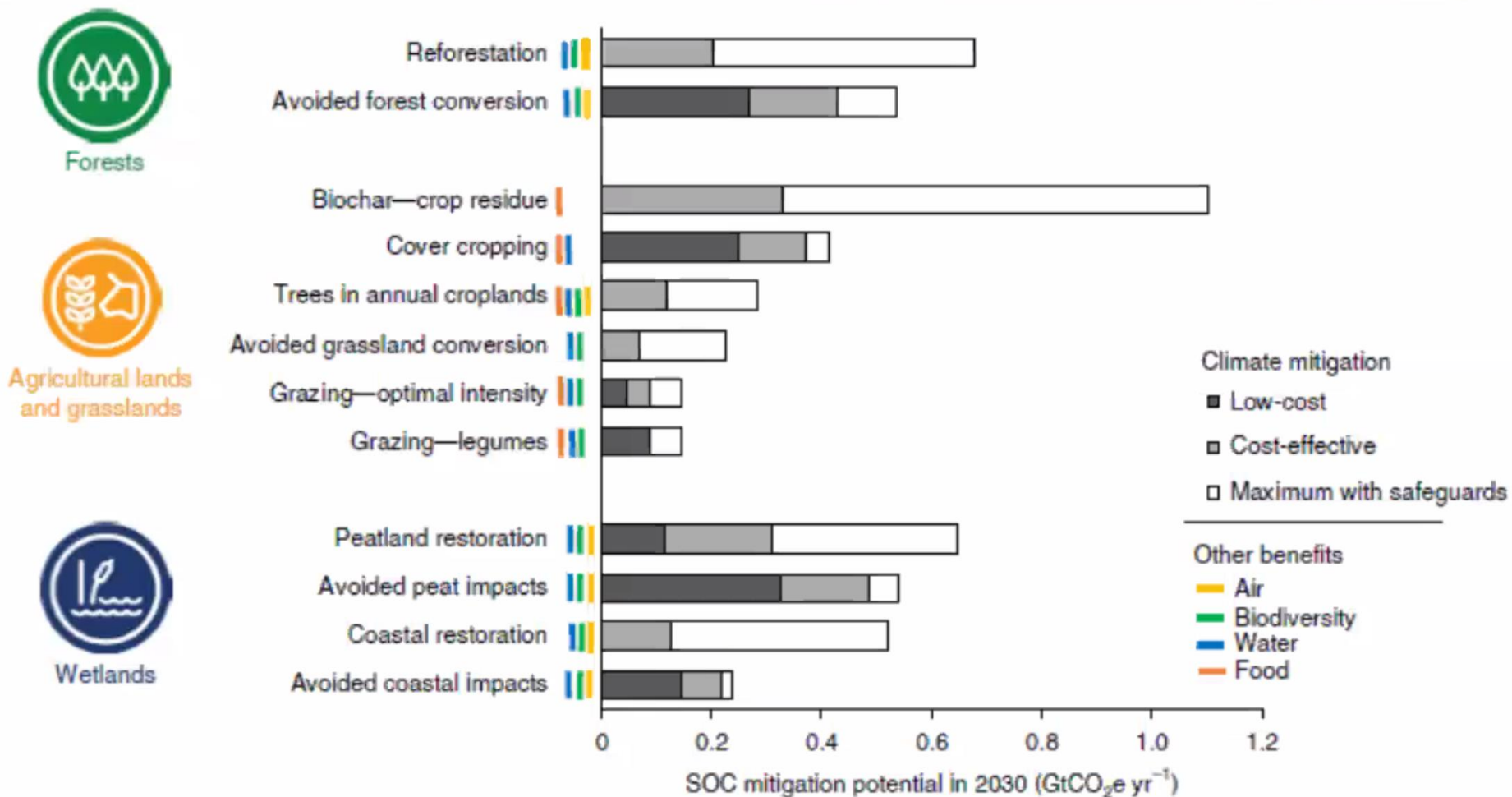
# Soil C sequestration – global mitigation potentials

Technical potential = **1.3 Gt Ceq/yr**

Economic potential at 20-100 US\$/tCO<sub>2</sub>eq = **0.4-0.7 Gt Ceq/yr**



# Additional SOC storage potential for 12 natural pathways to climate mitigation



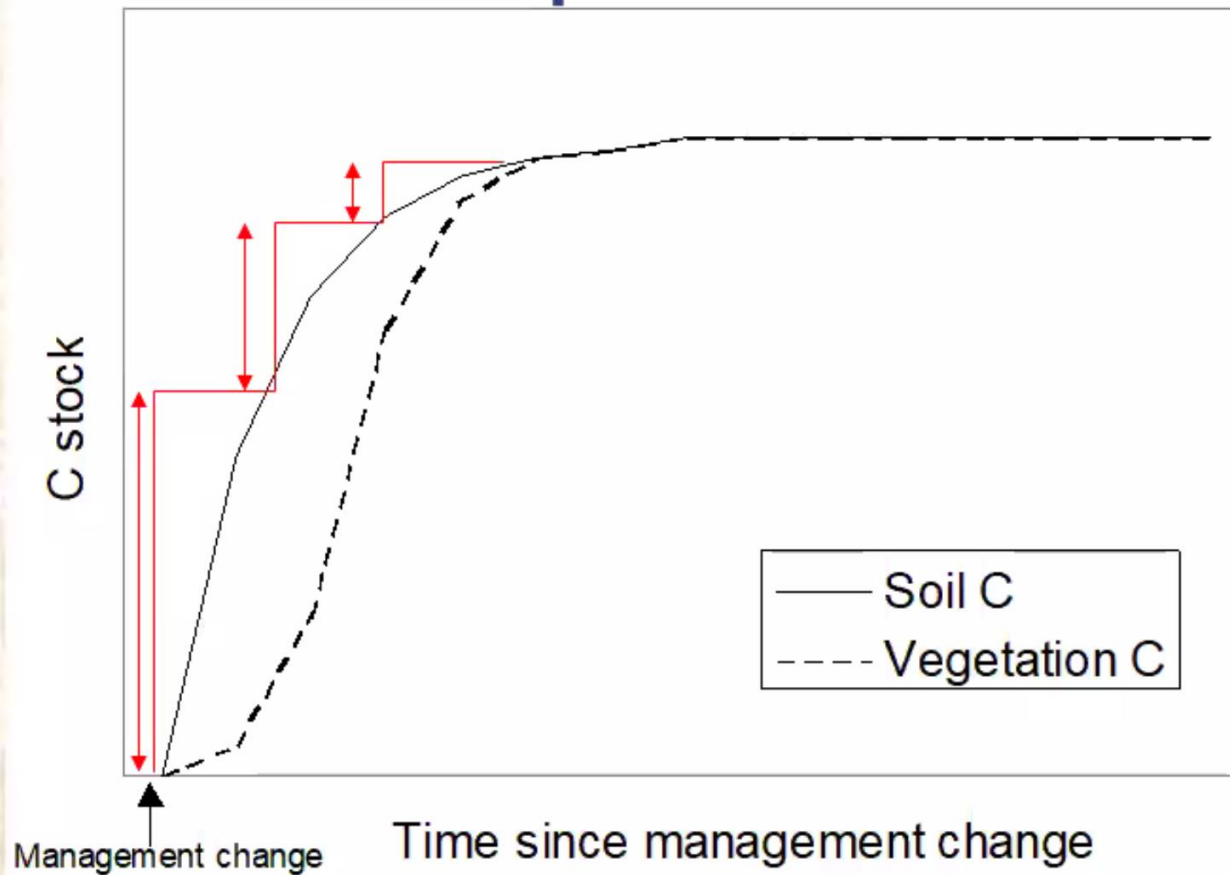
# Beneficial impacts for Soil C sequestration on ecosystem services and the UN SDGs



## Smith (2008) International Journal of Agricultural Sustainability 6(3),169–170

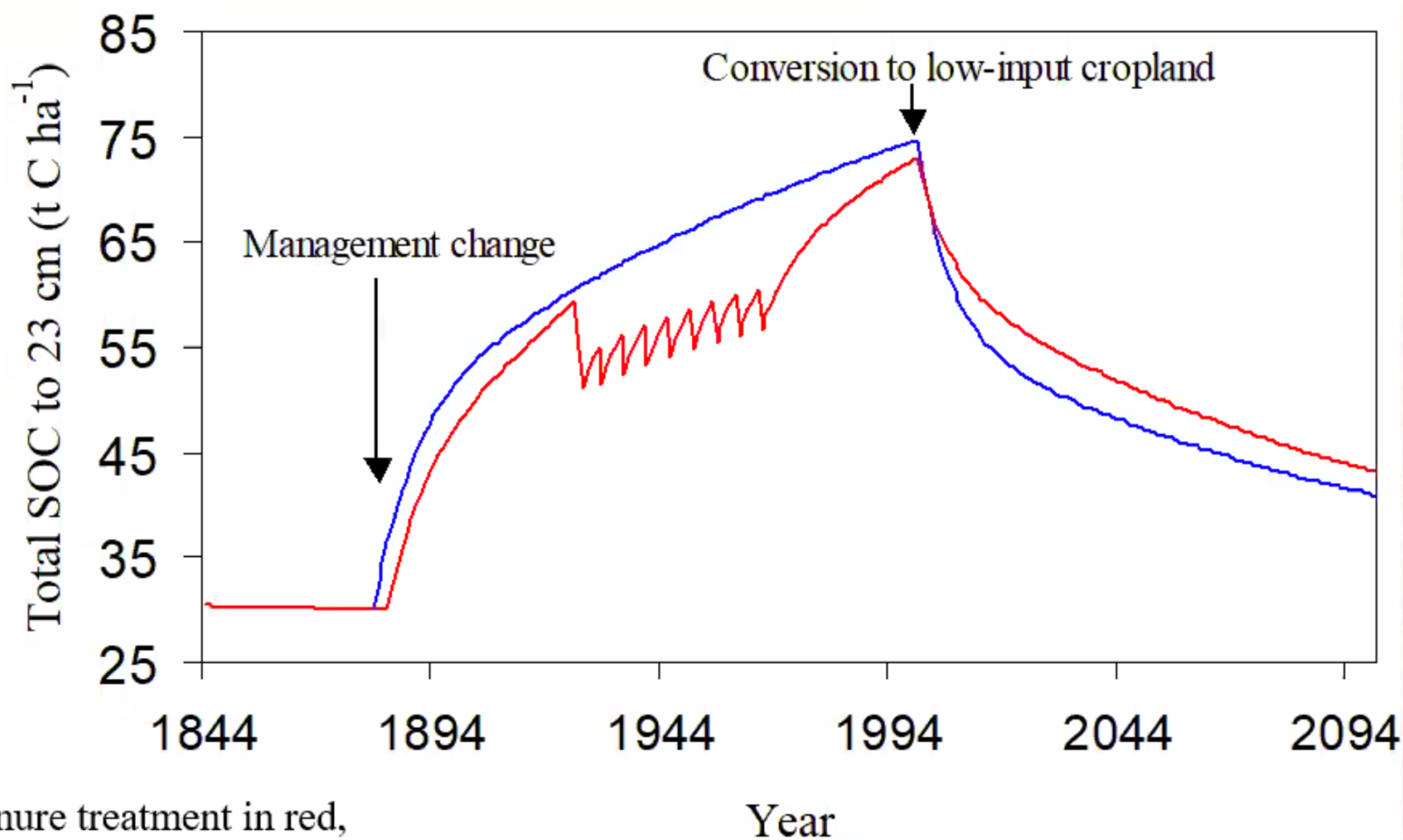
- “There are a number of well rehearsed arguments against reliance on carbon sequestration for tackling climate change, involving **saturation** of the carbon sink (the carbon is only removed from the atmosphere while the tree is growing or until the soil reaches a new equilibrium soil carbon level; Smith, 2005), **permanence** (carbon sinks can be reversed at any stage by deforestation or poor soil management; Smith, 2005), **leakage/displacement** (e.g. planting trees in one area leads to deforestation in another; Intergovernmental Panel on Climate Change (IPCC), 2000), **verification** issues (can the sinks be measured; Smith, 2004), and **total effectiveness relative to emission reduction** targets (only a fraction of the reduction can be achieved through sinks; IPCC, 2007)”.

# Saturation – the time course of C sequestration



- Sink saturation ~ 20-100 years
- Sink strength declines towards new equilibrium

# Permanence



Manure treatment in red,  
Woodland in blue

Smith (2005)

# Leakage / displacement: are we actually sequestering carbon or just moving it about?

Manure



Farm with more manure

Manure

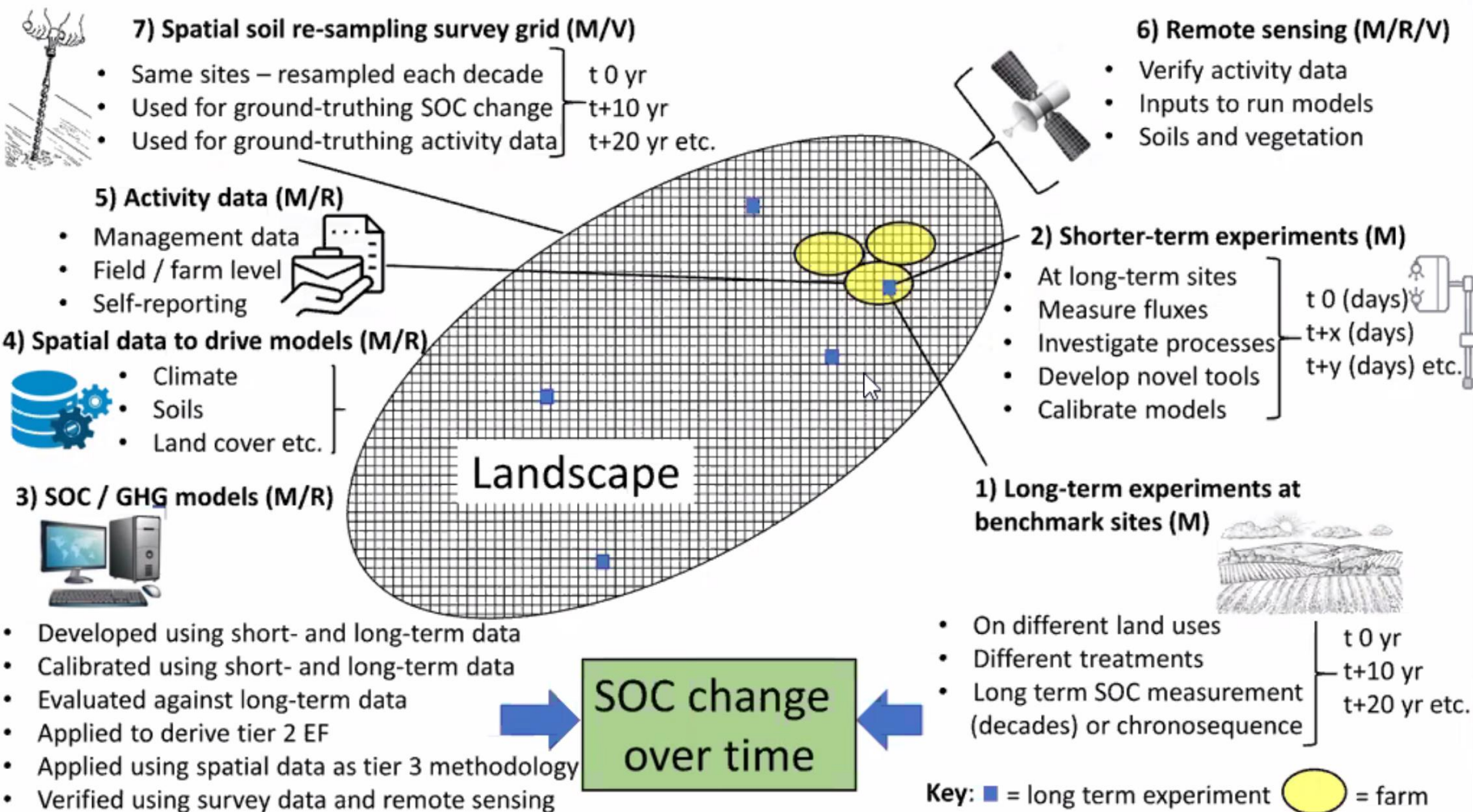


Mineral N



Farm with less manure

# Soil Monitoring, Reporting and Verification



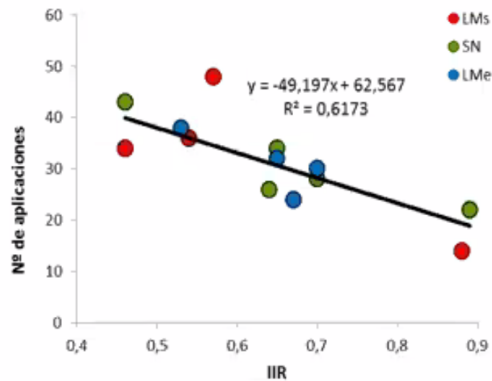


# Use of herbicides and fertilizers

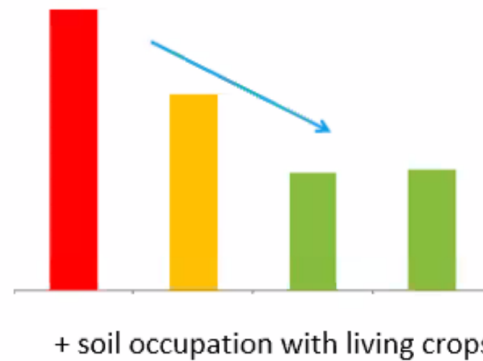


Reduction in Number of herbicide applications up to 50%

Reduction in the environmental impact index (EIQ) of up to 60%



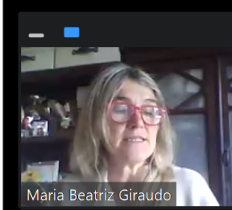
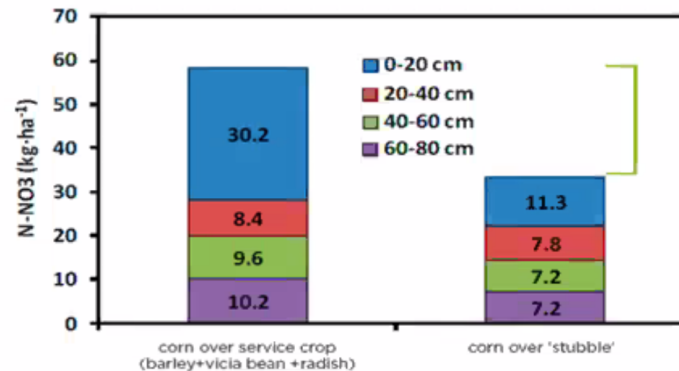
% soil occupation with living crops



Chacra Aapresid Bragado-Chivilikoy, 2017

N-NO<sub>3</sub> availability in corn (R1) over different precedent crops.

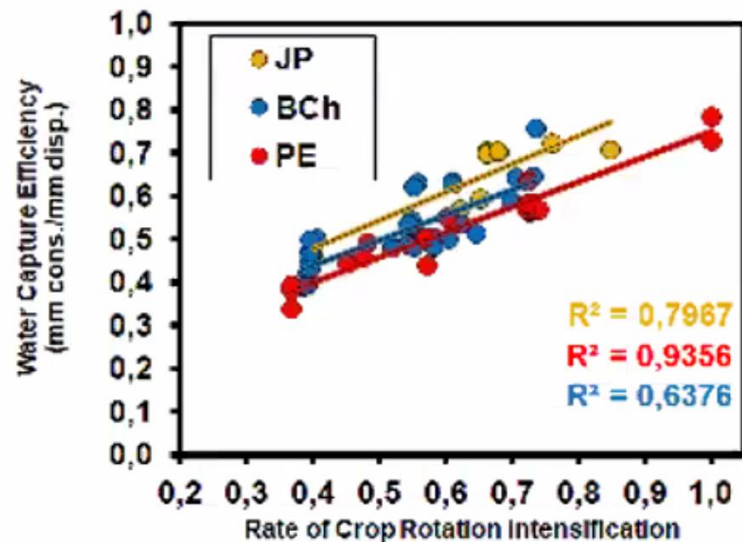
x3 increase in N-NO<sub>3</sub> availability in soil



Maria Beatriz Giraudo

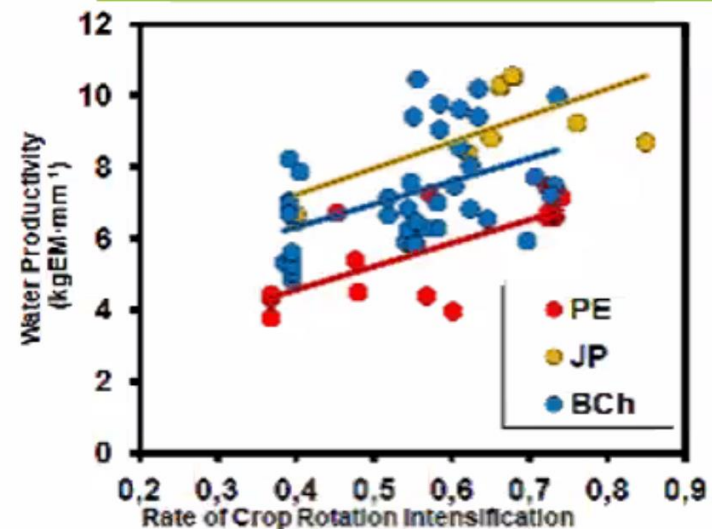
## Improved water management

Increase in water capture  
up to 40%



% soil occupation with living crops

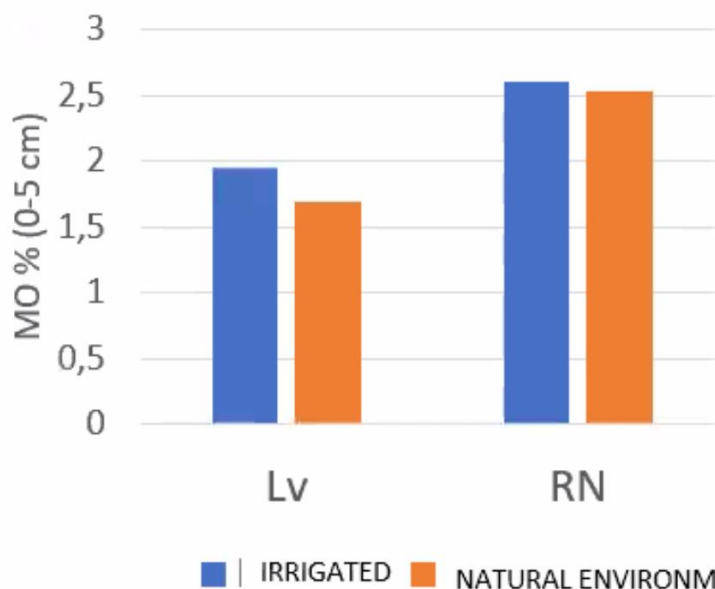
Increase in water productivity  
(kg of grain/mm available  
water): up to 30%



% soil occupation with living crops

# Responsible advance of the agricultural frontier

North Patagonia



- Arid environment
- High levels of radiation
- Low temperatures
- Irrigation
- High biomass generation
- Slow decomposition of straw
- Increase SOM

LV : Ancient floodplain  
RN: Recent floodplain



# BIOSPAS



## Aapresid

*BIología del Suelo y Producción Agraria Sustentable*  
(Soil Biology and Sustainable Agricultural Production)

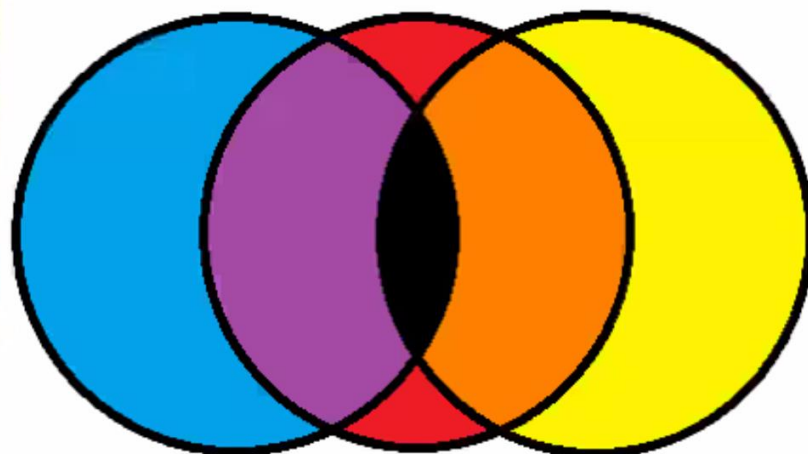
**A DREAM...**



**NEXT STEPS...**

- i) interpretation of the biological processes that occur in soil and its impact on productivity
- ii) the impact of soil pathogens causing and controlling diseases
- iii) the use of biological soil variables as indicators of environmental performance
- iv) the use of microorganisms with specific agronomic applications.

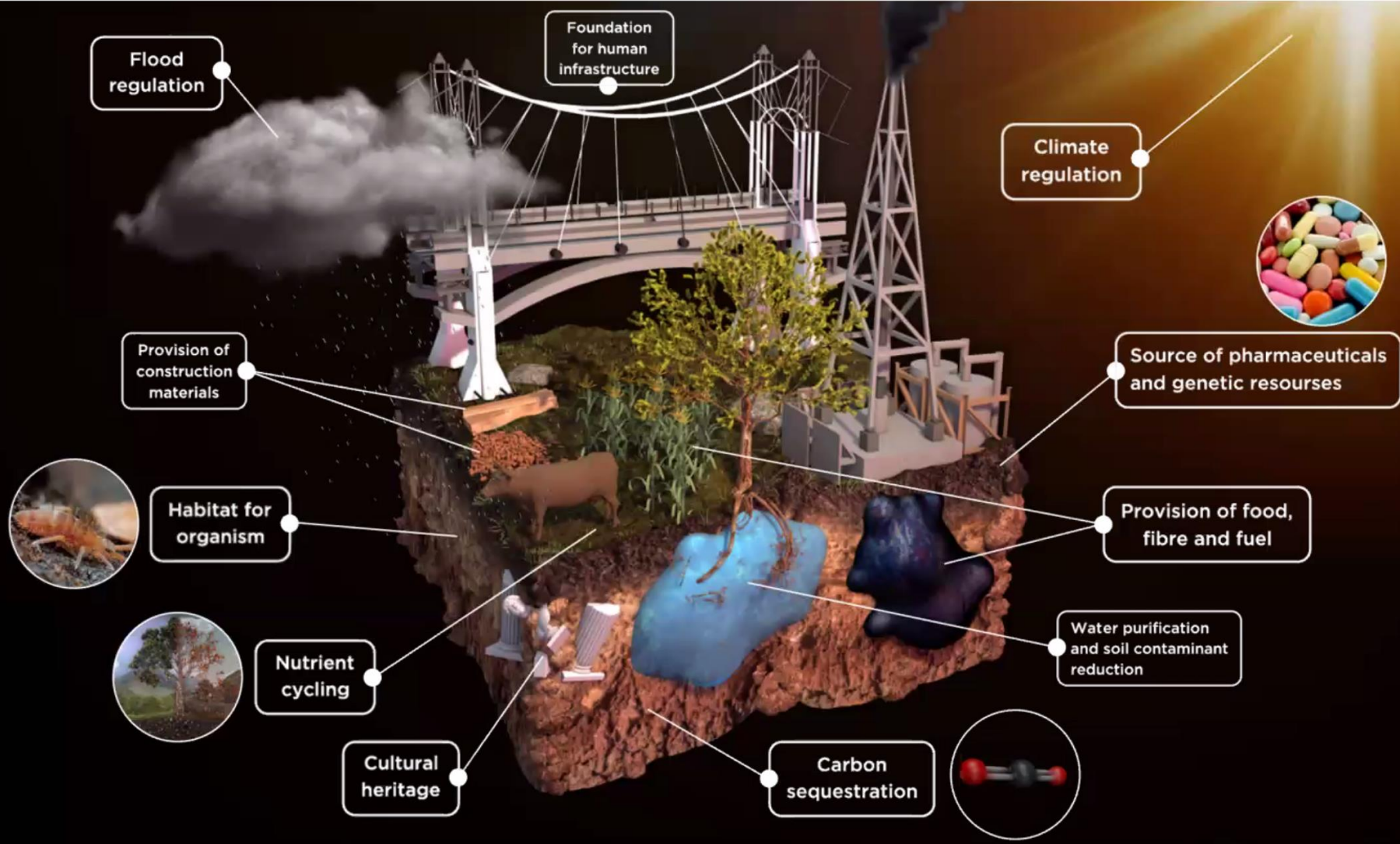
NE GAP NSAP



**SUMMARY CONCLUSION**

- ✓ GAP is more similar to NE than NSAP and it is in between those situations (Growth promoters, phosphorus availability, pathogens as controllers, etc)

# Soil is a valuable natural capital, but....



# The current global challenges



**United Nations**  
Convention to Combat  
Desertification

**Desertification, drought, Land degradation**



**Convention on  
Biological Diversity**

**Protecting, conserving, restoring Biodiversity**



**United Nations**  
Framework Convention on  
Climate Change

**Climate change – Mitigation and Adaptation**



**Food and Agriculture  
Organization of the  
United Nations**

**Food security and nutrition**

**Soil carbon, the heart of the soil**



**Healthy soils = SOC**

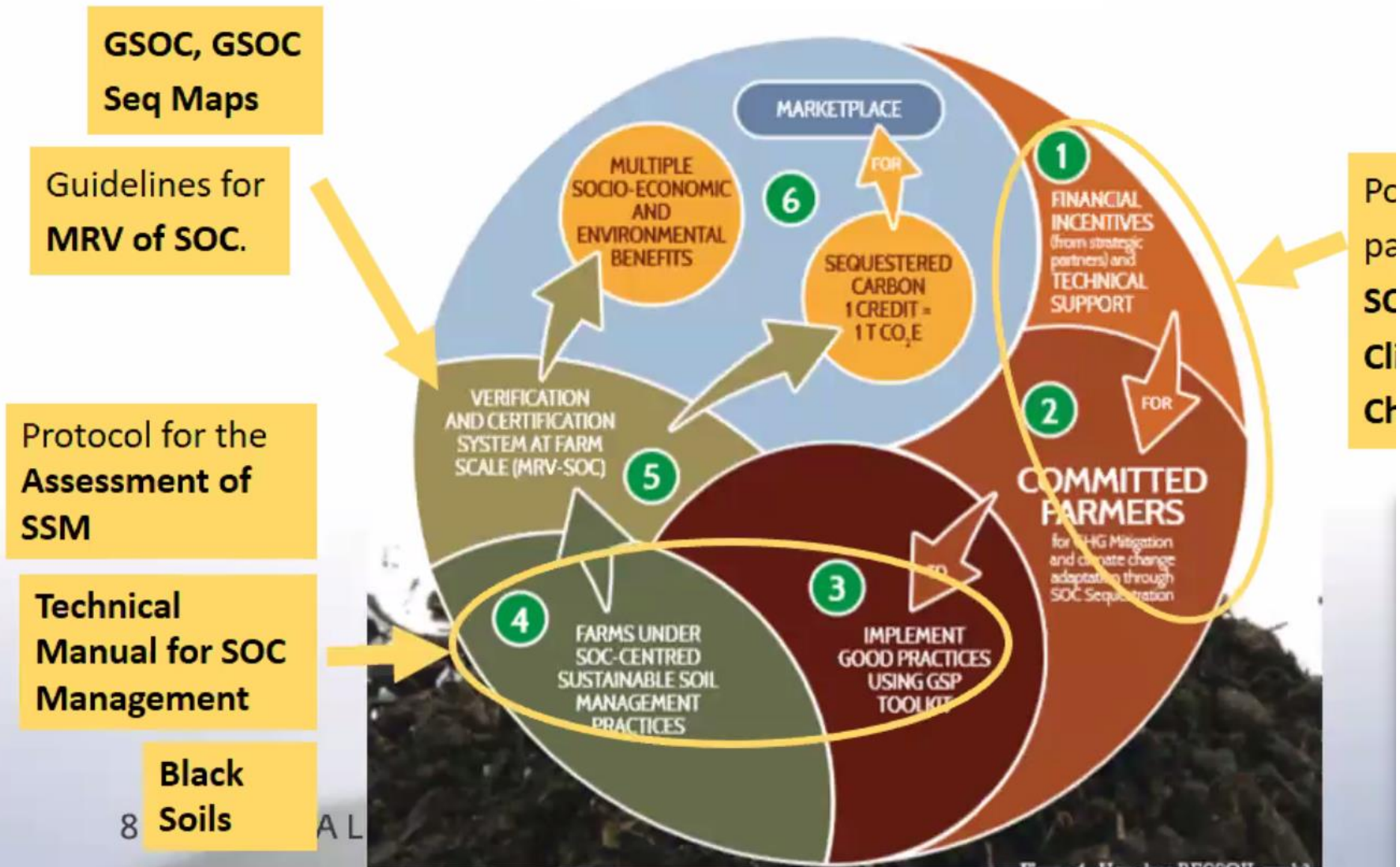


# RECARBONIZATION OF GLOBAL SOILS



# What has been done?

## RECOSOIL TOOLKIT





Enregistrement

Sondages

l'animateur est en train de partager les résultats du...

1. There are some contradictory positions indicating that SOC sequestration is not a feasible option for large-scale emissions reduction but mainly for enhancing soil health. Do you agree with this?

Yes	44%
No	56%

Fermer

Paramètres audio

Converser Sondages

Quitter

Conversation du webinaire Zoom

De Amanullah Amanull... à [Tous les conférenciers et les participants](#)  
Plants Competitions Influence Carbon Accumulation and Partitioning among Warm (Maize, Sorghum & Millets) and Cool Season Cereals (Wheat, Rye, Barley & Oats)

De Annette Cowie à [Tous les conférenciers et les participants](#):  
Woolf et al 2010 quantified sustainable supply of biomass that could be used for biochar. There is a substantial resource available, but clearly need good governance to avoid unsustainable biomass extraction

De Jalal Uddin Shoab à [Tous les conférenciers et les participants](#):  
Excellent

De Suellen Vasconcelos à [Tous les conférenciers et les participants](#):  
Very reflective presentation!

De Marta Alvarez Rome... à [Tous les conférenciers et les participants](#):  
Thank you Prof. Pete Smith, excellent presentation

De moi à [Tous les conférenciers et les participants](#):  
Thank you Pete for your presentation.

De Amanullah Amanull... à [Tous les conférenciers et les participants](#):  
please share the presentations

De Gurveen Arora à [Tous les conférenciers et les participants](#):  
Wonderful presentation by Prof. Smith

De Gérard Rass à [Tous les conférenciers et les participants](#):  
THANK YOU DEAR EDUARDO MANSUR ; I LIKE : YES WE CAN !!!!!

De Ed Bourgeois à [Tous les conférenciers et les participants](#):  
Why aren't we talking about the soil foodweb?

De Giulia Stanco à [Tous les conférenciers et les participants](#):  
Presentations and recordings will be shared with all attendees in the follow-up of the webinar

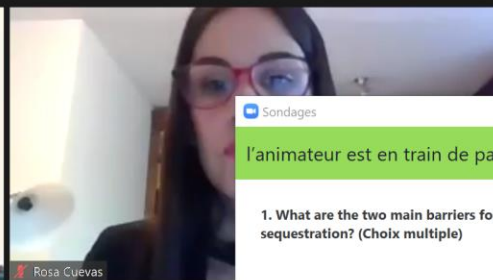
De Jean-Francois Sous... à [Tous les conférenciers et les participants](#):  
The EU funded CIRCASA project, also with Pete Smith, develops an international R&I consortium that will support projects in this area, including RECSOIL.

Envoyer à : [Tous les conférenciers et les participants](#)

Votre texte peut être lu [Tous les conférenciers et les participants](#) participants.



Arianna Giullodori



Rosa Cuevas



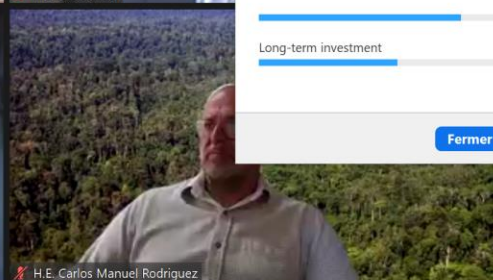
Prof. Pete Smith



Prof. Rattan Lal



Maria Beatriz Giraudo



H.E. Carlos Manuel Rodriguez



Barney Debnam



### Conversation du webinaire Zoom

DE MARIELE CURRICE à Tous les conférenciers et les participants.

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De Miguel Navia à Tous les conférenciers et les participants:  
The thing is to reach the big farmers

De Gérard Rass à Tous les conférenciers et les participants:  
SOM is good for all parameters of a good soil. Farmers know this and can operate on this

Envoyer à : Tous les conférenciers et les participants

Votre texte peut être lu par d'autres conférenciers ou d'autres participants.