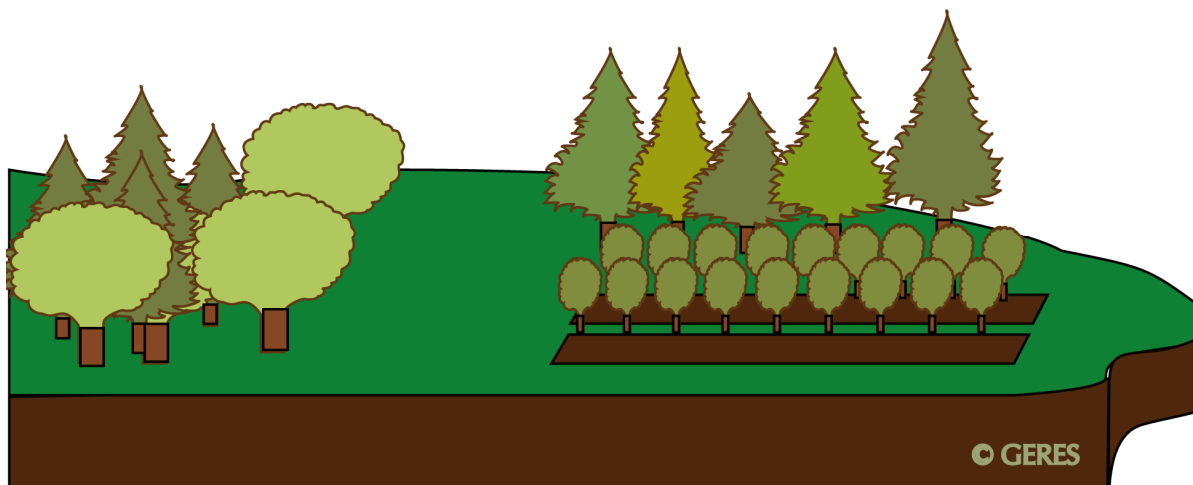


AFOLU

Agriculture, Forestry and Other Land Uses



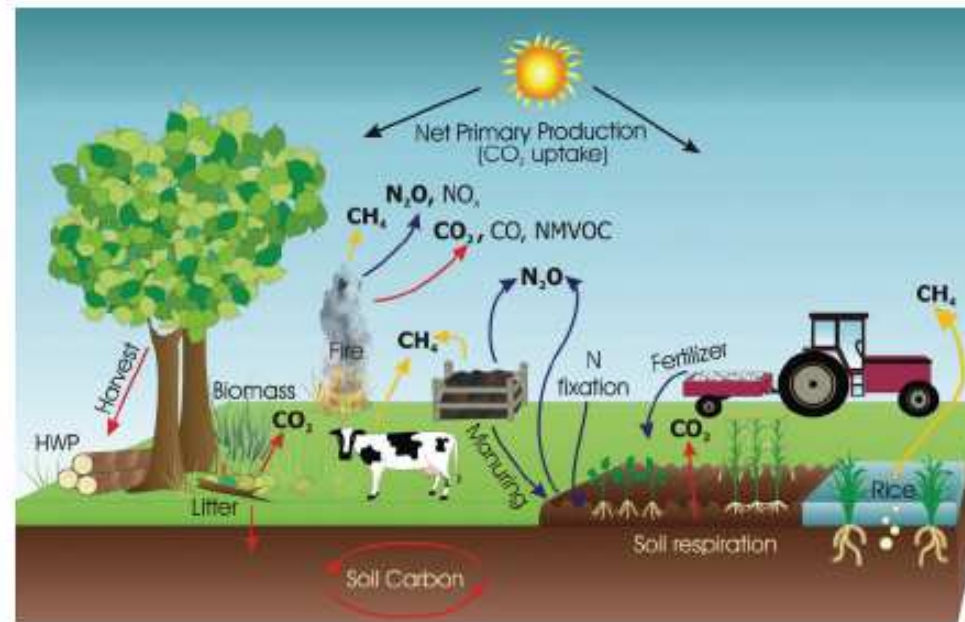
0. A LONG HISTORY IN A NUTSHELL

AFOLU/LULUCF under the UNFCCC

The Intergovernmental Panel on Climate Change (IPCC) has developed six categories of land use:

- ▶ forest land, cropland, grassland, wetlands, settlements and other lands (e.g. bare soil, rock, ice, etc.)
- ▶ In addition there are *agricultural practices* on farms, such as burning of crop residues, fertilizer application, rice cultivation, and livestock, which produce emissions, mainly of methane and nitrous oxide.

Figure 1: Pictorial representation of emissions and removals in the land use sector¹



AFOLU/LULUCF under the UNFCCC

Why is it different from the other sectors?

- Can act as a sink and a source of GHG
- Non-permanence
- Natural effects can be relatively large
- Difficulty to separate natural and anthropogenical impacts
- Legacy effect

Under the Convention ->

Table 2: Summary of Land Use in the UNFCCC

	UNFCCC reporting (All Parties)	Kyoto Protocol 2 nd commitment period (CP) QELRC ³ (Annex I KP Parties)	Kyoto Protocol CDM (non-Annex I)	REDD+ (developing countries)	NAMAS (non-Annex I)
Purpose	Reporting only	Legally-binding economy wide targets; liabilities if commitment unmet	Incentives provided for non-Annex I	To contribute to mitigation action in the forest sector and to seek results-based finance ⁴	To enhance mitigation action
Scale	National	National	Project	National, or subnational ⁵ as an interim step	Not specified
Scope	<p>Comprehensive coverage of LULUCF:</p> <ul style="list-style-type: none"> • Forest land • Cropland • Grassland • Wetlands • Settlements • Other land <p>Non CO₂ emissions from agricultural practices⁵</p>	<p>Mandatory activities:</p> <ul style="list-style-type: none"> • LULUCF • Afforestation • Reforestation • Deforestation • Forest management <p>Comprehensive coverage of agricultural practices</p> <p>Voluntary (unless elected in the 1st CP):</p> <ul style="list-style-type: none"> • Cropland management • Grazing land management • Revegetation • Wetland drainage and rewetting 	<p>Allowed activities:</p> <p>LULUCF</p> <ul style="list-style-type: none"> • Afforestation • Reforestation <p>Non CO₂ emissions from agricultural practices</p>	<p>Activities involved:</p> <ul style="list-style-type: none"> • Deforestation • Forest degradation • Forest conservation • Sustainable management of forests • Enhancement of forest carbon stocks 	<p>Not specified. A wide range of activities in the land use sector have been submitted.</p>

Source: *Understanding Land Use in the UNFCCC, 2014*

Kyoto Protocol

- Only Afforestation and Reforestation (A/R) is considered
- Agriculture is left aside

Under the Convention (former Long Term Cooperation Actions), aside from Kyoto Protocol

- REDD+ includes the notion of increase of carbon stocks/« sustainable systems » - the + means: A/R and sustainable agriculture, and communities

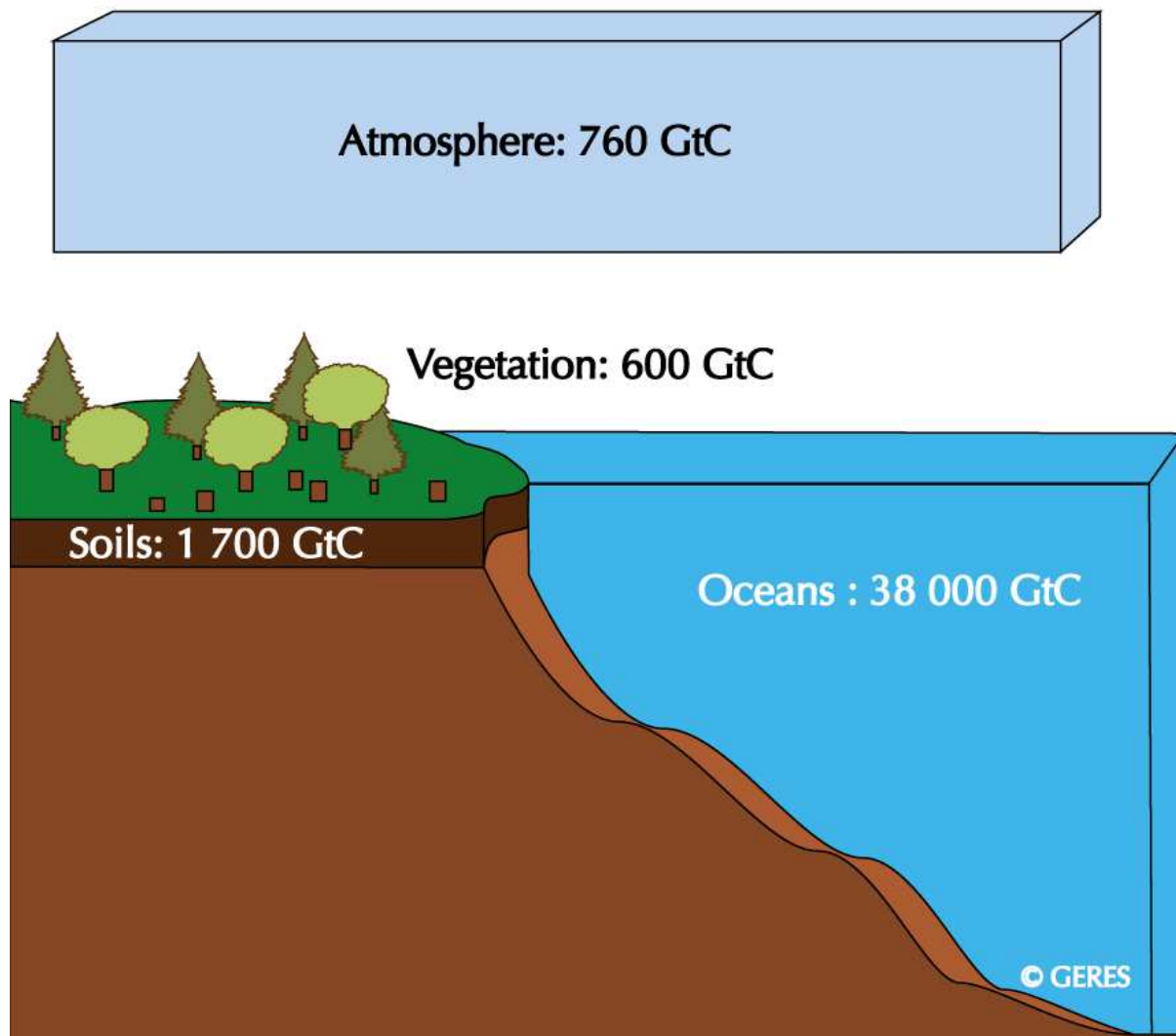
Under the voluntary markets...many options exist:

- **VCS:** SALM, ALM, REDD+, A/R, IFM
- **CAR:** REDD+, N₂O – reduction of chemical fertilisers
- **Gold Standard:**
 - Climate Smart Agriculture (CSA) - draft methodology
 - Afforestation and Reforestation
- **Plan Vivo:** still alive?



1. HOW DOES IT WORK?

Main Carbon sinks

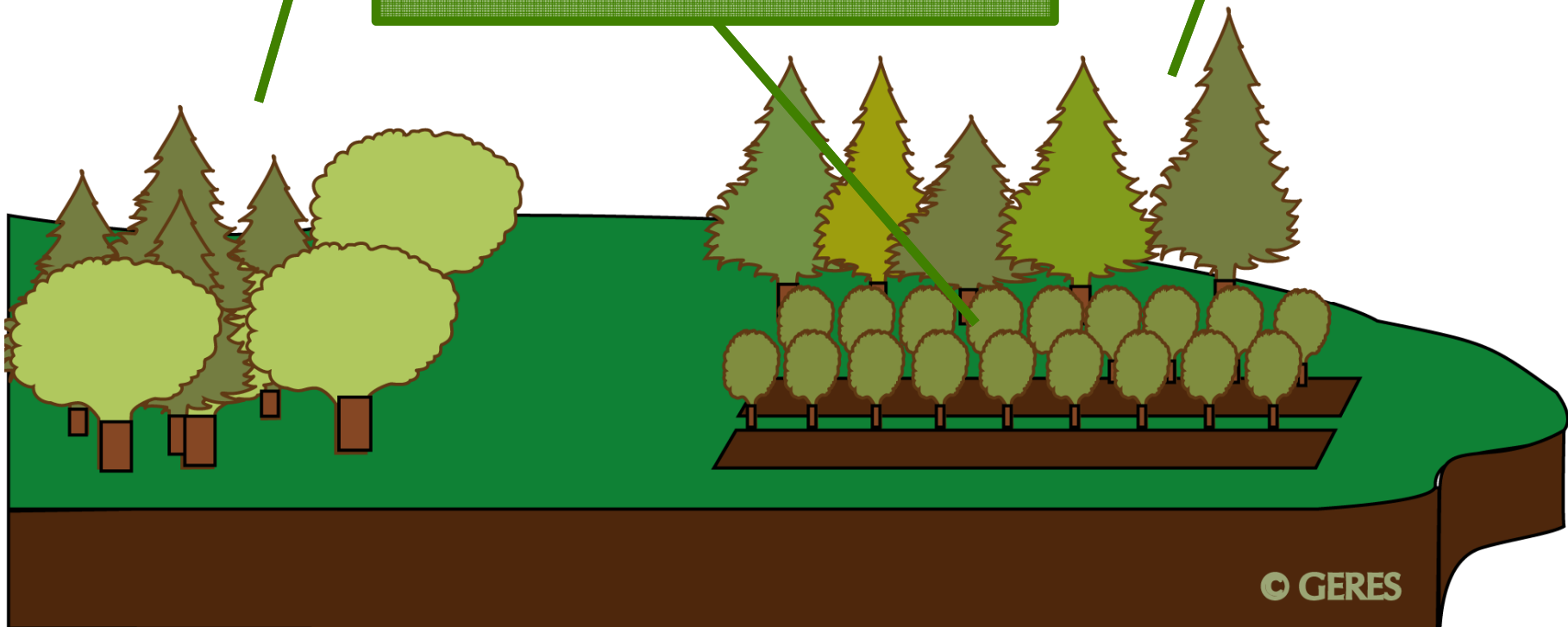


Eligible activities

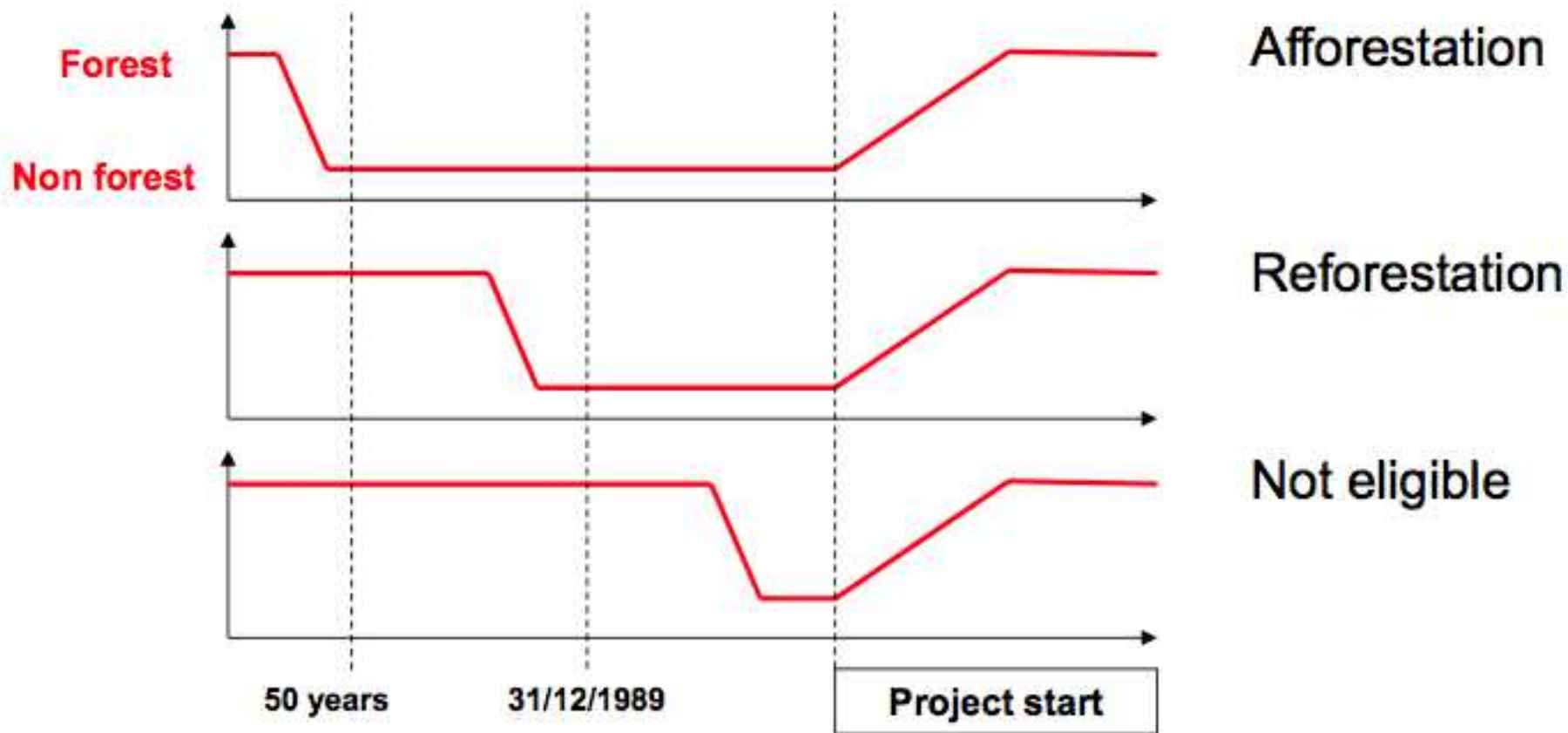
REDD + and Sustainable Forest Management

Afforestation and reforestation

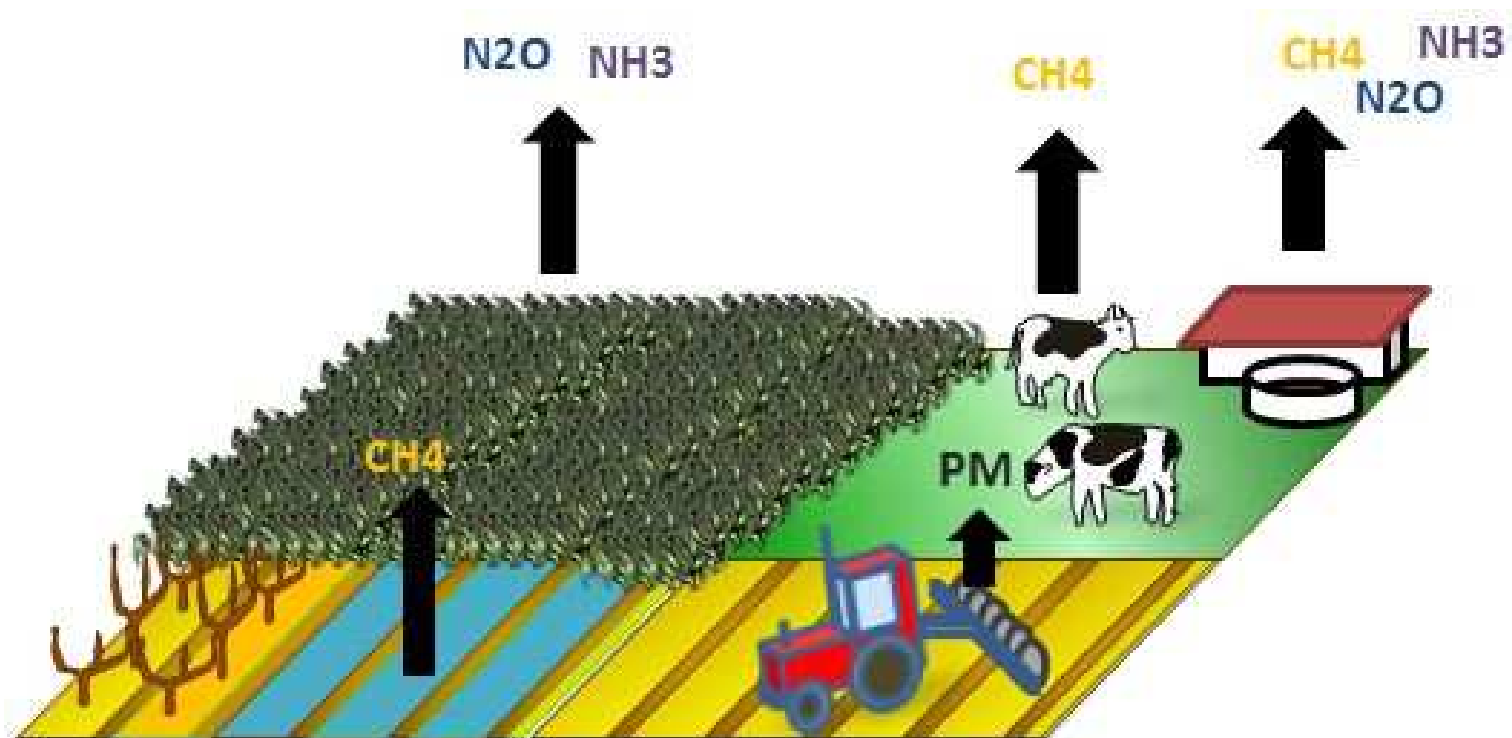
Agricultural Land Management (or
Climate-Smart Agriculture)



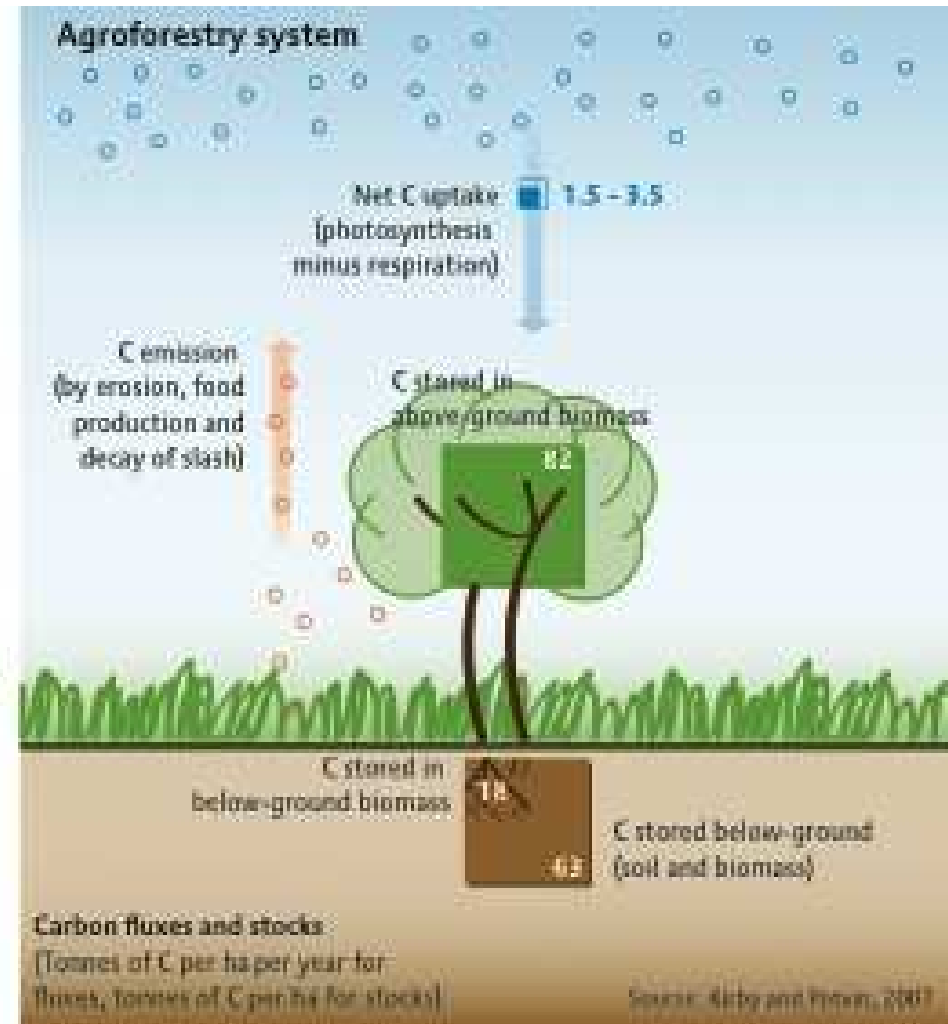
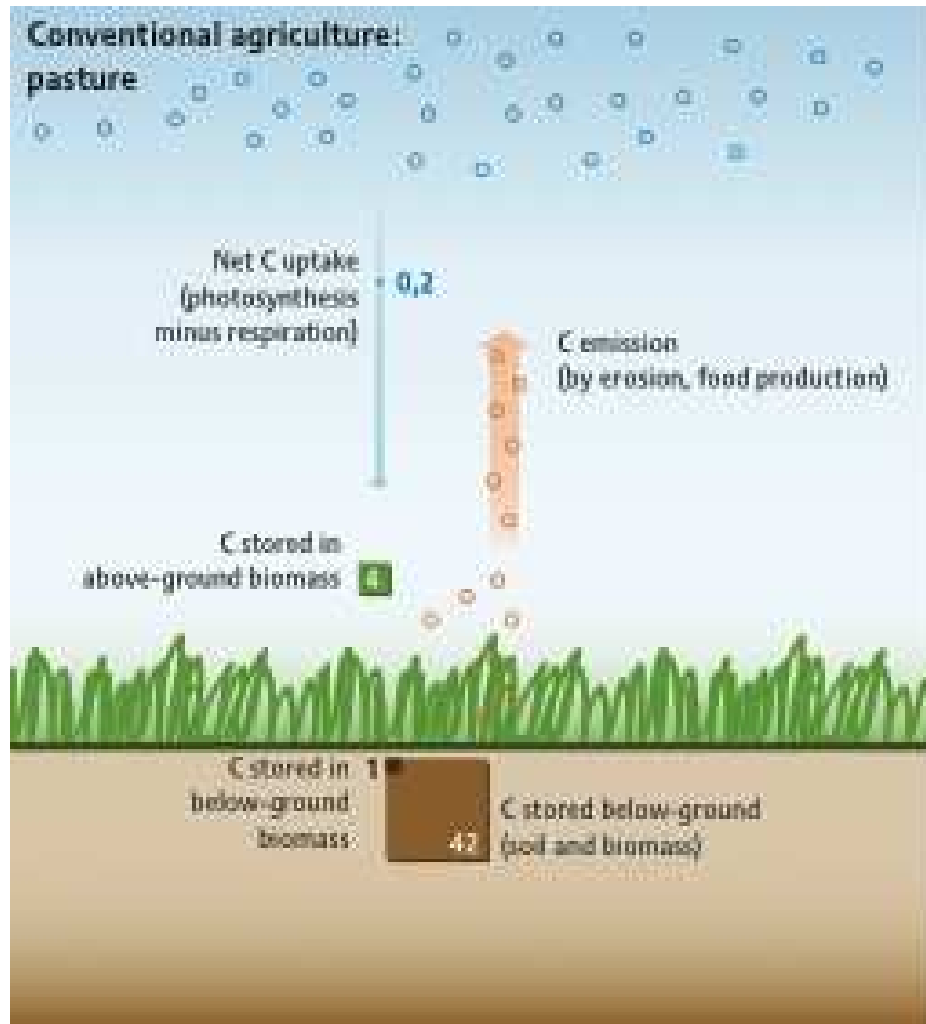
Afforestation / Reforestation



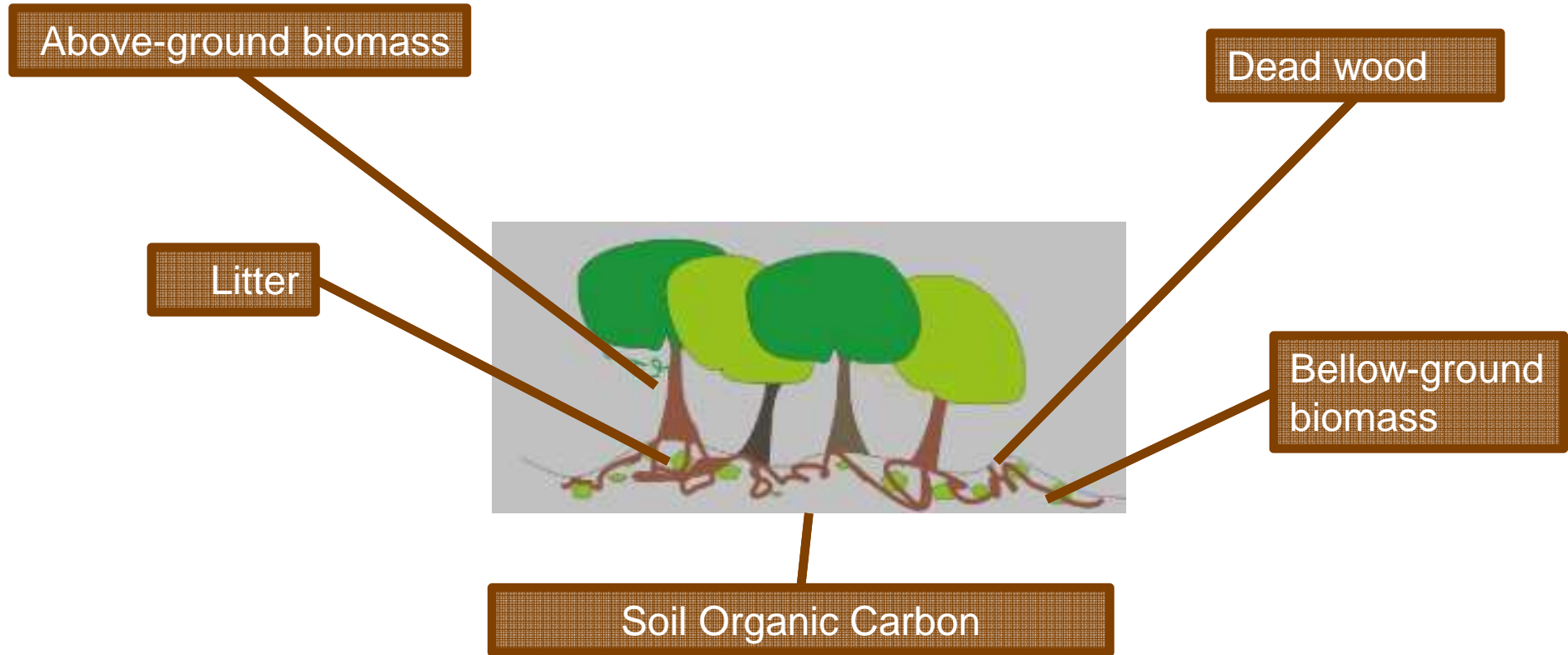
Agriculture - Main sources of GHG



Carbon sequestration through Sustainable Agricultural Land Management



AFOLU carbon pools and emission sources



+ other gases emissions:

- Nitrous oxyde: N_2O from N fertilizers

How do we measure all that ?

1 Trees selection and sampling

2 Inventories on DBH (1,3m)



3 Calculation of stocks based on allometric equations or BEF

$$B_{TREE,j,p,i,t} = f_j(DBH_t, H_t) * (1 + R_j)$$

$$B_{TREE,j,p,i,t} = V_{TREE,j,p,i,t} \times D_j \times BEF_{2,j} \times (1 + R_j)$$

4 Multiplication of the stock by 0,5 and CO₂ molecular weight

SALM: carbon pools and emissions sources

CARBON POOLS	INCLUSION?
Above ground biomass	Yes
Bellow ground biomass	Yes
Dead wood	No
Litter	No
Soil Organic Carbon	Yes
Woody products	No

EMISSIONS SOURCES	GASES
Use of fertilizers	N ₂ O
Use of N-fixing species	N ₂ O
Biomass combustion	CO ₂ , CH ₄ , N ₂ O
Fossil fuel combustion	CO ₂ , CH ₄ , N ₂ O

Soil Organic Carbon



“In many ways the ground beneath our feet is as alien as a distant planet.”

Sugden, A., R. Stone, et al. (2004). "Soils - The Final Frontier." *Science* (304).

"For example, a change of just 10% in the SOC pool would be equivalent to 30 years of anthropogenic emissions and could dramatically affect concentrations of atmospheric CO₂."

Par exemple, un changement de juste 10% de la quantité de carbone stocké dans les sols équivaldrait à 30 ans d'émissions d'origine humaine et affecteraient dramatiquement la concentration atmosphérique en CO₂.

Source: Stockmann, U., M. A. Adams, et al. (2013). "The knowns, known unknowns and unknowns of sequestration of soil organic carbon." *Agriculture, Ecosystems and Environment* **163**: 80–99.

How do we measure SOC?

- 1 Sampling**
- 2 Soil collection – 30cm deep**



3- option a) Lab analysis

3- option b) Spectral analysis

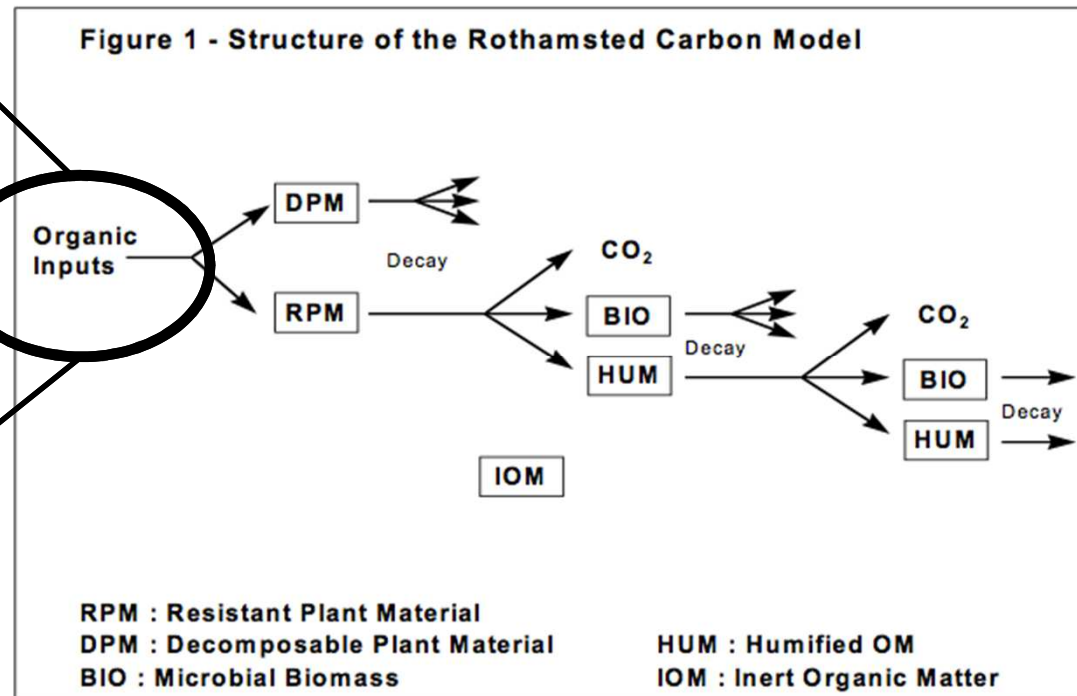
RothC

Litter

Crop residues

Compost

Manure



And others Century, etc....

2. ISSUES AND RELEVANCE

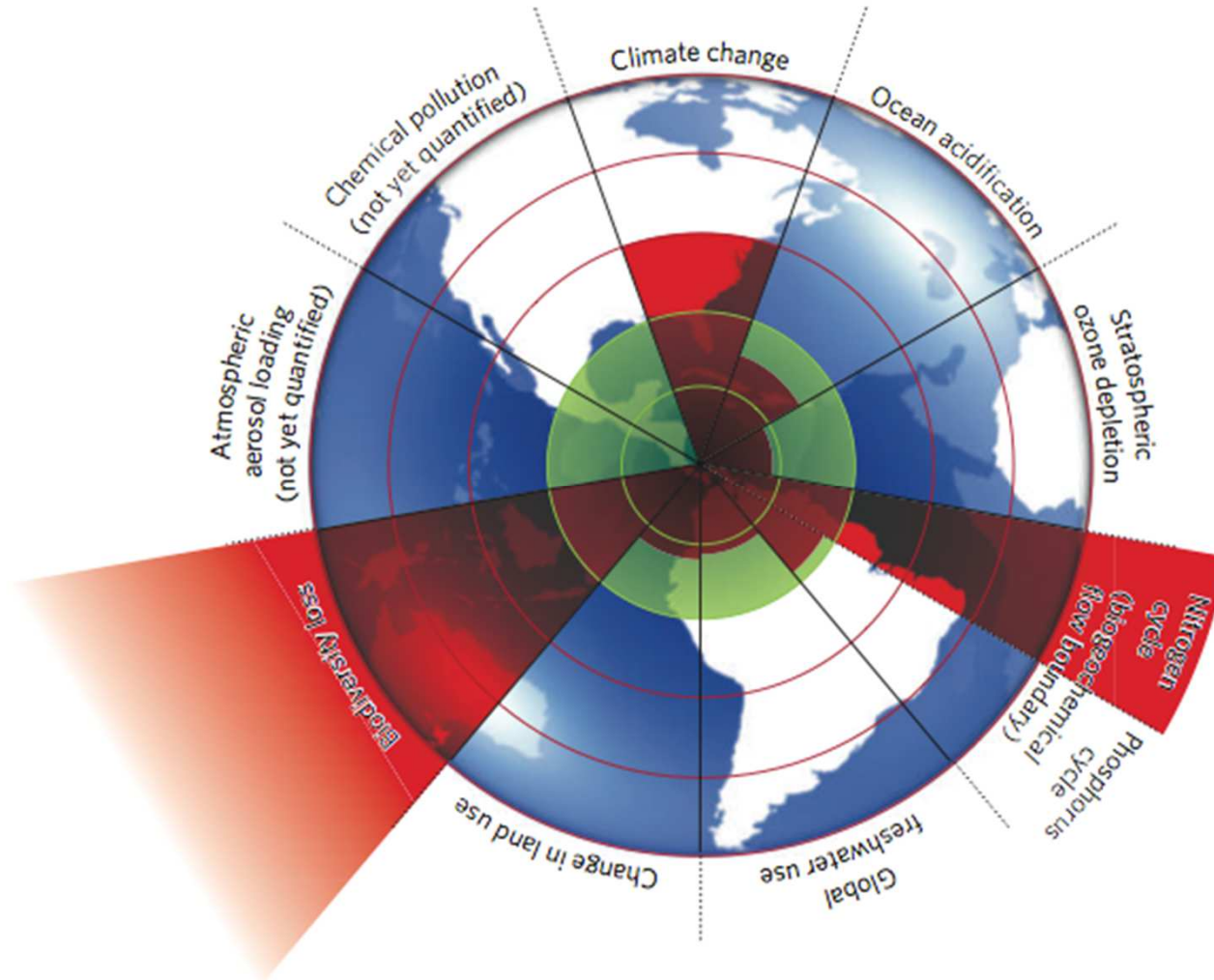
Complexity of methodologies and low estimates

- Reduced impact when compared to the investments
- Diffuse sources

Different understandings of what is sustainable agriculture

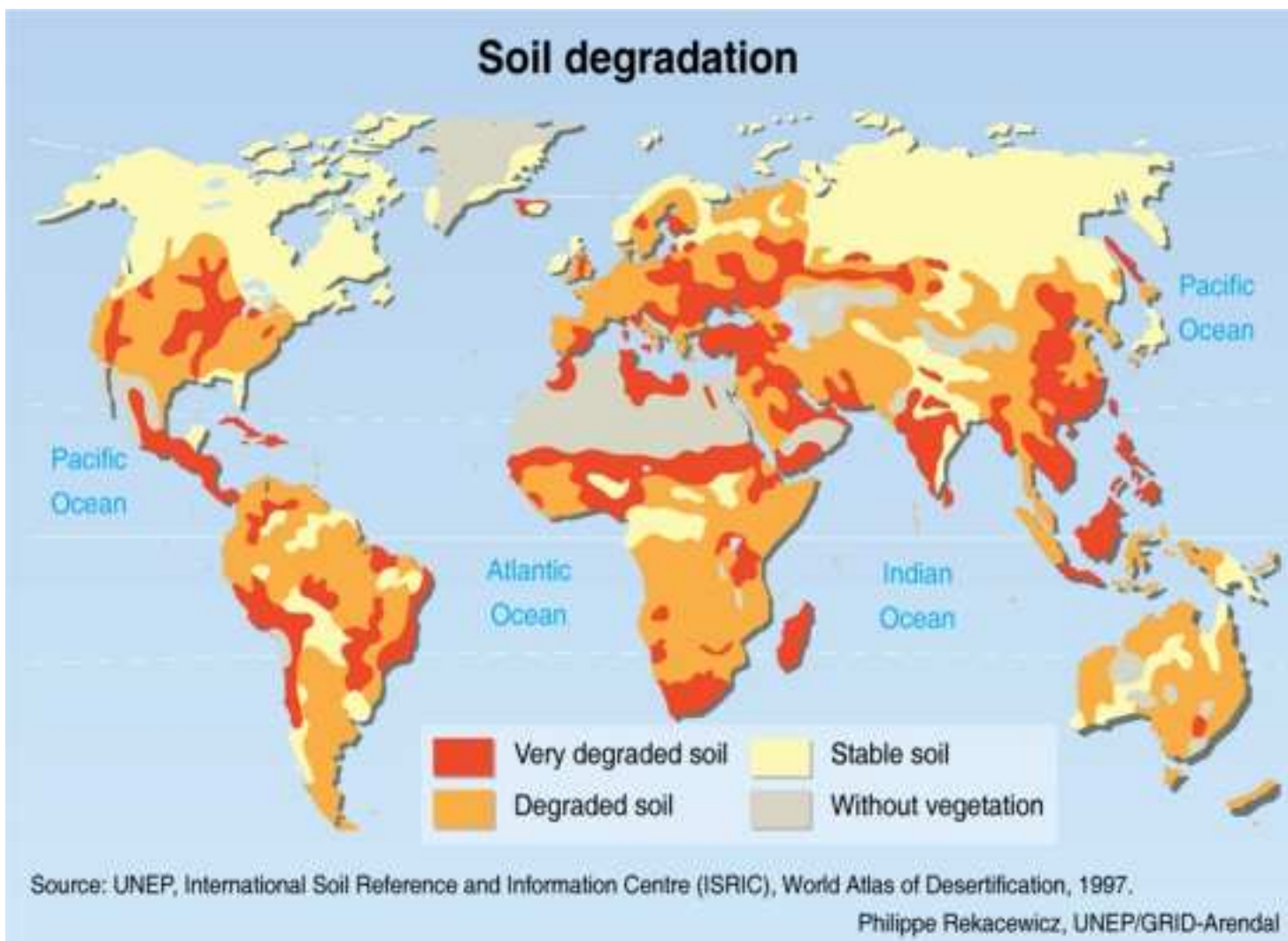
**Risks: Non-permanence remains a problem
therefore, financial risks**

But AFOLU is at the crossroad of the global challenges

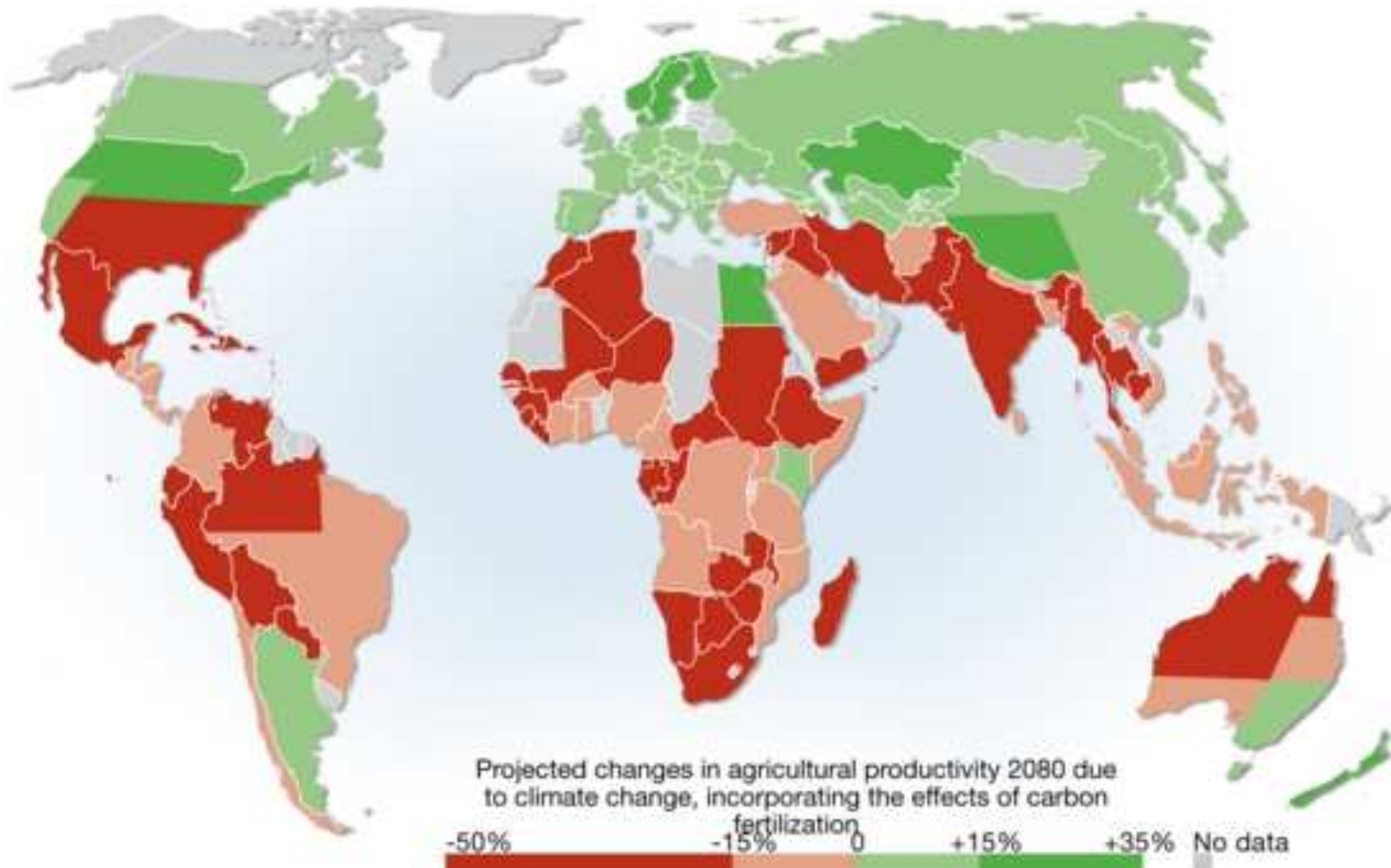


Rockstrom, J. (2009). "A safe operating space for humanity." *Nature* 461.

Vulnerabilities already exist

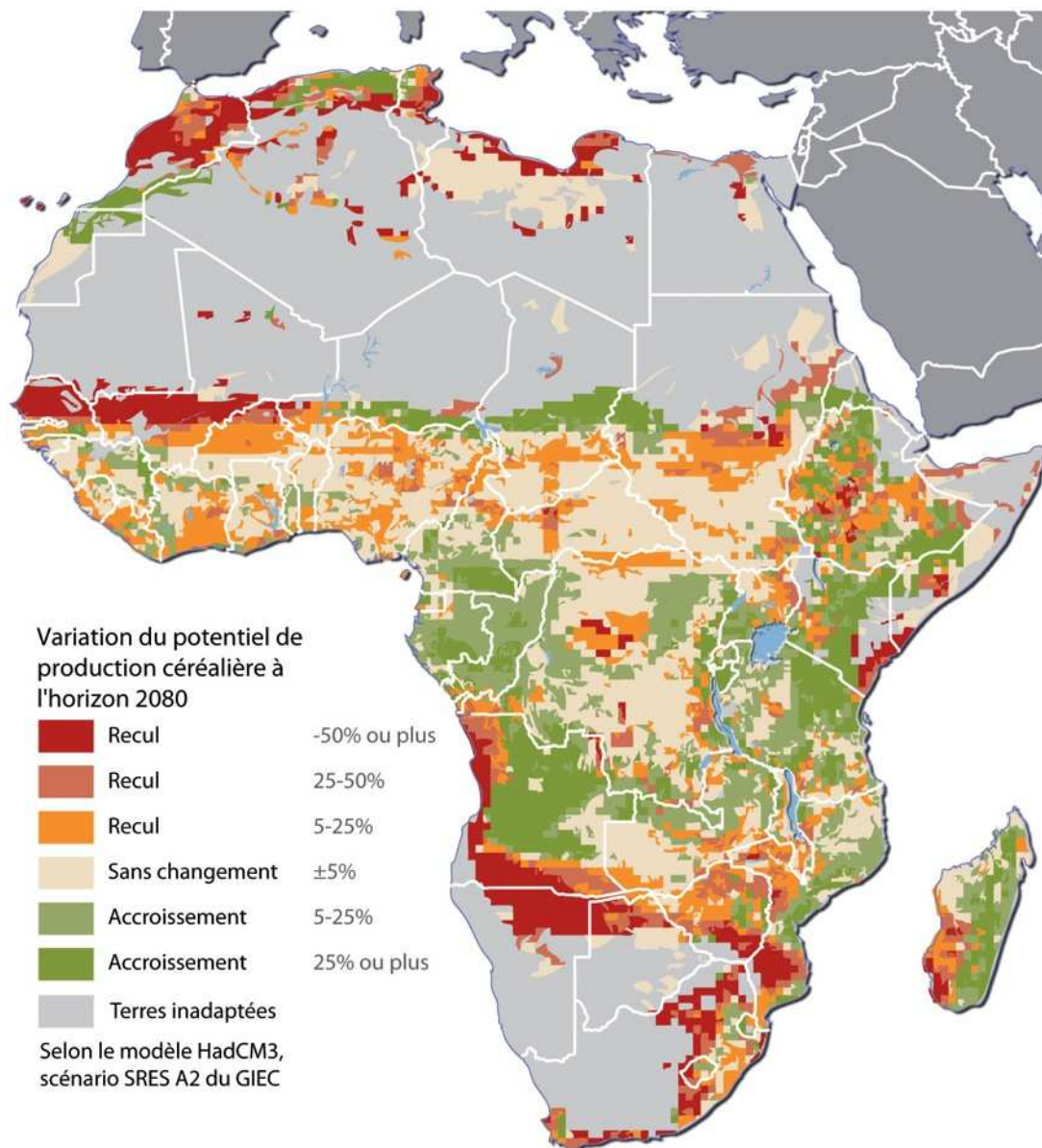


Projected changes in agricultural production in 2080

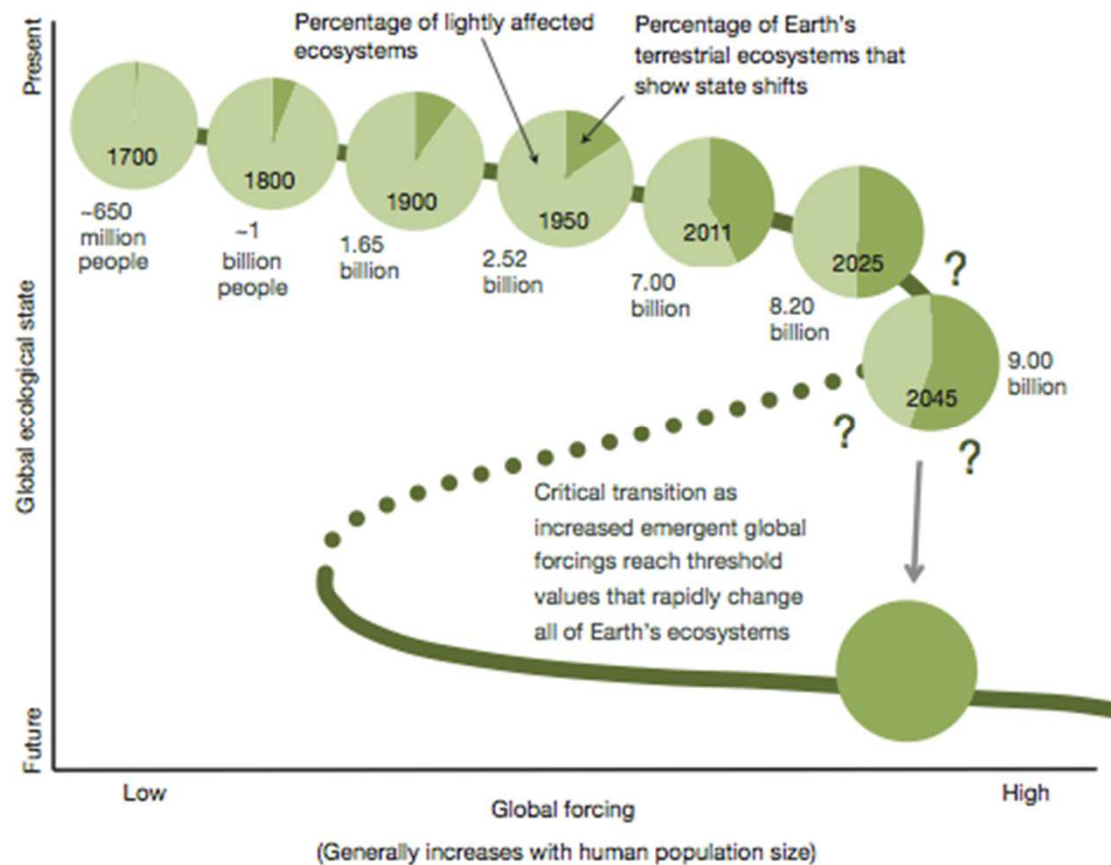


Source: Cline 2007

Projected changes in agricultural production in 2080



Ecosystems fragmentation – a “new” Earth



“For example, rapid climate change combined with highly fragmented species ranges can be expected to magnify the potential for ecosystem collapse, and wholesale landscape changes may in turn influence the biology of oceans.”

“Comparison of the present extent of planetary change with that characterizing past global-scale state shifts, and the enormous global forcings we continue to exert, suggests that another global-scale state shift is highly plausible within decades to centuries, if it has not already been initiated.”

Source: Barnosky, A. D., E. A. Hadly, et al. (2012). "Approaching a state shift in Earth's biosphere." *Nature* (486).

SOC has a strong correlation with food security

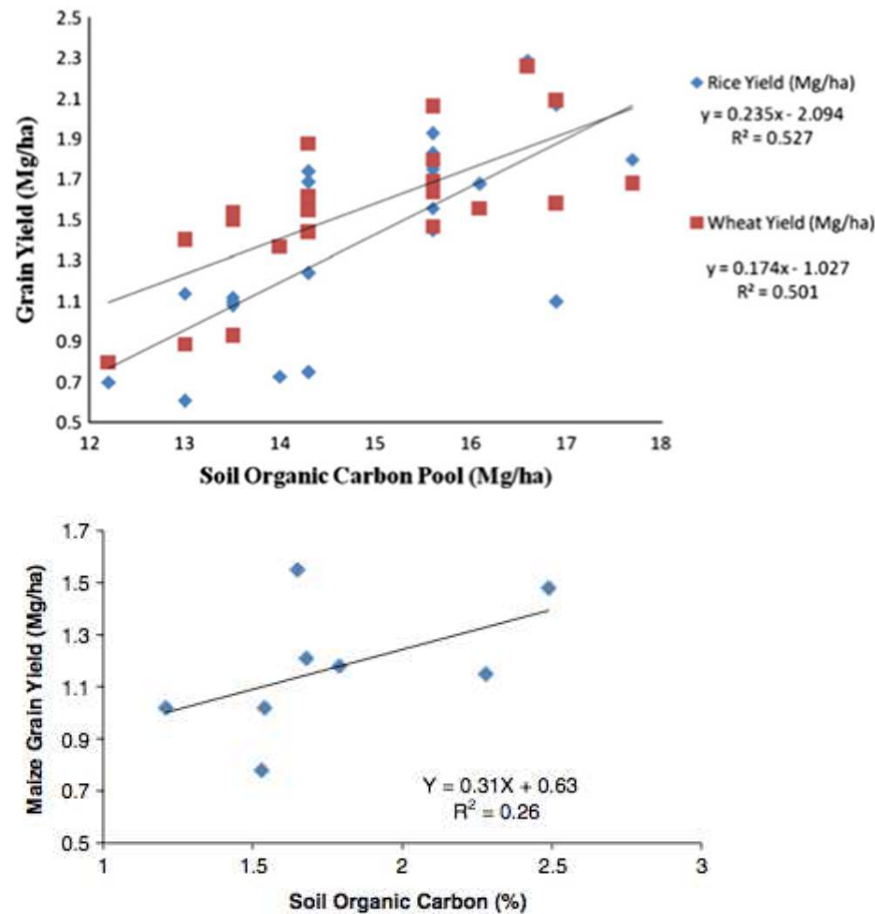


Fig. 4 Grain yield of upland rice as affected by soil organic carbon concentration across different ecoregions in West Africa (redrawn from Becker and Johnson 2001)

Fig. 3 Grain yields of rice and wheat on a Vertisol in Central India under low input and rainfed farming (Redrawn from the data of More 1994)

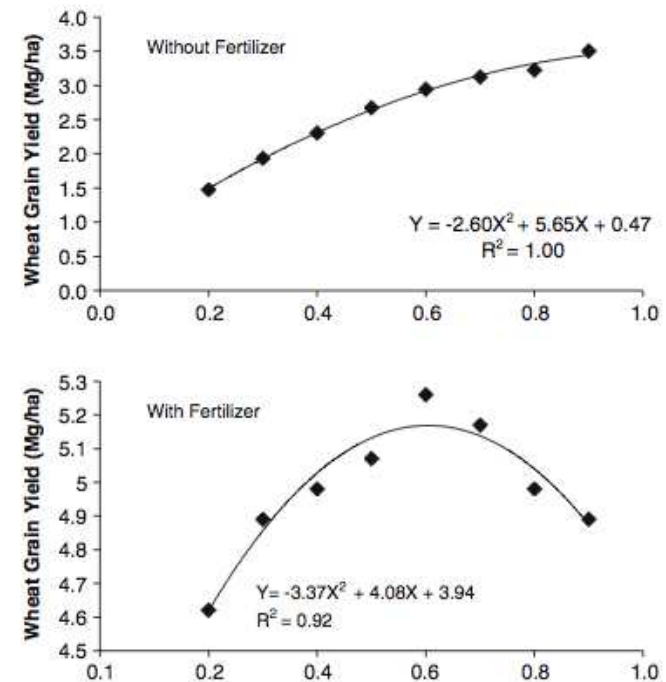


Fig. 2 Influence of soil organic carbon concentration on grain yield of wheat with and without fertilizer and on productivity (redrawn from Benbi and Chand 2007)

Source: Lal, R. (2010). "Beyond Copenhagen: mitigating climate change and achieving food security through soil carbon sequestration." *Food Security* 2.

CARBON FINANCE

KENYA AGRICULTURAL CARBON PROJECT



Kenya Agricultural Carbon Project

- ▶ 64 800 households involved
- ▶ Various practices proposed to the farmers: minimum tillage, leaving crop residues on the fields, livestock enclosures, composting, crops associations, agroforestry...
- ▶ Farmers are eligible if they have the potential of sequestering 0,5 tCO₂e/ha/year
- ▶ Monitoring is done by groups of farmers
- ▶ Project potential of 1,2 millions of tCO₂e over the 20 years of project, 494 549 tCO₂e after the permanence buffer discount

3. NEW TRENDS... AND CONCLUSIONS...

Market evolvments at regional scale in 2013:

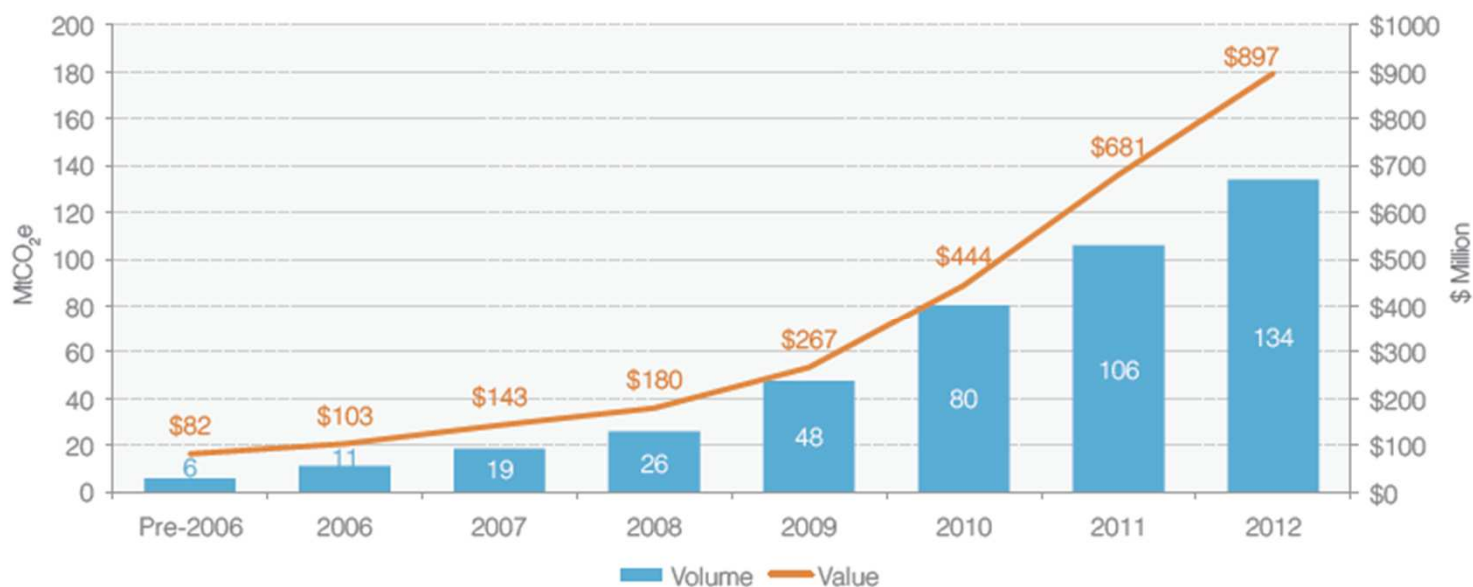
Europe: -36%

USA: -68%

Australie: +100%

The AFOLU credits appear to be fine – although 2014 data are not available

Figure 2: Cumulative Forestry Offset Transaction Volume and Value, All Markets



Notes: Based on data reported by 513 AFOLU projects and countless offset suppliers over eight years.

Source: Forest Trends' Ecosystem Marketplace. *State of the Forest Carbon Markets 2013*.

Some of the new « hot » accronyms

- Climate-Smart Agriculture (CSA)
- Low Emissions Development Strategies (LEDS)
- Nationally Appropriated Mitigation Actions (NAMAs)

Finally,

- High level of investments for reduced amount of credits, but relevant changes
- Technologies are improving in order to allow better and cheaper measurements for diffuse pollutions sources
- If UNFCCC is not ready to integrate agriculture, however voluntary markets will probably keep on moving
- Huge awareness on land tenure problems and sustainability from standards and civil society – i.e. safeguards from GS/Fair Trade (thresholds as minimum species diversity, connectors, HCV, social aspects, grievance mechanism)
- A place for Agroforestry

->How to deal with an continuously degradating scenario and industrial agricultural practices?

- *There may not be a 2nd CP Kyoto!*
- *How to question the UN efficiency? Efficiency of the standardized baselines, PoAs, etc...*
- *How to deal with low governance and economic crisis ?*
- *How to deal with forestry – complex ecosystems and property rights systems? Knowing that deforestation is, very often, informal and illegal?*
- Warning on NAMAs – so far, an empty basket: credited or no-credited? - what shall we do about this new mechanism?

Moving forward...

- Financial instruments are needed...market or not-market based! Review of the UN system is obligatory!
- Differentiation of scopes and project types is also needed
- Bilateral arrangements can be and are showing to be much faster!
- Inclusion of Free, Prior, Informed Consent, Local Stakeholders Consultations during the project and not only in the beginning
- NAMAs and sustainable flexibility mechanisms should be merged!

Thank you for your attention!

Marina Gavaldão

m.gavaldao@geres.eu

Climate Change Unit technical director



CYCLE de PROJET CARBONE

