Research Institute of Organic Agriculture FiBL
info.suisse@fibl.org, www.fibl.org

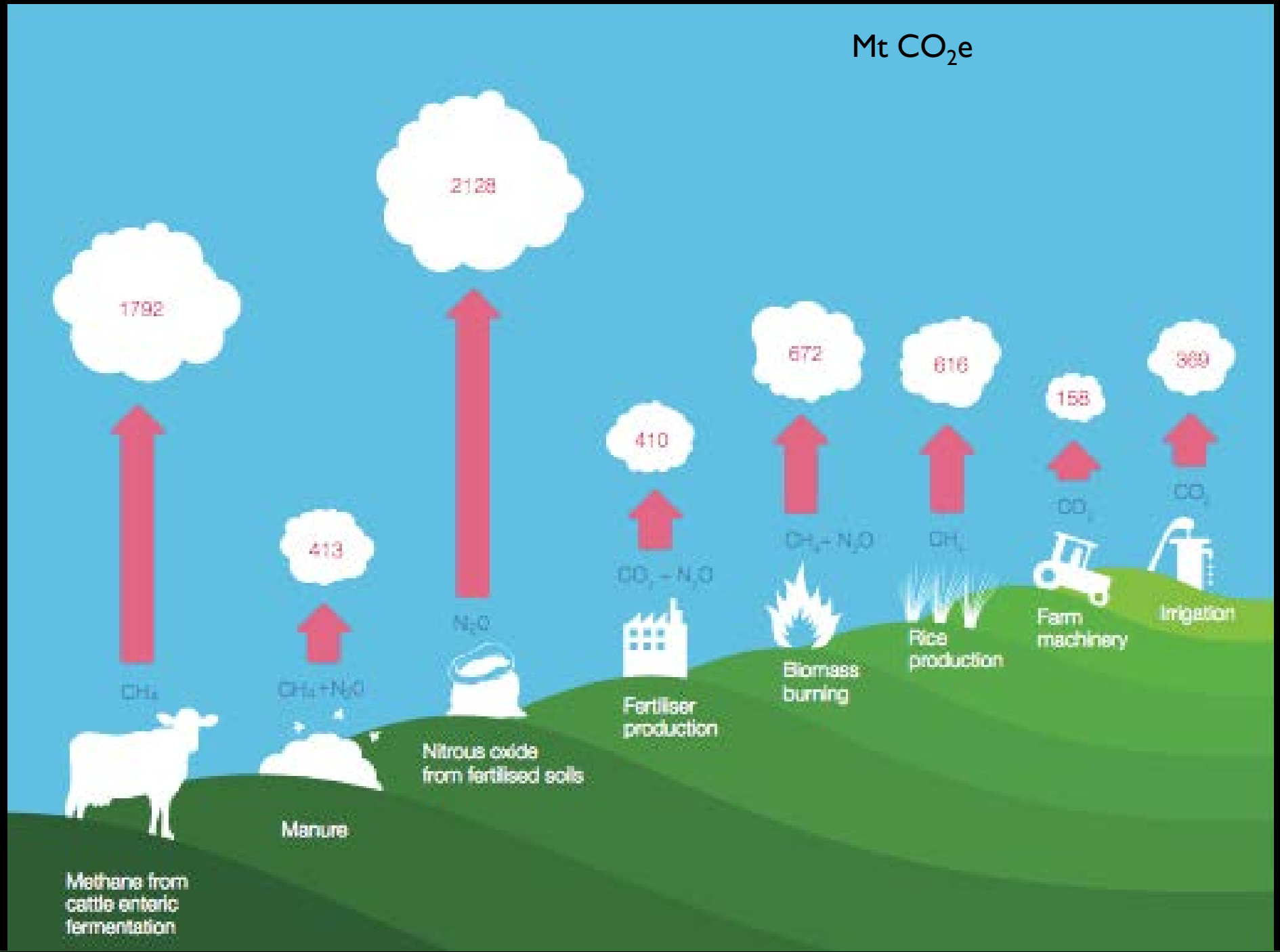
Sustainability in global agriculture driven by organic farming

The impacts of a 100% conversion scenario to organic agriculture with a focus on climate change related indicators

Adrian Muller

Biofach 2021 – Climate Safe Diets

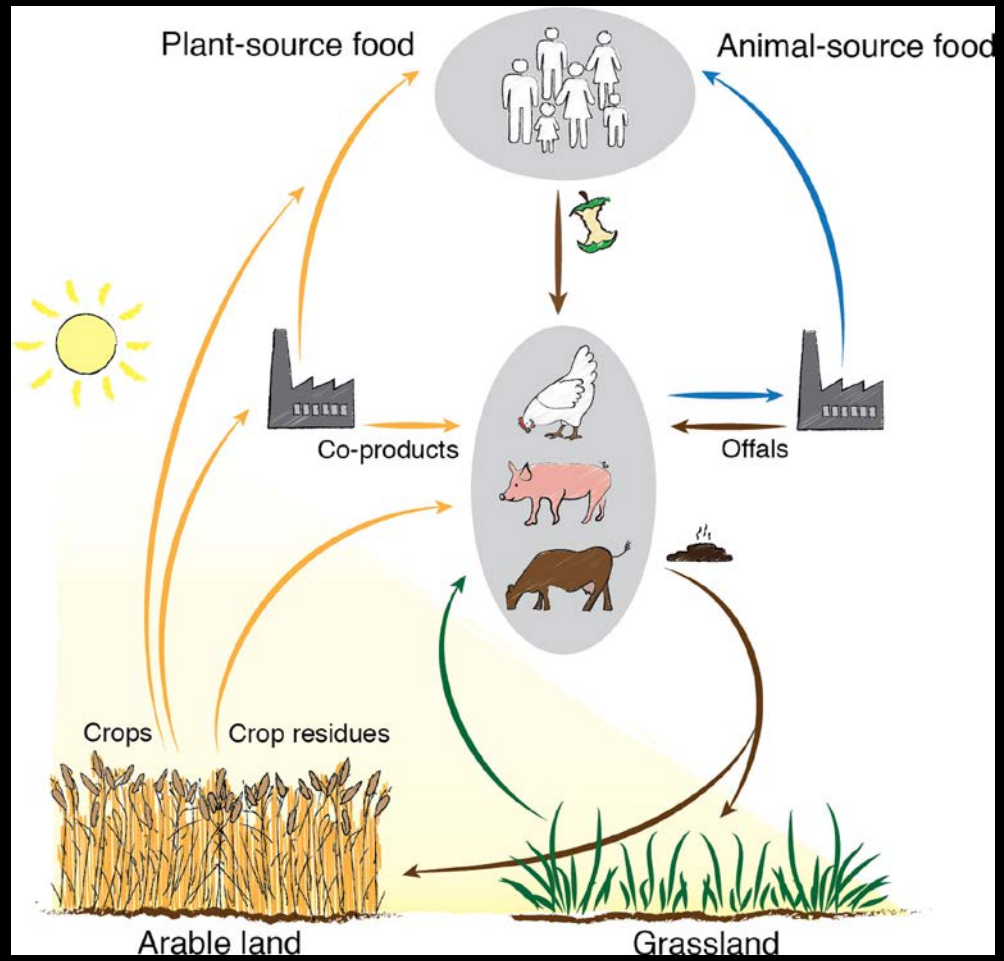
Online, February 19, 2021, 10.00-11.30



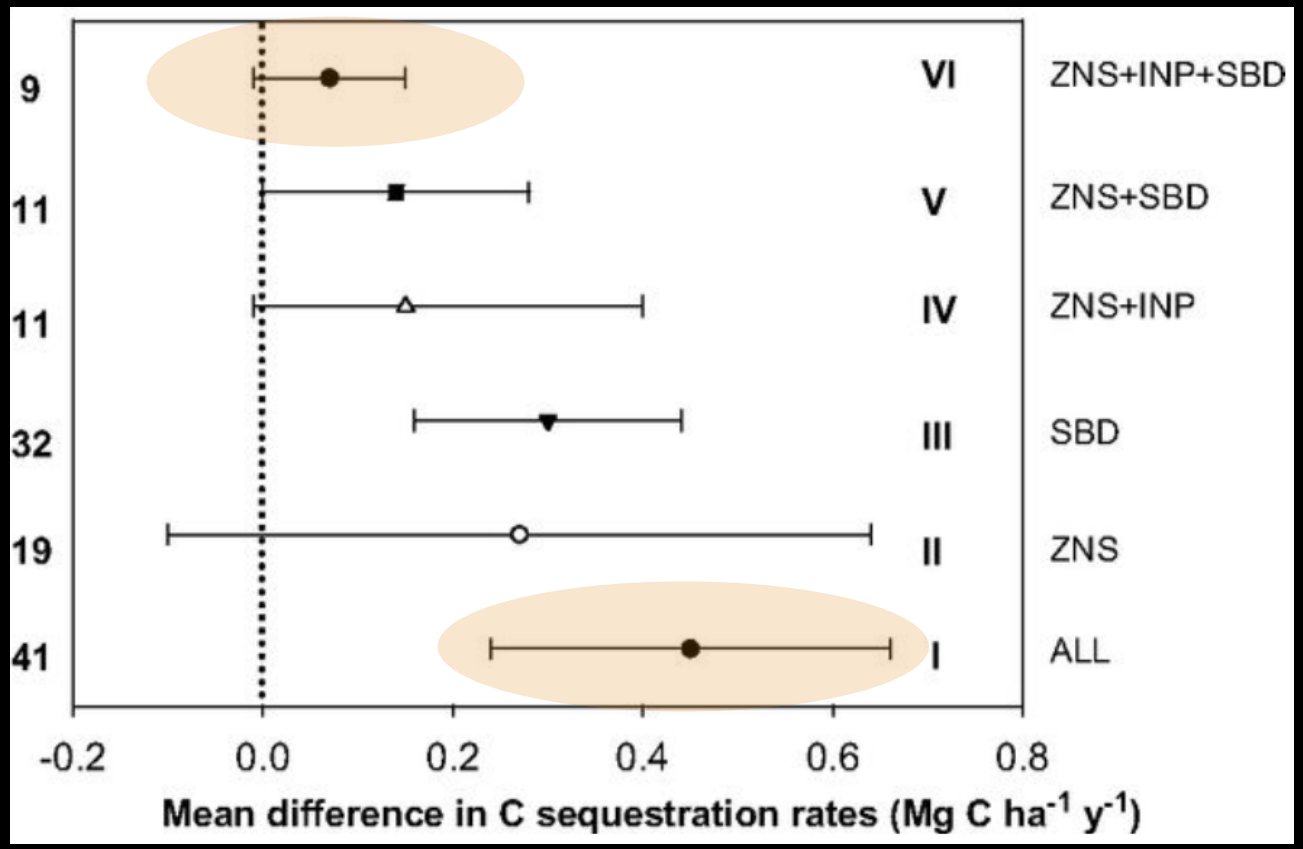
Bellarby et al. 2008
Old data, but still illustrates the situation also today.

Mitigation paths provided by organic agriculture

- Ideas from circular food systems –
  less nitrogen, less feed imports, less animals

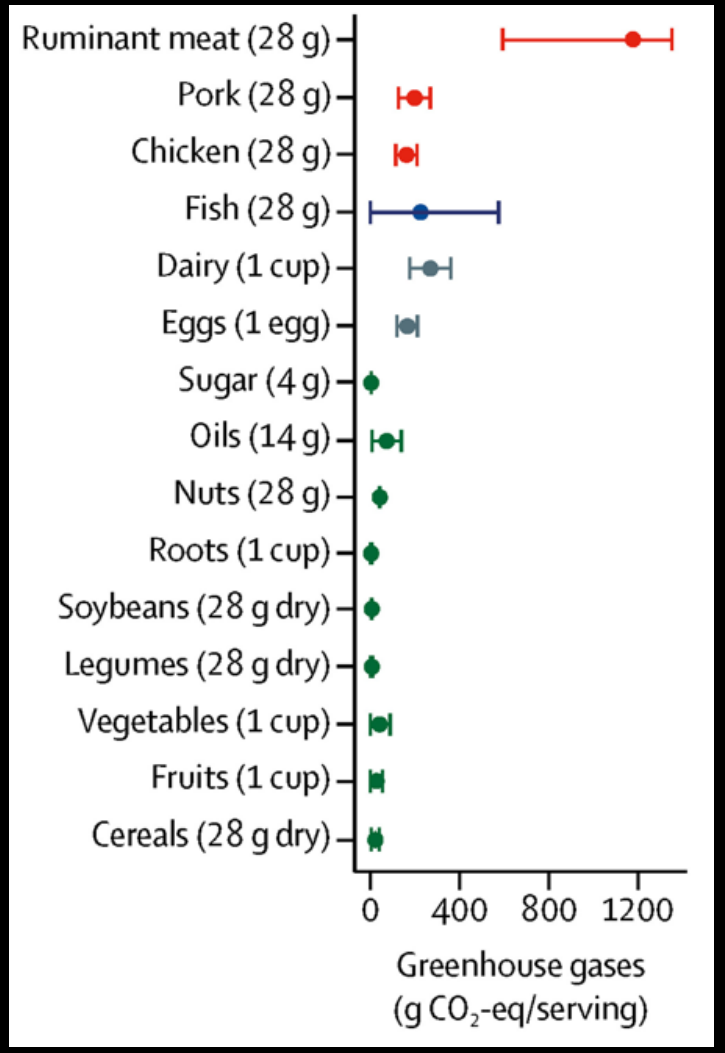


- Partly: Higher soil organic carbon levels

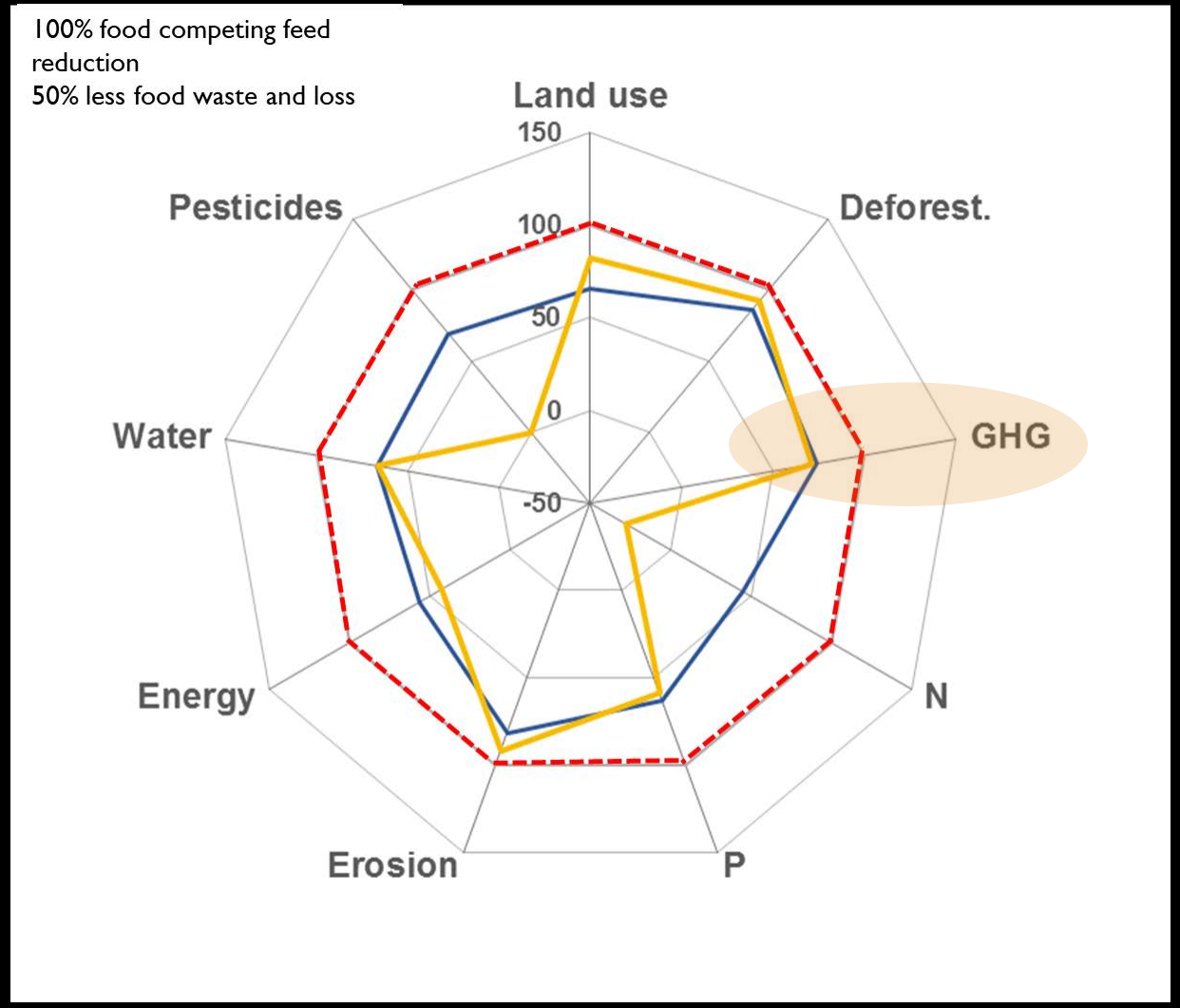


van Zanten et al. 2018; Gattinger et al. 2012

GHG emissions per kg



vs.



Total GHG emissions

Willet et al. 2019, Muller et al. 2017

Adaptation

Table key	Performance with respect to the baseline:
✓	significanlty b / ✓ better, but not significant
×	significantly w / × worse, but not significant
0	no effect
red	Practices reported in meta-analyses that may not be deemed agroecological in all cases
blue	Indicators referring to temporal stability/variability

Soil organic carbon | Soil microbiome | soil biodiversity

		Indicators for climate change adaptation																										
		Soil health									Biodiversity		Plant protection					Productivity									Employment	Health
		Soil organic carbon contents	Soil organic carbon sequestration	Total soil N	Soil loss	Soil fertility	Soil microbial activity	Soil microbial biomass	Soil biodiversity (microbial diversity/ richness)	Nematode abundance	Species richness/abundance/diversity	Stability of species richness/ abundance	Natural plant protection	Level of biological control	Animal pest abundance	Weed abundance	Pathogen abundance	Total biomass production	Stability in total production	Yield	Yield stability	Pollination services	Resource use efficiency	Ecosystem services stability	Profitability	Stability of costs and profits	Rural employment	Exposure to pesticides
Agroecological practices	Organic agriculture	✓	✓		✓		✓	✓	✓		✓	✓		✓	✓	×	✓			×	×		0			0	✓	✓
	Low-input systems									✓	✓									×								
	Agroforestry (incl. silvopast.)				✓	✓	✓				✓							✓										
	No tillage	✓				✓														×	×							
	Reduced tillage	✓		✓		✓	✓	✓										×		✓								
	Cover crops	✓		✓				✓																				
	Biochar	✓																										
	Organic fertilizers (incl. residues)	✓		✓		✓				✓	✓							×		✓								
	Crop rot./ diversity/ intercropping	✓	✓	✓				✓	✓		✓		✓						✓	✓	✓				✓	✓	✓	
	Grassland diversity																			✓								
	Practices enhancing biodiversity & complex landscapes												✓							✓		✓	✓	✓				

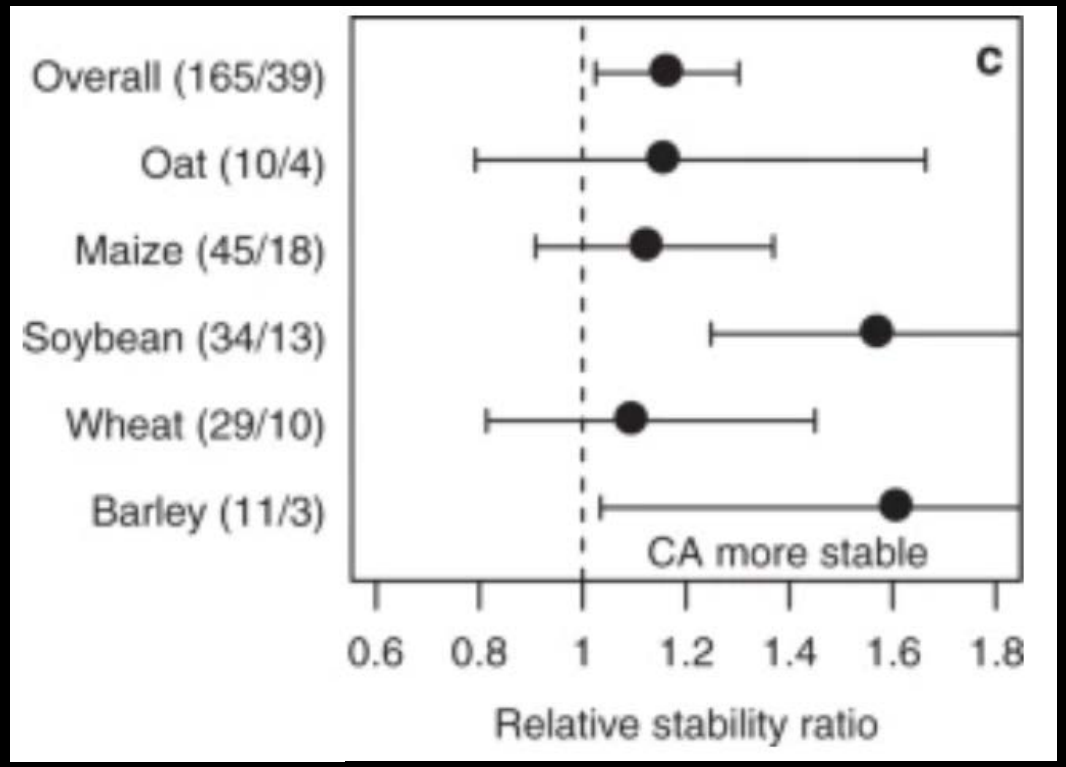
Muller et al. 2020

Challenges of high shares of organic production

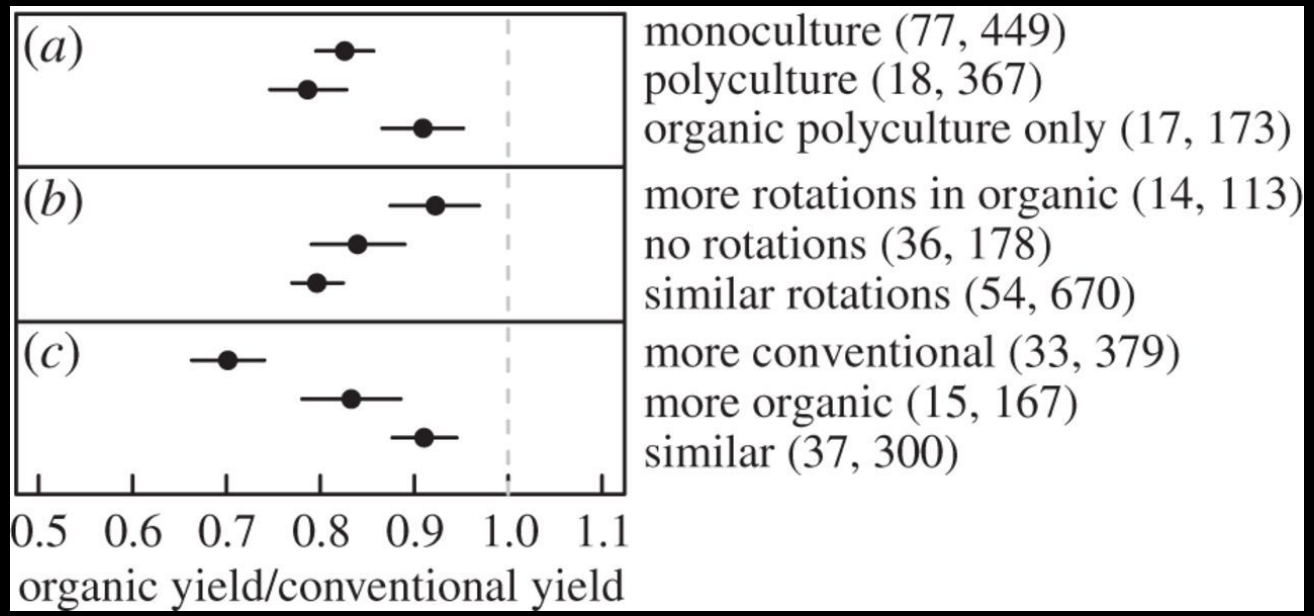
- Drastic changes in diets needed
- Sufficient nitrogen/nutrient supply
- Processing, storage of products

Challenges of high shares of organic production

- Yield stability



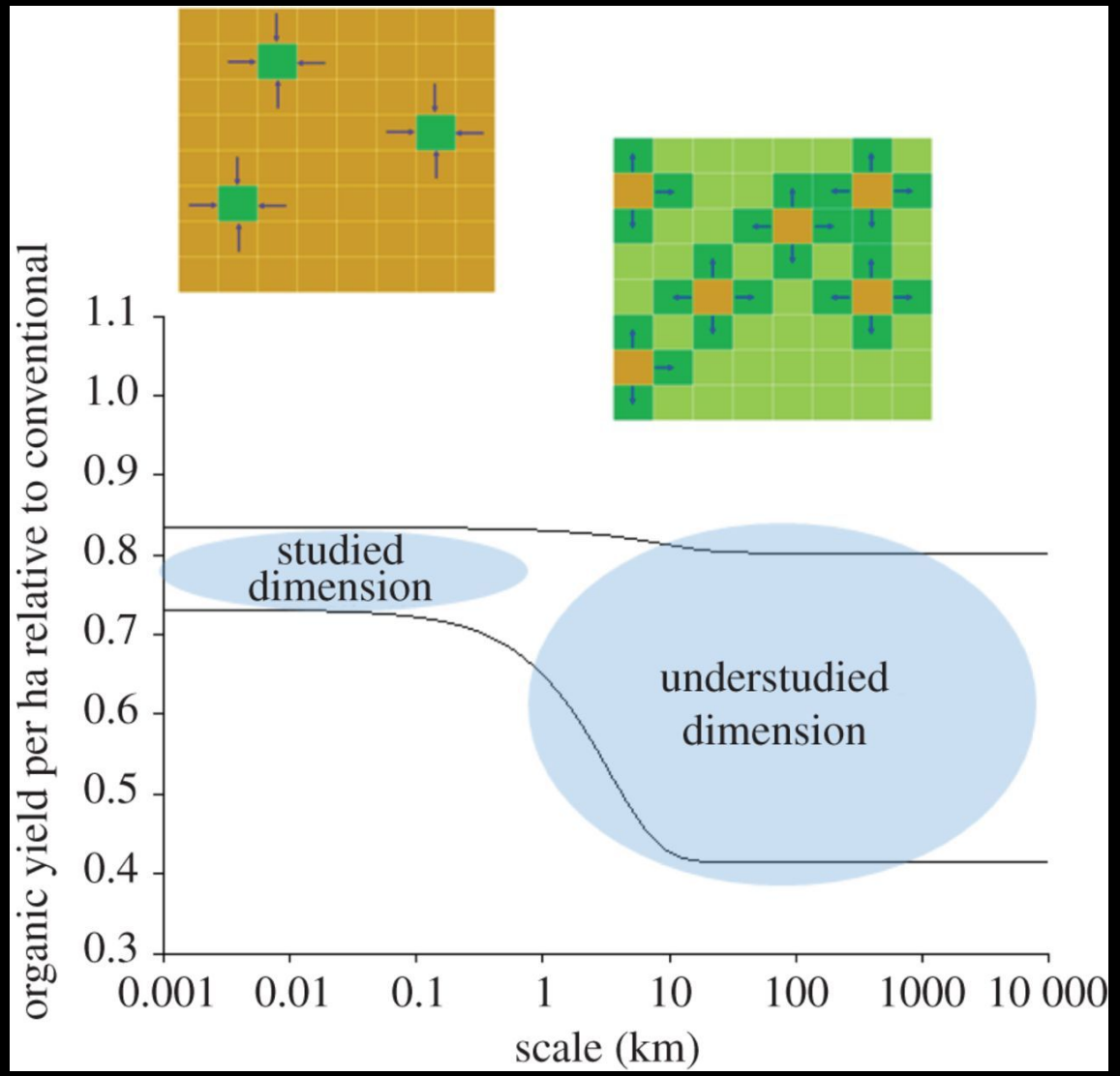
- BUT: Yield gap and diversity



Knapp et al. 2018

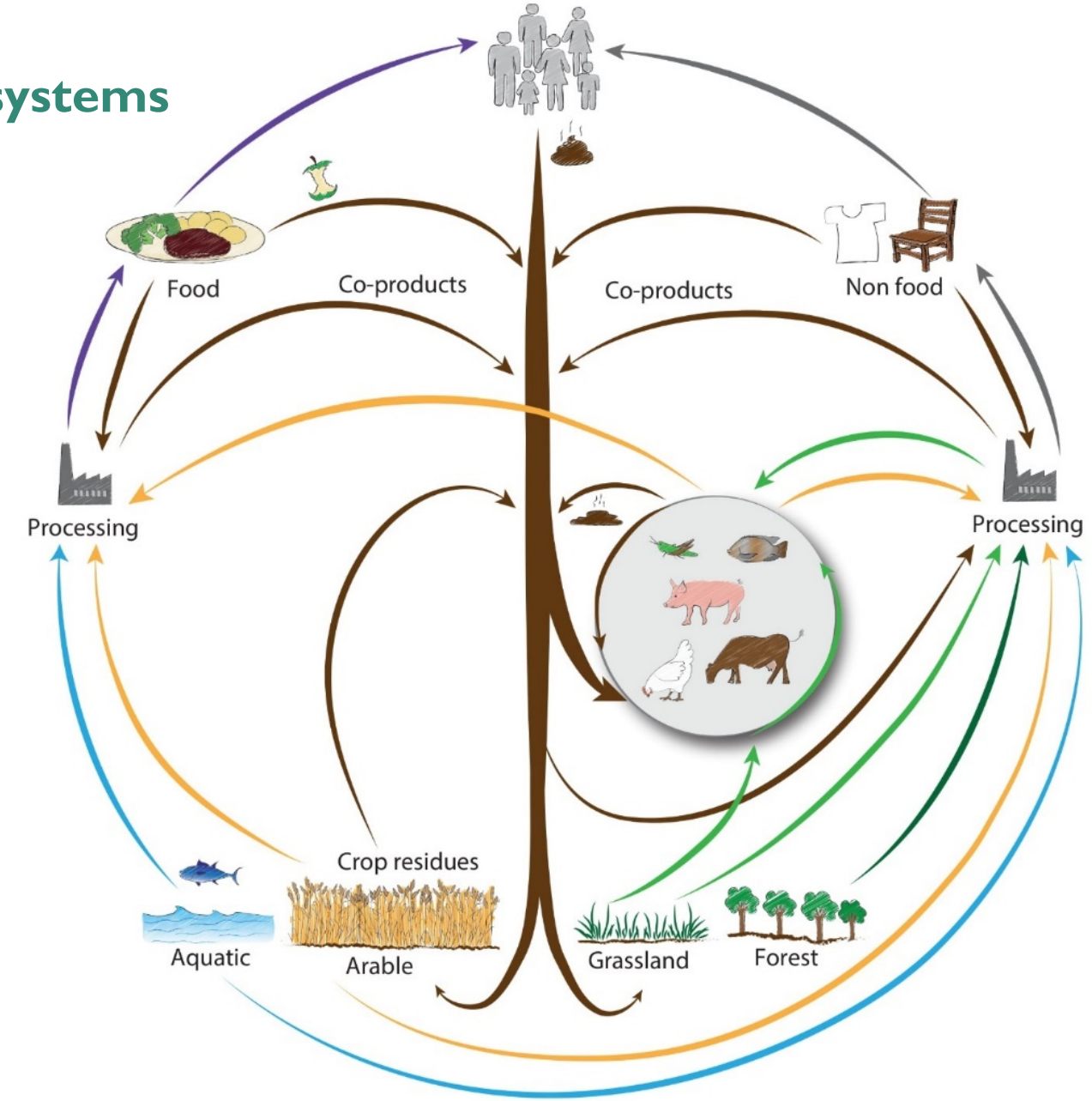
Challenges of high shares of organic production

- Plant protection in a conventional / organic context



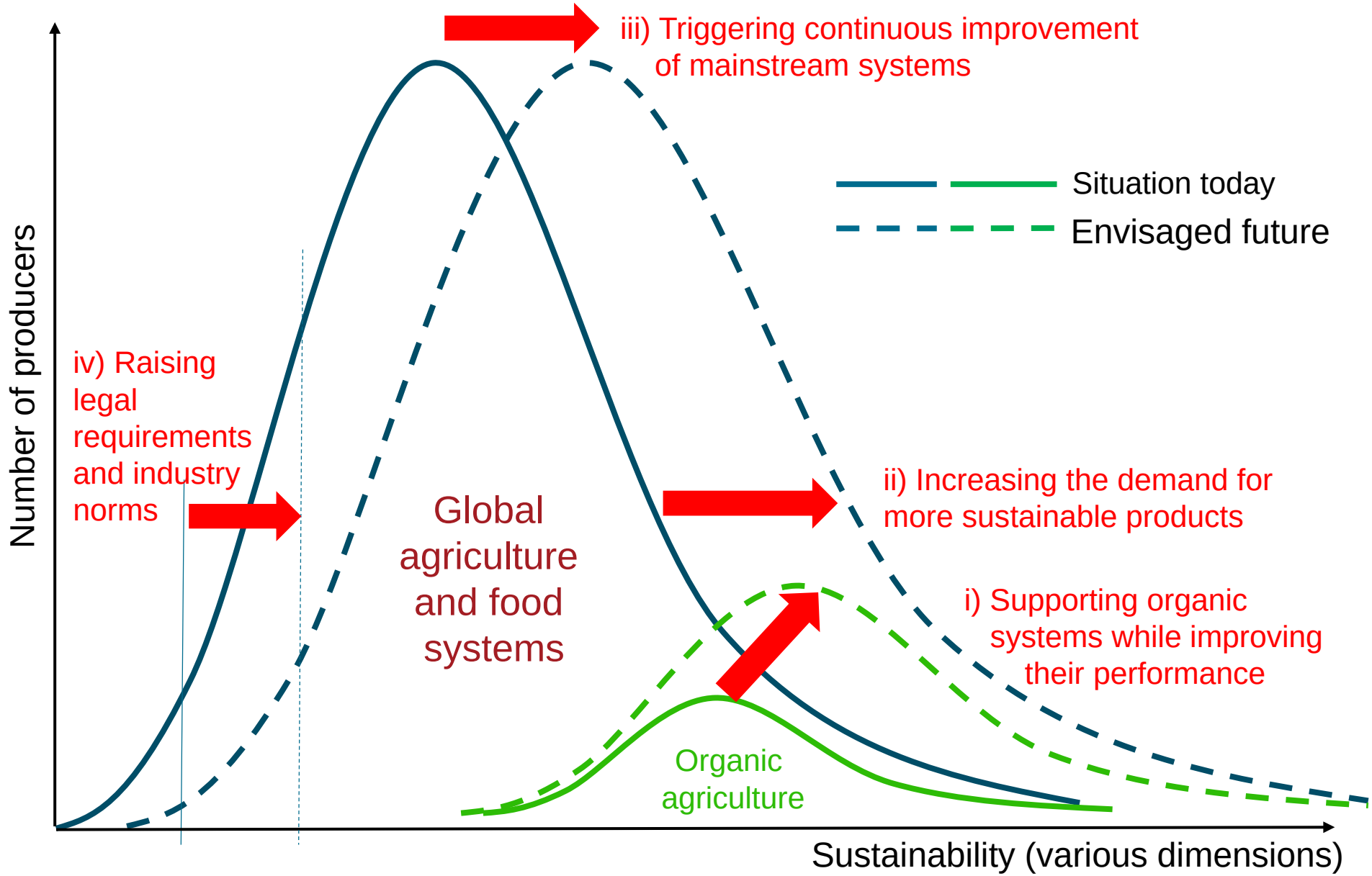
Leifeld 2016

Solutions for climate friendly food systems with organic agriculture: Circularity



Muscat et al. 2021

Policy levers driving sustainability in global agriculture



Eyhorn et al. 2019

Recap

- Mitigation
  Less nitrogen, less animals, soil carbon - circularity

- Adaptation
  big potential – besides productivity

- Challenges
  diets, sufficient nutrients, sufficient diversity, plant protection in organic landscapes

- Policies
  blueprint for all agriculture – but no need to have 100% organic