

Mission of Switzerland to the European Union

Swiss Science Briefing

Agroecological approaches in times of fertiliser crisis

Evidence from Swiss-EU collaboration in the Global South

31 May 2023

#SwissEU4Science





50 years of FiBL: a differentiated approach to sustainable research for organic agriculture

Beate Huber

Agroecological Approaches in Times of Fertilizer Crisis

Brussels, 31.05.2023

FiBL 50 JAHRE
ANS
YEARS

together one step ahead



FiBL 50 JAHRE
ANS
YEARS

together one step ahead



50 Years FiBL or research in organic agriculture

FiBL 50 JAHRE
ANS
YEARS

Systems Thinking
Participatory and Transdisciplinary
Solution oriented



SysCom - Farming Systems Comparison in the Tropics

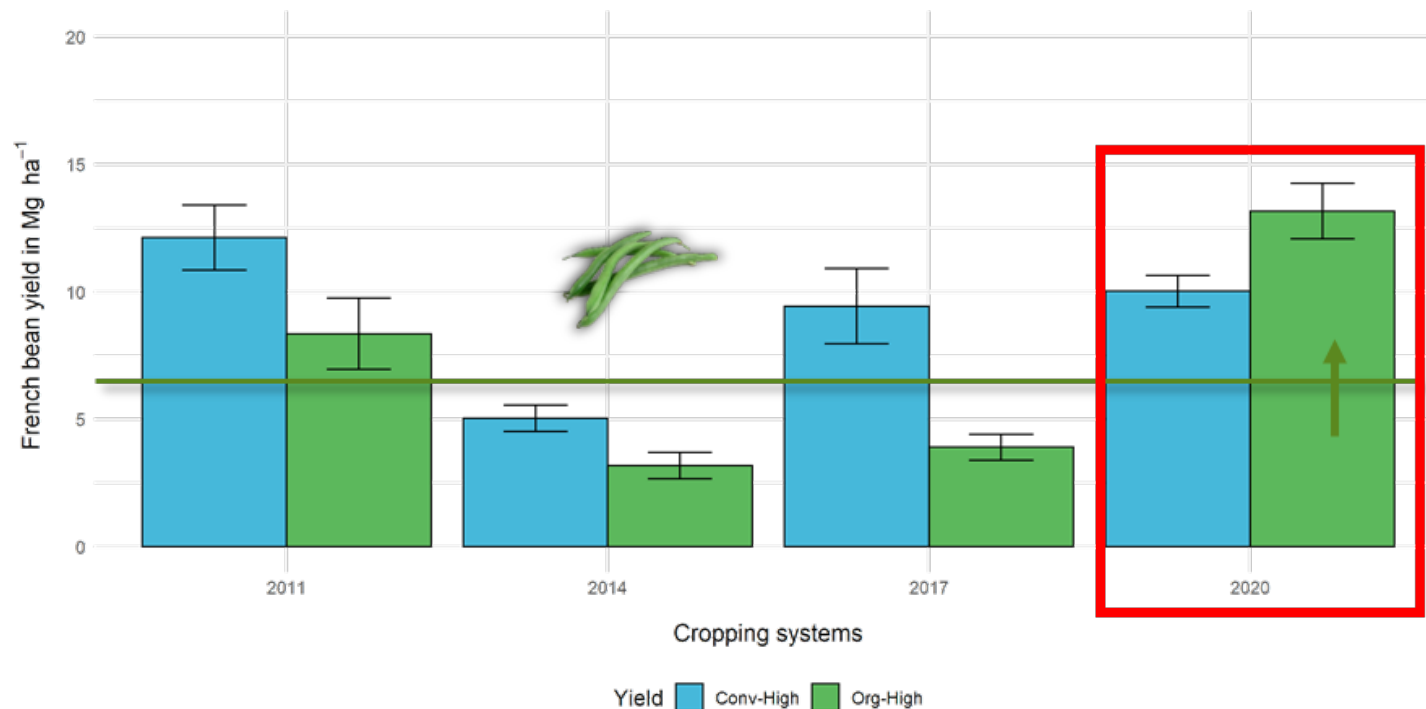
Pro-Eco Africa - OFSA

The image features a world map with a focus on Africa. Three photographs are overlaid on the map: a forested area in Bolivia, a cornfield in Kenya, and a large agricultural field in India. The map also features icons for SysCom Bolivia, SysCom Kenya, and SysCom India, along with ProEco Africa and OFSA logos. Various partner logos are displayed at the bottom.

Systems Thinking: results from our comparison work

Productivity

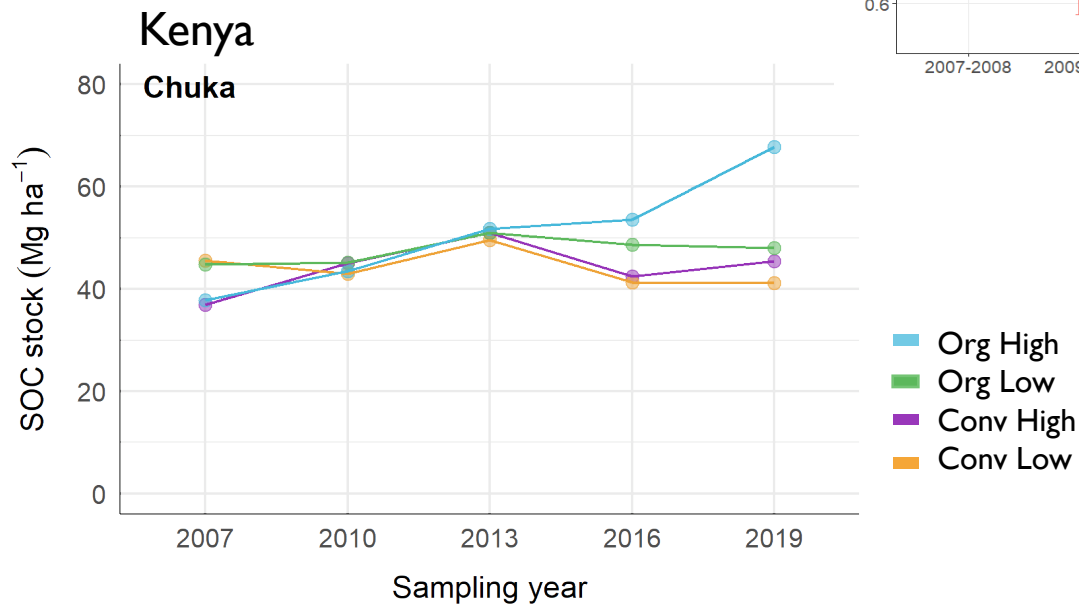
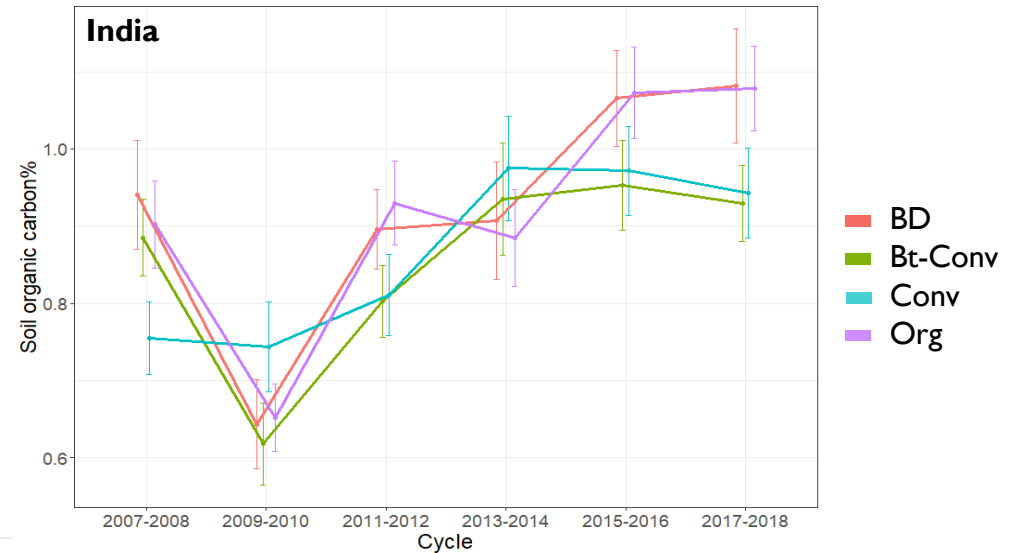
Effect of the System approach on French beans yield



The yield gap between conventional and organic high input systems reduced from 30% to 2.8%.

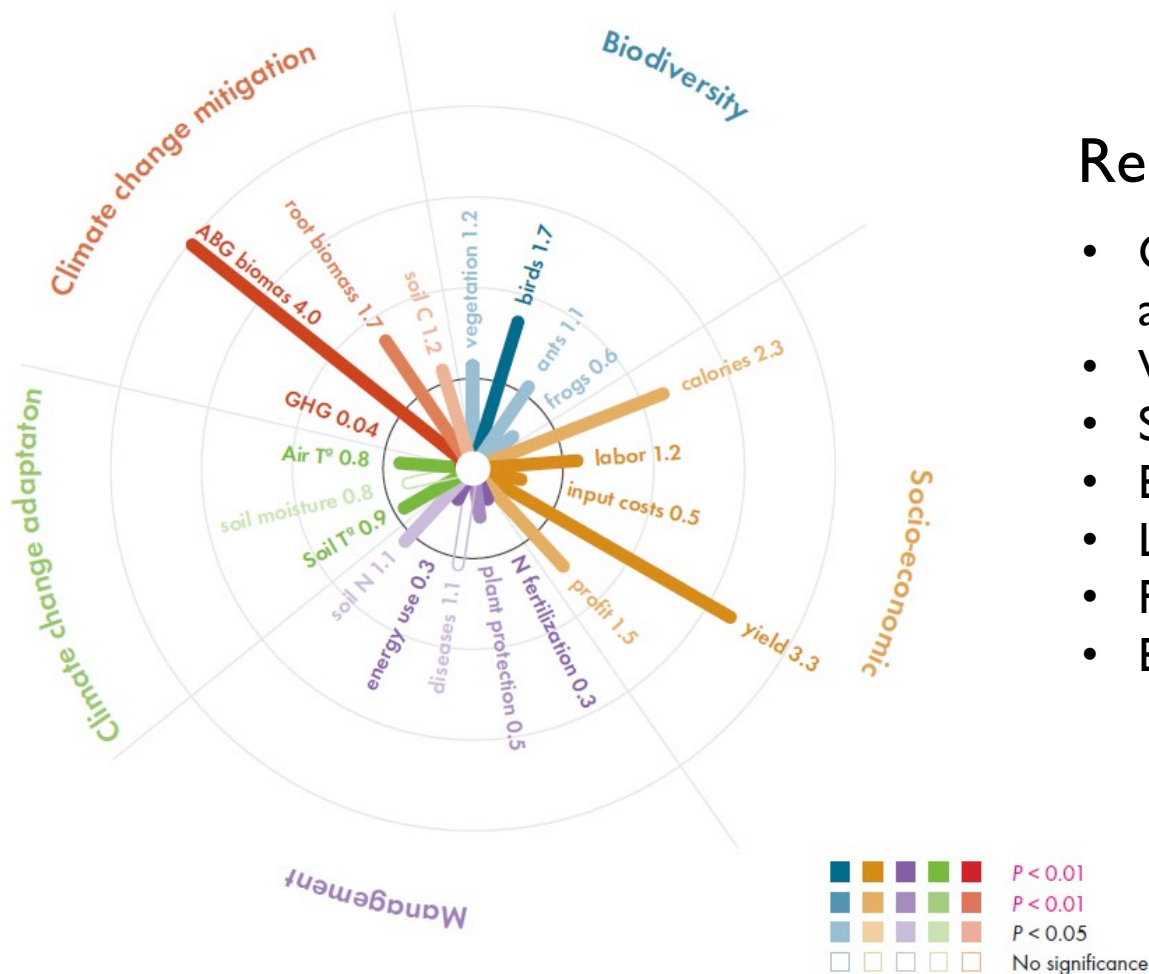
Systems Thinking: results from our comparison work

➤ Soil Carbon changes after 12 years



Systems Thinking: results from our comparison work

➤ System assessment: agroforestry vs monoculture in Bolivia



Research in key topics:

- Climate change adaptation/mitigation
- Water-Food-Energy Nexus
- Soil fertility
- Biodiversity
- Land use intensity
- Food security and nutrition
- Etc.

Participatory and transdisciplinary: results from our comparison work approach

➤ Effects of participatory approaches and capacity building to yields

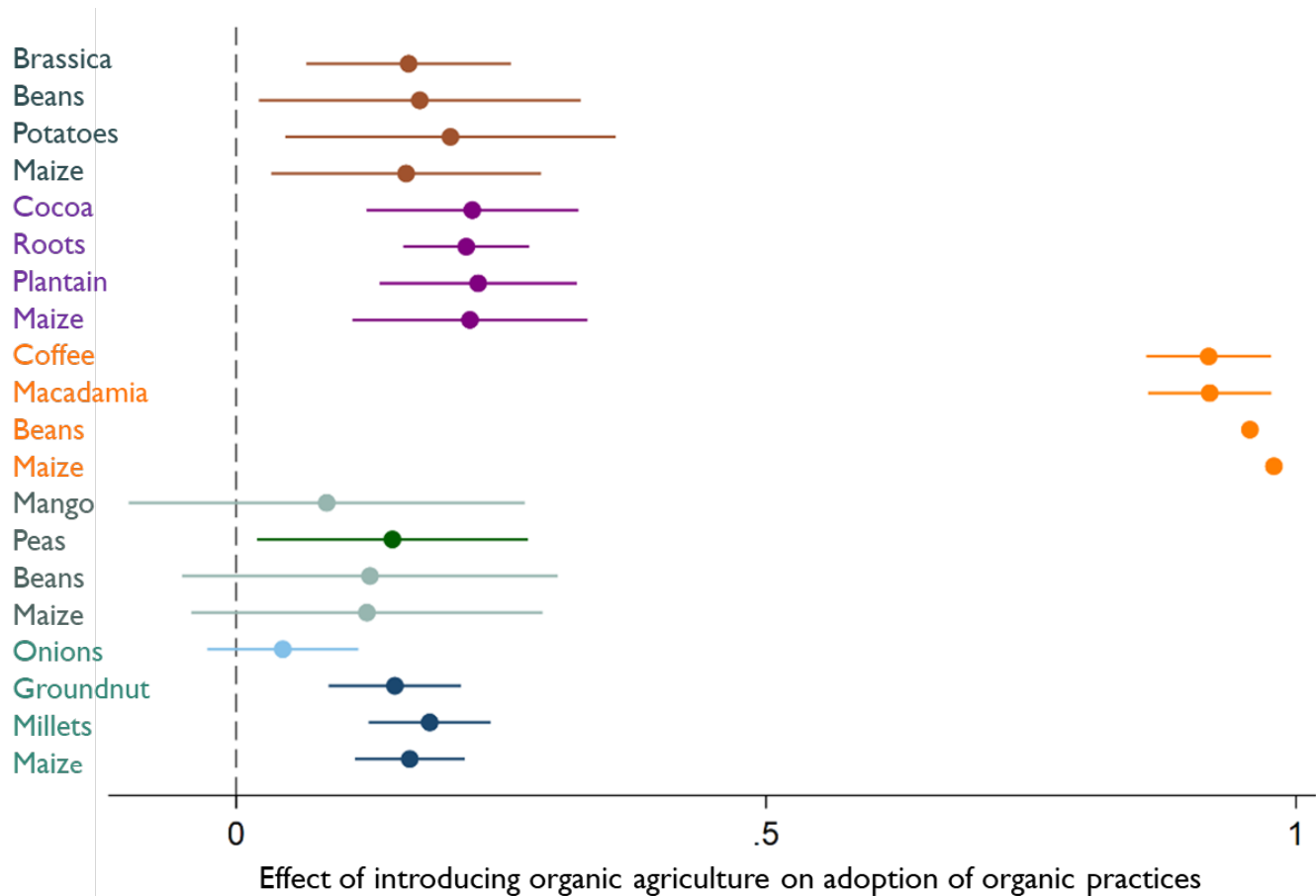
Cabbage
Case Study

Cocoa
Case Study

Macadamia
Case Study

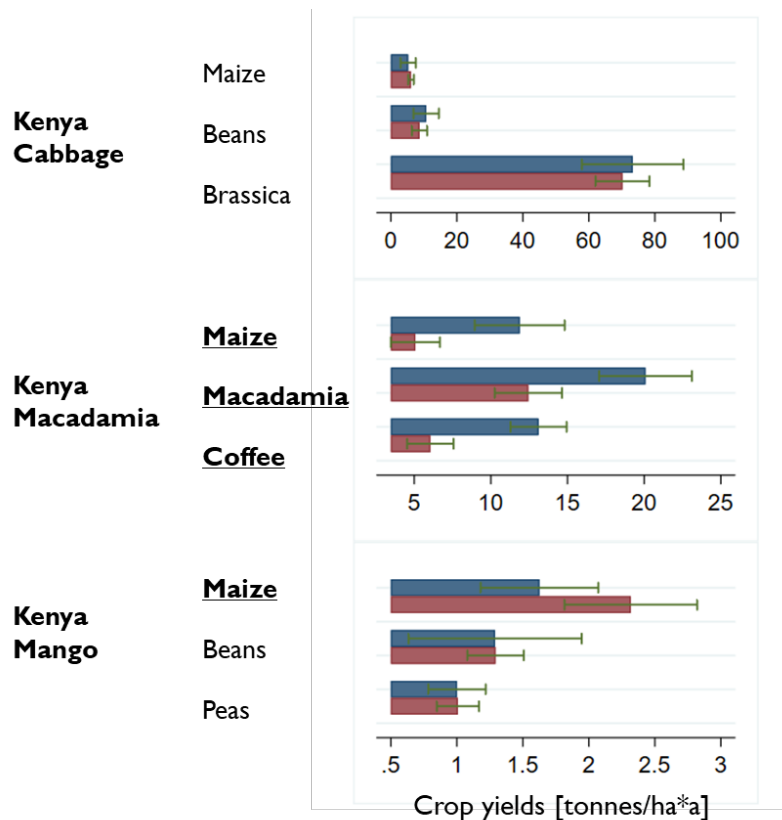
Mango
Case Study

Onion
Case Study



Participatory and transdisciplinary: results from our comparison work approach

- Effects of participatory approaches and capacity building to yields



■ *Organic*
■ *Conventional*

Schader et al., in preparation; preliminary results, do not cite

Participatory and transdisciplinary: cotton breeding

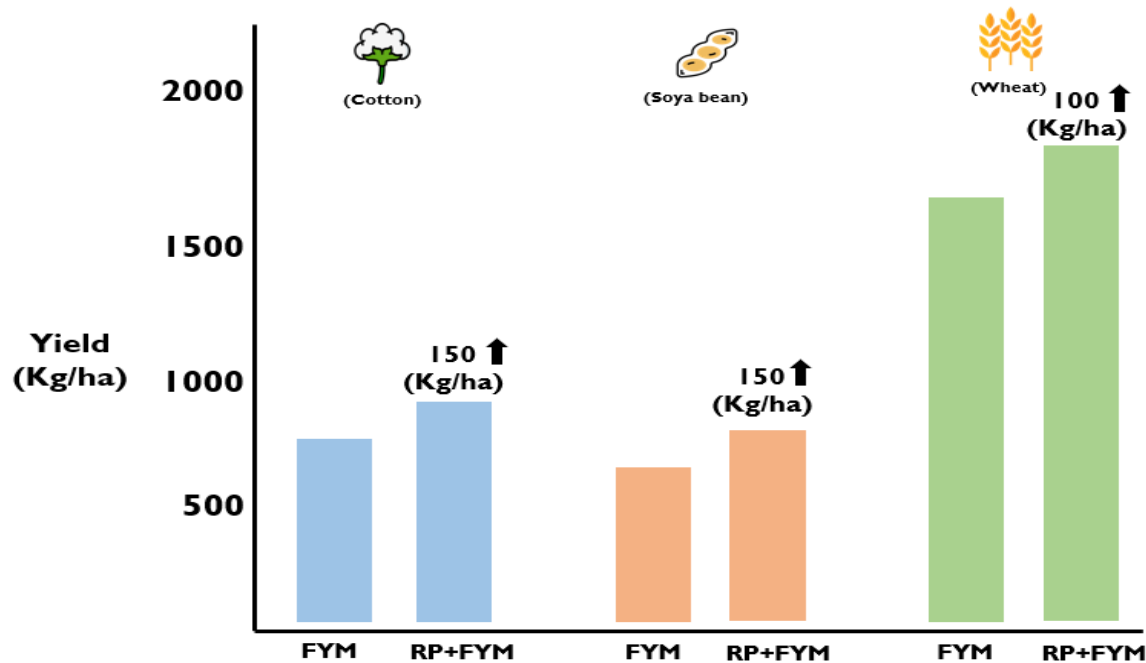
- India: Cotton breeding from a participatory approach



First ever release of organic cotton varieties in India in 2022.

Solution-oriented innovations

- Compost enriched with buttermilk acidulated Rock Phosphate



Uptake of SysCom findings



A multi-stakeholder initiative for more sustainability in the cocoa value chain



FIBL FOAM

Can organic agriculture improve yields and incomes for smallholder farmers in Africa?

Friday 24 September
8h - 10h (GMT) | 9h - 10h (GMT) | 10h - 11h (GMT)

Speakers:
Christine Schuler / FIBL
David Bourde / FIBL
Gabor Fagcsy / FOAM - Organic International
David Ametey / Research Africa Trust

Moderators:
Irene Kaduna / FIBL

COCA Why Organic What We Do About Us Impact Resources News & Blog [Contribute Page](#) [Jobs](#)

Seed Programme

Quality organic cotton seeds are essential for ensuring the availability, access and genetic diversity of raw cotton for organic cotton farmers. This working group focuses on the global development and production of truly adapted organic cottonseed.

[Join the movement](#)



Sys Com Bolivia

FIBL

ECOTOP

ELCOTOP

icipe

KALRO

HUMAN RIGHTS ORGANIC COTTON

Sys Com Kenya

Sys Com India

Agroecology – The economic case

Wednesday 20th October 2021 - 2:00-3:30pm (GMT)

giz **KFW**

ix **KfM**

Factsheet
2019-2020

Pest and diseases
How to manage pests and diseases organically?

Farm productivity
How organic growers can improve ecological organic farming?

Key findings from the research

Key messages from the research

How does the holistic organic farming approach improve soil fertility?

FIBL

The projects have been supported by

This project is supported by the
Coop Sustainability Fund.



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Schweizerische Eidgenossenschaft
Confédération suisse
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Thank you very much!

FiBL

SysCom 



Systematic integration of crops, shrubs and livestock in the Sahel



Harun Cicek

Agroecological Approaches in Times of Fertilizer Crisis; Swiss Science Briefing

Brussels

31.05.2023





Project Partners



FiBL



Centre de Suivi Ecologique



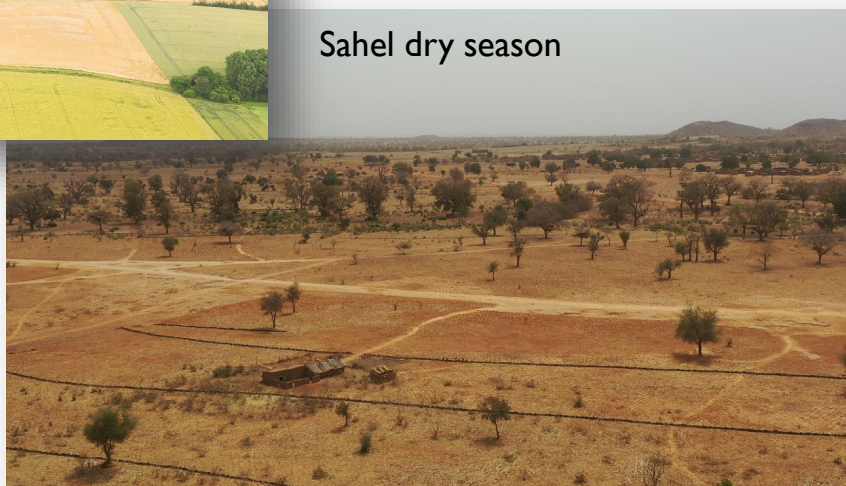
**U N I K A S S E L
V E R S I T Ä T**





European
Trees concentrated in certain areas

-Saharan versus European croplands



Sahel dry season



Sahel rainy season

Trees and shrubs appear
randomly in croplands



Experiments

- 12 on-station trials
 - 5 in Mali
 - 4 in Burkina Faso
 - 3 in Senegal
- 17 on-farm trials (around 80 farms across tree countries)
 - 5 in Mali
 - 5 in Burkina Faso
 - 7 in Senegal
- 13 PhD students
- >20 MSc students

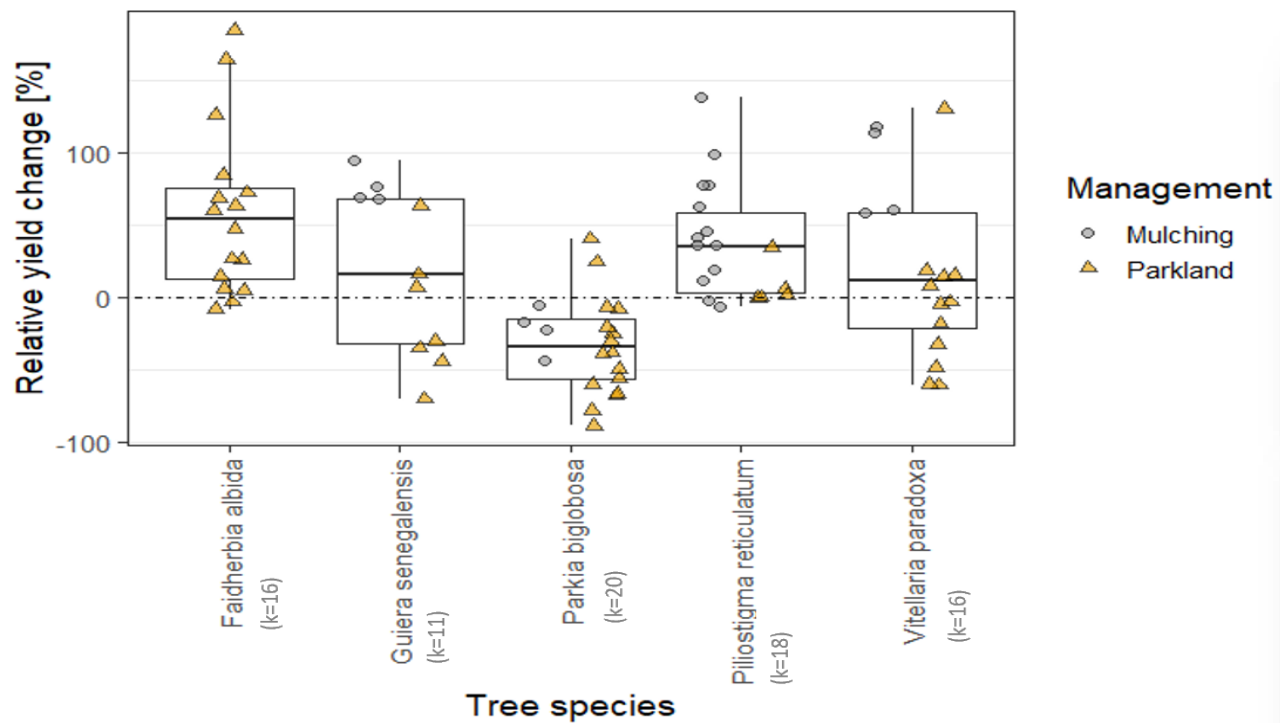


Questions

- How does **density** of shrubs/trees affect crop growth and soil health?
- **Which tree/shrub species** and management technique is best for crop growth and soil fertility?
- What are the **rates of decomposition** of various tree/shrub species?

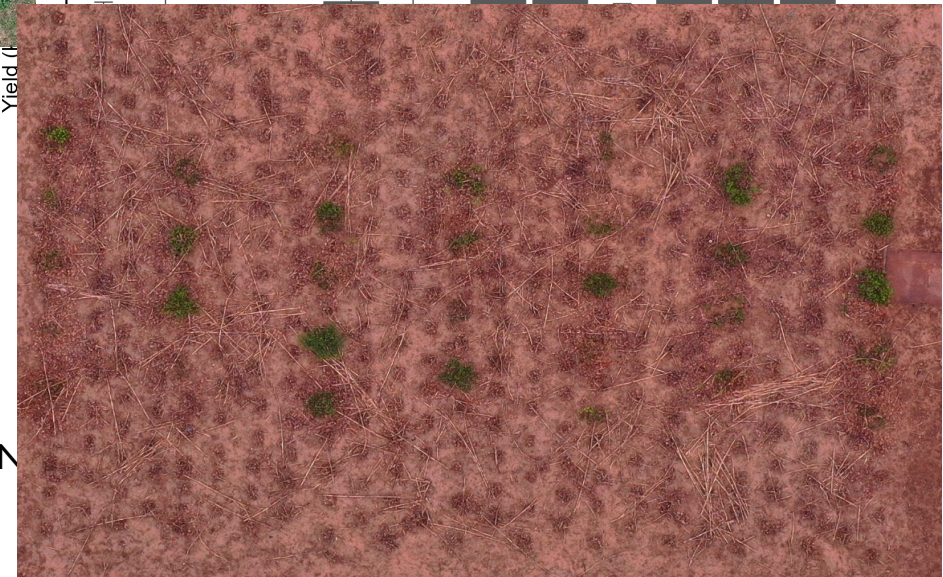
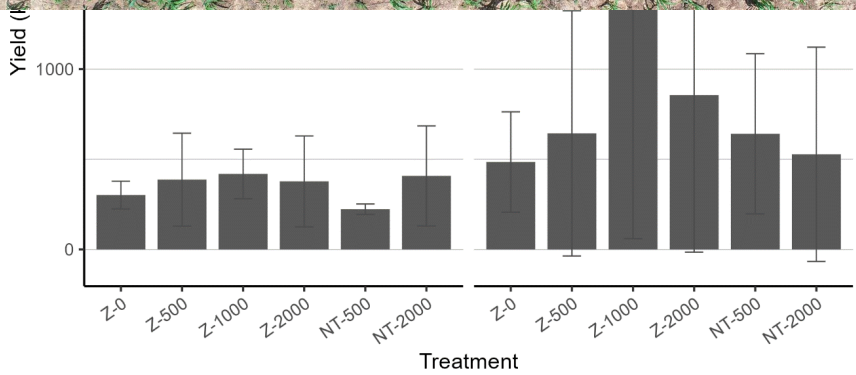
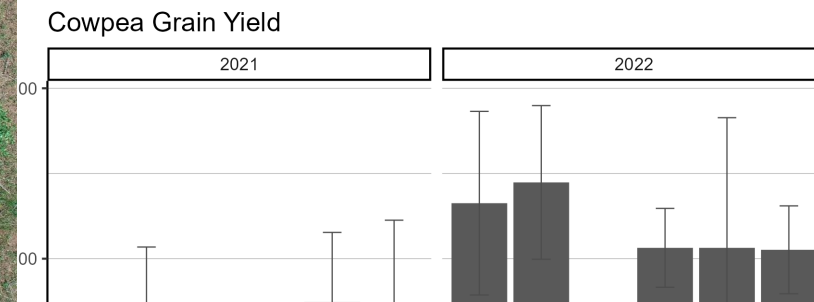


Evidence from scientific literature





Borghum and Cowpea

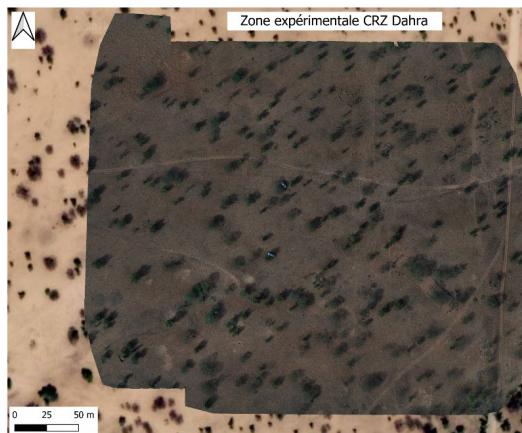


Z: Zai, NT: N

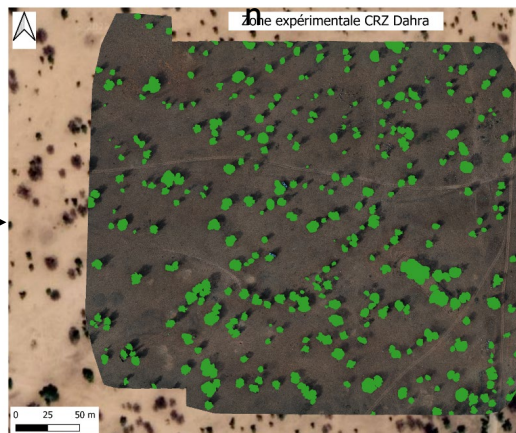


UAV data processing (Canopy cover calculation)

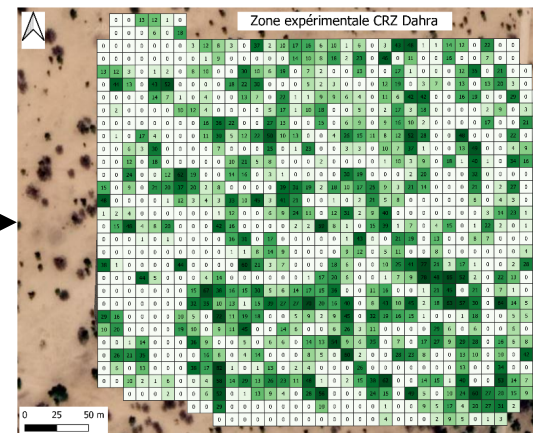
Orthomosaic



Classification/Digitalisatio

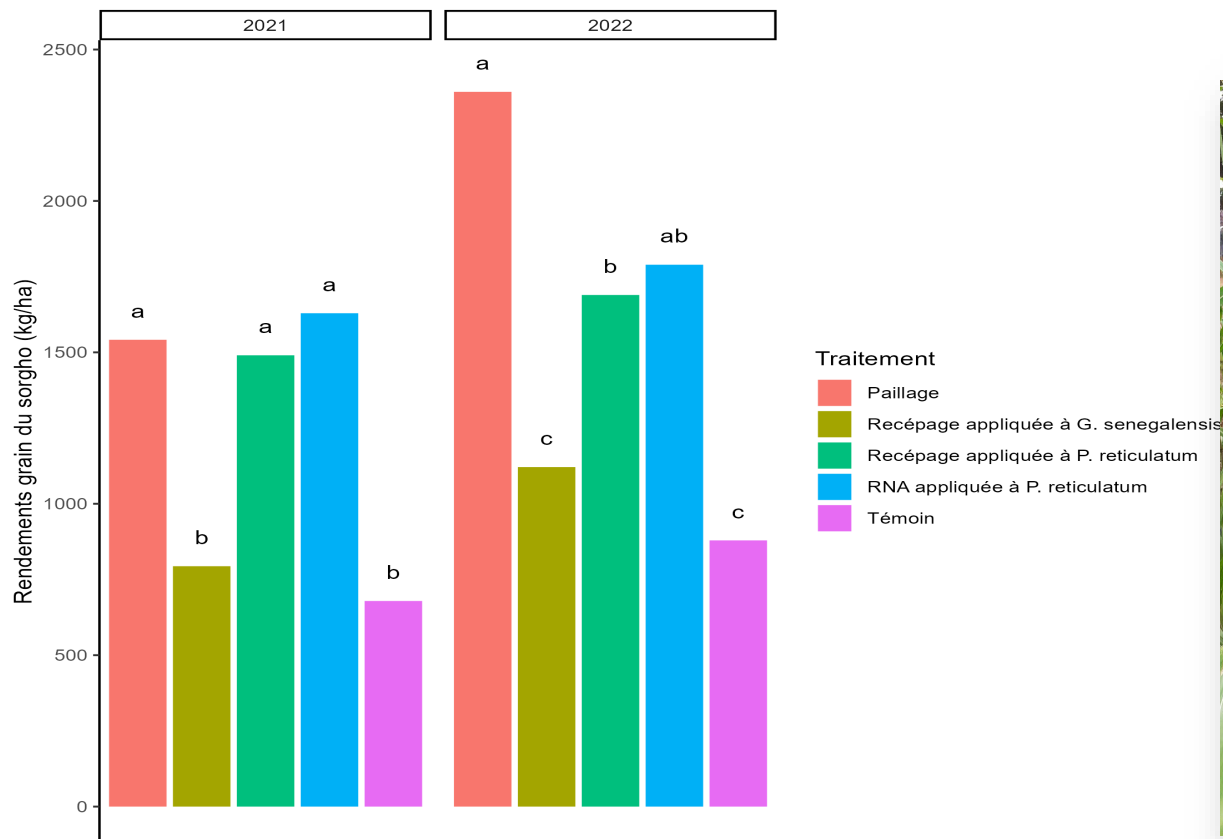


Woody cover %



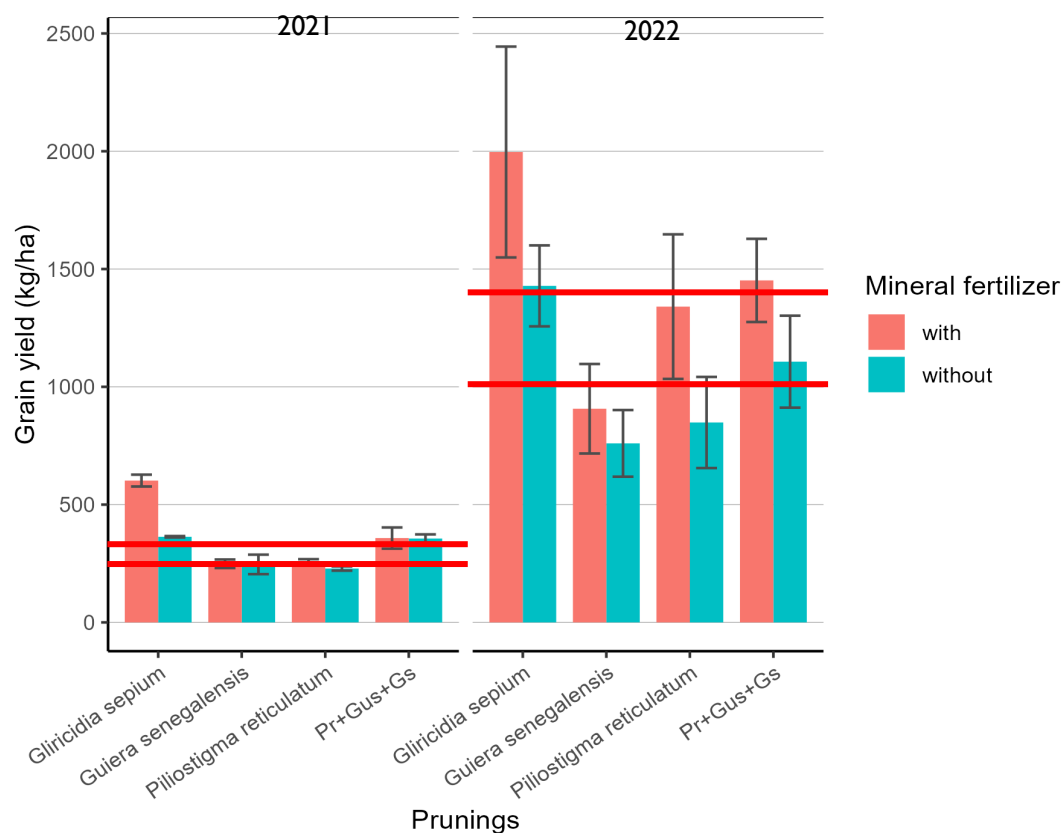
(CSE, Senegal)

Shrub management and crop productivity



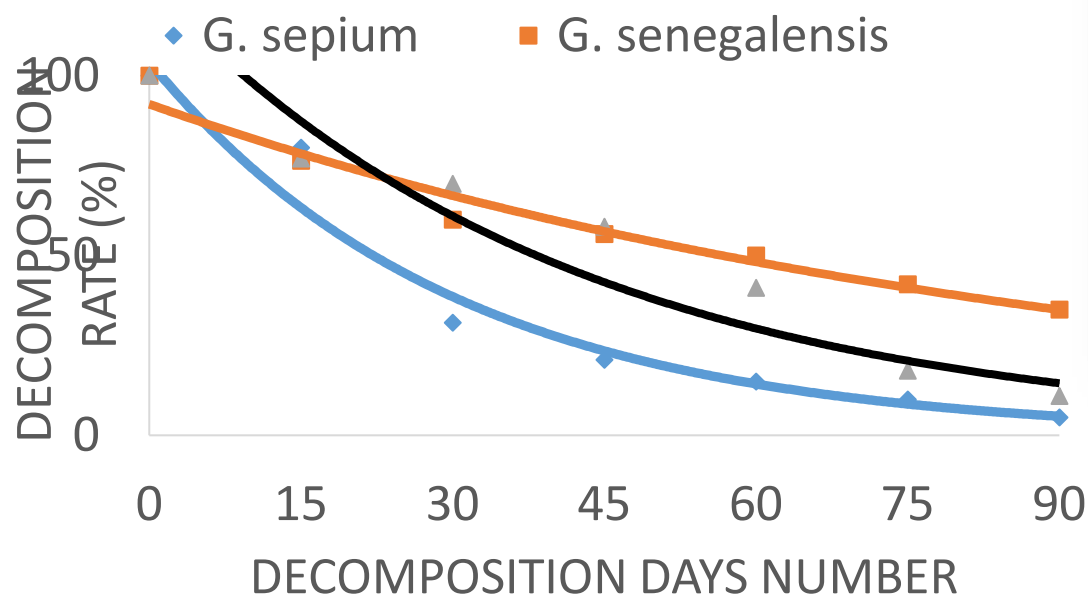
BAZONGO Bessibié (UNB and INERA)

Shrub mulching on crop productivity



(Souleymane Kone, IPR)

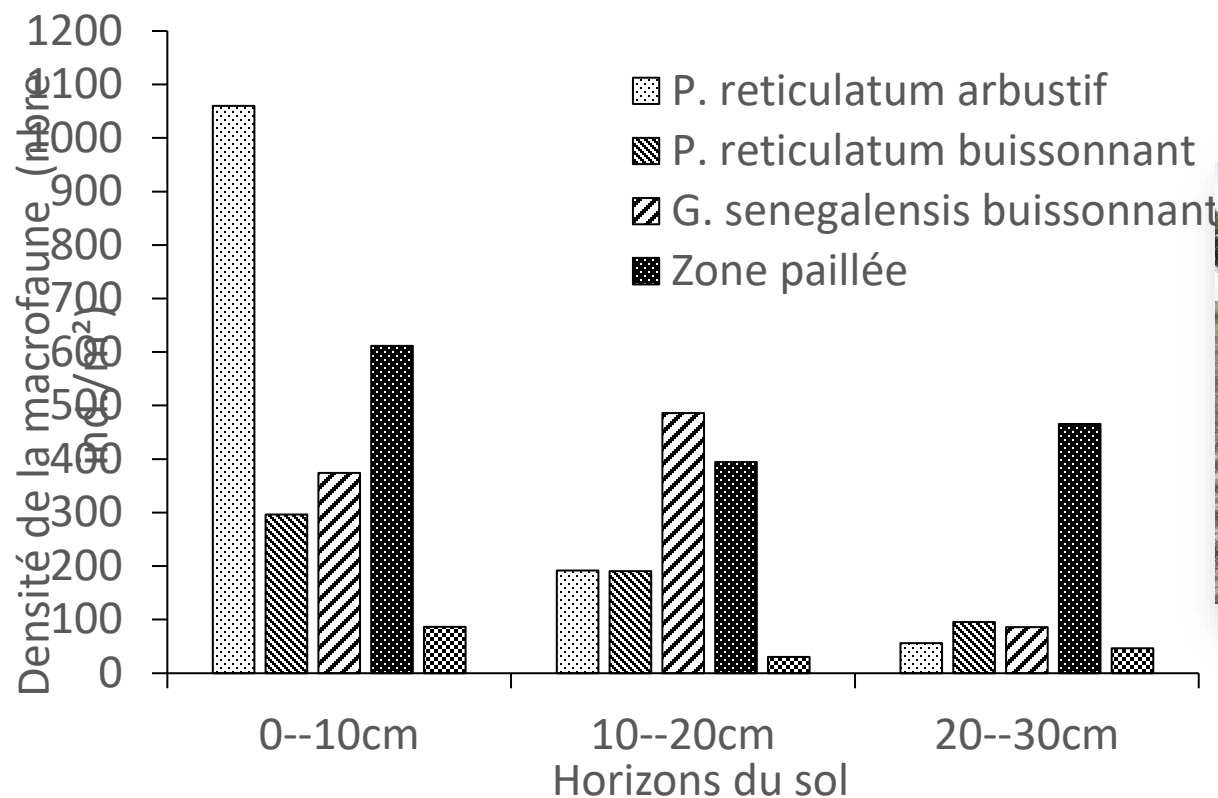
Decomposition rates of different shrubs



Many other species are also tested and but shown here.

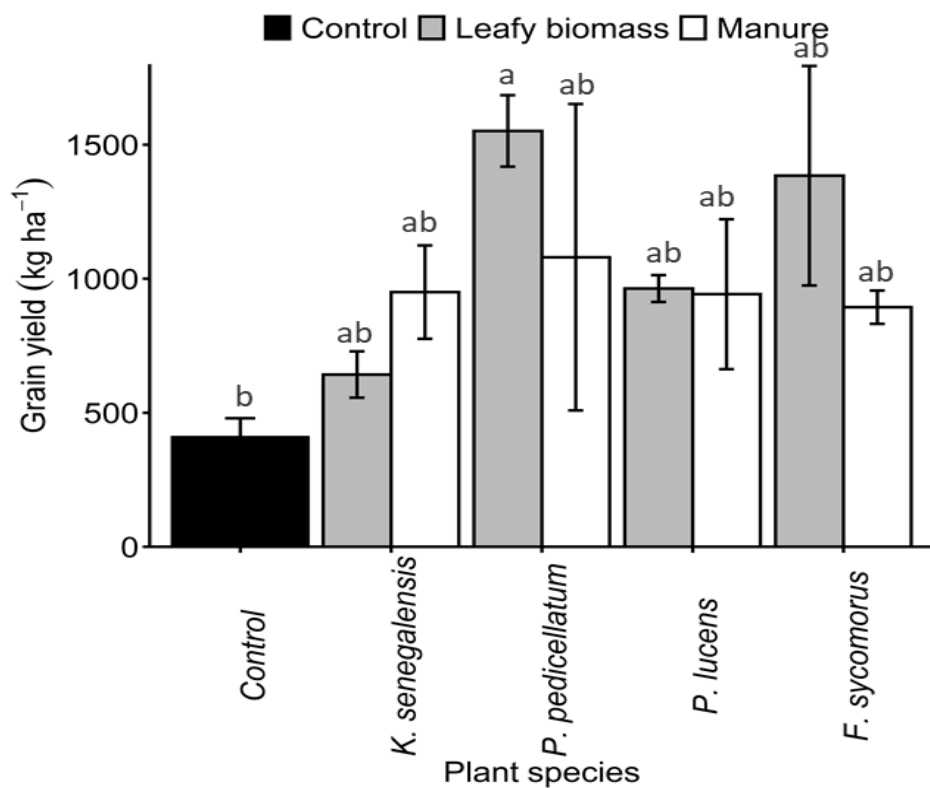
(Souleymane Kone, IPR)

Shrubs and soil macrofauna



(Bazongo Bessibié, UNB and INERA)

Livestock integration



(Siriki Fane, UKassel)



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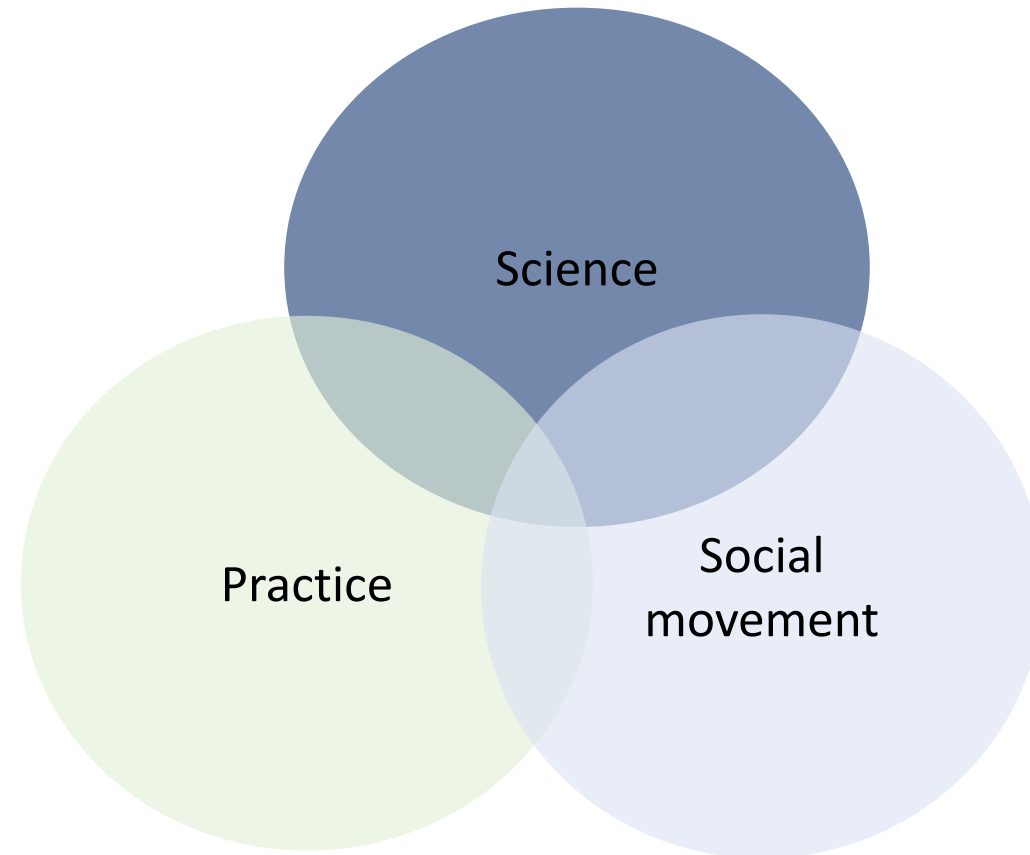
This project has received funding from the European Union's Horizon 2020 sustainable food security programme | Project No: 861974 under call H2020-SFS-2019-2



Agroecology as a more viable, resilient and ecologically sound alternative to conventional farming

Prof. Dr. Johanna Jacobi, Institute of Agricultural Sciences, ETH Zurich

Agronomy + Ecology = Agroecology



FAO (2015): *“...a realm where science, practice and social movements converge to seek a transition to sustainable food systems, built upon the foundations of equity, participation and justice”*

Different approaches, different metrics, different results

Productionist paradigm: «If the growth paradigm has replaced quality, quality can replace the growth paradigm» (Jason Hickel)

«Un-yielding» (Chaplin-Kramer et al. 2023): FARE agriculture:

Food secure, **A**grobiodiverse, **R**egenerative and **E**quitable → local, global and long-term.

- Not «**yield-gap**» but «**system yield**»
- Not **monoculture-technology** but **mixed** cropping
- **Diversity** not just on the field but also on the **plate**
- Not **calories**, but **nutrients**
- Not **unidimensional** but **multidimensional** analyses

«High-yielding» crops are actually «highly input-responsive» and do not necessarily perform well under non-ideal conditions

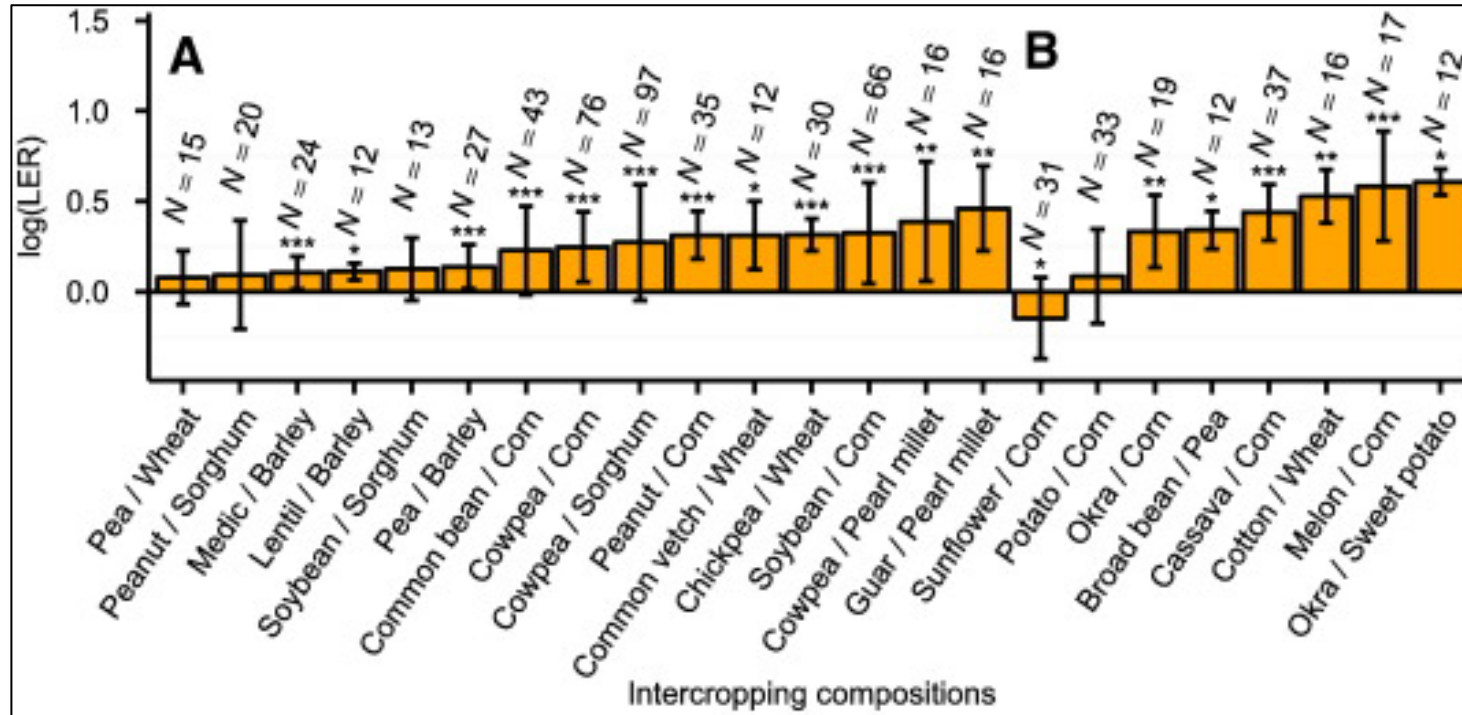


Drying red chillis under the sun provides one of the few sources of employment for women in an area of Bangladesh.

Fix food metrics

Source: Sukhdev et al. 2016, Nature

Total productivity and land-equivalent ratio of polycultures



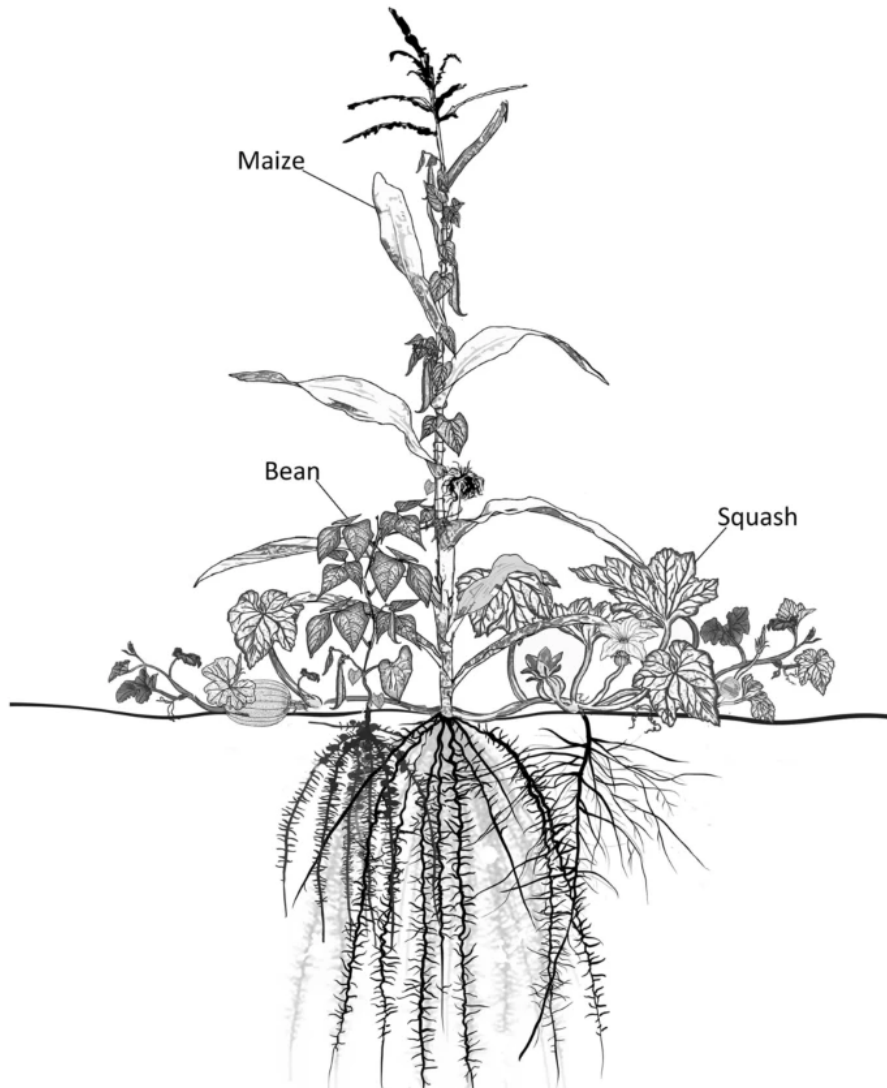
Meta-analysis of intercropping productivity studies. Source: Martin-Guay et al. 2018

$$LER = \sum_{i=1}^m \frac{IY_i}{SY_i}$$

m= number of intercropped plants
 IY=yield of one crop in intercropping
 SY=yield of one crop in monoculture

LER shows the land that would be required for the same yield in monoculture. If it is >1, intercropping is more productive

Milpa (maize/bean/squash) system, productivity, and nutrition



LER of maize/bean/squash Milpas in Guatemala: 1.6-1.9

High potential nutrient adequacy (PNA)

Problem: Families' plots are too small (<0.25 ha)

Land distribution and marginalization are main causes of poverty and malnutrition

Source: Lopez-Ridaura et al. 2021, Nature Scientific Reports

Agroecology and soil management

Review paper Bezner-Kerr 2021 «*Can agroecology improve food security and nutrition*» of 275 articles found:

- 4 studies with positive and 0 with negative **soil fertility outcomes**
- Better **crop resilience** to climate shocks (Bliss 2017)
- Reduced **workload** and increased farm **productivity** (Nyatakyl Frimpong et al., 2016)
- Similar **crop yields** as with chemical fertilizer (Calderon et al. 2018)
- Increased FSN by **spending less** on fertilizer (4 studies)
- Better **dietary diversity** with agroecological soil management such as legume intercropping, mulching, organic soil amendments (Kamau et al. 2018)

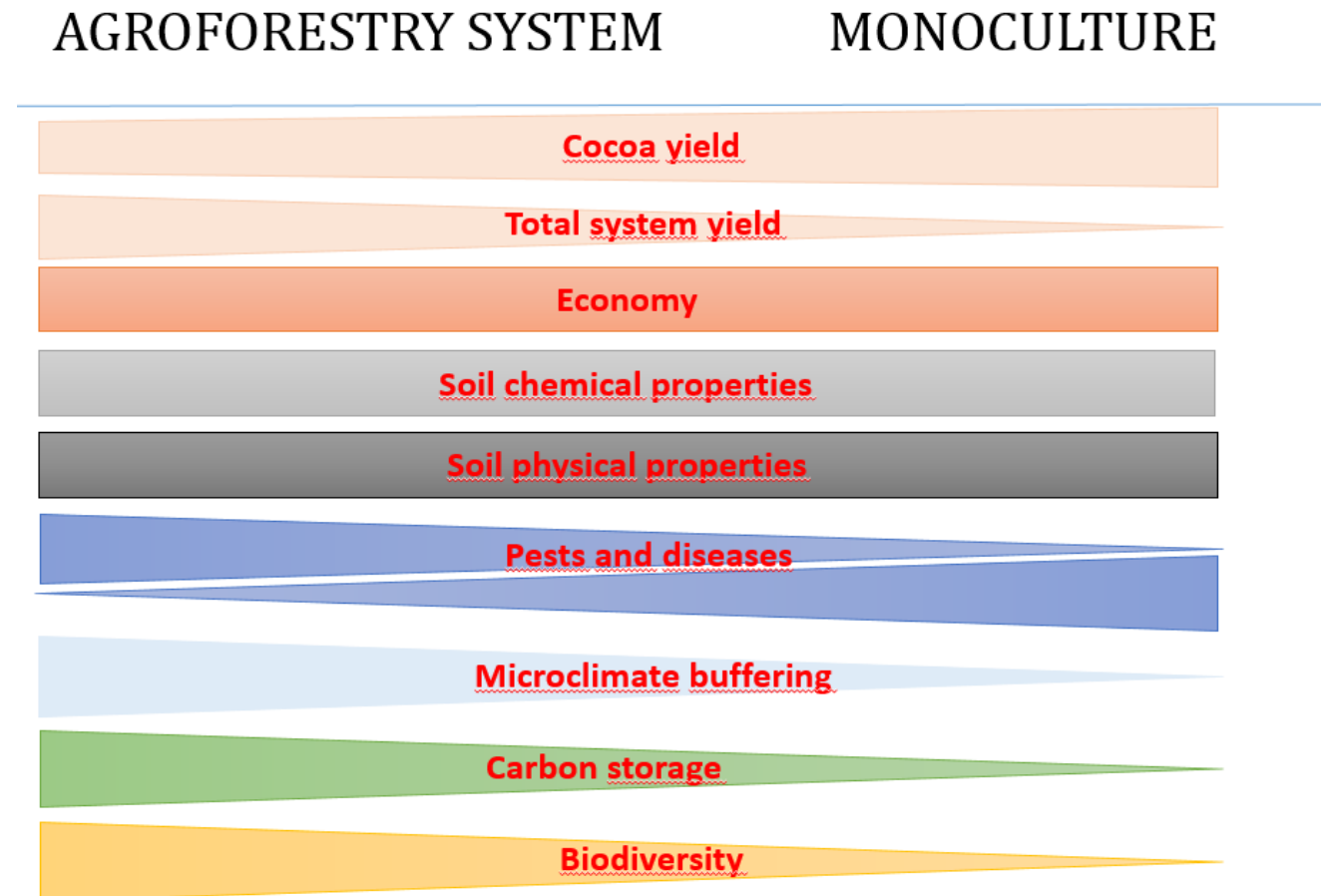
Source: Bezner-Kerr et al. 2021, Global Food Security



Intercropping of tree tomato and onion, Laikipia County, Kenya

Agroforestry in tropical agriculture

Example of cocoa farming: comparisons with monocultures, dynamic agroforestry systems (or: successional agroforestry), based on the principles of the natural succession of species, biodiversity and biomass density.

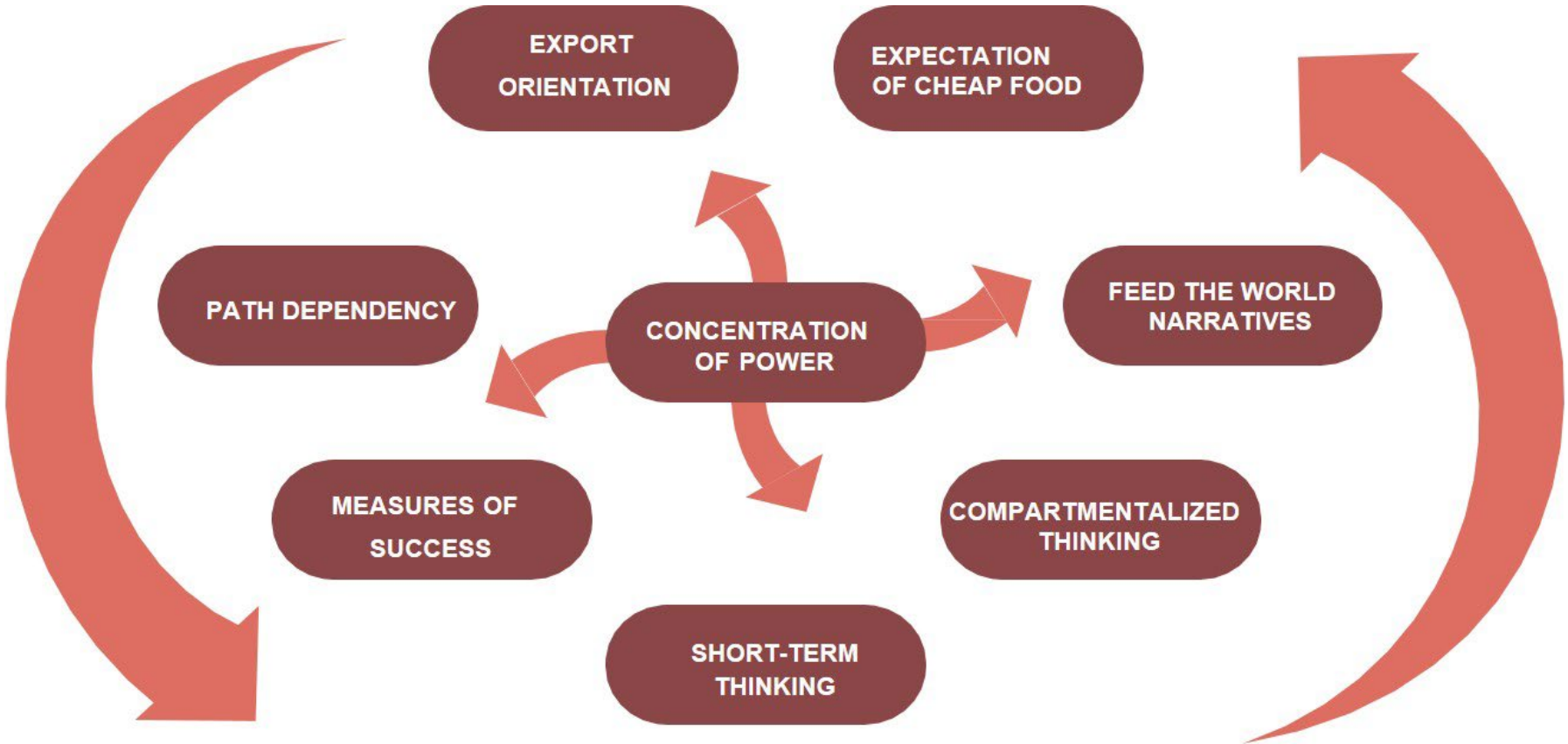




Agroforestry studies show:

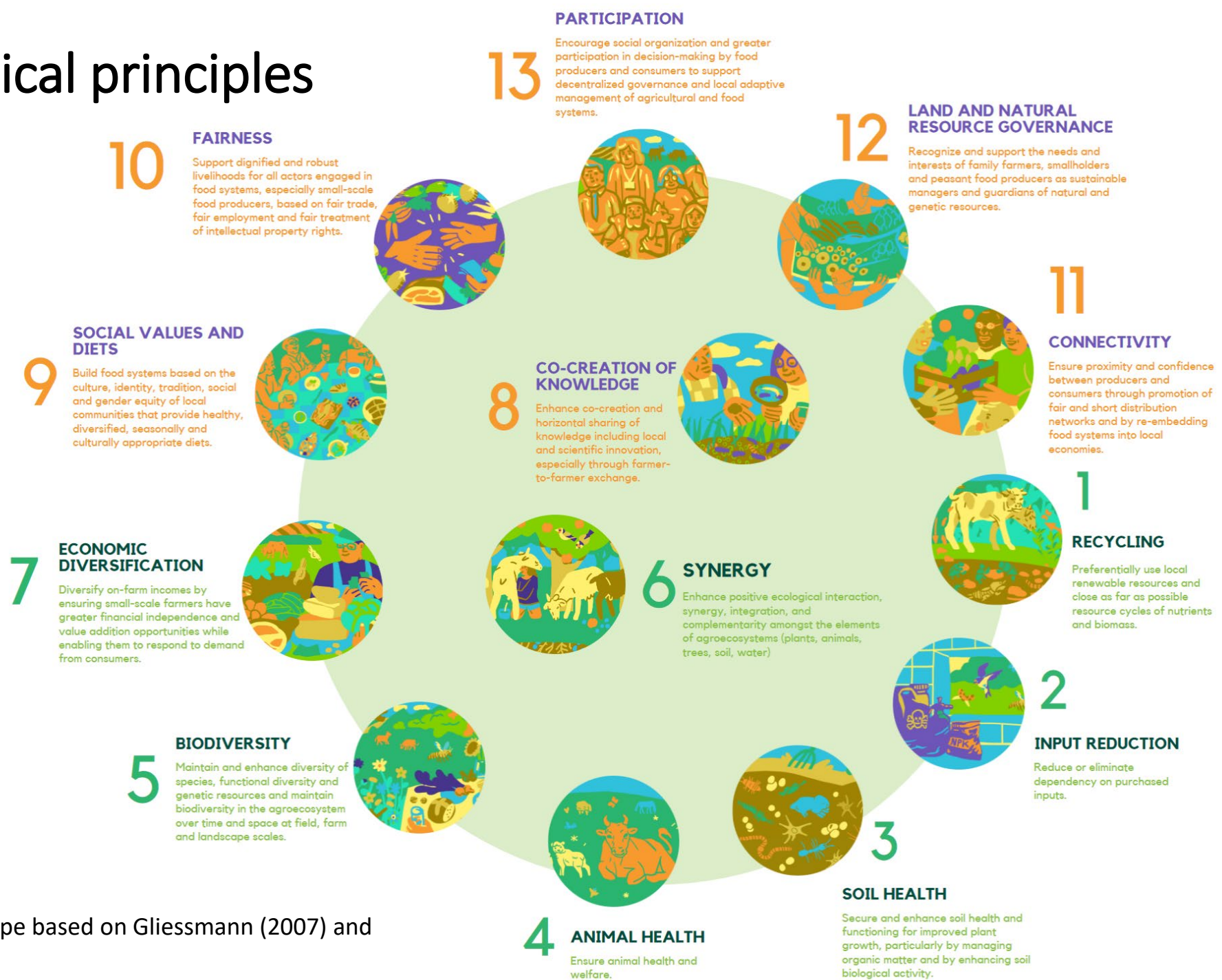
- Improved soils, less water stress, manifold products
(Niether 2019, Tscharntke et al. 2011, Sperber et al. 2004)
- Conservation of (agro) biodiversity
(Altieri et al. 2012, Bhagwat et al. 2008, Verchot et al. 2007)
- Livelihoods, resilience and food security
(Jacobi 2016, Altieri et al. 2012)
- System yield >10 times monoculture yield
(FiBL 2021, Niether et al. 2020, Schneider et al. 2016)
- Carbon stocks 2-3 times higher
(Niether et al. 2020, Jacobi et al. 2015, Nair et al. 2009)
- Constraints: mainly socio-economic
(Jacobi et al. 2017)

Political (agro)ecology: Identifying and overcoming lock-ins



Source: IPES-Food 2015 «From Uniformity to Diversity»

Agroecological principles



Source: Agroecology Europe based on Gliessmann (2007) and HLPE (2019)

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