The « 4 per 1000 » Initiative

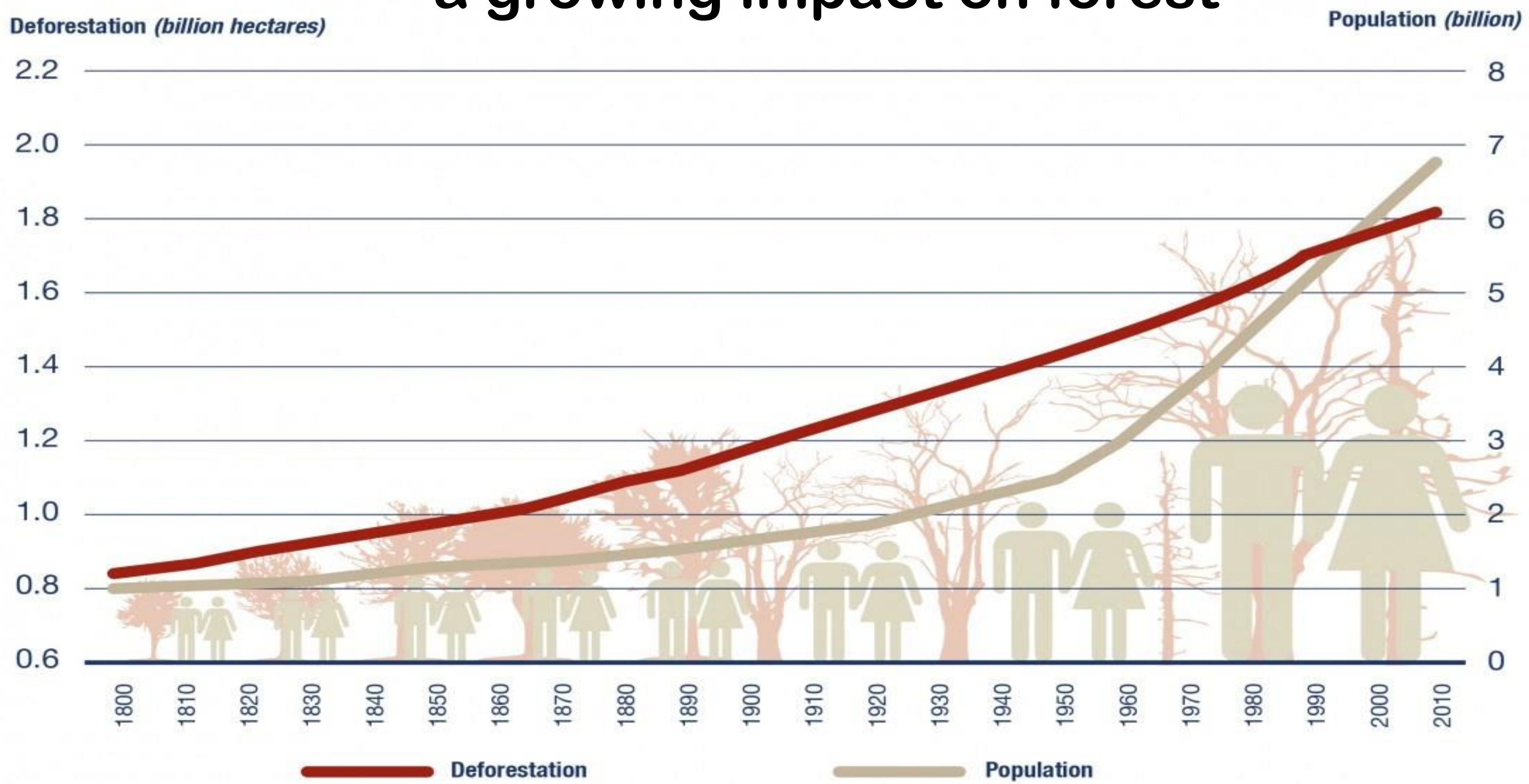
A global network for international cooperation on accelerating the adoption of best practices of agriculture transition

Paul LUU, Executive Secretary

February 21st, 2020

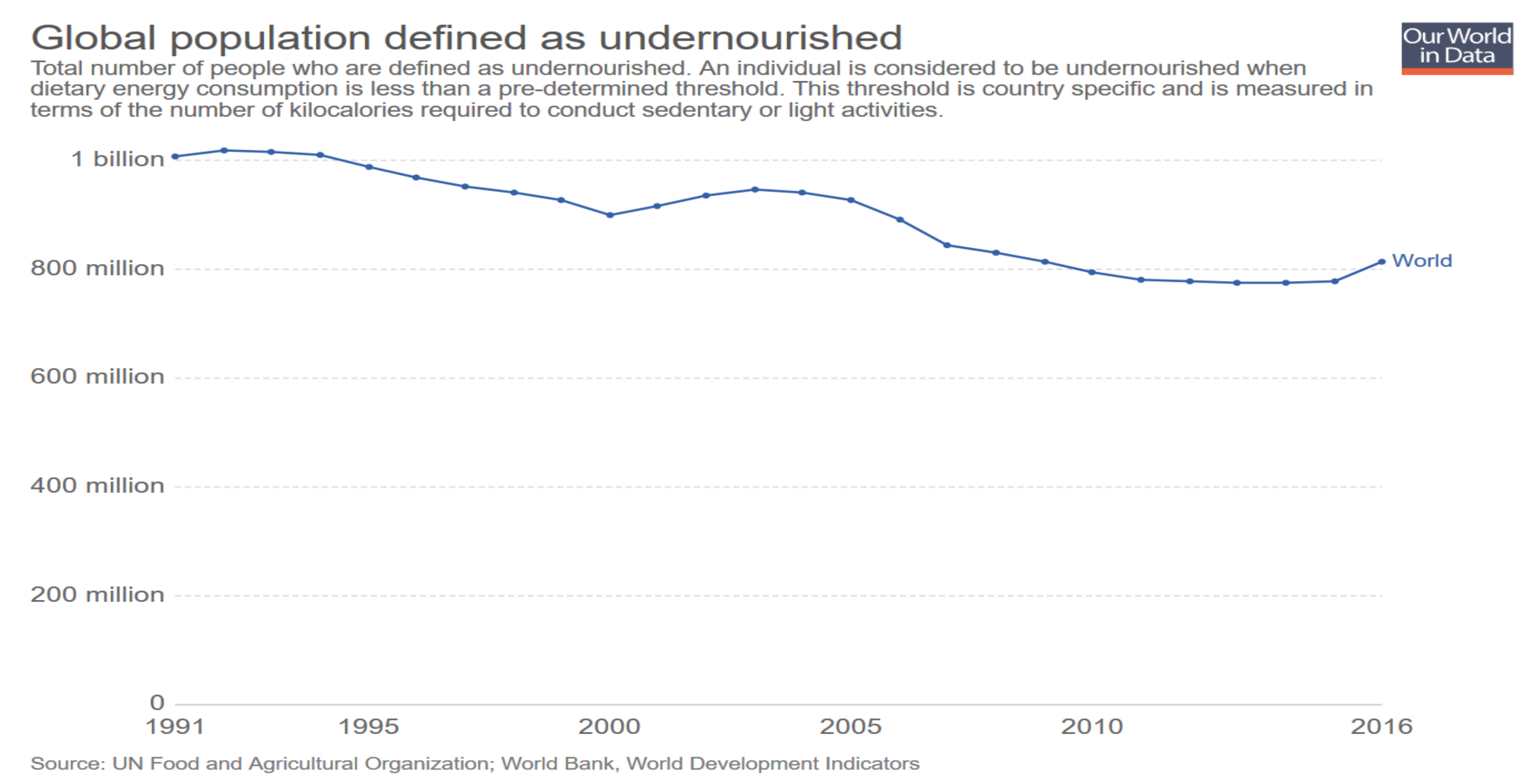
The context

A growing world population & a growing impact on forest



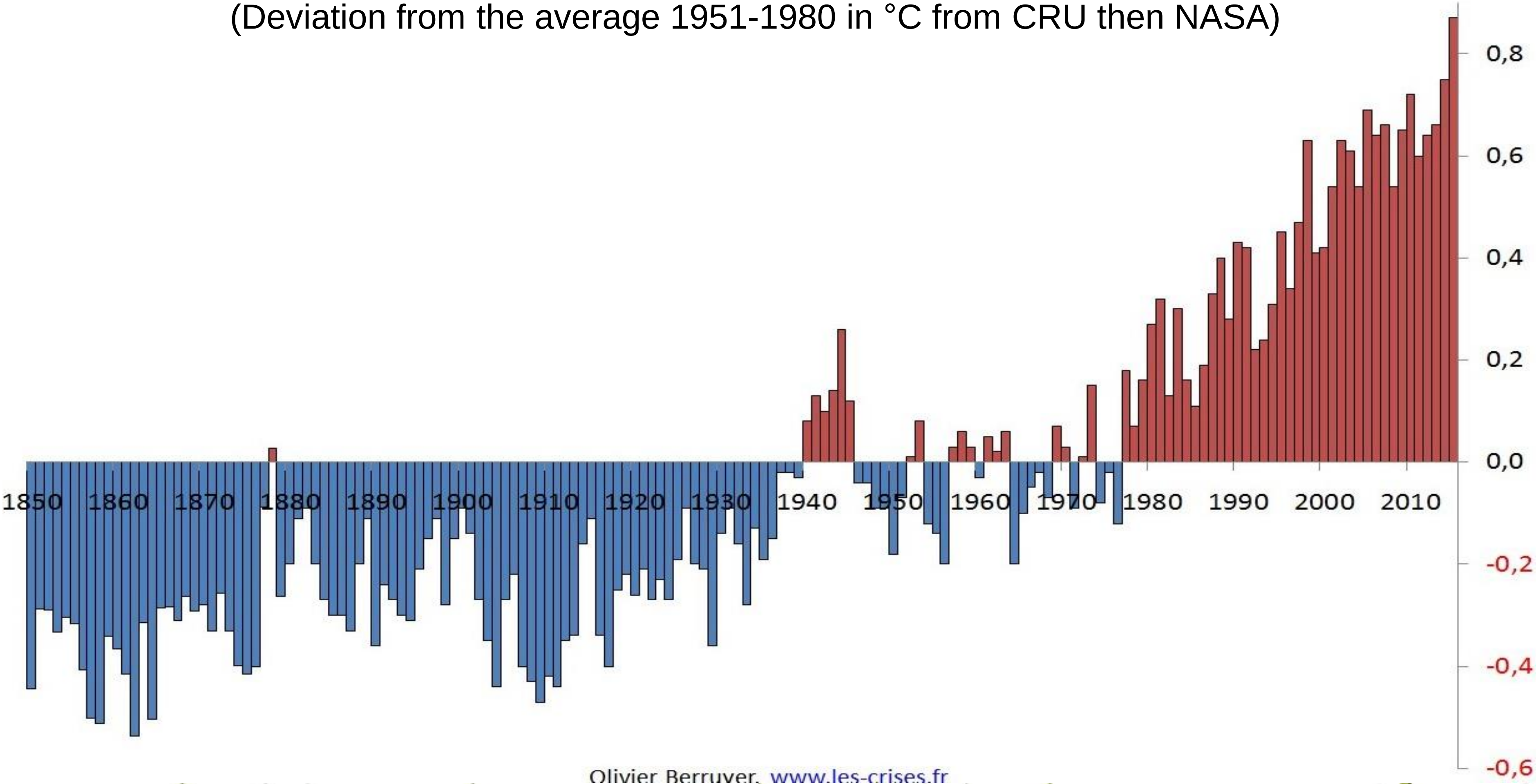
SOURCE: FAO (2012)

A (too) slowly decreasing population of undernourished

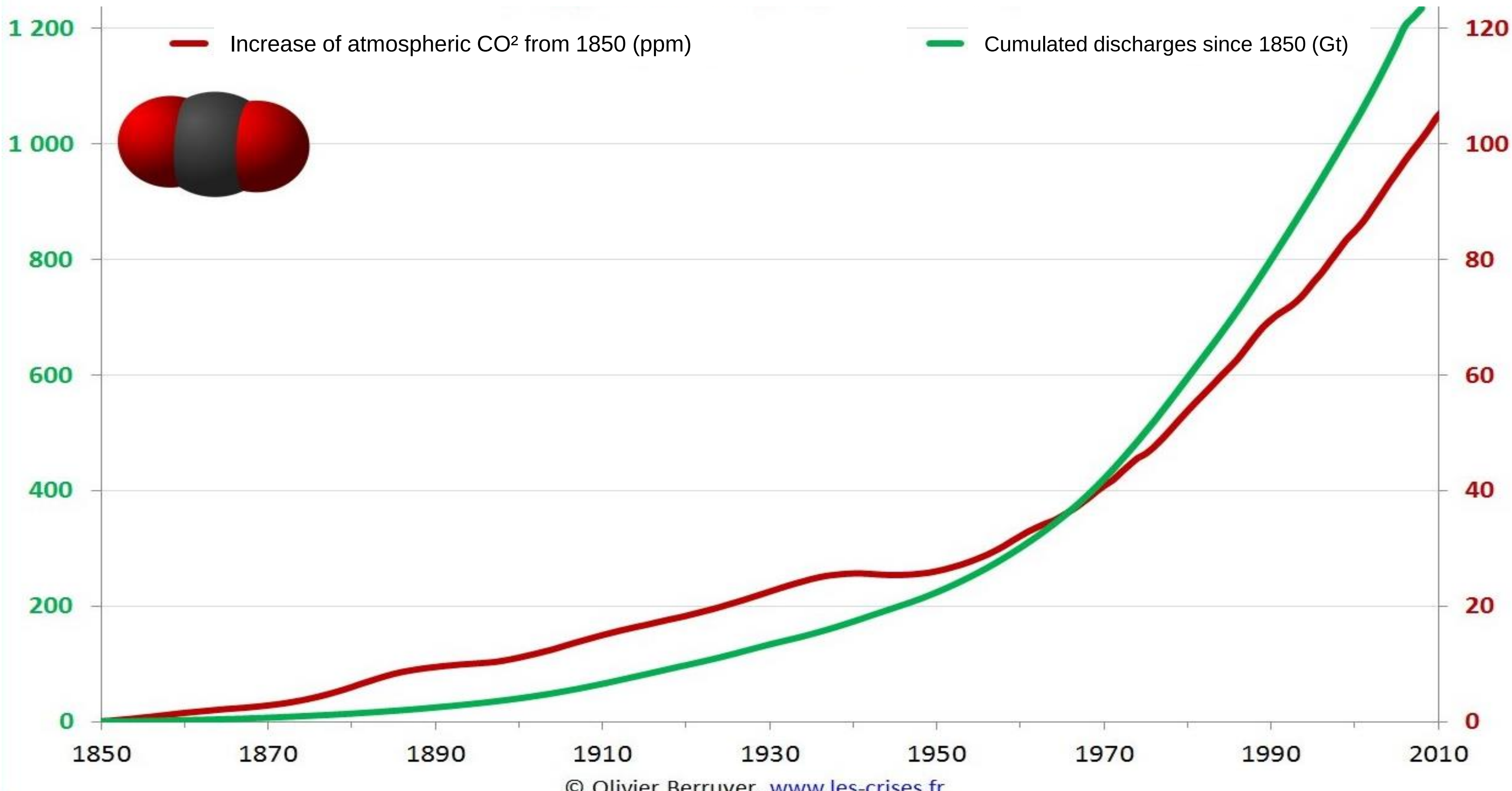


Evolution of the planet temperature (1850 to 2015)

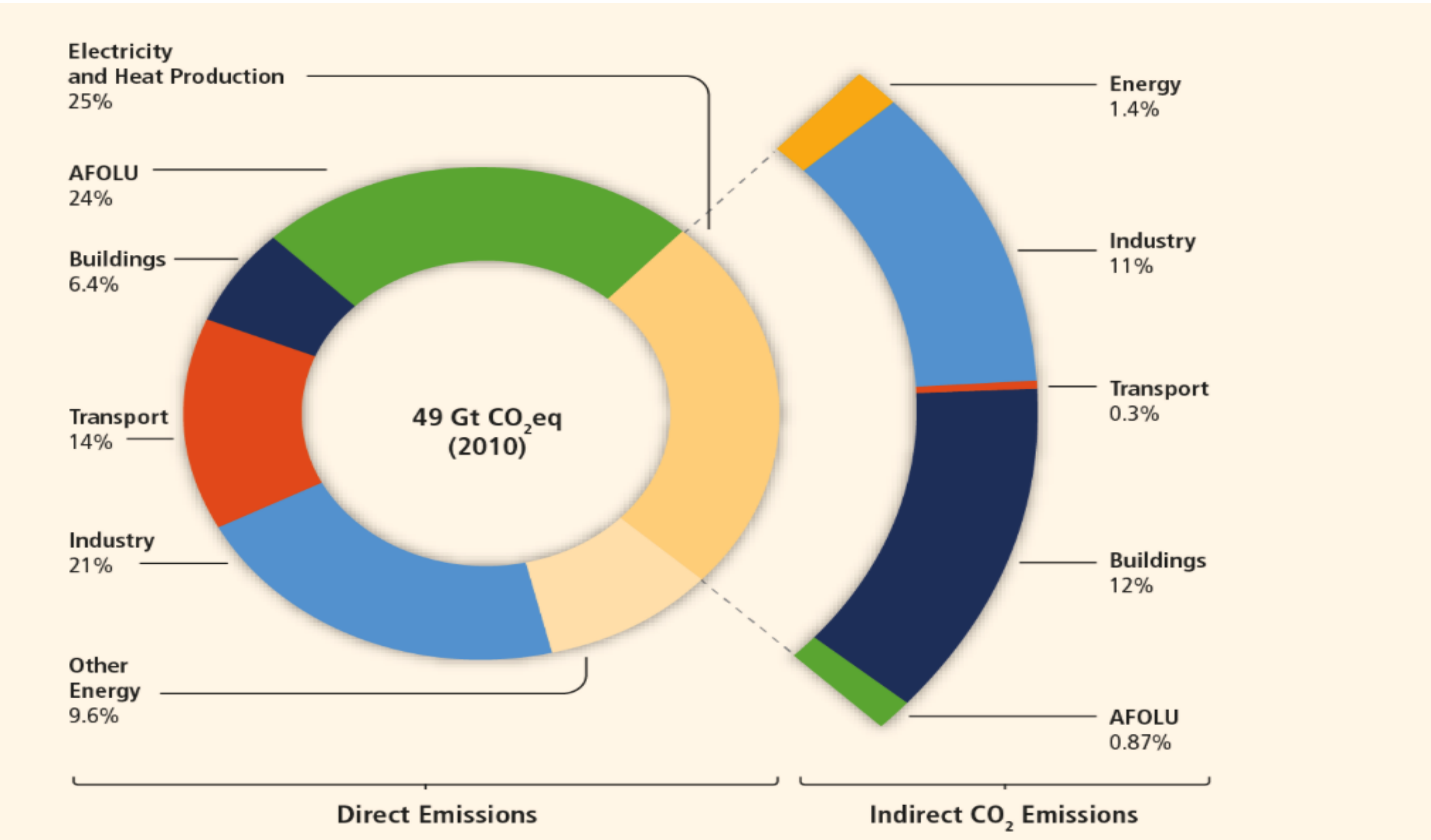
(Deviation from the average 1951-1980 in °C from CRU then NASA)



Human emissions of CO² & concentration of CO² in the atmosphere since 1850 (NOA)



Agriculture-related activities = 25% of global greenhouse gas emissions (CO2 eq.)

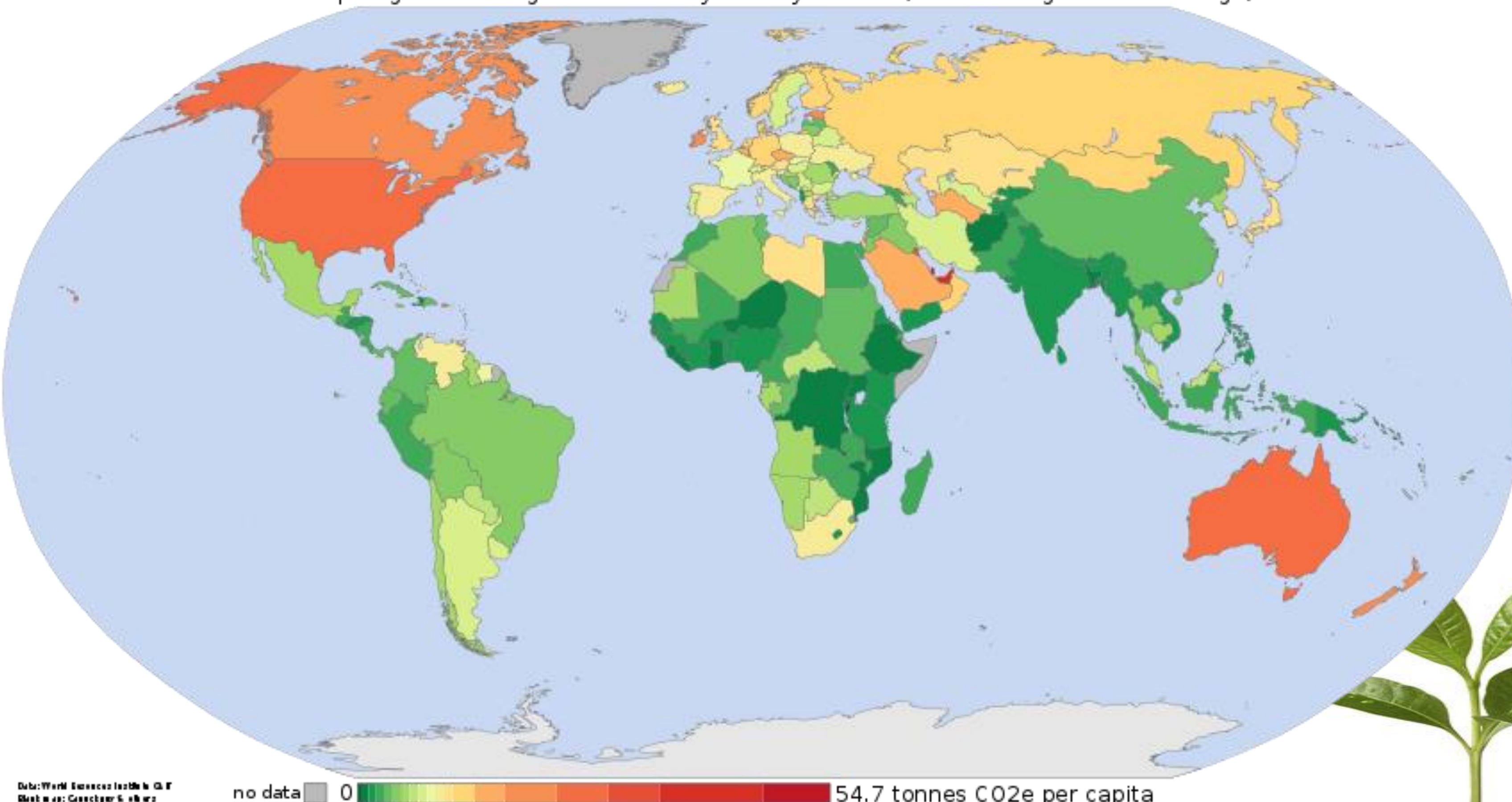


AFOLU: Agriculture, FOrestry and Land Use

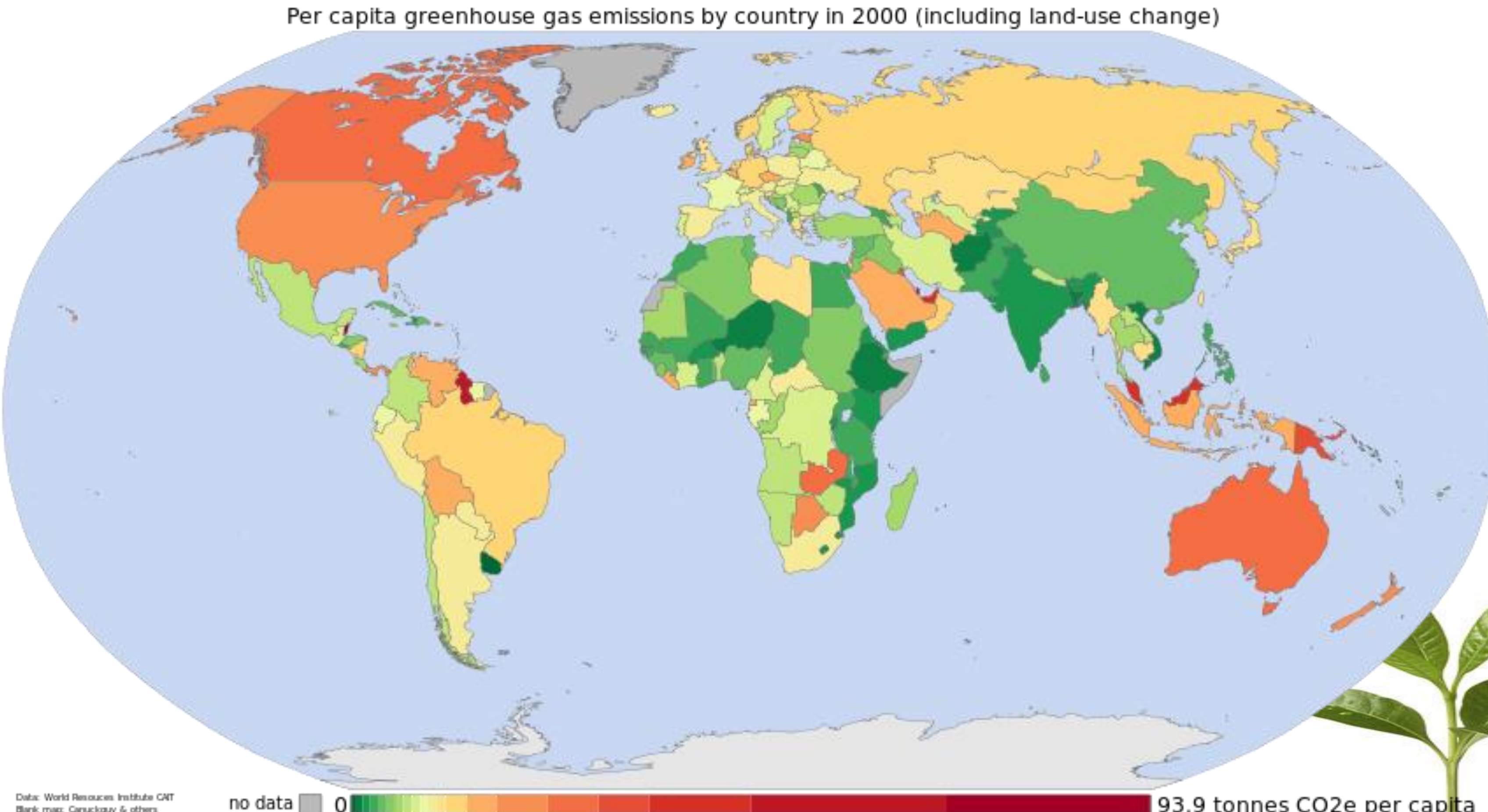
Source: IPCC WGIII - 2010

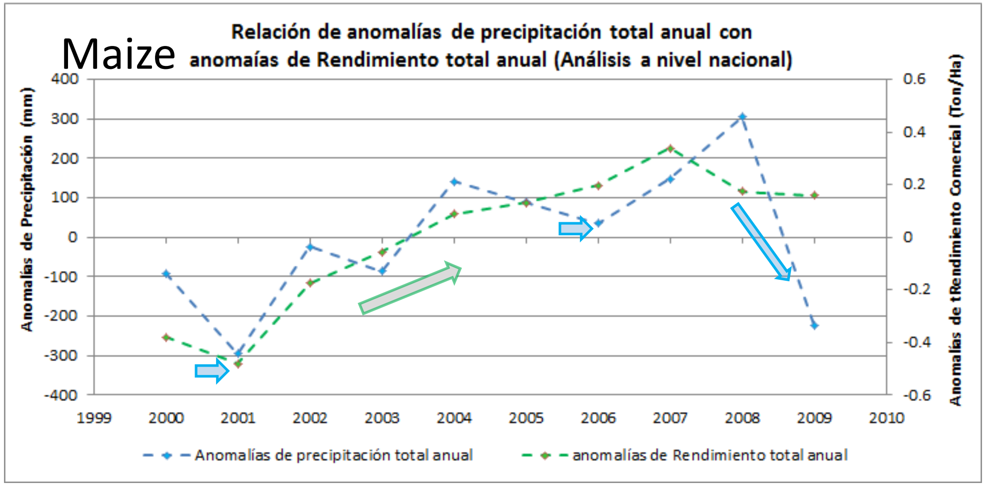
Importance of Land-Use Change (1)

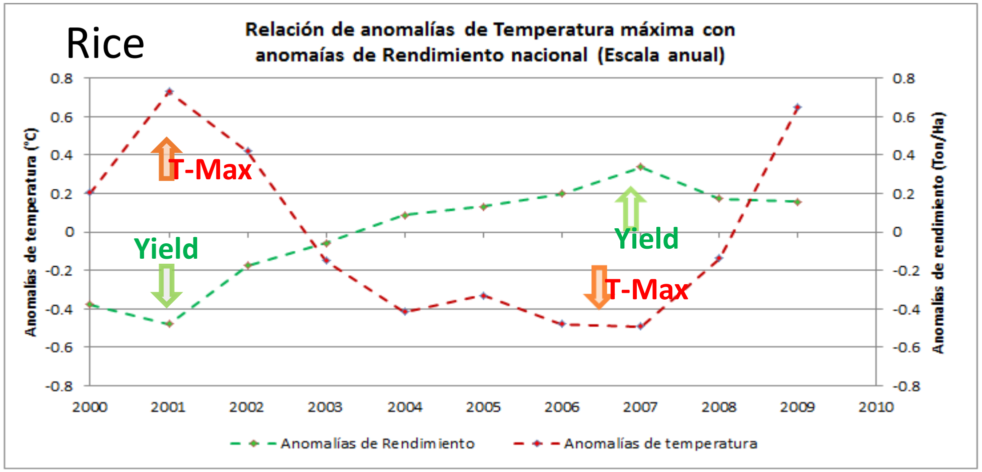
Per capita greenhouse gas emissions by country in 2000 (not including land-use change)



Importance of Land-Use Change (2)







Climate drives yield variation: our food systems are **sensitive** to climate,
not *resilient* to it

CGIAR

Research Program on Climate Change, Agriculture and Food Security

CCAFS

So, as an introduction: some facts

- A growing population with a (too) slowly decreasing number of undernourished
- An agriculture in the hot sea due to actions in the other economic sectors to reduce GHG emissions
- A need to adapt agriculture and forestry to ongoing climate change

And so … What?

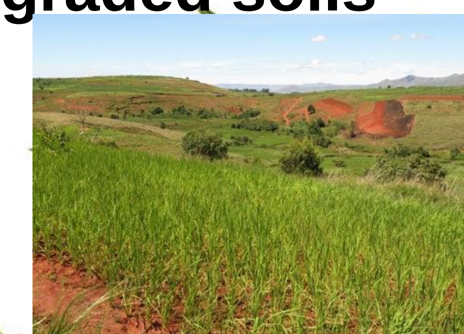
From these facts, 3 guidelines for action ….

- Act on GHG emissions (mitigation) at all level including agriculture and forestry
- Adapt agriculture and forestry to climate change
- Ensure food security that will otherwise be strongly impacted by climate change

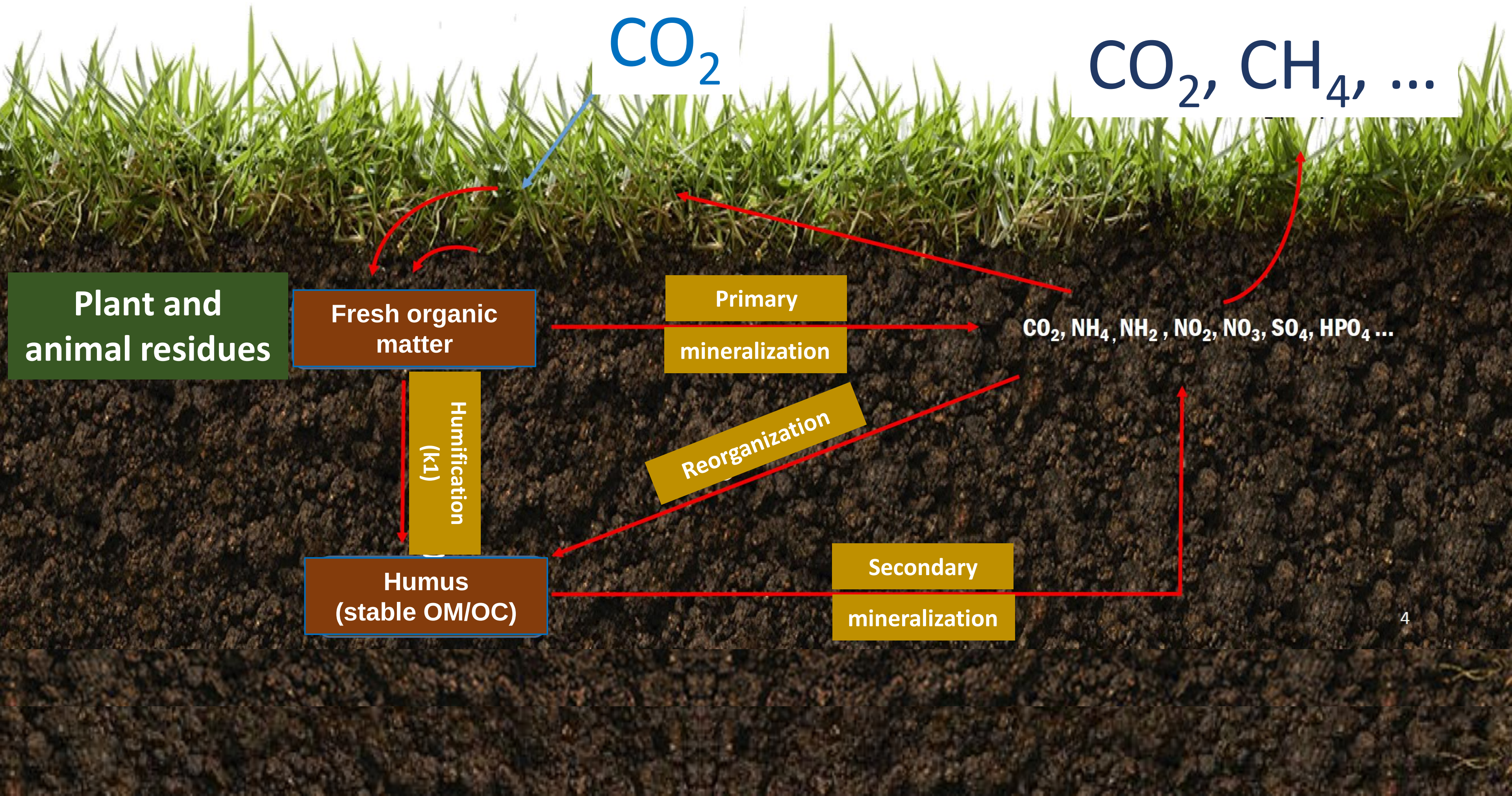
… Through one support: Soils and one action: carbon sequestration

Why storing C in soils?

- To **Mitigate climate change**
  - Attenuate GHG emissions. OC can be stored in soils for decades to millenia
  - Low cost negative emission technology
- To **Adapt to climate change**
  - Soil organic matter increases water retention capacity by soils,
  - decreases sensitivity to erosion
- To **Contribute to food security & restore degraded soils**
  - Major role of soil organic matter in soil fertility
  - Yields stability
  - Restoring degraded soils

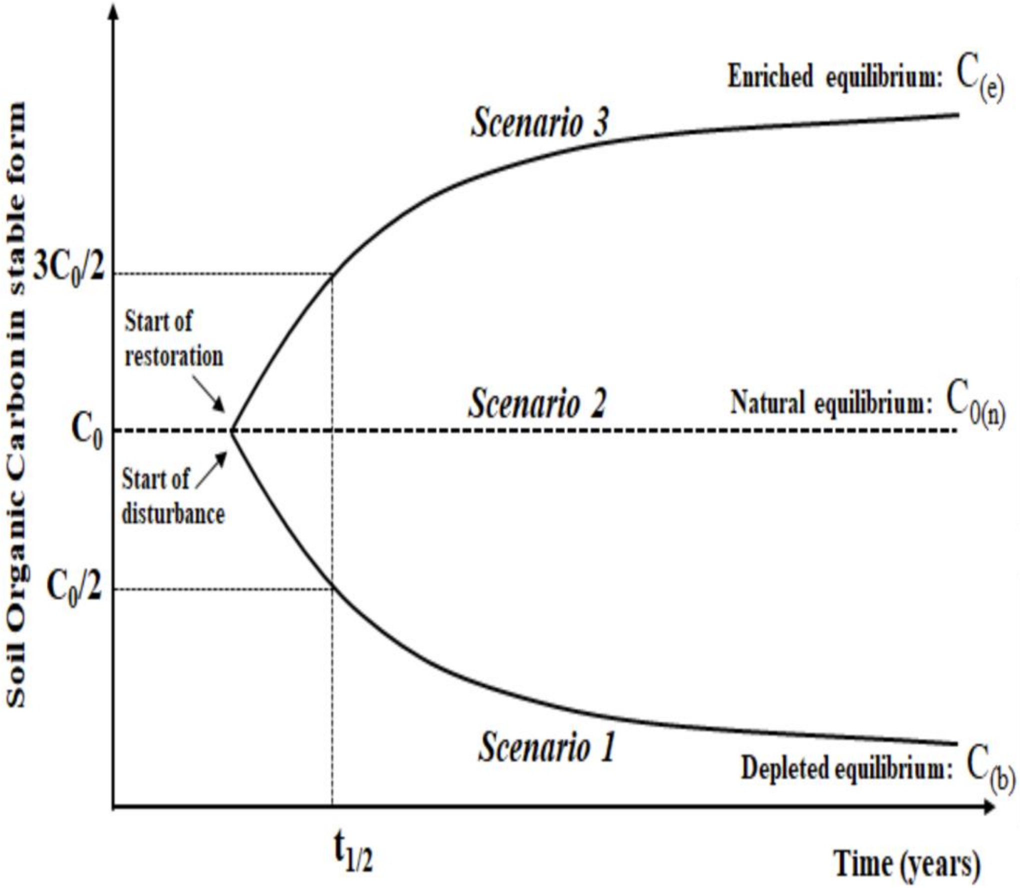


Carbon sequestration mecanisms in soils



Possible evolution of C in soils

3 possible scenarii



Ideal scenario: increase of the carbon stock (first order cinetique)

Very difficult scenario to realize

Normal « balanced » scenario: Loss of SOC by mineralization = Production of stable SOC by humification (dC/dt=0)

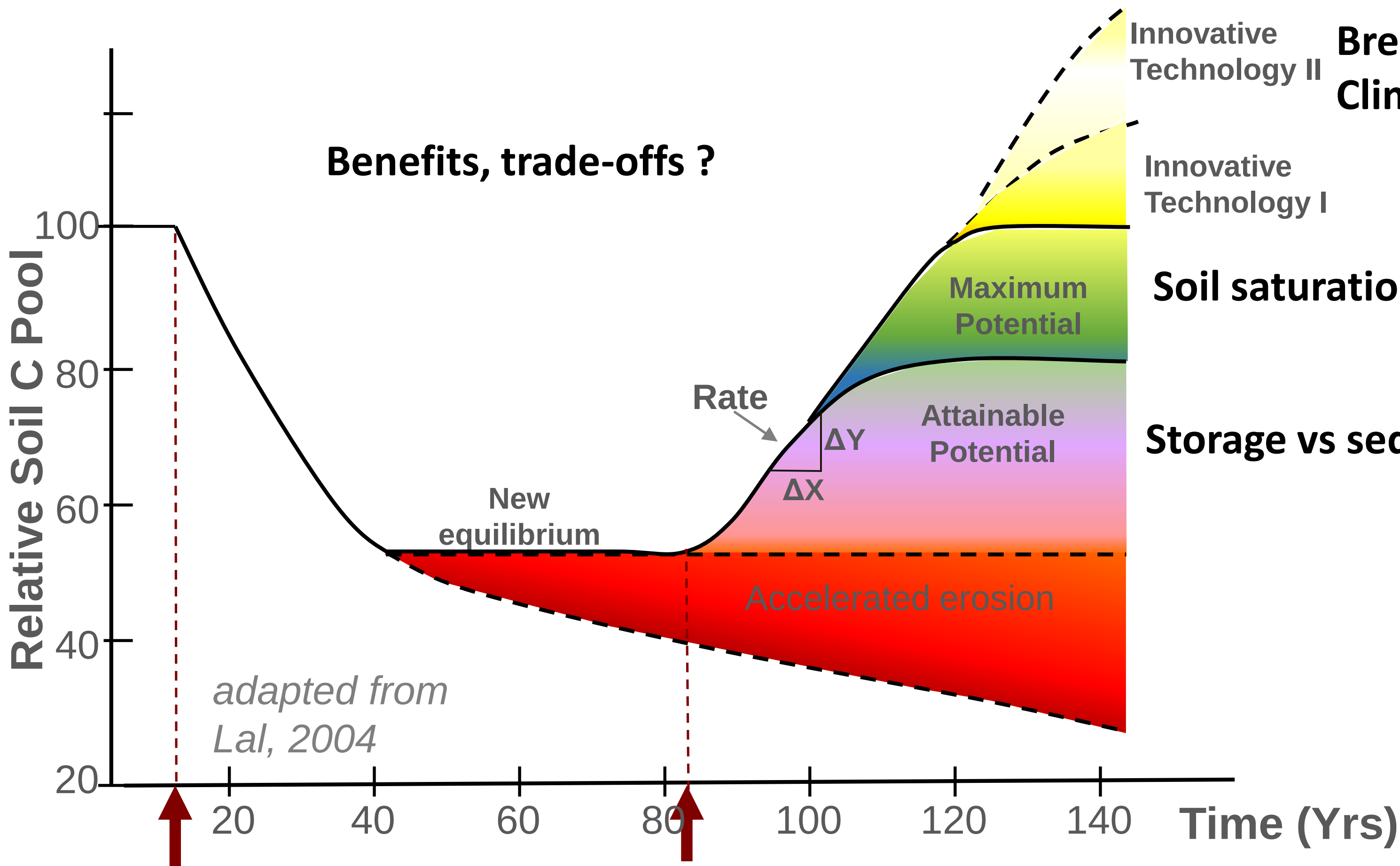
Possible scenario if rational practices

Scenario of « Losses » : Loss of SOC by mineralization > Production of stable SOC by humification

Recurent scenario in soils in dry areas

Source: Soudi & Bouabid (2018)

Research Priorities: Estimating the Potential of Soil Carbon and Associated Benefits

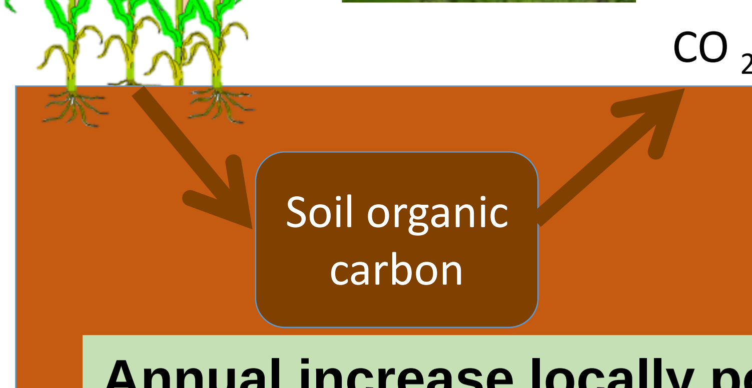


Subsistence farming, none or low off-farm input soil degradation

Adoption of better management practices

Limits and feasability: practices

Integrated soil fertility management



Agroforestry

Conservation agriculture

Water management

Annual increase locally possible

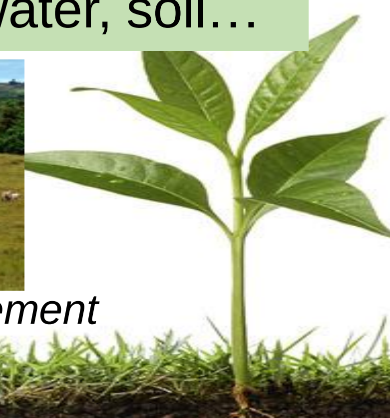
Great variability of C storage rates (climate, soil..)

Limits : biomass availability, nutrients, water, soil…

Cover crops

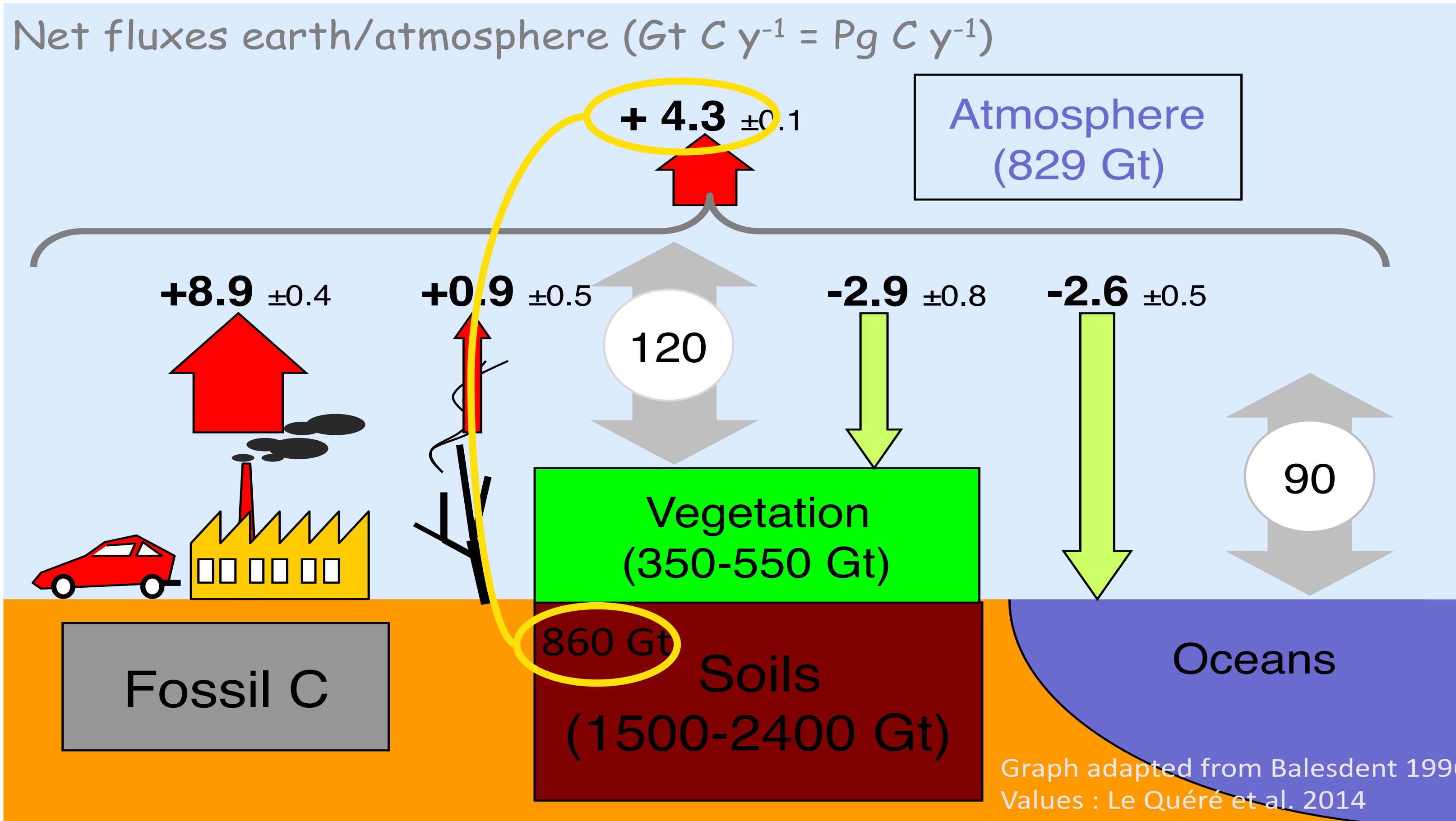
Organic fertilization

Rangeland management



The « 4 per 1000 » Initiative: Soils for Food Security & Climate

4/1000 : where does it come from?



An **annual increase of 4 ‰ of the world soil surface C stocks** (860*0.004) would nearly **compensate the annual CO_2 increase of the atmosphere**

Why storing C in soils?

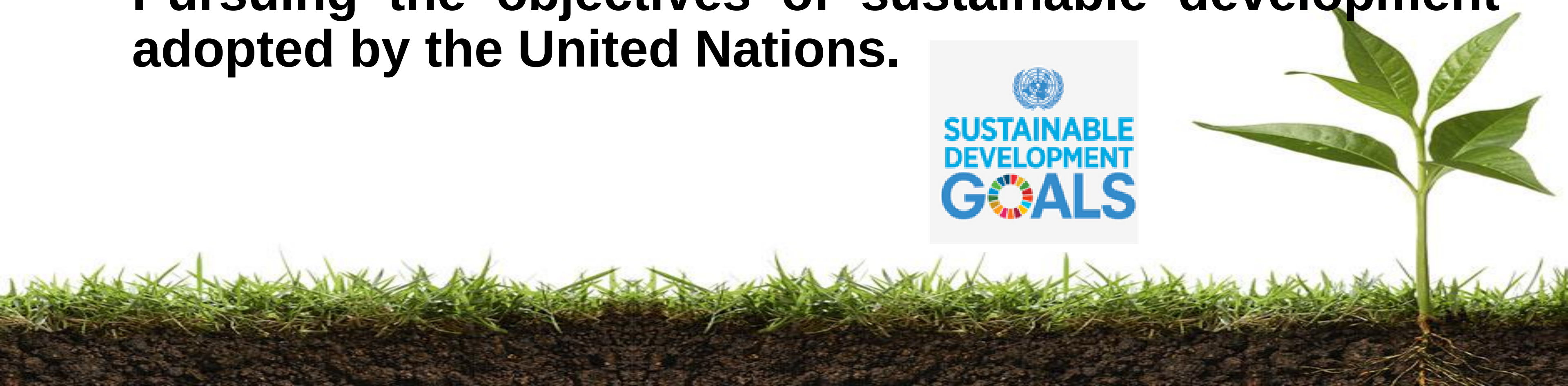
- To **Mitigate climate change**
  - Using a low cost negative emission technology
  - Attenuate GHG emissions, through organic Carbon that can be stored in soils for decades to millenia
- To **Adapt to climate change**
  - Soil organic matter:
    - increases water retention capacity of soils
    - decreases sensitivity of soils to erosion
- To **Contribute to food security & restore degraded soils**
  - Soil organic matter plays a major role in soil fertility…
  - … and in yields stability
  - It also helps restoring degraded soils

Goals of the 4‰ Initiative

Increase carbon sequestration in soils as organic matter, for:

- increasing food security
- adapting agriculture to climatic changes
- mitigating climate change

Pursuing the objectives of sustainable development adopted by the United Nations.



Targets of 4°/oo and SDGs

SUSTAINABLE DEVELOPMENT GOALS

Direct TARGETS

ASSOCIATED TARGETS

Safeguard TARGETS: help Ex-ante assessment to avoid harmful impacts

Partners & Members (Feb. 2020)

FORUM partners

448 signatories of the Paris Declaration

Including 46 countries & provinces,13 international organizations, 11 foundations & development banks, 144 NGOs, 89 research & education bodies & Universities, 47 Farmers organizations and 98 enterprises

CONSORTIUM Members

Already 214 signatories of the Declaration of Intention n°2

Chair : **Dr. Ibrahim MAYAKI** (ES NEPAD)

Vice-Chair : **Mr. Stephane LE FOLL** (ex - Min. Agriculture – France)

An overview of Partners & Members

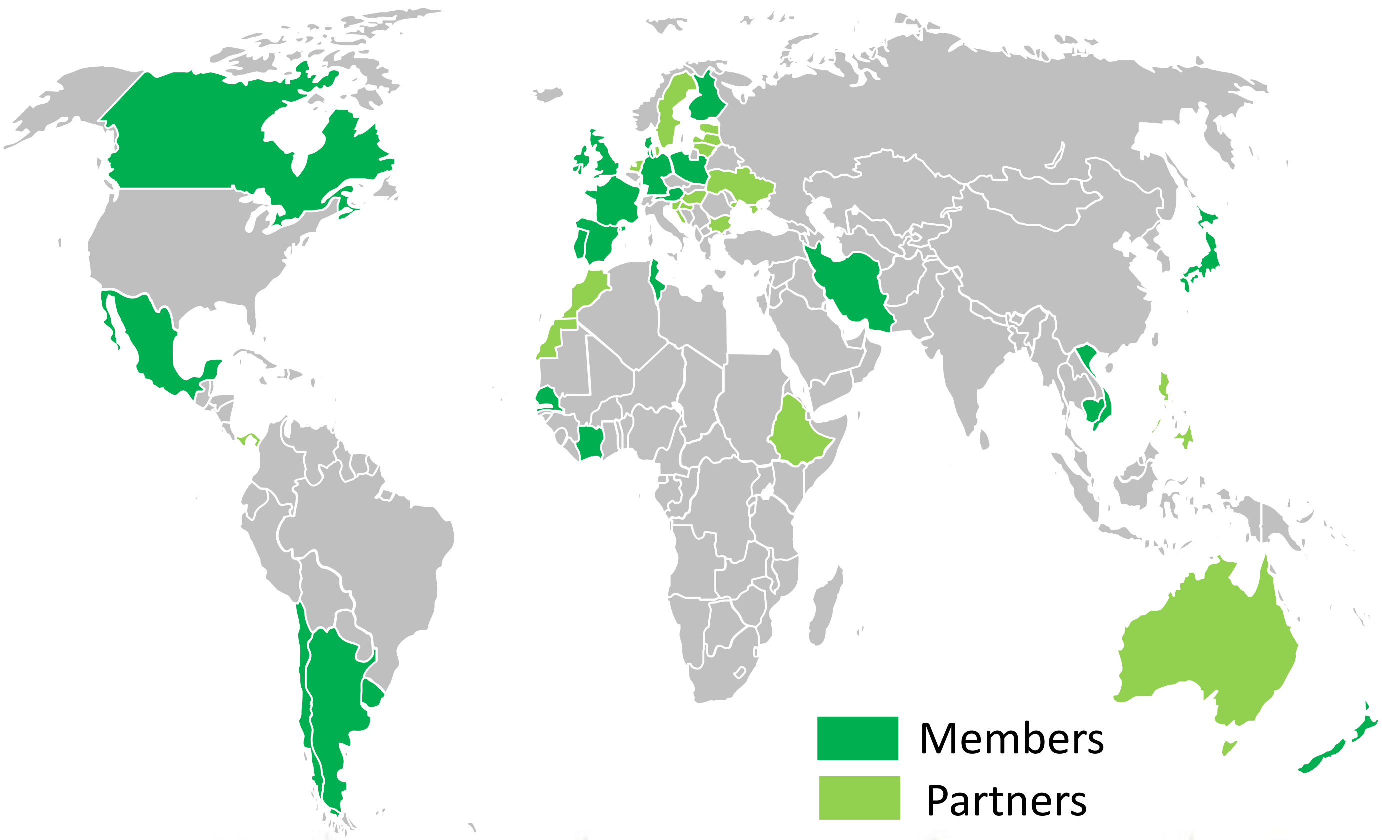
448 Partners

among which

214 Members

(February 2020)

Some Partners & Members in 2020



Etc.

What do we have to do ?

Some results according to pratices

Country	Practice	Impact on soil C (‰ year^{-1})	References
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, Mediterranean zone	Wheat / walnut agroforestry associations	7 (after 18 years)	*Cardinael et al. 2015a, b; 2017*

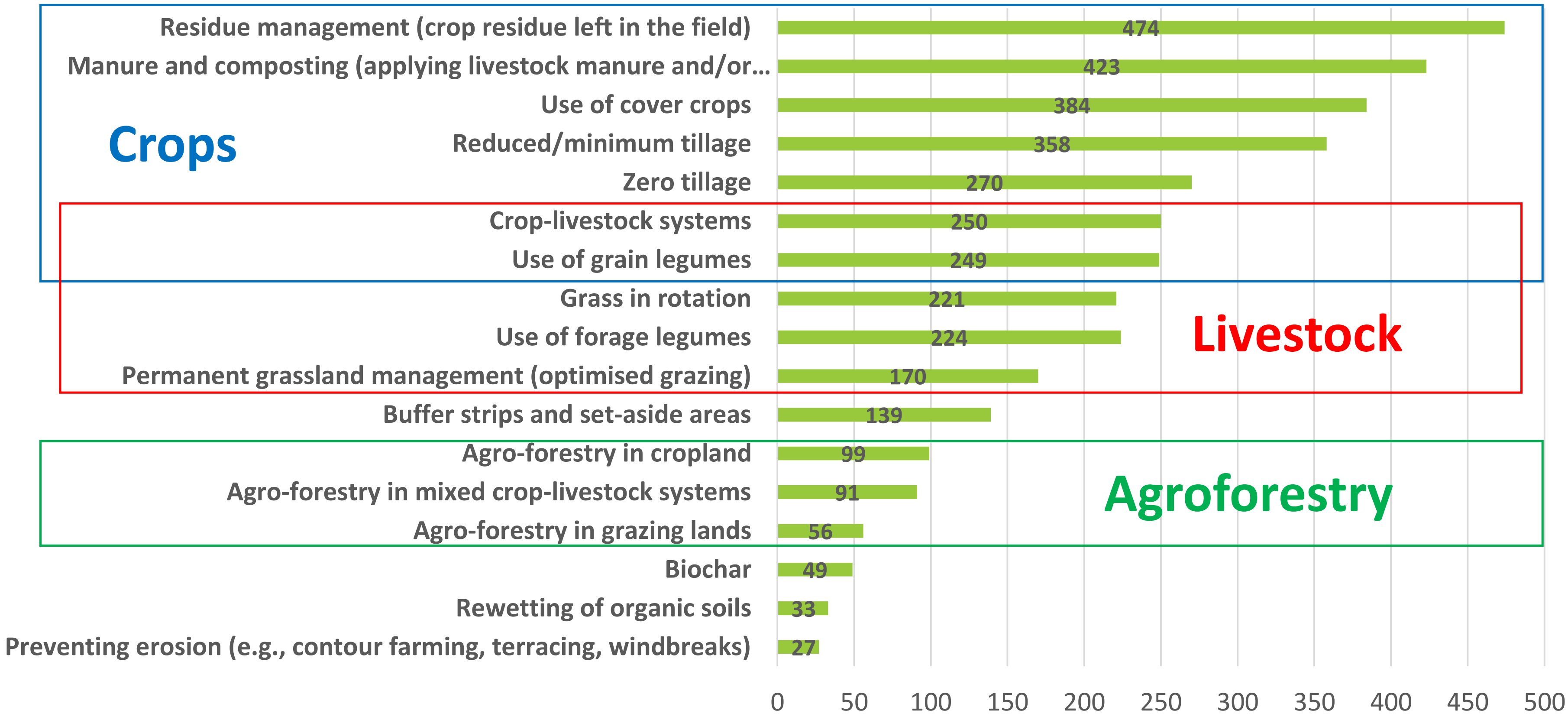
E. Torquebiau et al., CIRAD

Mechanisms for Soil C Sequestration in Agriculture

Activity	Practice	Specific management change	Increase C inputs	Decrease C losses	Reduce disturbance
Cropland management	Agronomy	Increased productivity	X		
		Rotations	X		
		Catch crops	X		
		Less fallow	X		
		More legumes	X		
		Deintensification			X
		Improved cultivars	X		
	Nutrient management	Fertilizer placement	X		
		Fertilizer timing	X		
	Tillage / residue management	Reduced tillage			X
		Zero tillage			X
		Reduced residue removal	X		X
		Reduced residue burning	X		X
	Upland water management	Irrigation	X		
		Drainage	X		
	Set-aside and land use change	Set aside	X		X
		Wetlands	X	X	
	Agroforestry	Tree crops inc. Shelterbelts etc.	X		X
Grazing land management	Livestock grazing intensity	Livestock grazing intensity		X	
	Fertilization	Fertilization	X		
	Fire management	Fire management		X	
	Species introduction	Species introduction	X		
	More legumes	More legumes	X		
	Increased productivity	Increased productivity	X		
Organic soils	Restoration	Rewetting / abandonment		X	X
Degraded lands	Restoration	Restoration	X	X	X

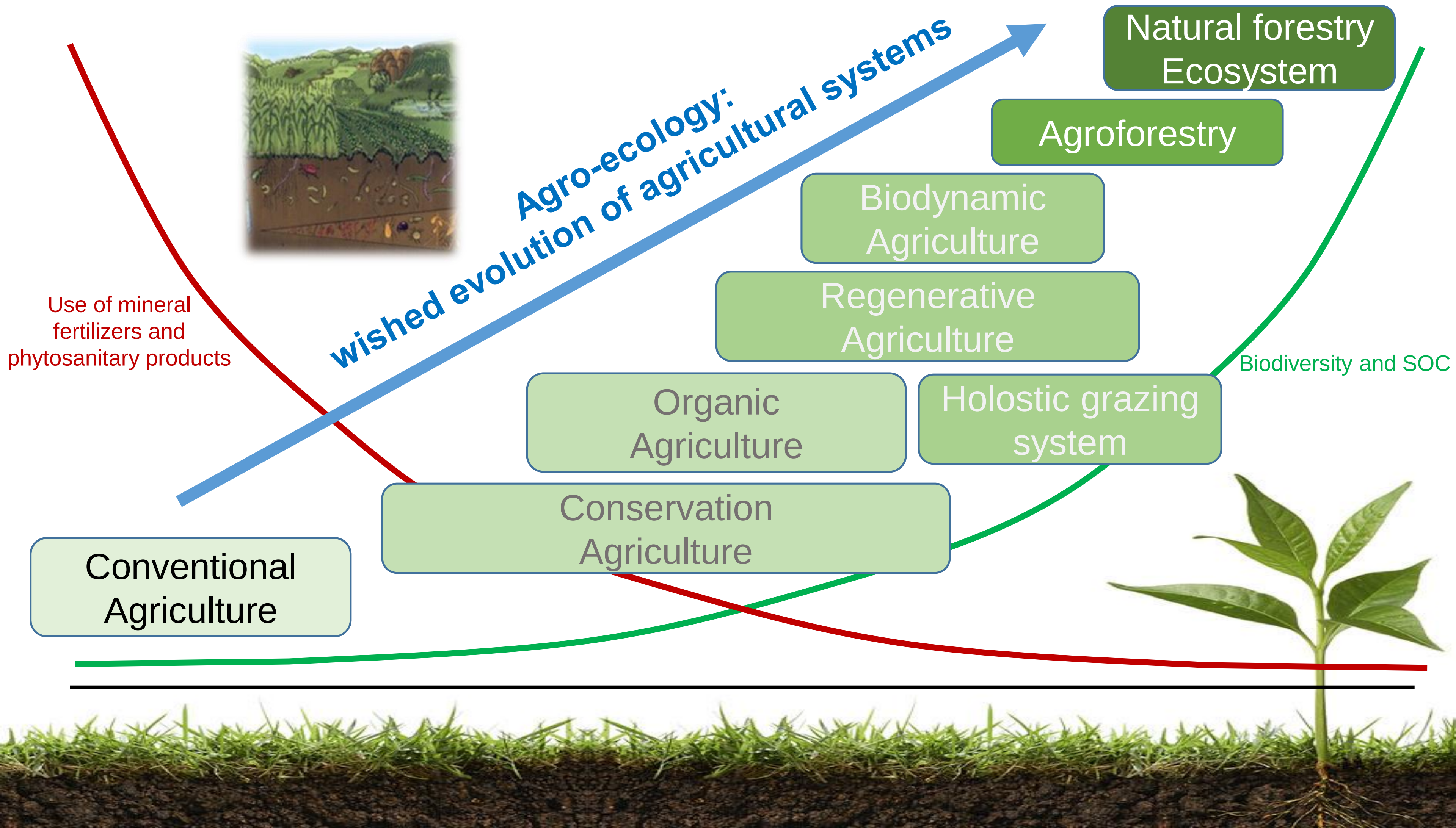
Smith et al. (2008)

Options that farmers are using for soil organic carbon management



(International survey for farmers: 7 languages, 975 respondents) – Circasa 2019

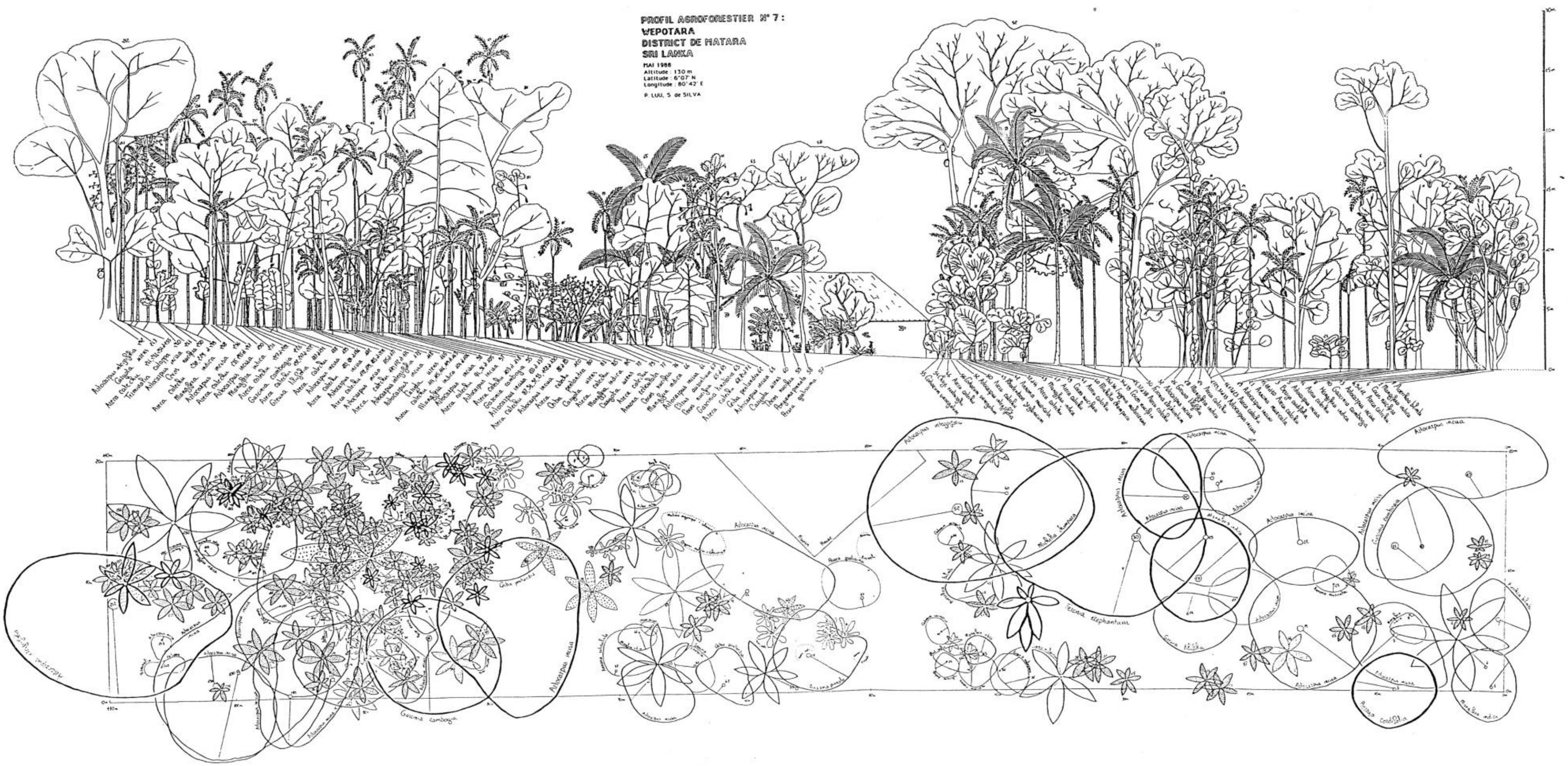
Future trend towards agro-ecology



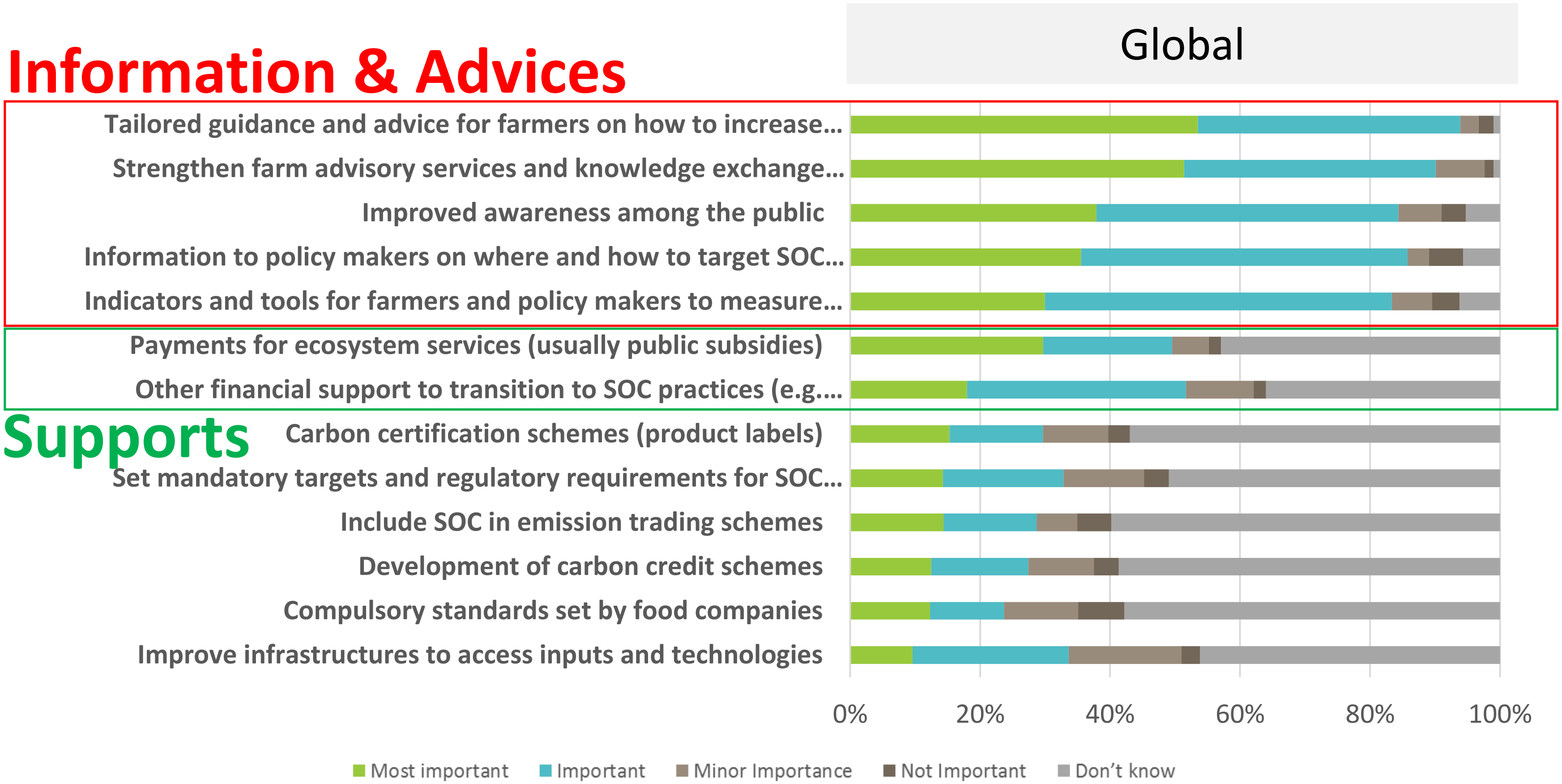
Comparison of main agricultural syst.

	Tillage	Inputs: Pesticides & mineral fertilizers	Crops rotation & association	Cover crops	Trees and Schrubs	Livestock
Conventional Agriculture	Heavy down to 40 cm deep	No constraint	Possible	No	No	Possible with indirect link (Manure)
Conservation agriculture	No or very low	No constraint but limited use (lower need)	Crops rotation in time and/or in space	Compulsary (no bare soil)	Possible (often natural fences around fields)	Possible with indirect link (Manure)
Organic agriculture	No constraint	Positive list of authorized pest. & organic fertil.	Possible	Possible	Possible (often natural fences around fields)	Possible with indirect link (Manure)
Holistic grazing system	No	Organic inputs	Not relevant	Soil never bare due to grass	Possible (often natural fences around fields or for shade)	Grazing system based on natural movements of hordes of wild ruminants
Regenerative agriculture	No	Organic inputs	Crops rotation in time and/or in space	Compulsary (no bare soil)	Possible (often natural fences around fields)	Recommended with indirect link (Manure)
Biodynamic agriculture	No constraint	Specific preparations from plants & animals - organic inputs	Crops rotation in time and/or in space	Possible	Possible (often natural fences around fields)	Possible with indirect link (Manure and preparations)
Agroforestry	No constraint but no or very low (trees	No constraint but limited use (lower need)	By nature: trees and shrubs from alley cropping to multilayer systems	Soil never bare due to trees and shrubs vegetation	Compulsary: presence of trees is at the heart of agroforesrty	Possible with indirect link (Manure - forage)

Agroforestry systems: the closest to the natural ecosystem

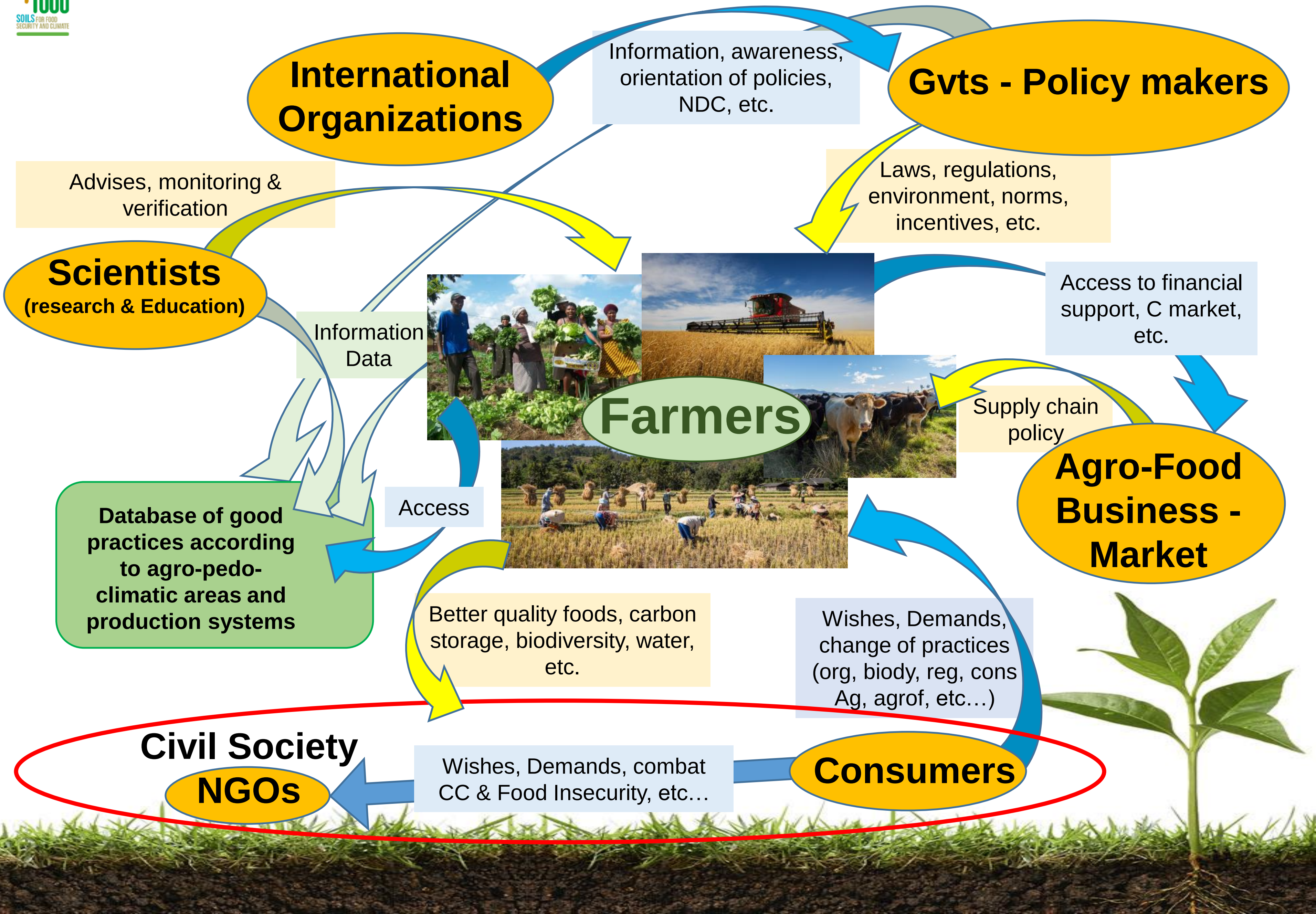


Farmers' views on solutions to increase adoption of soil carbon sequestration



(International survey for farmers: 7 languages, 975 respondents) – Circasa 2019

Agriculture & Climate in the NorthEast: Soil & Ecosystem Health -Tufts University - Feb. 21st 2020



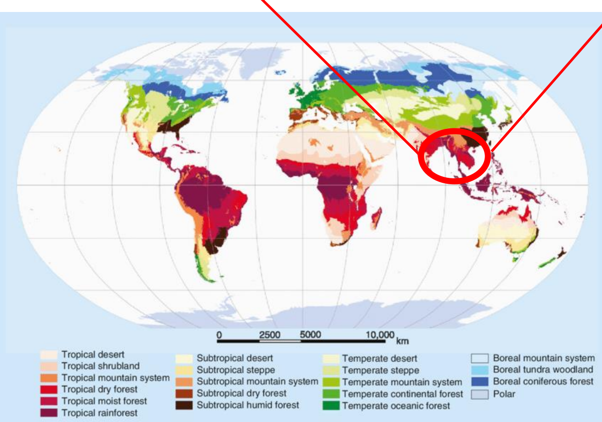
An international database accessible to farmers…

In each Agro-pedo-climatic zone: different farming systems:

- Large industrial farm
- Medium size farm
- Small and family farm
- Subsistence family unit
- ……

In each farming system: different cropping and livestock systems:

- Crop. Syst 1
- Crop. Syst. 2
- Livestock Syst. 1
- Livestock Syst. 2
- Agrofor. 1
- …



The FAO Global Ecological Zones © FAO (2012)

List of possible adapted practices	Descrition of Each practice	Economic results

Practice 1
Practice 2
Practice 3
…..
	- Exemples
	- Tutorials
	- Technical results :
	  - Yield
	  - C stored
	  - W in man/ha
	- …..
		- Level of investment
		- Equipment needed
		- Time scale for implementation
		- Net margin per ha
		- ……

Give the choice and the power to decide to farmers

Ideal solution : a mix of obligation of means and results

Prior to adoption by farmers: discussion, sensibilisation and information on agro-ecology

Database of practices → **Proposition of practices** (technical advises / Orientations) for the specific agro-pedo-climatic conditions of farmers and according to their farming systems, and cropping & livetock systems

Permanent control on practices :

- no tillage,
- cover crops,
- crops rotation,
- trees,
- holistic grazing management,
- etc…

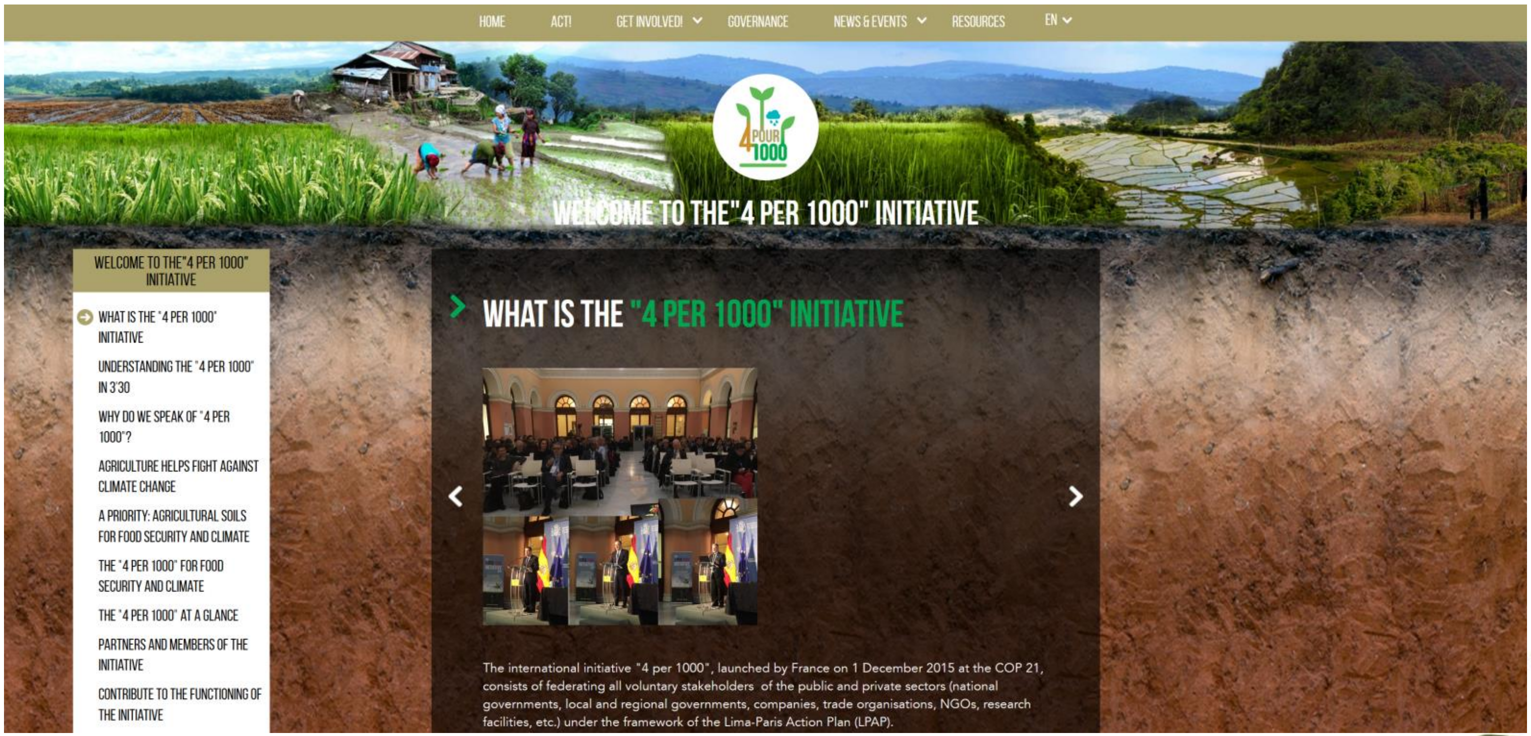
Agreement by farmers to obligation of means: farmers commit to implement the recommanded practices with regular checking through various methods (remote sensing, visits, etc…) **and obligation of results** with soil sampling every 5 years (C stored, water retention capacity, biodiversity, etc.)

Payment of higher prices on productions to farmers **and/or payment of environmental services**: C storage, land protection, etc…

t0 1 2 3 4 5 6 7 10 15

Periodic Samplings : measurement in lab – evolution on the long run

www.4p1000.org



Thank you for your attention….