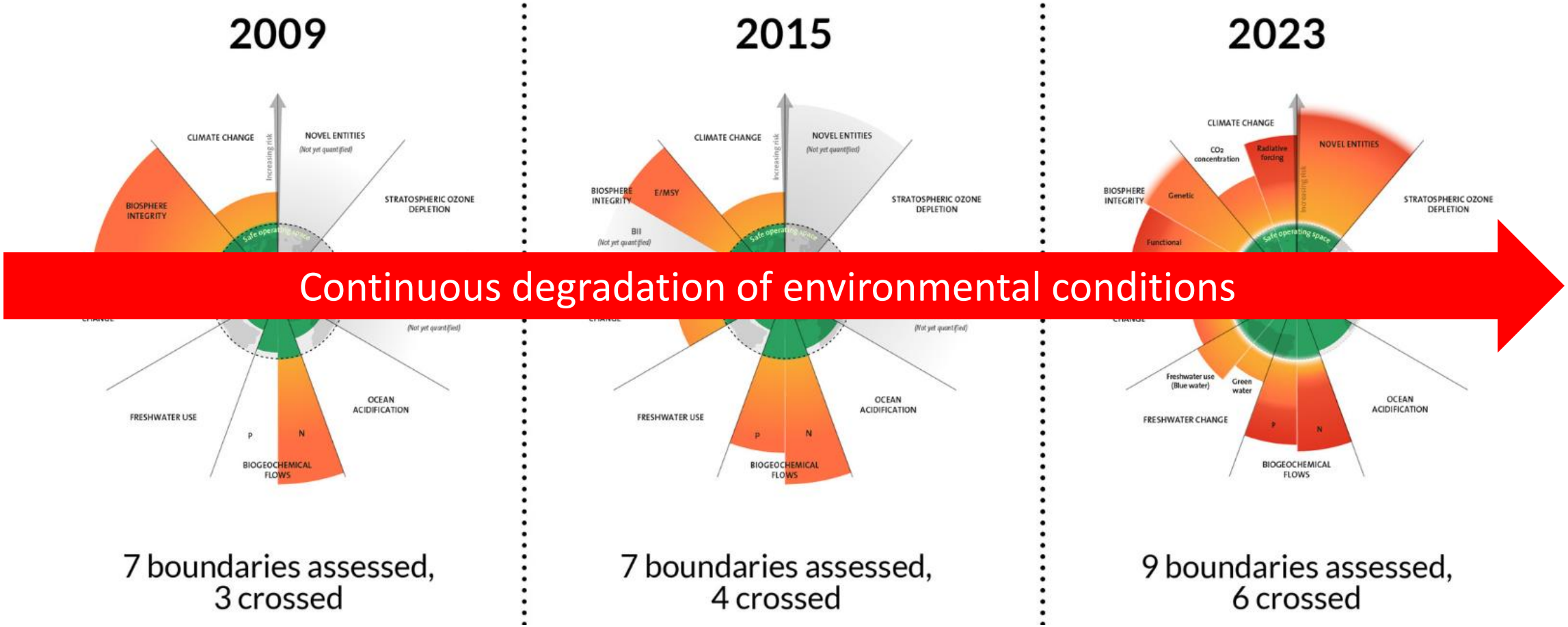
# Reconciling short- and long-term goals in agrifood systems: what role for agricultural sciences?

Guillaume Martin

INRAE Occitanie-Toulouse – UMR AGIR

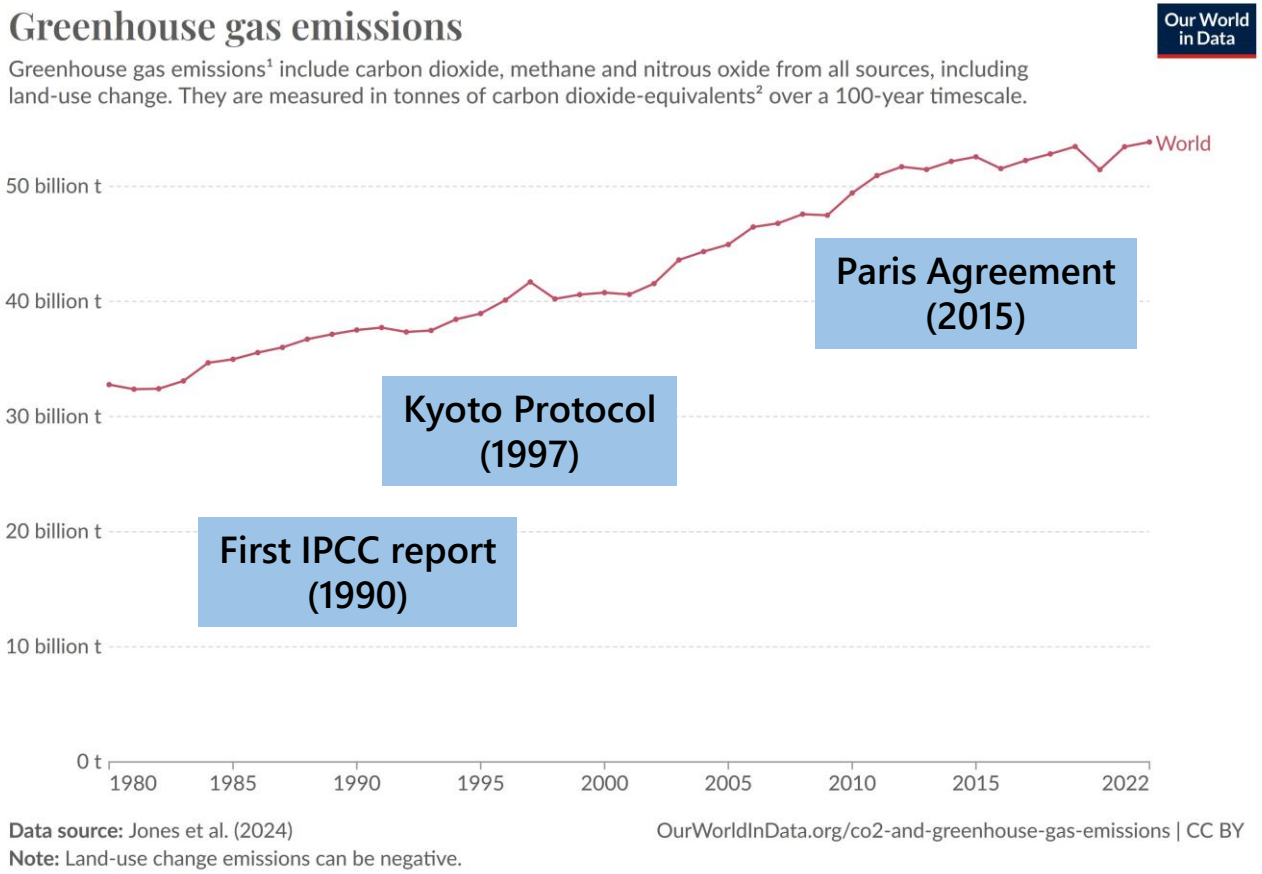
18th Congress of the European Society for Agronomy in Rennes, France

# Multiple long-term environmental challenges




The evolution of the planetary boundaries framework. Licenced under CC BY-NC-ND 3.0 (Credit: Azote for Stockholm Resilience Centre, Stockholm University. Based on Richardson et al. 2023, Steffen et al. 2015, and Rockström et al. 2009) Click on the image to download.

# The failure of climate change mitigation



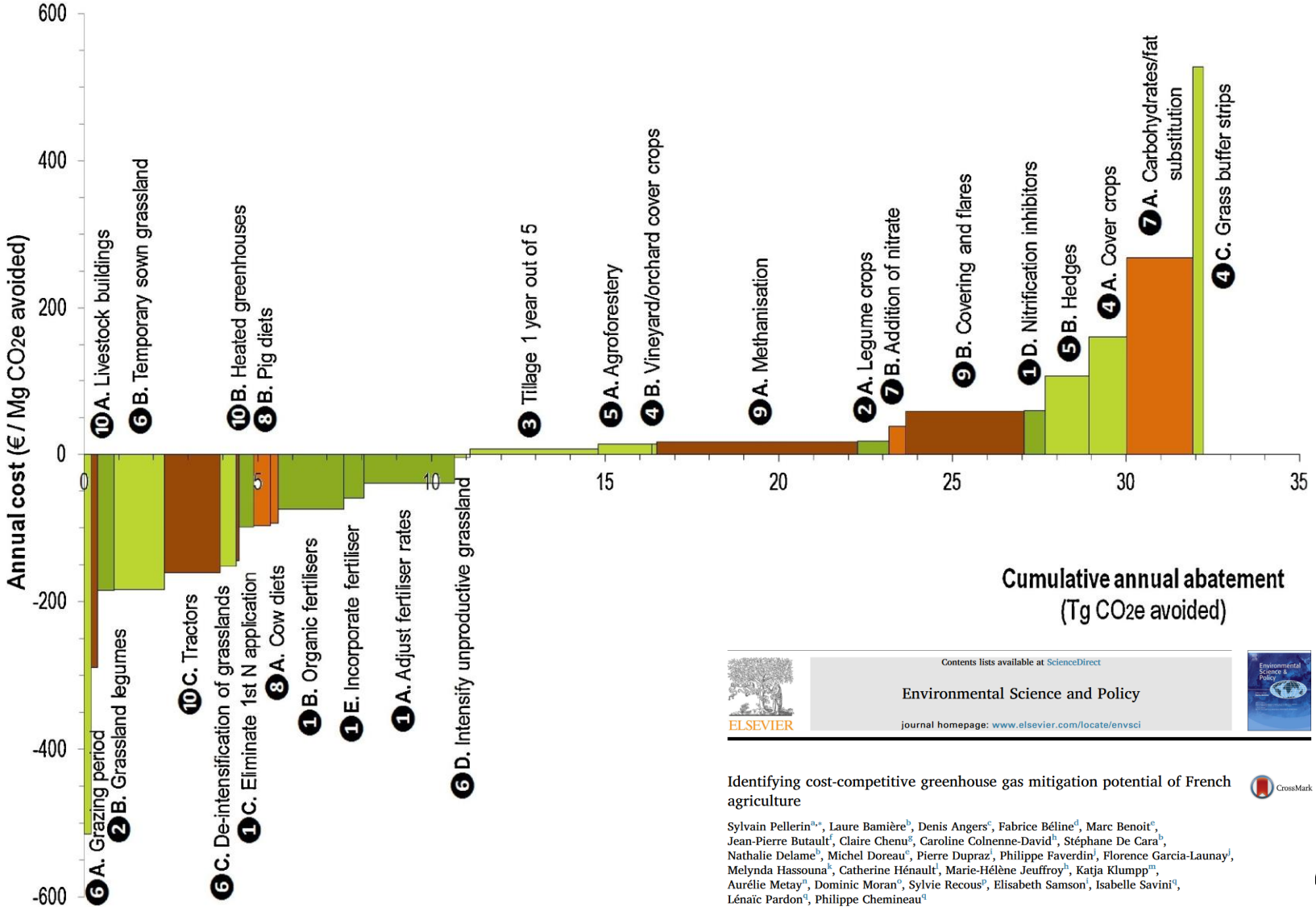

*Annual Review of Environment and Resources*

Three Decades of Climate Mitigation: Why Haven't We Bent the Global Emissions Curve?

Isak Stoddard,[1] Kevin Anderson,[1,2] Stuart Capstick,[3] Wim Carton,[4] Joanna Depledge,[5] Keri Facer,[1,6] Clair Gough,[2] Frederic Hache,[7] Claire Hoolohan,[2,3] Martin Hultman,[8] Niclas Hällström,[9] Sivan Kartha,[10] Sonja Klinsky,[11] Magdalena Kuchler,[1] Eva Lövbrand,[12] Naghmeh Nasiritousi,[13,14] Peter Newell,[15] Glen P. Peters,[16] Youba Sokona,[17] Andy Stirling,[18] Matthew Stilwell,[19] Clive L. Spash,[20] and Mariama Williams[17]

An urgent and unprecedented transformation is needed

# Risk aversion to change on the farms





Contents lists available at ScienceDirect

Environmental Science and Policy

journal homepage: www.elsevier.com/locate/envsci

Identifying cost-competitive greenhouse gas mitigation potential of French agriculture

Sylvain Pellerin[a,*], Laure Bamière[b], Denis Angers[c], Fabrice Béline[d], Marc Benoit[e], Jean-Pierre Butault[f], Claire Chenu[g], Caroline Colnenne-David[h], Stéphane De Cara[b], Nathalie Delame[b], Michel Doreau[e], Pierre Dupraz[i], Philippe Faverdin[j], Florence Garcia-Launay[j], Melynda Hassouna[k], Catherine Hénault[l], Marie-Hélène Jeuffroy[h], Katja Klumpp[m], Aurélie Metay[n], Dominic Moran[o], Sylvie Recous[p], Elisabeth Samson[i], Isabelle Savini[q], Lénaïc Pardon[q], Philippe Chemineau[q]

Mitigation/adaptation measures are sometimes at no cost and even generate savings

Risk aversion
Unexpected consequences e.g. on workload, stability of outlets
A matter of worldviews

# Farmers' anger is mounting across Europe and raises short-term challenges

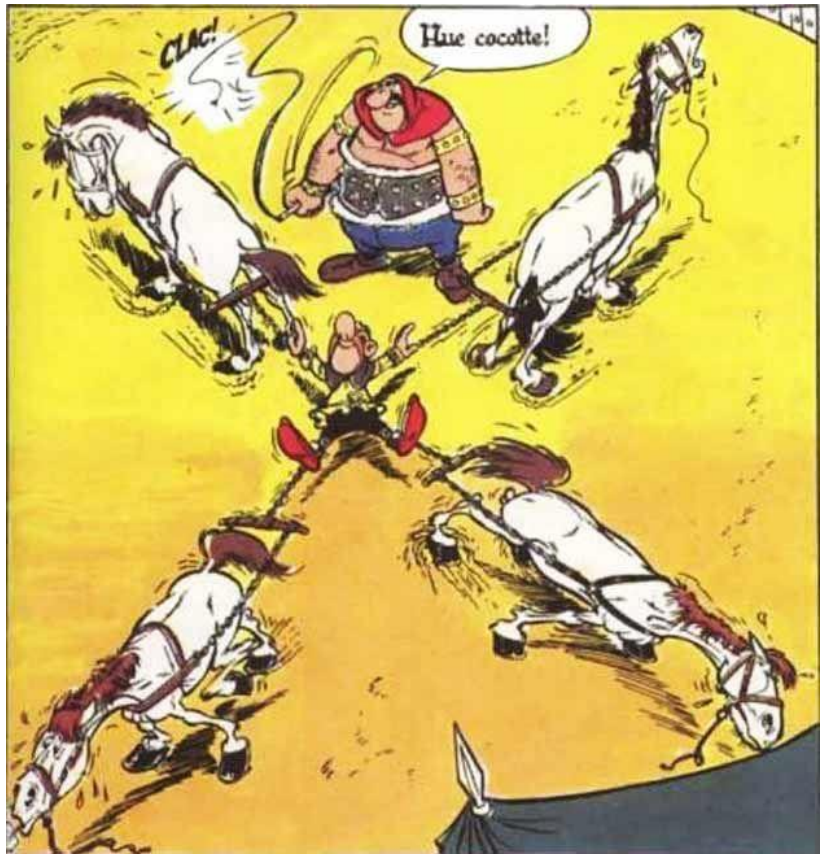
« No farmers, no food »

« We feed you but we die of it »

- 2024 protests in several European countries
- Main concerns regard
  - Rising input prices
  - Volatility and low level of output prices
  - Unfair competition with other countries/regions
  - Environmental norms and regulations
  - Lack of societal recognition
  - Immediate impacts of climate change

Low output prices

Biodiversity conservation




Source: Asterix and the Goths, Goscinny and Uderzo

Excess of environmental norms

Mitigation of climate change

# How can we contribute to reconcile short-term and long-term goals in agrifood systems?

# The rise and fall of the French organic agrifood sector

# What lessons for agricultural scientists?

# THE FOUR PRINCIPLES OF ORGANIC AGRICULTURE

## HEALTH

Healthy soils produce healthy crops that foster the health of animals and people.
Organic agriculture is intended to produce high quality, nutritious food that contributes to preventive health care and well-being.

## ECOLOGY

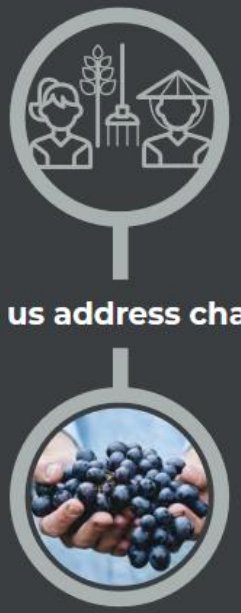
All land is home to wildlife and important for ecosystem services. Organic agriculture aims for ecological balance through the design of farming systems, establishment and good maintenance of habitats and conservation of agricultural biodiversity and genetic resources.

## FAIRNESS

Equity, respect, justice and stewardship of the shared world. Organic agriculture aims to provide good food for all and a decent living for farmers and food workers.

## CARE

Taking care of each other and our surroundings.
Organic agriculture focuses on how we can enhance efficiency and increase productivity without jeopardizing the health and well-being of people and the planet.



## How can organic agriculture help us address challenges?

## SOIL

Organic agriculture is centered on boosting soil health.
What are the benefits of healthy soil?

**What are some of the benefits of healthy soil?**

We can grow nourishing, nutrient-dense foods in it without using inputs like artificial fertilizers
It provides us with higher crop yields in the long term

## BIODIVERSITY

Organic agriculture seeks to maintain and boost biodiversity. Why does that matter?

**What are some of the reasons biodiversity matters?**

-Seed and crop diversity makes farms and landscapes more resilient to challenges (such as pest incursions) and change (such as global warming)
-Monoculture impacts negatively on soil health and biodiversity

## LIVELIHOODS

How can organic agriculture help create more sustainable, secure and resilient livelihoods?

**What are some of the key questions when considering sustainable livelihoods?**

-What is the difference between food security and food sovereignty?
-How can organic agriculture contribute to more secure and resilient food production?

## CLIMATE CHANGE

How can organic agriculture contribute to addressing the climate crisis?

**Some contributions include:**

-Soil that's cultivated organically stores more carbon than that which is cultivated for conventional agriculture
-It reduces greenhouse gas emissions by omitting the use of pesticides

Global Landscapes Forum

globallandscapesforum.org

Funding partners:

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

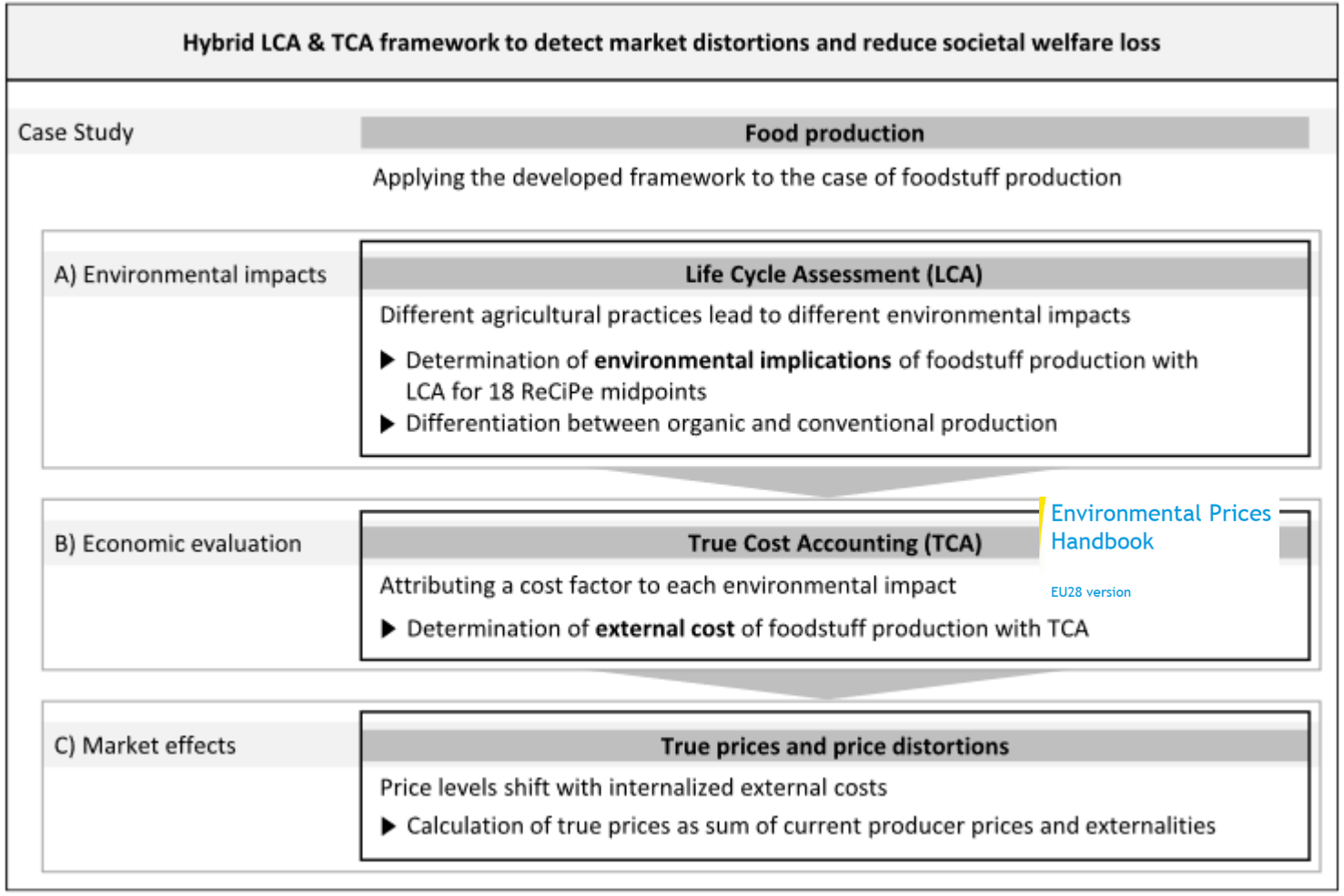
Federal Ministry for Economic Cooperation and Development

In collaboration with:

IFOAM ORGANICS INTERNATIONAL

INRAE

# Reduced environmental costs for society




Contents lists available at ScienceDirect
Journal of Cleaner Production
journal homepage: www.elsevier.com/locate/jclepro

True cost accounting of organic and conventional food production

Amelie Michalke [a,*], Sandra Köhler [b], Lukas Messmann [b], Andrea Thorenz [b], Axel Tuma [b], Tobias Gaugler [c]

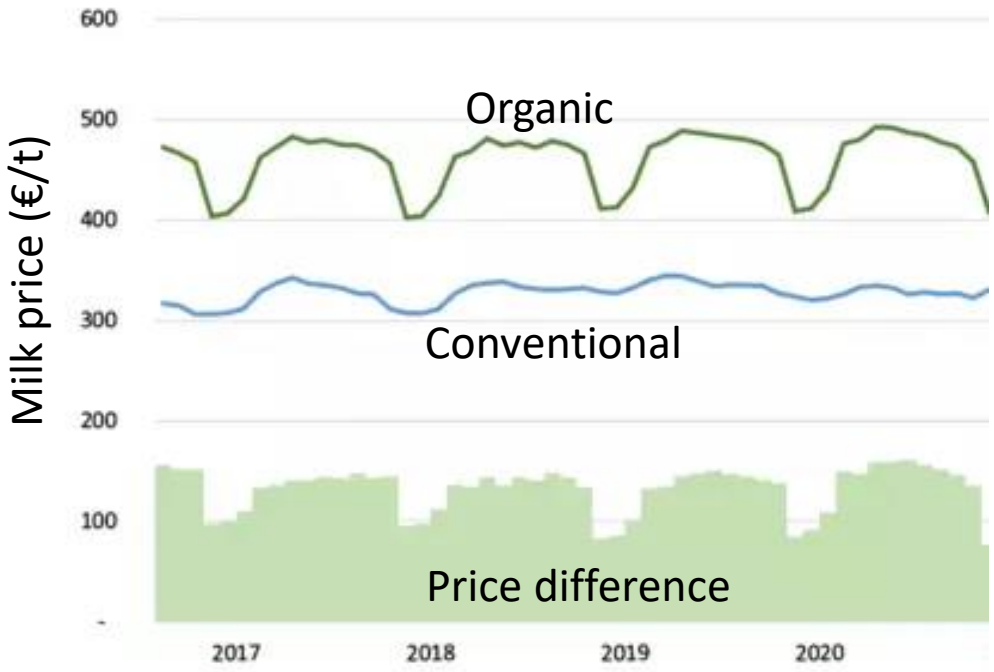
- Over 22 agricultural products
- Crop production generates externalities per kg product of about

**€0.79 for conventional**

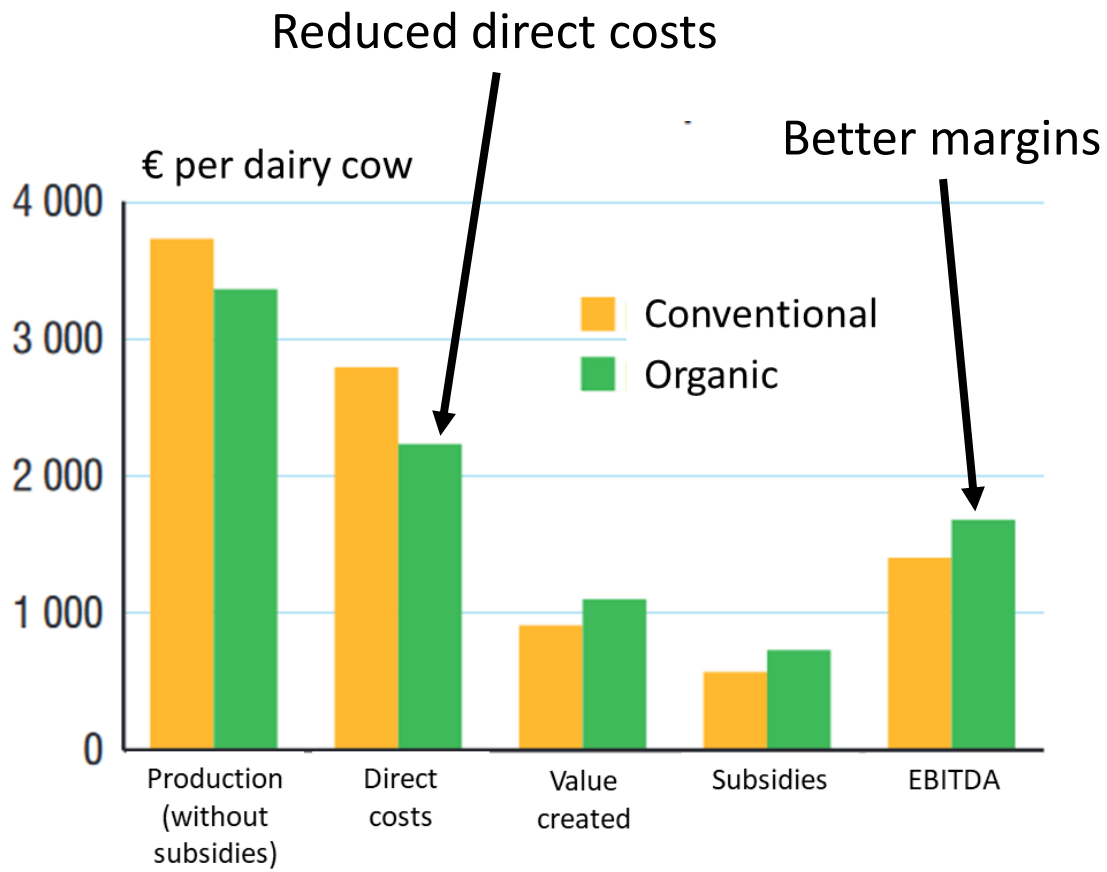
**€0.42 for organic**

# Better prices for farmers And better margins!

## The case of dairy production in France




Source: CNIEL




Champ : France métropolitaine, exploitations au régime fiscal des BRA, exploitations spécialisées en bovins production laitière.
*Source : SSP, ESEA 2013 - Agrfin 13-14.*

# Organic farming as a solution to reconcile short-term and long-term goals?

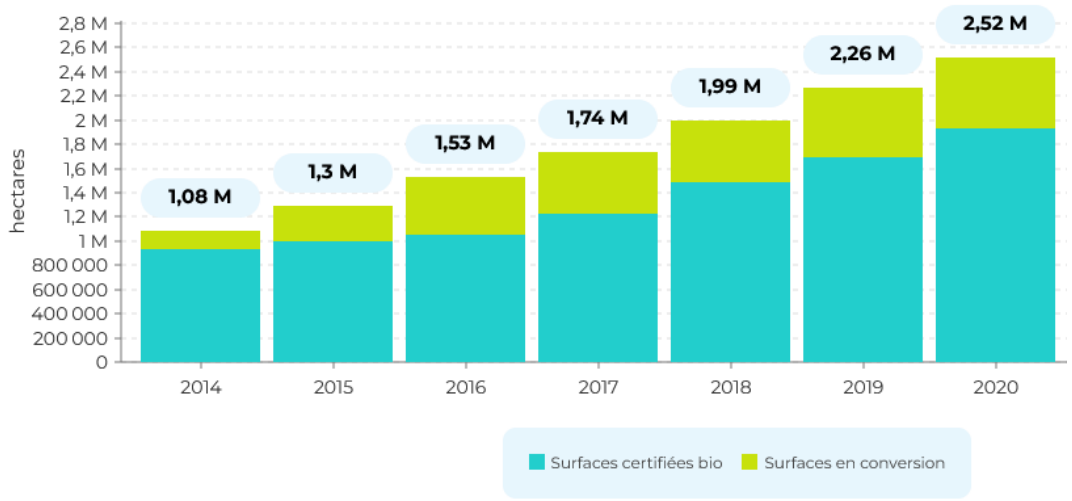
- Reduced environmental costs
- Better prices
- Reduced direct costs
- Better margins
- Shared production standards

→ An opportunity to address farmers' concerns over the short term while progressing towards the transformation needed to deal with long-term environmental challenges

# A massive movement towards organic farming

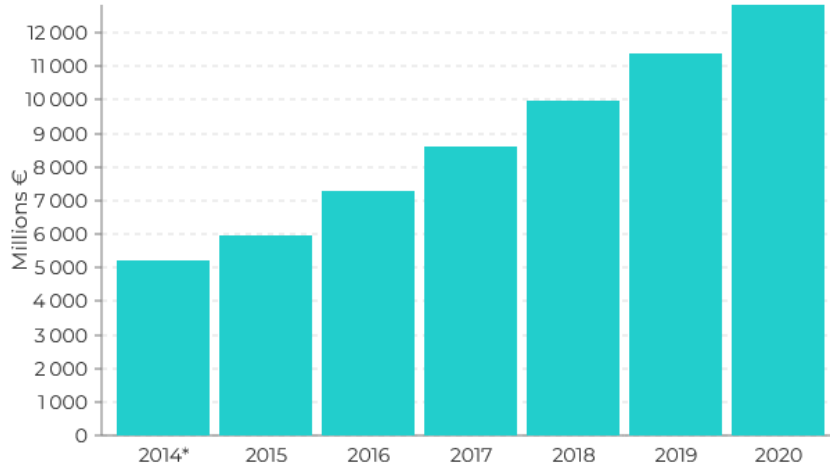
## On the production side

Land certified organic




## On the consumption side

Organic market



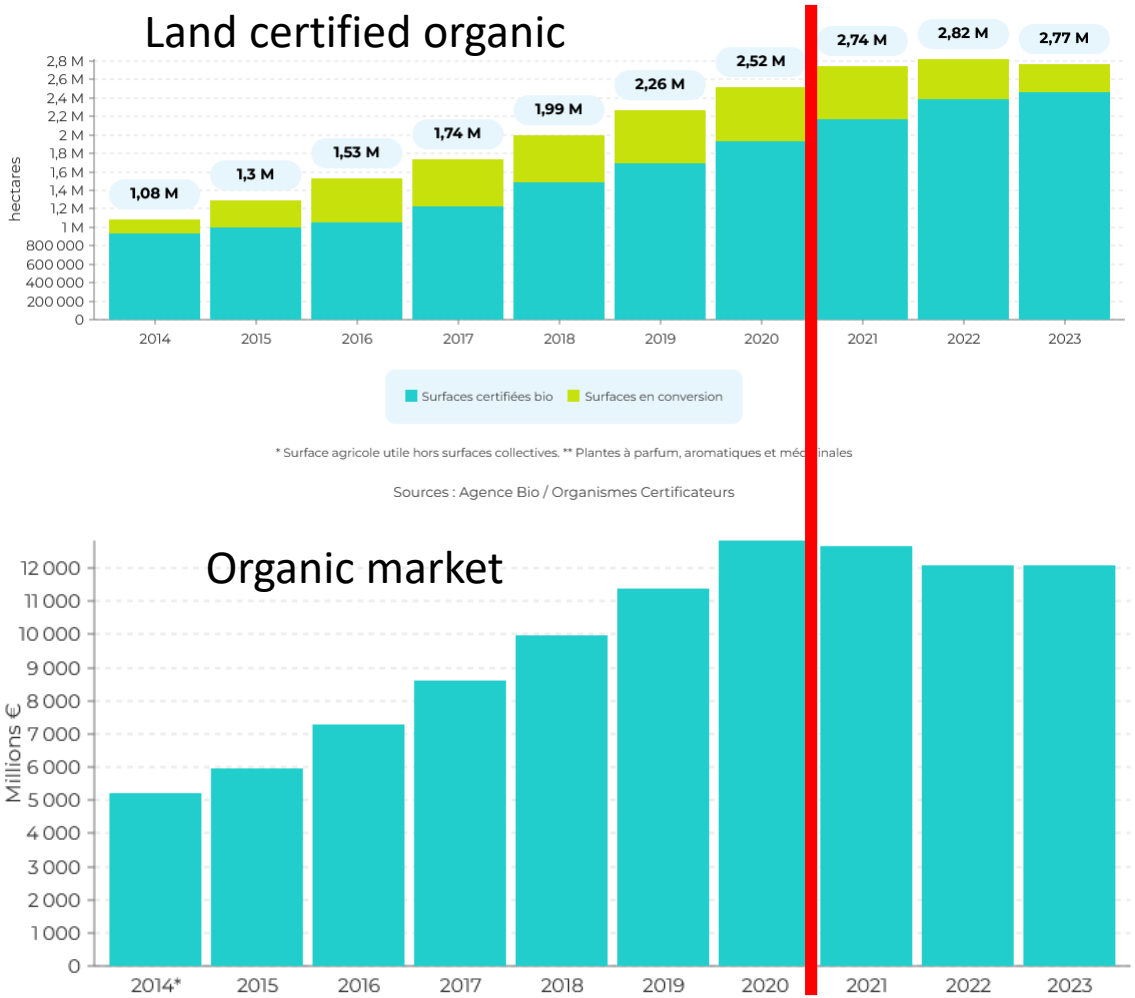

Source: Agence Bio

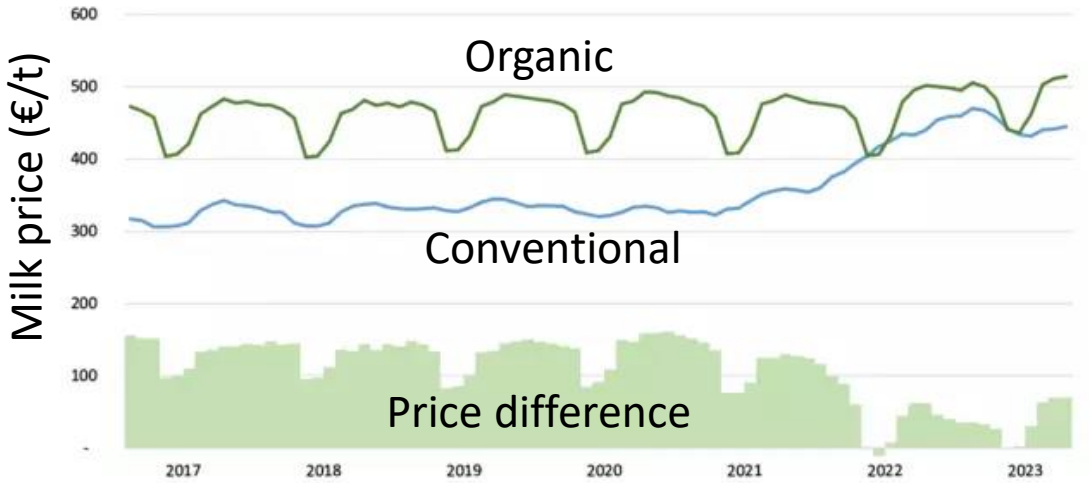
Encouraged by ambitious policy objectives

**Country level**: Plan Ambition Bio 2018 (15% certified organic land) and EGALIM law (20% organic products in institutional catering)

**EU level**: Farm to Fork Strategy (25% certified organic land)

# Until COVID time…




Average difference between organic and conventional
2020: 138€/t
2023: 37€/t

Source: CNIEL

- Consumers have turned away from organic
- Amounts of organic products have kept increasing
- The EGALIM law is not respected by institutional catering (7% only according to Agence Bio)
- Prices have dropped

➔ The sector faces a major crisis

# A lack of information for consumers

Survey in 2023 over a representative panel of 4000 French consumers

- Organic products are **too expensive** for 66% of weekly consumers and 75% of non consumers
- Only 41% consider they have enough information on the **impacts of organic on human health**
- And only 39% on the **impacts of organic on the environment**
- **Insufficient perception** of the benefits to expect from **organic vs other agricultural production models / standards**
- Some citizens including reknowned scientists consider that **organic farming is dangerous and will lead to hunger**


Contents lists available at ScienceDirect

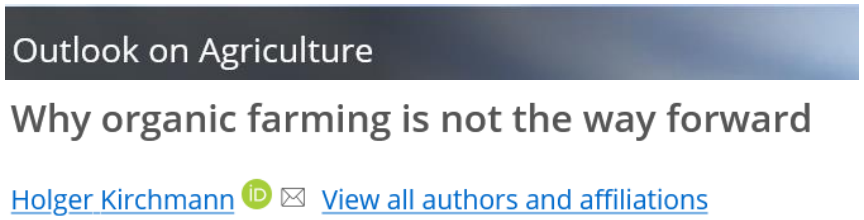
Field Crops Research

journal homepage: www.elsevier.com/locate/fcr

Short Communication

Organic agriculture and food security: A decade of unreason finally implodes

David J. Connor


Outlook on Agriculture

Why organic farming is not the way forward

Holger Kirchmann View all authors and affiliations

# A lack of investment into research on organic

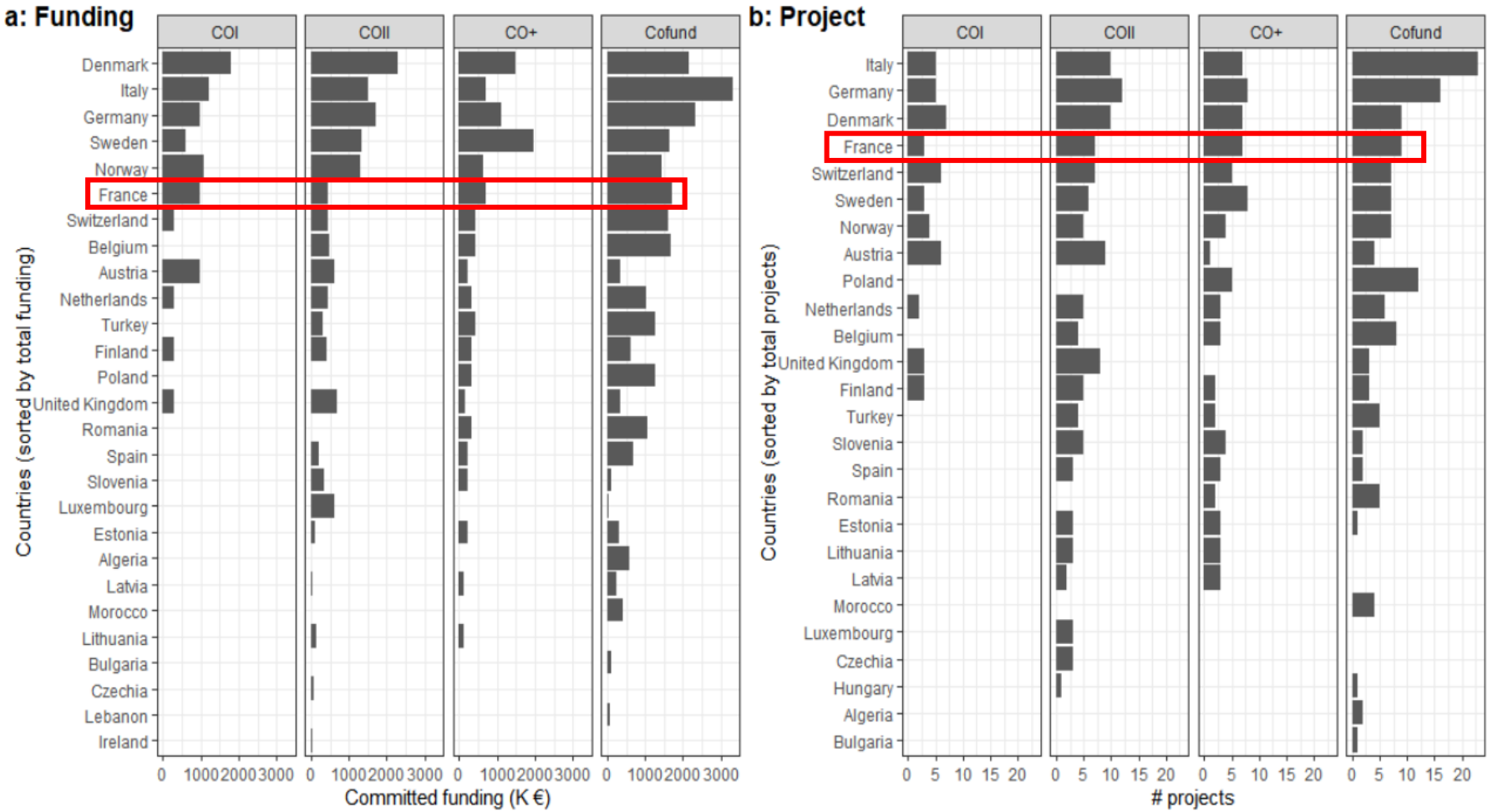



*Figure 14: Evolution of country contributions in CO projects (A: committed funding, B: number of projects).*

IFOAM TECHNOLOGY INNOVATION PLATFORM TIPI

**A Global Vision and Strategy for Organic Farming Research**

Condensed version
Evolution date: February, 2017

**Insufficient funding** [64-67]

With less than one percent of the budget for food and farming systems research spent on organic, there is a lack of funding for basic and applied projects, which hinders development of innovations by scientists and farm advisors.

**CORE ORGANIC - 15 YEARS OF JOINT RESEARCH FOR ORGANIC FOOD AND FARMING SYSTEMS**

CORE Organic 15-year activity report (2004-2019)

Stefano Grando (Mipaaf, IT), Guillaume Ollivier (INRAE, FR), Elena Capolino (Mipaaf, IT), Ivana Trkulja (ICROFS, DK) and Stéphane Bellon (INRAE, FR)

Could have made the organic agrifood system more resilient to such a market crisis

# A research mainly focused on farming practices

- Little budget and projects on market development
- Very little research addressing the continuum from farm to fork

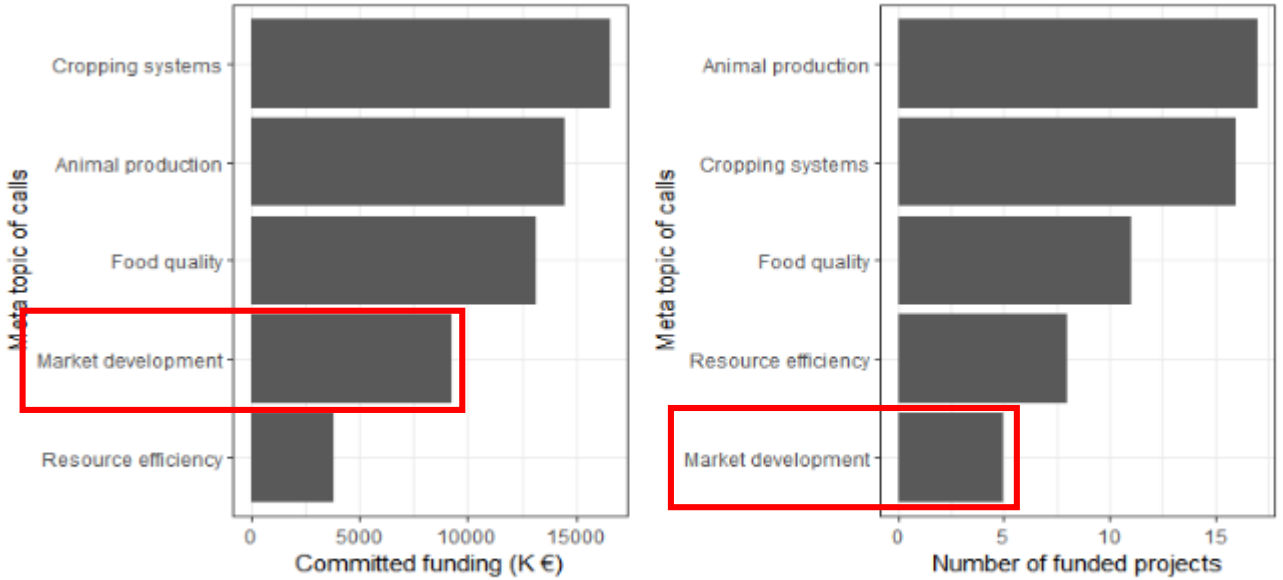



*Figure 5: Ranking of funding commitments on meta-topics (left) and subsequent number of funde*


Contents lists available at SciVerse ScienceDirect

Land Use Policy

journal homepage: www.elsevier.com/locate/landusepol

ELSEVIER

Viewpoint

Organic farming without organic products

Charissis Argyropoulos[a], Maria A. Tsiafouli[b,*], Stefanos P. Sgardelis[b], John D. Pantis[b]

Innovations in the fields/farms require changes on subsequent stages of the value chain, all the way to consumers

**CORE ORGANIC - 15 YEARS OF JOINT RESEARCH FOR ORGANIC FOOD AND FARMING SYSTEMS**

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Stefano Grando (Mipaaf, IT), Guillaume Ollivier (INRAE, FR), Elena Capolino (Mipaaf, IT), Ivana Trkulja (ICROFS, DK) and Stéphane Bellon (INRAE, FR)

# A lack of research on the conversion phase and on the resulting novel agricultural systems

Agron. Sustain. Dev. 29 (2009) 97–112
© INRA, EDP Sciences, 2008
DOI: 10.1051/agro:2008007

Available online at:
www.agronomy-journal.org

Review article

**Conversion to organic farming: a multidimensional research object at the crossroads of agricultural and social sciences. A review**

Claire LAMINE[1], Stéphane BELLON[2]

"the literature minimizes the importance of transitional aspects"
Most organic research still relies on **controlled experiments designed by researchers**

Agronomy for Sustainable Development (2019) 39: 19
https://doi.org/10.1007/s13593-019-0565-3

RESEARCH ARTICLE

**Conversion to organic farming decreases the vulnerability of dairy farms**

Maëlys Bouttes[1] · Niels Bize[1] · Goulven Maréchal[2] · Guillaume Michel[3] · Magali San Cristobal[4] · Guillaume Martin[1]

Agronomy for Sustainable Development (2019) 39: 16
https://doi.org/10.1007/s13593-019-0560-8

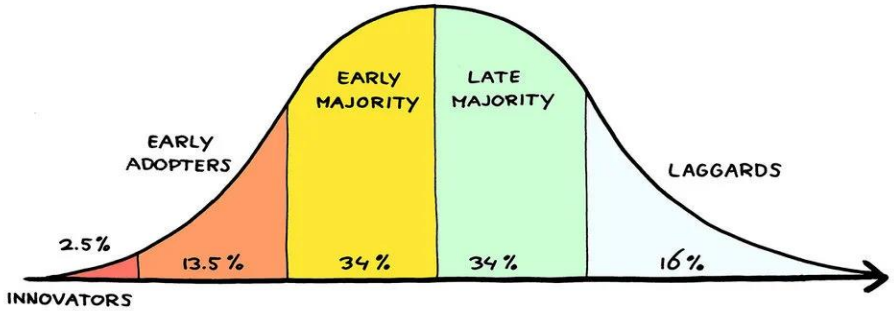
RESEARCH ARTICLE

**Diversity of conversion strategies for organic vineyards**

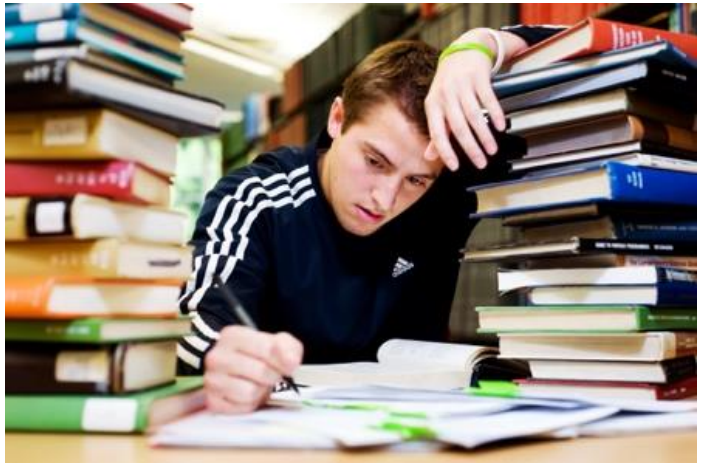
Anne Merot[1] · Adeline Alonso Ugaglia[2] · Jean-Marc Barbier[3] · Bernard Del'homme[4]

Limited knowledge of **novel systems** resulting from conversions to organic on **commercial farms**, their advantages and drawbacks to reconcile short-term and long-term goals, and their mainstreaming potential

# Lessons for agricultural scientists

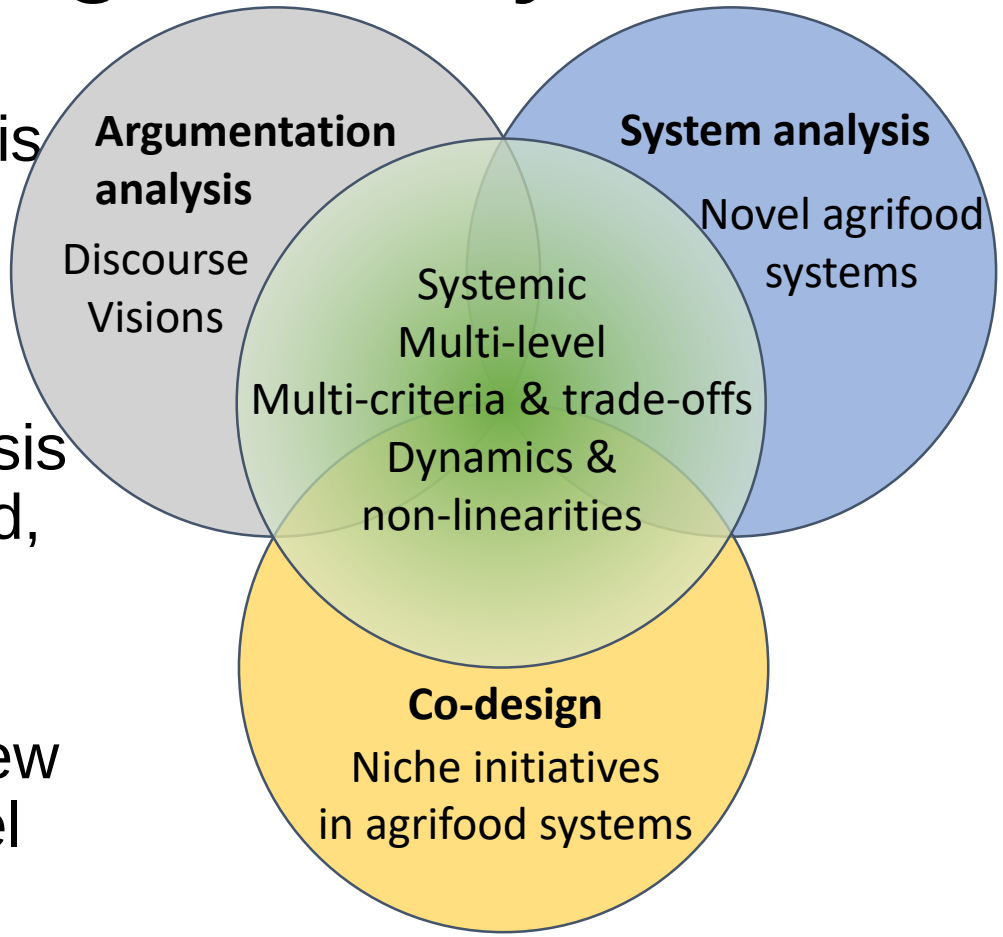



- 14.4% of French farms, probably not 14.4% of agricultural scientists ➔ **Are we laggards**?
- Inability to properly inform consumers and policy-makers on the **long-term impacts** and **true costs** of different agricultural production models / standards
- Lack of research on and in support of **novel farming systems in commercial farms** to document such systems and develop new narratives
- Lack of research addressing the **continuum from farm to fork** to induce/support change beyond the field/farm gate



# 3 approaches to contribute to reconciling short-term and long-term goals in agrifood systems?

- Part of the population still needs to be convinced about the need for change ➔ Argumentation analysis to de-construct well-rooted myths on the current agrifood system
- From farmers to consumers, knowledge about available solutions remains limited ➔ System analysis to document novel agrifood systems in the real world, their advantages and drawbacks, and their mainstreaming potential
- Gathering from farmers to consumers to consider new options ➔ Co-design to invent and experiment novel agrifood systems through pioneer initiatives



# Argumentation analysis to de-construct well-rooted myths on the current agrifood system

To further inform on the **long-term impacts and true costs** of agricultural production models and convince farmers, other agricultural stakeholders, consumers and policy-makers about the need for change

To better assess the strength of arguments i.e. their evidentiary power or capacity to justify the thesis which they aim to support

Food Ethics (2024) 9:15
https://doi.org/10.1007/s41055-024-00147-9

RESEARCH ARTICLE

Check for updates

**Are Animals Needed for Food Supply, Efficient Resource Use, and Sustainable Cropping Systems? An Argumentation Analysis Regarding Livestock Farming**

Olle Torpman[1] · Elin Röös[2]

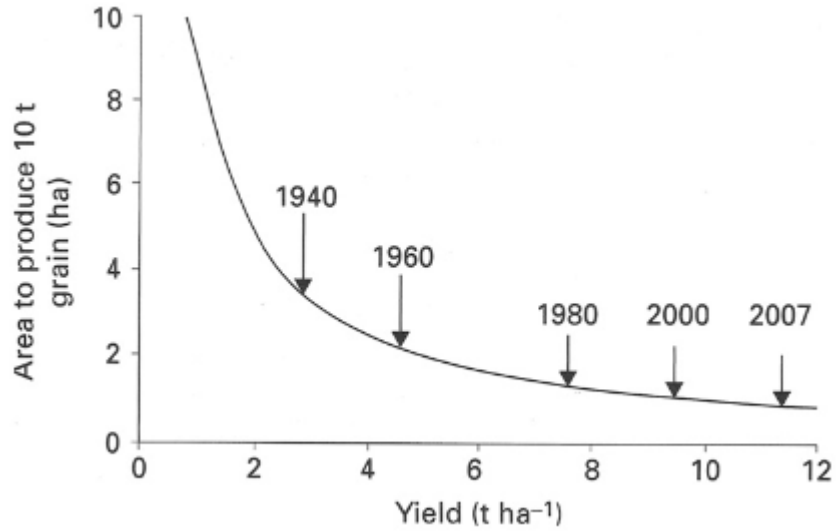
1. The Nutrition Argument:

(i) Livestock farming is needed to supply all the different nutrients required for humans to live healthy lives.
(ii) Livestock farming is needed to supply the amounts of food needed to feed a growing human population.

# The mainstream: a single avenue over the long term, intensify to produce more food

"food production be increased by 70%. This large increase can only be achieved by **combinations of greater crop yields and more intensive cropping**" […] "**Farming systems are** […] **achieving greater production and resource-use efficiency** by application of science and technology."

"Proposals to transform agriculture to low-input and organic systems would, because of low productivity, exacerbate the challenge"




Contents lists available at SciVerse ScienceDirect

Global Food Security

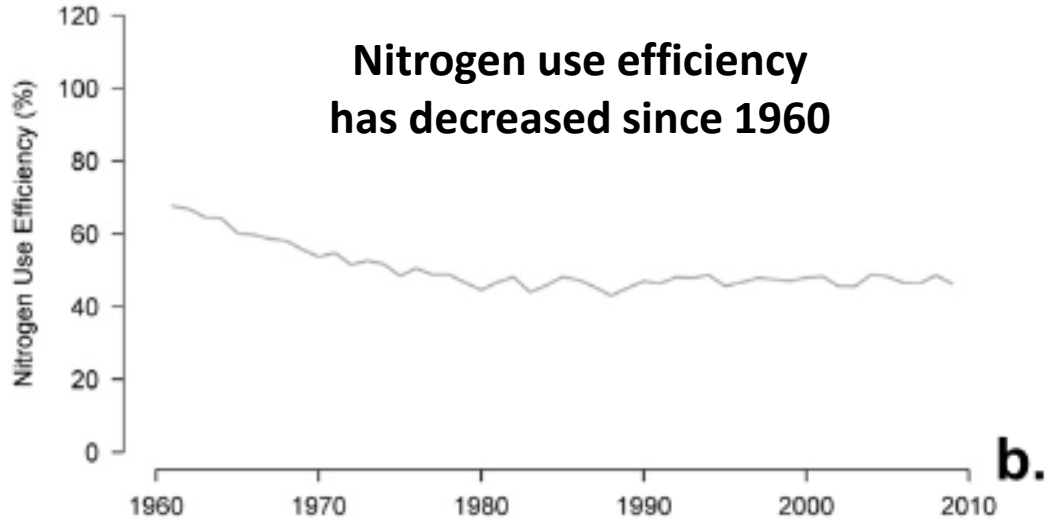
journal homepage: www.elsevier.com/locate/gfs

Evolution not revolution of farming systems will best feed and green the world

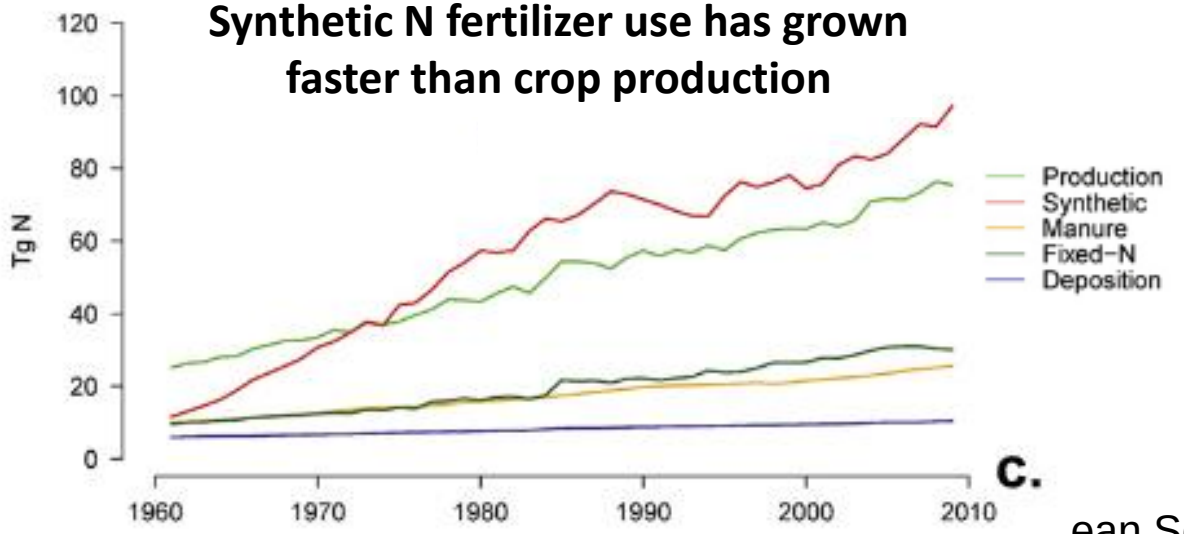
David J. Connor [a], M. Inés Mínguez [b,*]

# Myth #1 Resource use efficiency has improved much

**Nitrogen use efficiency has decreased since 1960**




**Synthetic N fertilizer use has grown faster than crop production**

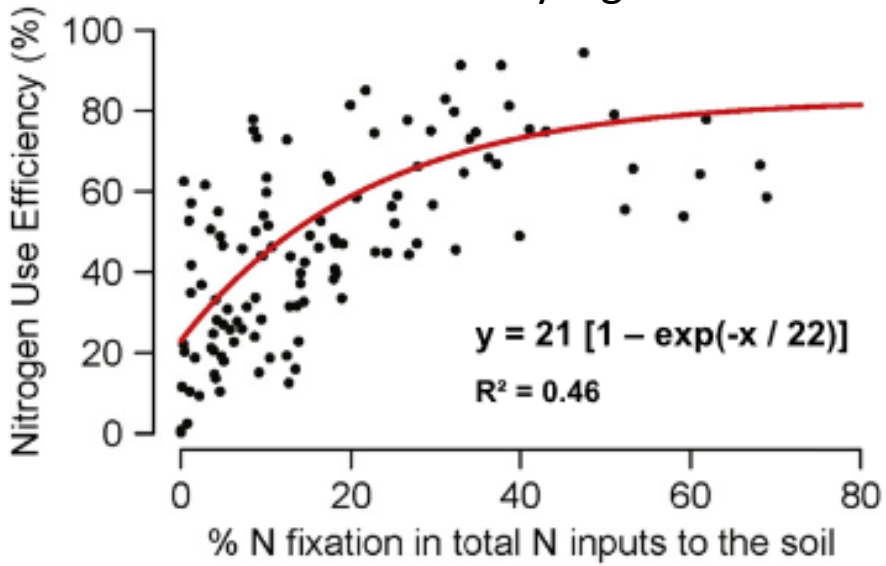



OPEN ACCESS
IOP Publishing
Environmental Research Letters
Environ. Res. Lett. 9 (2014) 105011 (9pp)
doi:10.1088/1748-9326/9/10/105011

**50 year trends in nitrogen use efficiency of world cropping systems: the relationship between yield and nitrogen input to cropland**

Luis Lassaletta[1], Gilles Billen[1,2], Bruna Grizzetti[3], Juliette Anglade[1] and Josette Garnier[1,2]

Nitrogen use efficiency is related to N fixed by legumes




ean Society for Agronomy

# Myth #2 Low-input systems cannot feed the world

*Journal of Sustainable Agriculture*, 36:595–598, 2012

ISSN: 1044-0046 print/1540-7578 online
DOI: 10.1080/10440046.2012.695331

Taylor & Francis
Taylor & Francis Group

**EDITORIAL**

## We Already Grow Enough Food for 10 Billion People . . . and Still Can't End Hunger

Eric Holt-Giménez, *Food First, Oakland, CA*
Annie Shattuck, *University of California, Berkeley, CA*
Miguel Altieri, *University of California, Berkeley, CA*
Hans Herren, *Millennium Institute, Washington, DC*
Steve Gliessman, *University of California, Santa Cruz, CA; JSA, Editor*

nature food
ARTICLES
https://doi.org/10.1038/s43016-021-00276-y
Check for updates

## Global option space for organic agriculture is delimited by nitrogen availability

Pietro Barbieri[1,2], Sylvain Pellerin[1], Verena Seufert[3], Laurence Smith[4], Navin Ramankutty[5] and Thomas Nesme[1,2]

nature COMMUNICATIONS
ARTICLE
DOI: 10.1038/s41467-017-01410-w OPEN

## Strategies for feeding the world more sustainably with organic agriculture

Adrian Muller[1,2], Christian Schader[1], Nadia El-Hage Scialabba[3], Judith Brüggemann[1], Anne Isensee[1], Karl-Heinz Erb[4], Pete Smith[5], Peter Klocke[1,6], Florian Leiber[1], Matthias Stolze[1] & Urs Niggli[1]

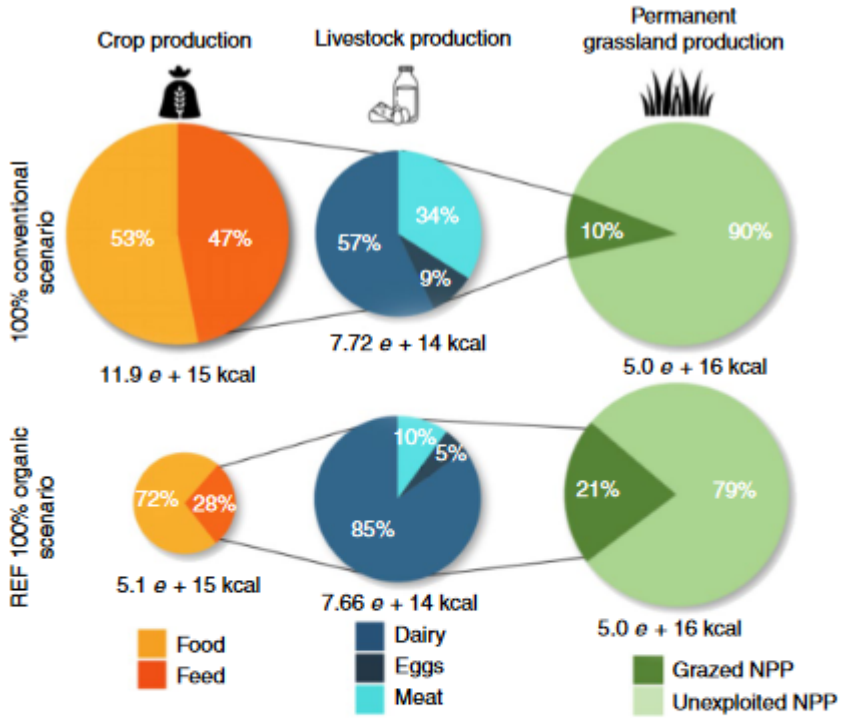
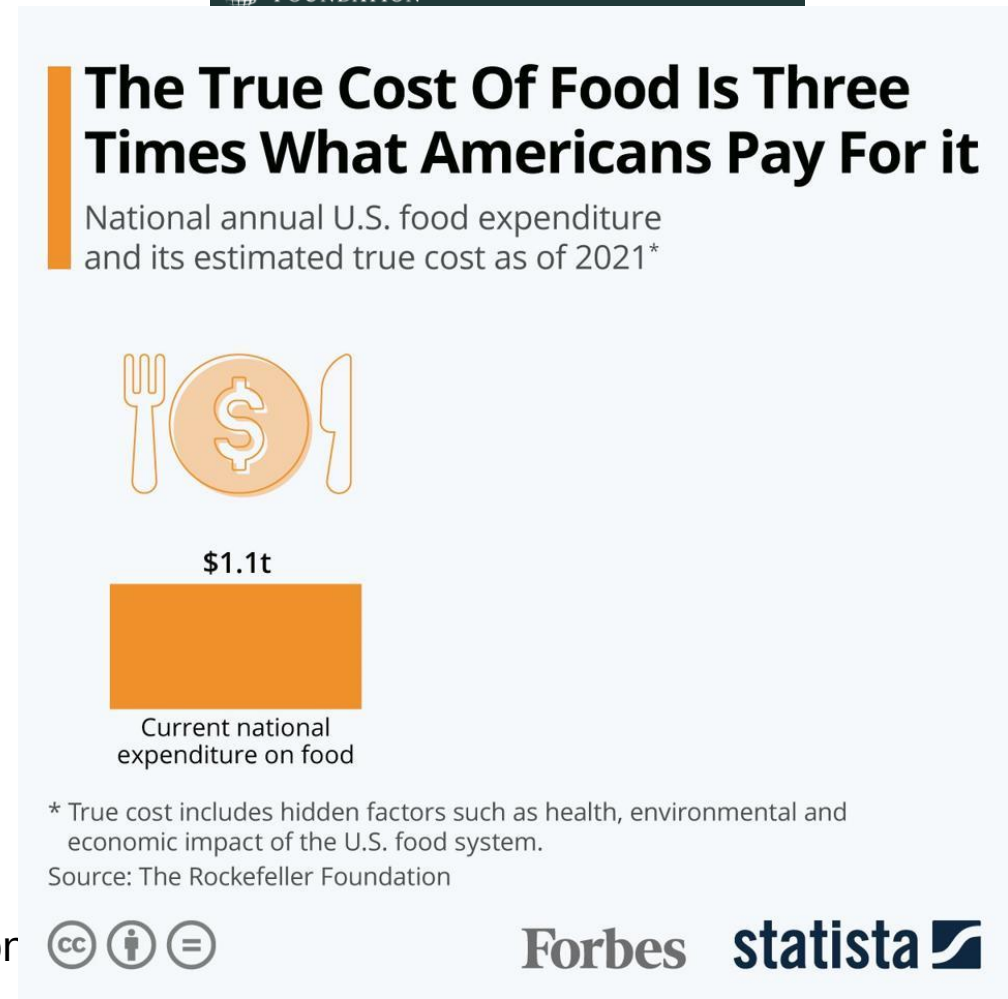



**Fig. 6 | Energy production from croplands, grassland and livestock in the 100% conventional and the REF 100% organic scenarios.** Energy production is shown for croplands (food and feed use, left), grassland (feed use, right) and livestock (food as milk, meat and eggs, centre). The REF 100% organic scenario refers to a planet farmed entirely organically alongside optimal livestock management. The size of the pie charts is scaled by total production within each production category (but not across crop, grassland and livestock). Conventional grazed NPP values are in line with the literature[57].

# Myth #3 Conventional products come with a lower cost

- In 2019, American consumers spent $1.1 trillion on food.
- That includes the cost of **producing, processing, retailing, and wholesaling** the food we buy and eat.
- It does not include the cost of **healthcare** due to **diet-related diseases**.
- Nor the costs of **water and air pollution, reduced biodiversity, or greenhouse gas emissions**.
- **Taking those costs into account, the true cost of the U.S. food system is at least three times as big: $3.2 trillion/yr.**

# Shifts to deconstruct these myths

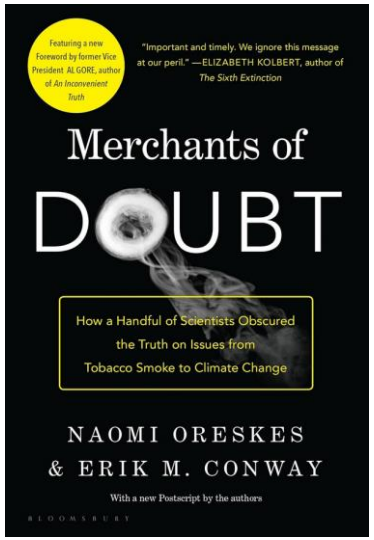
- Further develop argumentation analysis and its building stones
- **Historical and long-term analysis** to critically look back at the evolution of agrifood systems
- **Multi-level studies** (until the global level) to consider the impacts of upscaling a given practice/system
- **Multi-criteria evaluations** to consider the multiple impacts and true costs of agrifood systems beyond technical, economic and environmental aspects
- Further **engage in the public debate** with farmers, consumers and policy-makers to contribute to this deconstruction


SEPTEMBER 1, 2022 | 3 MIN READ

**The Public Wants Scientists to Be More Involved in Policy Debates**

Researchers worry about being branded as partisan, but people want to hear from experts

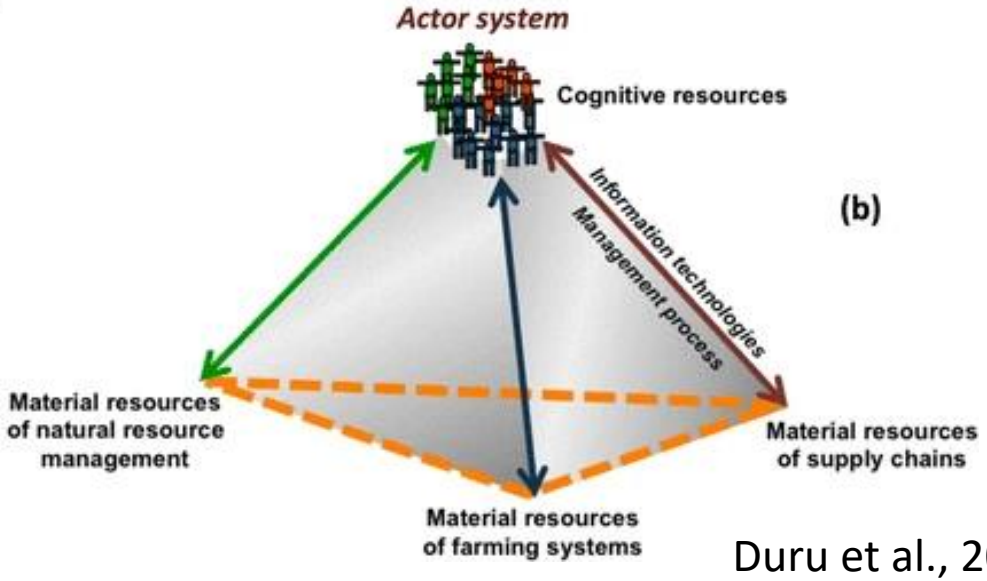
BY NAOMI ORESKES




# System analysis to document novel agrifood systems

To **fill knowledge gaps, develop new narratives and reduce farmers' risk aversion over the short term** to facilitate change, and to inform other stakeholders about the potential of alternatives

An activity that has a long history in agricultural sciences but for which several changes are needed




Duru et al., 2015

# Change #1 Dare considering such novel systems

- Burgeoning initiatives to develop diversified agricultural systems



Agricultural systems including tens of crop and/or livestock species associated

scientific **data**

Check for updates

OPEN

DATA DESCRIPTOR

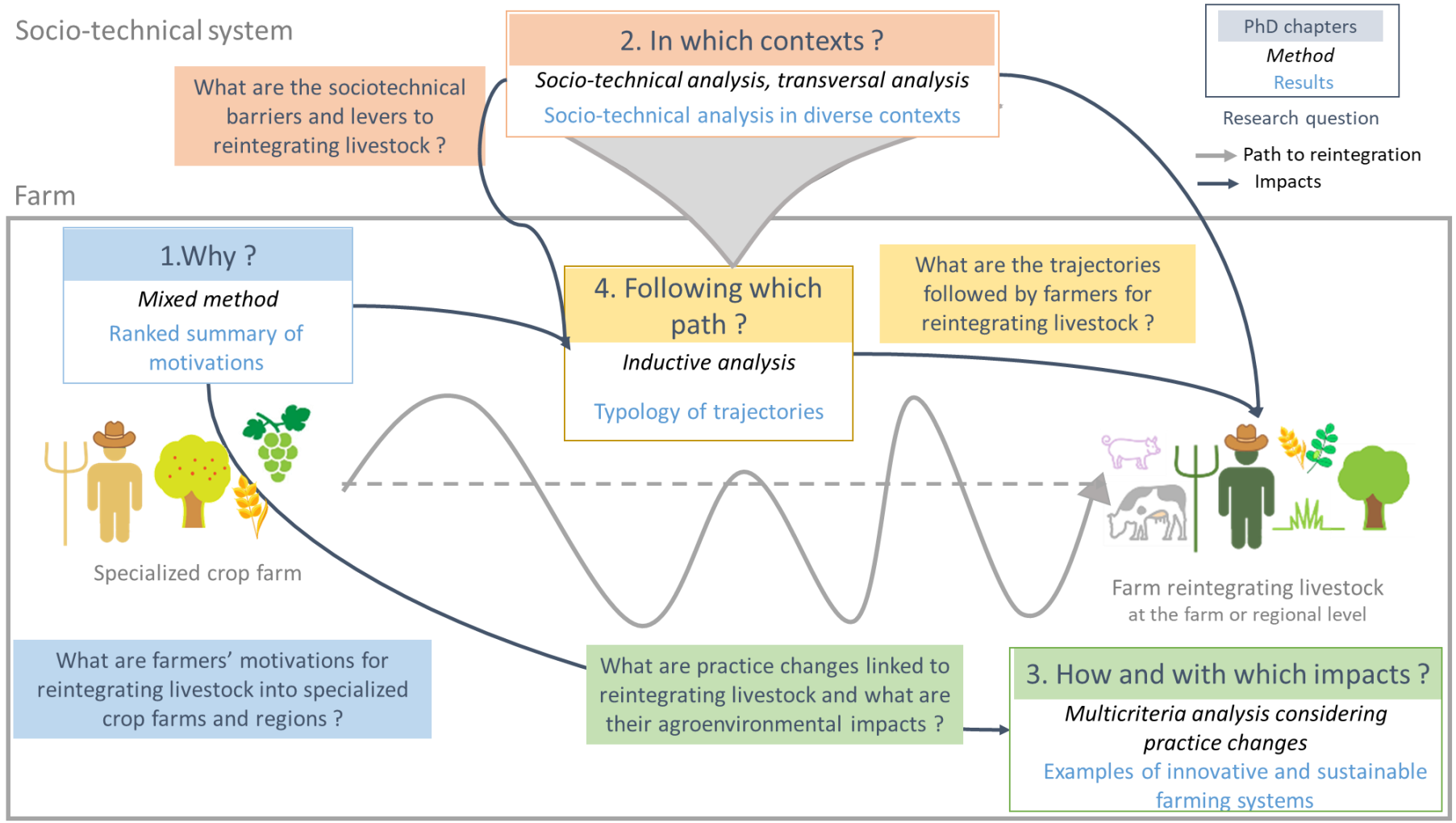
## A global dataset of experimental intercropping and agroforestry studies in horticulture

Raphaël Paut[1], Léa Garreau[2], Guillaume Ollivier[2], Rodolphe Sabatier[2] & Marc Tchamitchian[2]

13,572 potential two by two associations from 117 crops
Only 256 associations (<2%) have been studied
Studies on three by three associations are anecdotical
No study with more than three crops

# Change #2 Evaluate such systems comprehensively

Clémentine Meunier's PhD project on livestock **re-**integration into crop farms and regions



# Change #3 Evaluate under-studied dimensions and trade-offs

**Table 3**
Working conditions on dairy cattle farms and corresponding criteria, indicators, and scoring grid, with hypothetical links to farm general resilience.

| Working condition | Criterion | Indicator | Scoring grid | Hypothetical link to farm general resilience |
|---|---|---|---|---|
| Benefits/discomfort of work | Pleasure at work and its various tasks | Expression of pleasure at work | 1: Signs of displeasure<br>2: No signs of pleasure or displeasure<br>3: Signs of pleasure | Pleasure at work develops the capacity to remain in business over the long term. |
| | Stress at work | Number of perceived stressful periods for farmers during the year | 1: >2<br>2: 1–2<br>3: None | Stress at work compromises the capacity to step back and reflect on changes needed on the farm. |
| | Income fairness | Perceived level of income fairness | 1: Unfair and insufficient<br>2: Fair but want to increase it<br>3: Fully satisfied | A feeling of fairness is needed to remain in business over the long term |
| | Income | Annual income as minimum wage equivalent per worker unit | 1: <1<br>2: [1–2]<br>3: >2 | Sufficient income is needed to remain in business over the long term. |

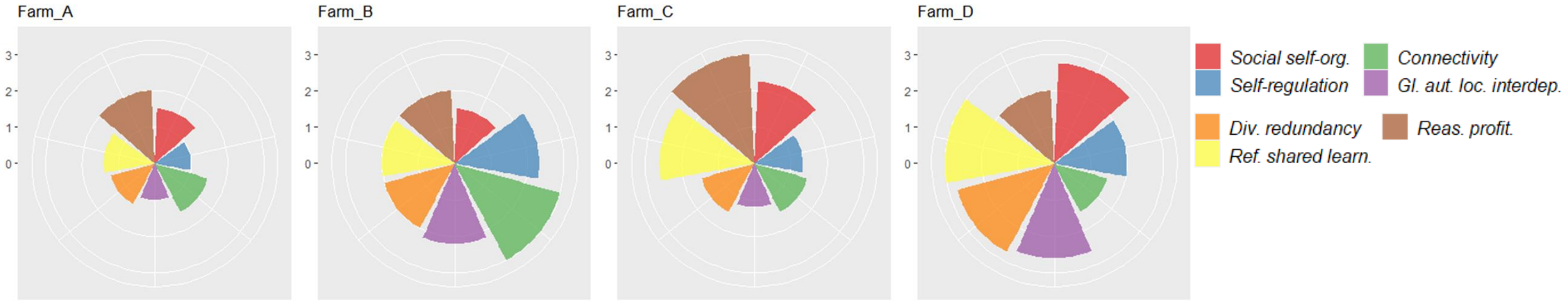
EL

Fu
resilience assessment

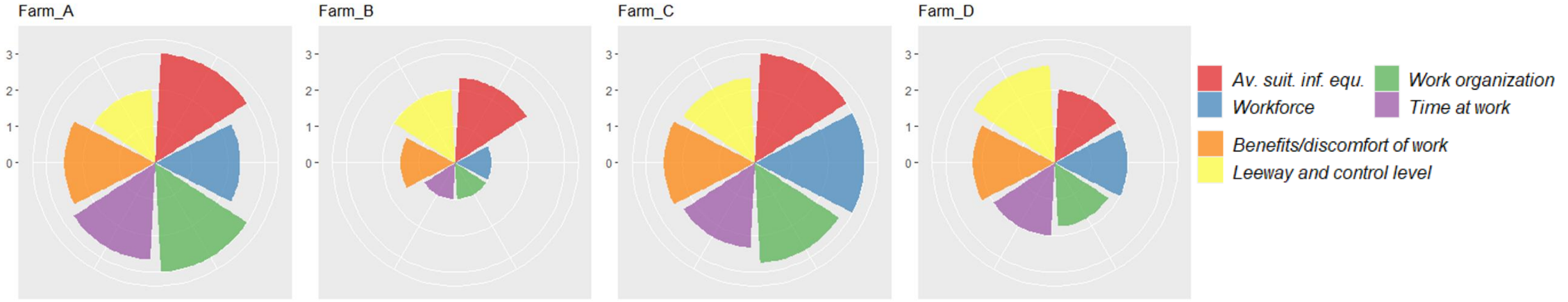
Augustine Perrin [a], Sylvie Cournut [b], Guillaume Martin [a,*]



Assessment of farm resilience based on predefined properties




Assessment of farm working conditions




Apparently resilient farms offer poor working conditions compromising their ability to remain over the long term

Consider working conditions as a cornerstone of farm resilience

# Change #4 Evaluate the mainstreaming potential of innovations from farm to fork

- Minor crops grown by farmers with limited outlets
- Canteen cooks making novel use of minor crop products

**Soft wheat flour** → **Chickpea flour**

**Durum wheat semolina** → **Millet**

**Potato** → **Squash**

frontiers | Frontiers in Sustainable Food Systems

Potential for and impacts of mainstreaming diversification crops through institutional catering

Marine André[1,2], Lise Pujos[2] and Guillaume Martin[1]*

**What is the scope for developing minor crops thanks to the canteens?**

# Video summary


https://youtu.be/-6T9PAcXzy8

# Shifts to better document novel agrifood systems

- Dare taking more risks regarding the agrifood systems you study, even in the framework of PhD projects
- Implement **sociotechnical analyses** to address the factors hindering/promoting novel agrifood systems
- Consider **pluriannual sequences / trajectories of change**
- **Extend the scope of your evaluations** to new dimensions (e.g. work) and address tradeoffs
- Consider the **mainstreaming potential** of such novel systems over the mid to long term
- **Communicate** the outcomes to farmers AND other stakeholders


Trade-offs between higher productivity and lower environmental impacts for biodiversity-friendly and conventional cattle-oriented systems

Aymeric Mondière[a], Michael S. Corson[a,*], Julie Auberger[a], Daphné Durant[b], Sylvain Foray[c], Jean-Francois Glinec[d], Penny Green[e], Sandra Novak[f], Frédéric Signoret[g], Hayo M.G. van der Werf[a]


ARTICLE

DOI: 10.1057/s41599-017-0046-8 OPEN

How to communicate effectively with policymakers: combine insights from psychology and policy studies

Paul Cairney[1] & Richard Kwiatkowski[2]

# Co-design of novel agrifood systems

To gather multiple stakeholders from farmers to consumers and **develop innovations** from farm to fork tempting to reconcile short-term and long-term goals

Design = Invention + experimentation + monitoring


Contents lists available at ScienceDirect

Agricultural Systems

journal homepage: www.elsevier.com/locate/agsy

Perspective

Revitalizing agricultural sciences with design sciences

Lorène Prost *

# Agrifood living labs

- New forms of **real-world innovation ecosystems** gathering multiple stakeholders
- Spaces for **co-creation** and for **testing new socio-technical arrangements**
- Living Labs popping up everywhere as new models of and for innovation processes in the agrifood sector
- **No published experience of co-design from farm to fork** in a living lab context

Contents lists available at ScienceDirect

Agricultural Systems

journal homepage: www.elsevier.com/locate/agsy

Ideal-types of experimentation practices in agricultural Living Labs: Various appropriations of an open innovation model

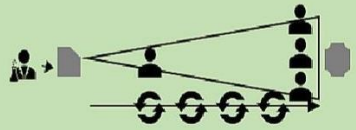
Quentin Toffolini [a,*], Mourad Hannachi [b], Mathieu Capitaine [c], Marianne Cerf [b]

**Results and conclusions :**

**3 ideal-types of experimentation practices**

- Game of creativity in a predefined space
  controlled space, reproduced reality, demonstration and evaluation of solutions

- Progressive contextual adaptation for innovation adoption
  iterations for adaptation, contexts favourable to adoption, progressive expansion of user communities, users as resources for evaluation



- Catalyst for long-term local collective action
  adaptive learning, co-creation of experimentation spaces, participation through "making"

# Not a panacea and not without risks

Contents lists available at ScienceDirect

Agricultural Systems

journal homepage: www.elsevier.com/locate/agsy

Perspective

## Living labs in agrifood studies: An opportunity to revisit fundamental questions about participatory research?

Ane Kirstine Aare *, Stine Rosenlund Hansen *

| Risks | Challenges |
|---|---|
| 1) Imposing predefined agendas masked as participatory processes | - Embracing conflicting ambition between participants and project requirements<br>- Handling confusion and frustration among participants<br>- Ensuring relevance for both research and practice |
| 2) Placing an overemphasis on confidentiality or knowledge sharing | - Sharing of information internally and externally<br>- Avoiding mistrust or breach confidentiality, while simultaneously enabling publication |
| 3) Getting lost in researcher roles | - Studying the living lab while at the same time engaging with participants in respectful ways<br>- Ensuring the appreciation of multiple resources and knowledges<br>- Acknowledging the extensive amount of time, resources and skills needed<br>- Making room for continuous reflection and dialogue about the roles and tasks of researchers and participants |

# Generation of solutions

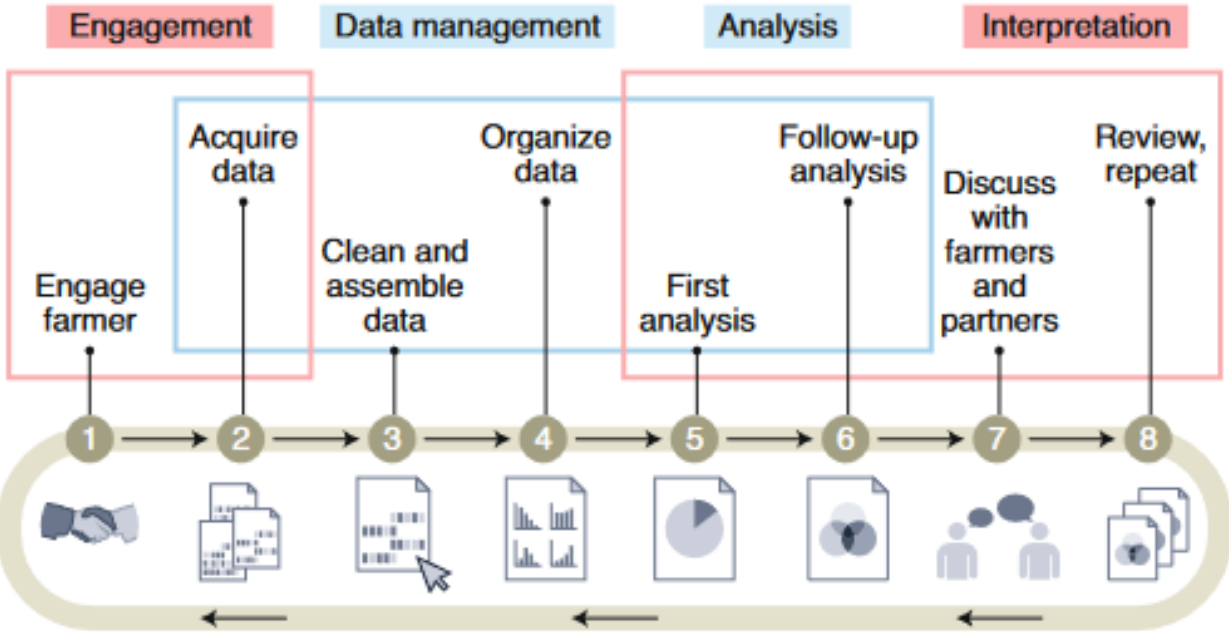
- **Serious games** i.e. games that have an explicit and consciously considered purpose and are not intended to be played primarily for fun
- Taking advantage of **indigenous knowledge** on how to select and integrate elementary components in a farm
- **Projection in the short term and in the long term** using simulation models
- Promote **peer-to-peer interactions and social learning**

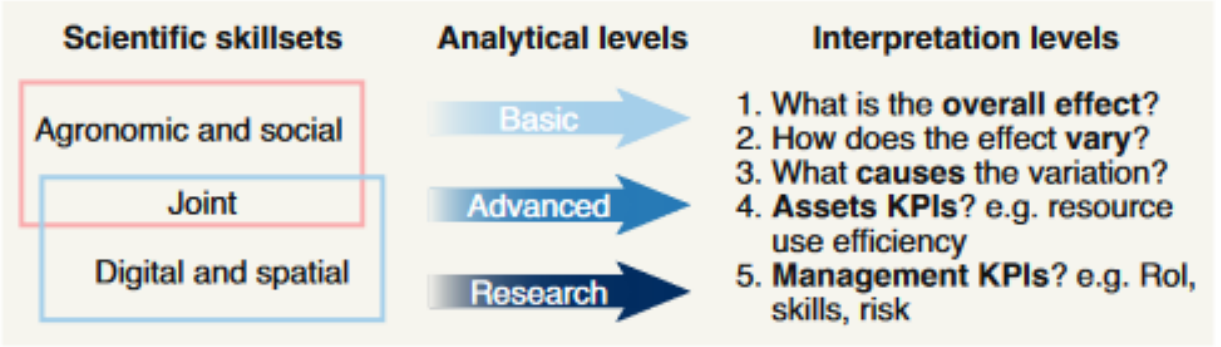

Contents lists available at SciVerse ScienceDirect
Environmental Modelling & Software
journal homepage: www.elsevier.com/locate/envsoft
ELSEVIER

Forage rummy: A game to support the participatory design of adapted livestock systems

G. Martin*, B. Felten, M. Duru

# On-farm experimentation of solutions




nature food

PERSPECTIVE

https://doi.org/10.1038/s43016-021-00424-4

Check for updates

## On-Farm Experimentation to transform global agriculture

Myrtille Lacoste[1,2]✉, Simon Cook[1,3], Matthew McNee[4], Danielle Gale[1], Julie Ingram[5], Véronique Bellon-Maurel[6,7], Tom MacMillan[8], Roger Sylvester-Bradley[9], Daniel Kindred[9], Rob Bramley[10], Nicolas Tremblay[11], Louis Longchamps[12], Laura Thompson[13], Julie Ruiz[14], Fernando Oscar García[15,16], Bruce Maxwell[17], Terry Griffin[18], Thomas Oberthür[19,20], Christian Huyghe[21], Weifeng Zhang[22], John McNamara[23] and Andrew Hall[24]

*Experimental Agriculture* (2020), **56**, 587–607
doi:10.1017/S0014479720000174

CAMBRIDGE UNIVERSITY PRESS

RESEARCH ARTICLE

## Reproducibility and external validity of on-farm experimental research in Africa

Hanna Kool[1], Jens A. Andersson[1,2] and Ken E. Giller[1,*]

ociety for Agronomy

esa EUROPEAN SOCIETY FOR AGRONOMY

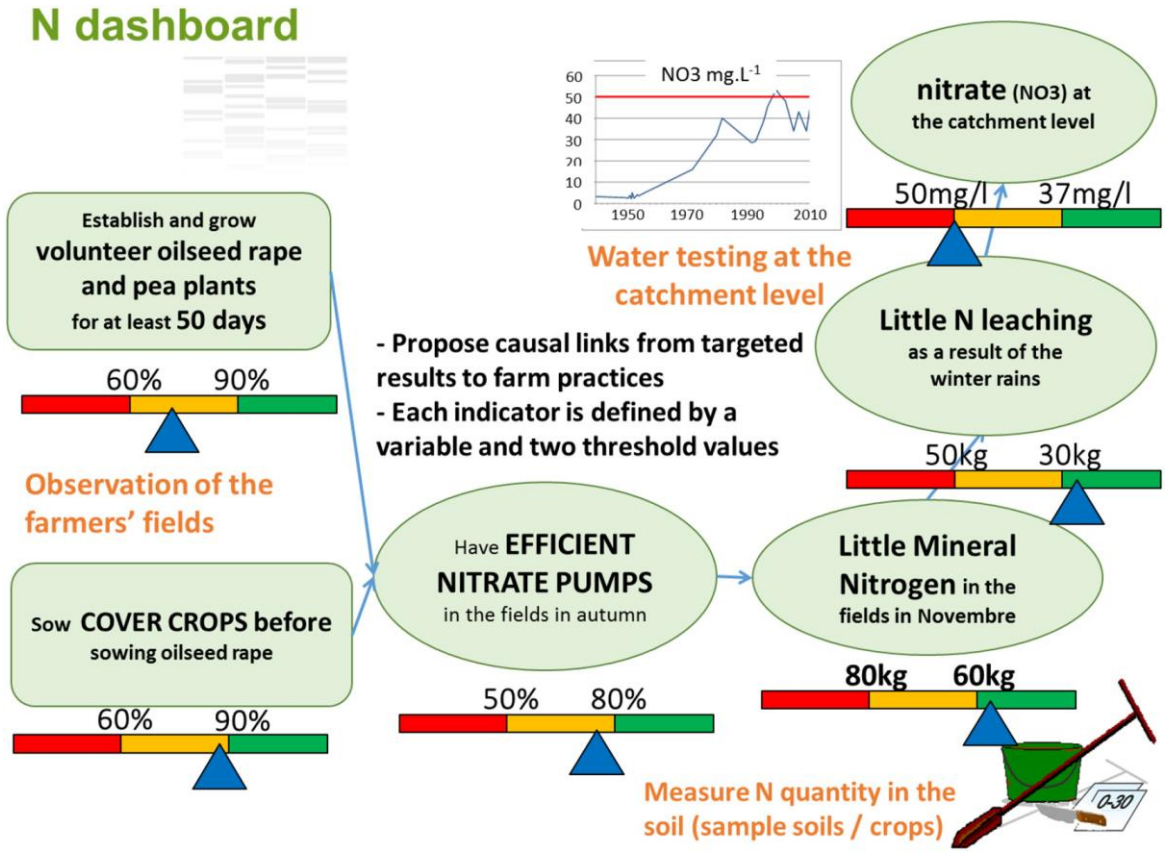
# Monitoring of solutions

Contents lists available at ScienceDirect
Agricultural Systems
journal homepage: www.elsevier.com/locate/agsy

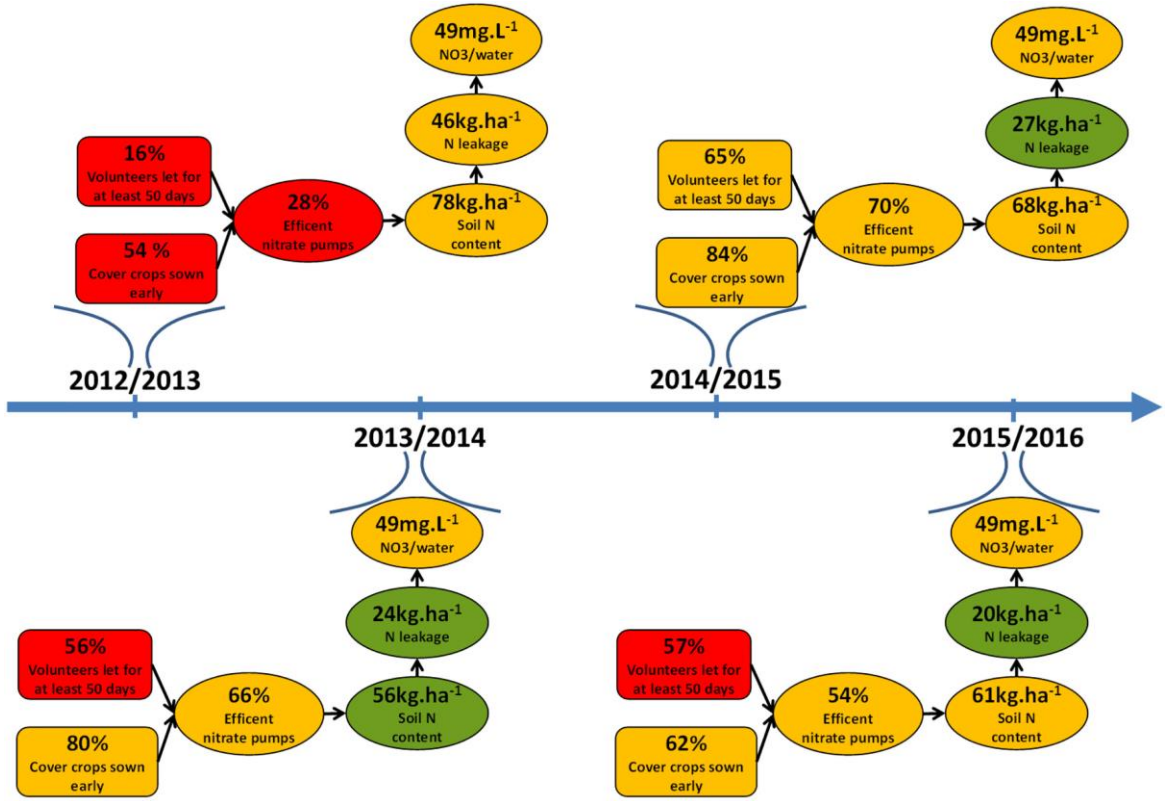
Designing agricultural systems from invention to implementation: the contribution of agronomy. Lessons from a case study

Lorène Prost[a,*], Raymond Reau[b], Laurette Paravano[c], Marianne Cerf[a], Marie-Hélène Jeuffroy[b]

A dashboard based on a causal chain from farmers' actions to water quality



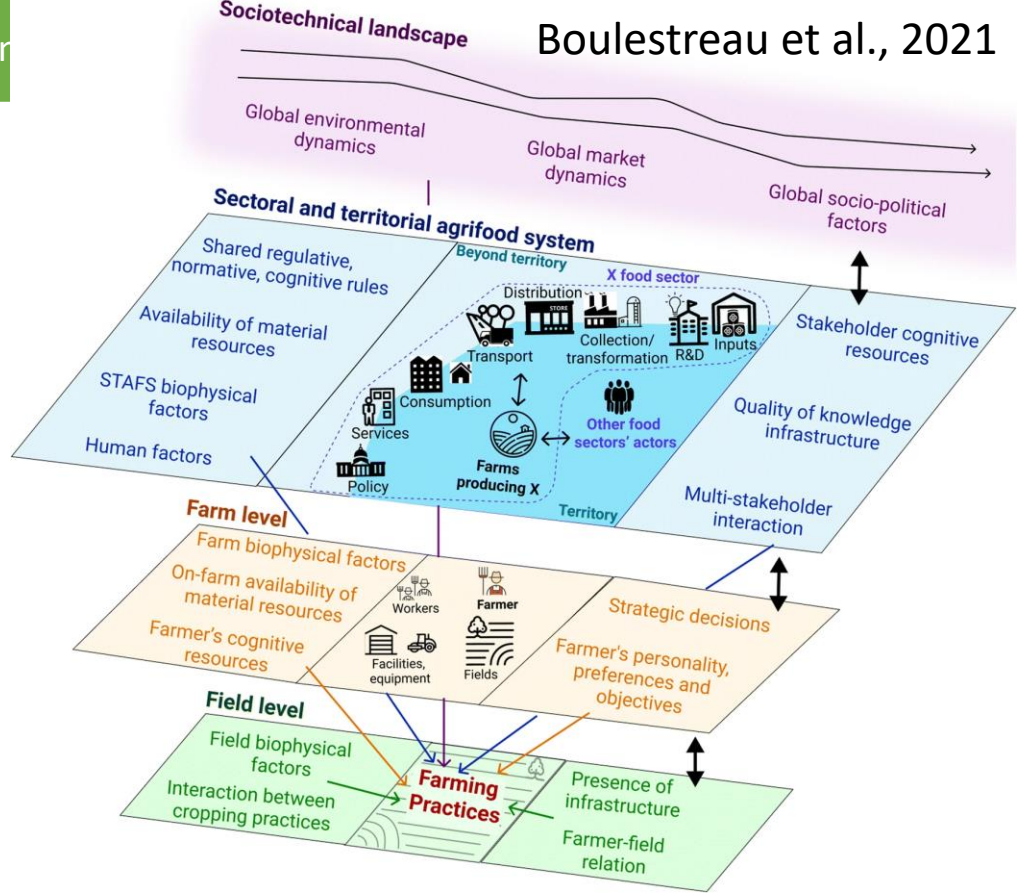

Monitor of the impacts of practice changes in the making



# Shifts to co-design novel agrifood systems

- Explore **solutions across levels** and **engage with multiple stakeholders**
- Move to a **full design process**: invention + implementation + monitoring and step-by-step improvement
- Develop **new methods and tools** to be used **in the making** with stakeholders across these steps

Boulestreau et al., 2021




Contents lists available at ScienceDirect
European Journal of Agronomy
journal homepage: www.elsevier.com/locate/eja

Unravelling the step-by-step process for farming system design to support agroecological transition

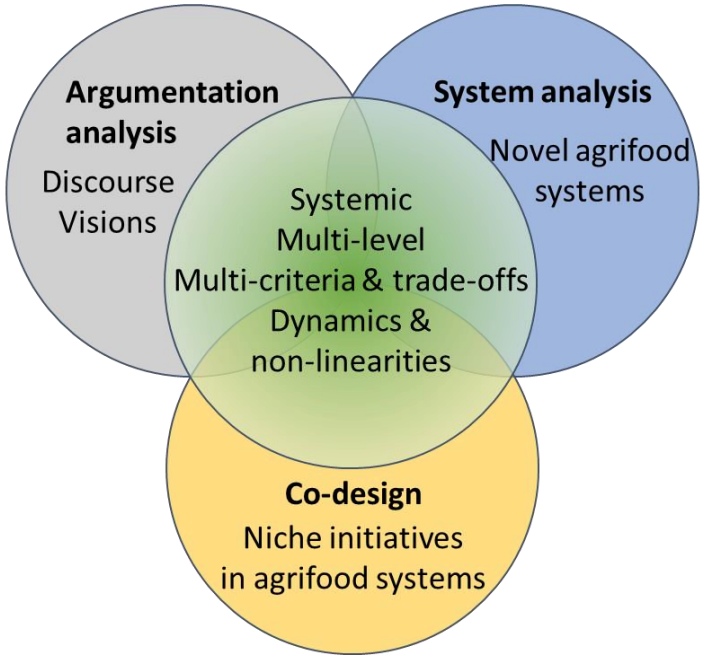
Jean-Marc Meynard[a,*], Marianne Cerf[a], Xavier Coquil[b,c], Daphné Durant[d], Marianne Le Bail[a], Amélie Lefèvre[e], Mireille Navarrete[f], Jérome Pernel[g], Anne Périnelle[h], Benjamin Perrin[e], Lorène Prost[a], Raymond Reau[i], Chloé Salembier[a,e], Eric Scopel[h], Quentin Toffolini[i], Marie-Hélène Jeuffroy[i]

# Conclusions – take-home messages

Transforming agrifood systems to reconcile short-term and long-term goals calls for changes across the entire sector, including for agric. scientists.

Dare considering novel agrifood systems

Change/extend our methods and tools to new levels, dimensions, etc.




Address and engage multiple stakeholders on the long run

Become more versatile or collaborate with new disciplines

Work funded through the European Union Horizon 2020 Programme for Research and Innovation under grant agreement no. 862357 (project MIXED) and the joint call ERA-NET Cofund SusAn, FACCE ERA-GAS, ICT-AGRI-FOOD and SusCrop through the project Mi Bicycle.

MIXED
EFFICIENT AND RESILIENT MIXED FARMING & AGROFORESTRY

Mi Bicycle
MItigation and adaption through better BIomass CYcling in Crop Livestock systems of north and western Europe

# Thank you for your attention!

# Time for questions

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