

Applying agroecological principles to animal farming systems fosters transition towards sustainable food systems

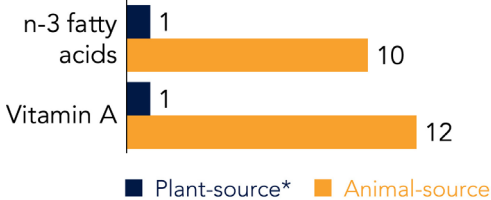
B. Dumont, P. Cassart, W.A.H. Rossing, C. Zagaria, C. Barlagne, J. Duval, J.L. Gourdine, J. Groot, O. Huguenin-Elie, Y. Kazakova, J. Klötzli, A. Lüscher, E. Oteros Rozas, D. Pomies, M.G. Rivera Ferre, V. Stefanova, A. Swartebroecx



Debate around the role of animal-source foods in healthy and environmentally sustainable diets is often polarizing

- Animal production systems undeniably contribute to improving human condition

Bioavailability (proportion of plant-source)



Beal et al., 2023



- BUT...

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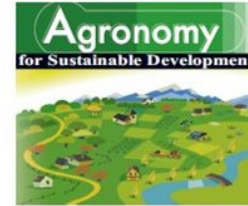


Agroecology is among the most promising options to achieve food system sustainability

- The term **Agroecology** can be tracked back to the 1930s and has been used to refer to a scientific discipline, a set of agricultural practices and a social movement

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Review article

Agroecology as a science, a movement and a practice. A review

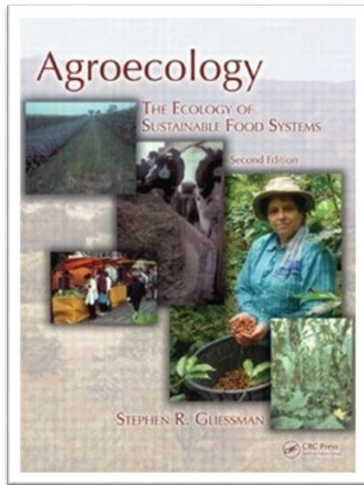
A. WEZEL^{1*}, S. BELLON², T. DORÉ³, C. FRANCIS⁴, D. VALLOD¹, C. DAVID¹

- As a scientific discipline Agroecology **applies ecology theory** to the **design** and **management** of sustainable **agroecosystems** (*Altieri, 1987, 2002*) or of the **entire food system** (*Francis et al., 2003*)
- It aims to **stimulate natural processes** to design agricultural systems that are weakly artificialized (less dependent on inputs), productive, environmentally friendly and **socially fair**



Animal production systems have been seldom considered by agroecological thinking

In Latin America where AE has developed a lot, cattle farming is often associated with problems of deforestation and land grabbing by large farms, and was thus outside Agroecology's scope

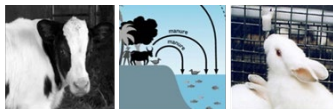


➔ 'The problem lies not in the animals themselves or in the consumption of animal products, but rather in the way they are integrated into agroecosystems. [...] **Understanding the integration of the animal in its agroecosystem** provides levers to ensure sustainable environmental and economic concerns'

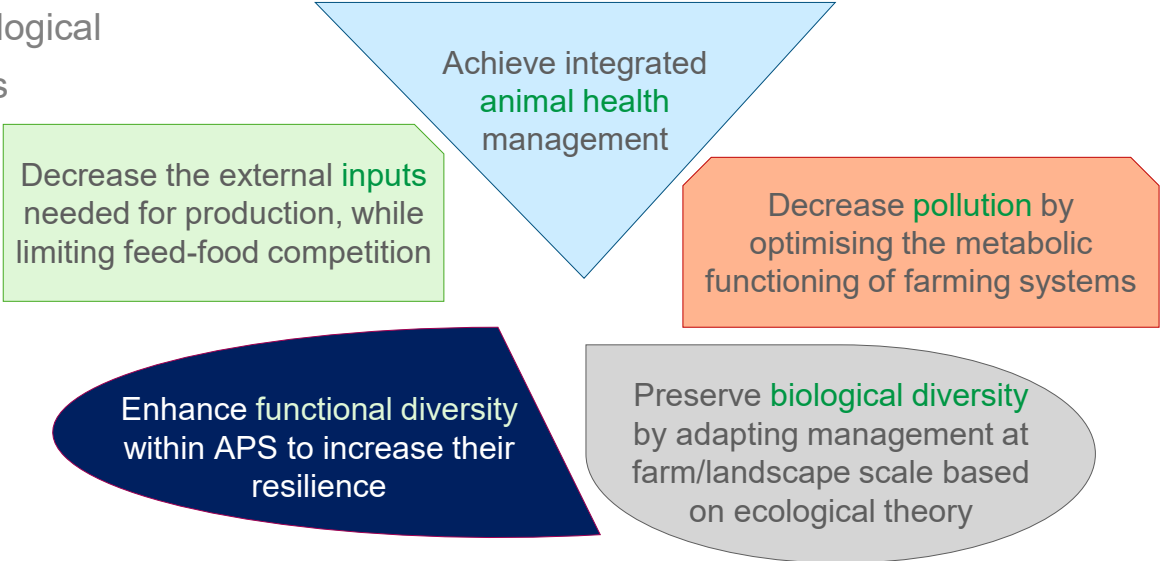


Agroecological principles for APS based on key ecological processes to be optimized

Principles can be used as **guidelines** to implement combinations of agroecological practices adapted to local conditions



Health			**
↓ inputs	***	***	***
↓ pollution	***	**	
Diversity	**	**	**
Biodiv.	*		*



➡ Several principles combine => redesign and transformational approach

Dumont et al., 2013



A consolidated list of 13 generic principles as part of a transition pathway to more sustainable food systems



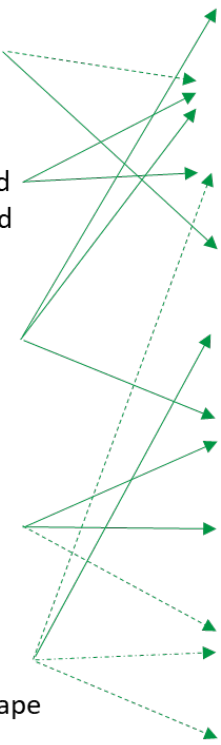
Wezel et al., 2020



Nine of these 13 principles are directly related to the five principles for APS

Field & Farm scales

- 1. Achieve integrated **animal health** management
- 2. Decrease the external **inputs** needed for production, while limiting feed-food competition
- 3. Decrease **pollution** by optimising the metabolic functioning of farming systems
- 4. Enhance functional **diversity** within animal production systems to increase their **resilience**
- 5. Preserve **biological diversity** by adapting management at farm, landscape scale based on ecological theory



Field, Farm, Food system

- 1. **Recycling**: Close cycles of nutrients
- 2. **Input Reduction** to reduce dependency on purchased inputs
- 3. **Soil Health**: Manage OM, enhance biological activity
- 4. **Animal Health**: Ensure animal health and welfare
- 5. **Biodiversity** over time and space at field, farm and landscape scales
- 6. **Synergy**: Enhance positive ecological interaction, synergy, integration and complementarities
- 7. **Economic Diversification** to ensure financial independence and value addition opportunities
- 9. **Social Values and Diets**: Build food systems to provide healthy, diversified, culturally appropriate diets
- 12. **Land and Natural Resource Governance**: Smallholder farmers guardians of natural and genetic resources

Dumont et al., 2013

Wezel et al., 2020



A list of 13 generic principles as part of a transition pathway to more sustainable food systems

Wezel et al., 2020



Additional emphasis is given to:

- Fairness
- Connectivity: re-embedding systems into local economy
- Participation: promoting decentralized governance and local adaptive management of F. system
- Co-creation of knowledge

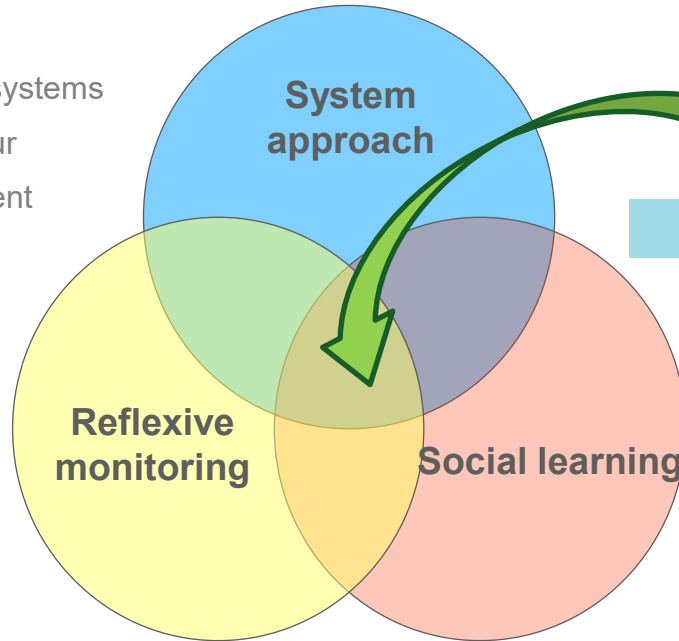


Learning from farmers' knowledge in a co-innovation process

Co-creation of knowledge between farmers, scientists, NGOs and citizens aims at producing actionable knowledge that supports decision making (*Geertsema et al., 2016*) and facilitates transition towards more sustainable APS

- Nested socio-ecological systems
 - Emergent behaviour
 - Adaptive management

- Interventions and responses
- Learning cycles (*Kolb, 1984; Giller et al., 2008*)



- Perception of each stakeholder's priorities and values
- Identifying stakeholder networks

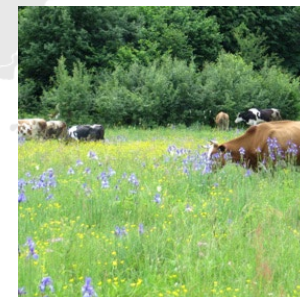
Rossing et al., 2021



Illustrations of five out of the 11 Innovation Hubs from Agroecology-TRANSECT

Three grassland based systems

Two integrated crop-livestock systems



Integrated animal health management as a three-pronged strategy

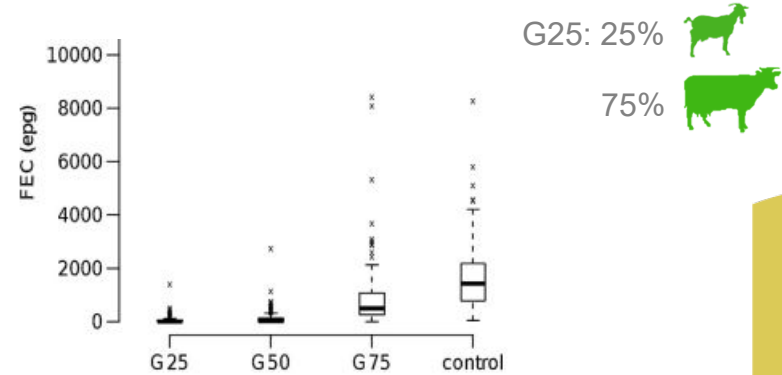
Resist (preventive):

FR, CH: Use of leys (e.g., sainfoin) or forage mixtures (e.g. chicory) with species containing condensed tannins

Brunet et al., 2007; Heckendorn et al., 2013; Malsa et al., 2023

Dilution effect:

BG, GU: Mixed grazing with a non-susceptible species to reduce strongyle load on pastures



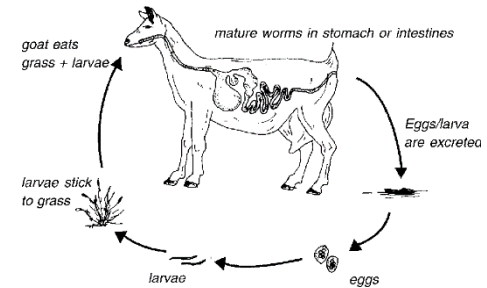
G25: 25%



75%



Mahieu, 2013



Integrated animal health management as a three-pronged strategy

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Brunet et al., 2007; Heckendorn et al., 2013; Malsa et al., 2023

Dilution effect:

BG, GU: Mixed grazing with a non-susceptible species to reduce strongyle load on pastures



Treat selectively and differently:

GU: looking at animal eyelids to determine which animals to treat

GU: Use of phytotherapy (papaya, banana leaves) to complement veterinary products

Marie Magdelaine et al., 2010

BG: Graze animals on willow (*Salix sp.*) or *Filipendula ulmaria* that contain salicylic acid

Give *Calvatia utriformis* to the animals for its anthelmintic action

*Larsen et al., 1995; Healey et al., 2018
Costa Fausto et al, 2021*



Forage mixture diversity limits use of external inputs and yield variability

CH: Multi-species mixtures, compared to pure stands, strongly suppress weeds and thus prevent use of herbicides (*Connolly et al., 2018; Suter et al. 2017*)

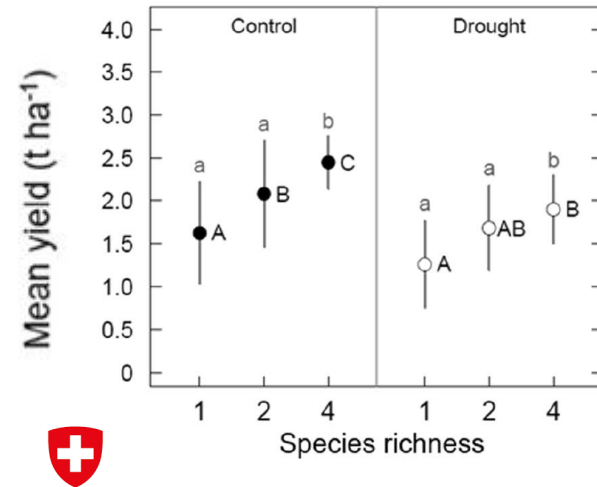
- Synergy with seed companies: gains from the label invested in variety testing, development of new mixtures
- On-farm surveys demonstrate adaptive management strategy to prevent specific weed problems, e.g. *Rumex obtusifolius*, *Setaria pumila*, ...



AGFF video on adapted management of *Setaria pumila*



Plant diversity secures the system against climatic variability thanks to portfolio effect (*Figge, 2004*) and species asynchrony that increase the temporal stability of mixtures



Haughey et al., 2018



Diversifying microfarms benefits economic and environmental performance while enhancing resilience to extreme climatic events

GU: More than 30 cultivated species, with cultivars selected for improving drought and pest tolerance

- Animals allow valorizing co-products and fallows, while providing manure to the system



Better economic and environmental performance



	Diversified microfarm	Regional values
Autonomy (%)	62%	-20%
Gross margin (\$/ha)	8,100	3,300
Labour productivity (\$/h)	7,4	23,3
SOC Δ^{ion} (tCO _{2eq} /ha)	3,8	-0,5
GHG balance (tCO _{2eq} /ha)	-1,1	2,4

Selbonne et al., 2023



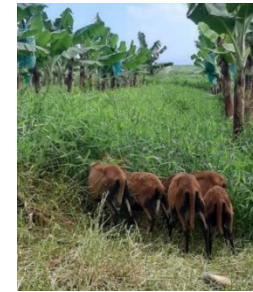
Diversifying microfarms benefits economic and environmental performance while enhancing resilience to extreme climatic events

GU: More than 30 cultivated species, with cultivars selected for improving drought and pest tolerance

- Animals allow valorizing co-products and fallows, while providing manure to the system

Weed management estimated at 50% of workload on farm

- Recycling of sugarcane straw and banana leaves for mulching
- Use of grazing sheep to control weeds in banana plantation



Farms with several vegetation strata, including trees, showed buffered forage yields in cases of severe droughts and an 80–90% productivity recovery 40 days after a hurricane (*Murgueitio et al., 2011; Altieri et al., 2015*)



Diversification of food system allows retaining added value within the region



Martin et al., 2020



ES: Researchers and farmers together with the local agricultural officers explore opportunities for local small-scale slaughter and transformation of meat and dairy at public infrastructures

- Investments in public transformation infrastructures, including material means, training and legal coverage
- Extensive multispecies farming (small ruminants, Iberian pigs) to control shrub vegetation under chestnut trees
- Engage with all local stakeholders and artistic approach to overcome cultural-political limitations

9 SOCIAL VALUES AND DIETS
Build food systems based on the culture, identity, tradition, social and gender equity of local communities that provide healthy, diversified, seasonally and culturally appropriate diets.

11 CONNECTIVITY
Ensure proximity and confidence between producers and consumers through promotion of fair and short distribution networks and by re-embedding food systems into local economies.

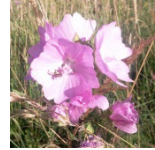
13 PARTICIPATION
Encourage social organization and greater participation in decision-making by food producers and consumers to support decentralized governance and local adaptive management of agricultural and food systems.



Raising awareness on the benefits of High Nature Value farming for wildlife



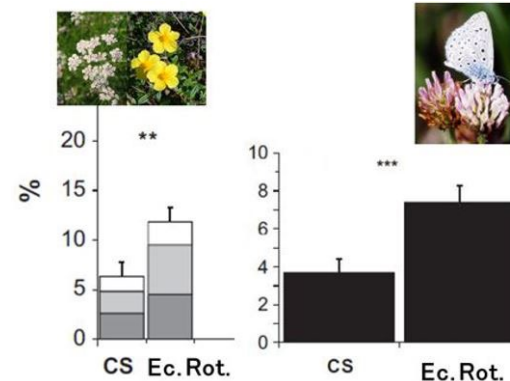
Habitat heterogeneity hypothesis



Trophic hypothesis

FR, BG: Grassland management practices (extensive grazing, late mowing, multispecies grazing, avoid grazing of some areas to \nearrow flowering, etc.) aim to increase farm habitat value for biodiversity

FR:



Farruggia et al., 2012



Raising awareness on the benefits of High Nature Value farming for wildlife

BG: Focus is on establishing a fair and common governance of grassland system accompanied by economically viable livelihood strategies for dairy (cattle and sheep) and beef cattle farmers while preserving and benefiting from biodiversity

A YouTube video shows interviews of local farmers about their willingness to practice this type of animal farming, and how it can benefit wildlife and preserve landscapes

SOCIAL VALUES AND DIETS

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CONNECTIVITY

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Ensure proximity and confidence between producers and consumers through promotion of fair and short distribution networks and by re-embedding food systems into local economies.

Changing regulation from local to EU scales



- Changing the rules for using municipal grasslands in favour of livestock farmers
- Securing the support for HNV farming in CAP 2023-2027



LAND AND NATURAL RESOURCE GOVERNANCE

12

Recognize and support the needs and interests of family farmers, smallholders and peasant food producers as sustainable managers and guardians of natural and genetic resources.

coll. with the Bulgarian Society for Protection of Birds



Including citizens through co-design projects to explore innovative food systems

Context & research question



A global questioning of current agricultural systems

Livestock controversies between the farming sector and society (Delanoue et al. 2018)



Co-design tomorrow's farming system with a large diversity of actors to improve their sustainability (Berthet 2013, Roguet et al. 2020)



However...

No inclusion of citizens //actors who do not work in the agricultural field, at the same level as researchers and agricultural professionals

Hatchuel & Weil, 2003



C Space

New ideas and characteristics for the subject



K Space

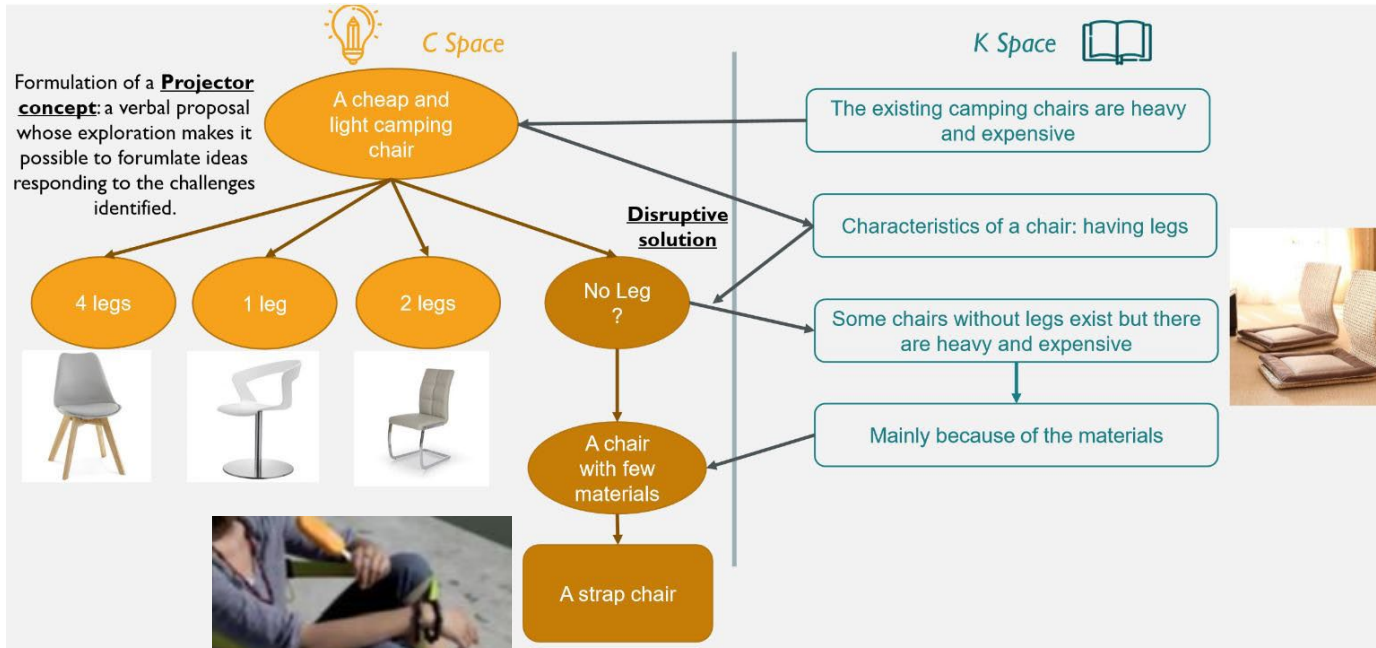
Knowledge on the subject



FR: Adapting existing methods (KCP) to promote horizontal dialogue between dairy farmers, citizens & researchers

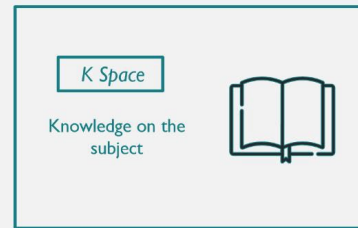
Innovation based on interactions between 2 types of space





PhD thesis of Philippine Coeugnet

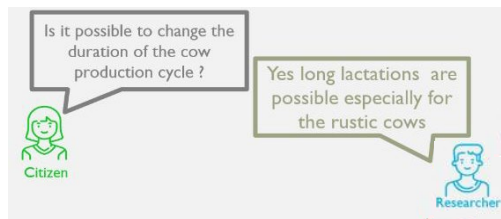
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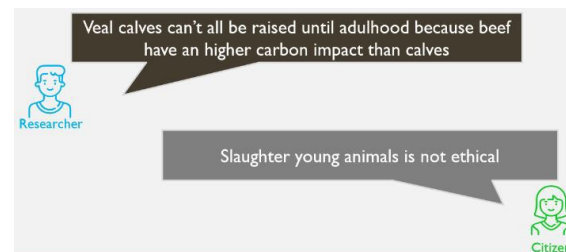
Including citizens through co-design projects to explore innovative food systems

FR: Adapting existing methods (KCP) to promote horizontal dialogue between dairy farmers, citizens & researchers

① Exchange of knowledge and understanding



② Sharing values related to dairy farming



③ Identification of innovative solutions



A cooperative inter-generational veal fattening system

- Veal calves raised by nurse cows intended for culling,
- by a local cooperative composed of dairy farmers,
- whose products are sold locally

Coeugnet et al., 2023

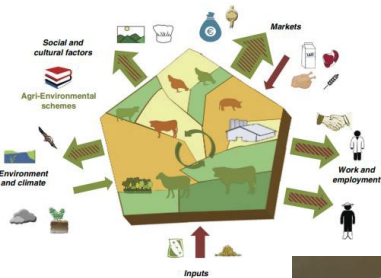


Including citizens through co-design projects to explore innovative food systems

Putting farmers and citizens in a construction position to explore desirable futures

- Asked to design a system, not just their opinion
- Serious games can support agricultural system transition

Citizens, researchers and agricultural professionals have all different knowledge and expectations.



Game reveals trade-offs and synergies



- While representing the system, players challenge each other's priorities and values in a safe environment

Dernat et al., 2023



Take home messages

- Agroecology provides a scientific and operational framework for moving animal production systems (APS) toward more sustainability
- Principles are generic and can be used as guidelines to implement herd management practices that are locally adapted
- Animals are most useful for the agroecological transition (nutrient cycling, biodiversity conservation, healthy, diversified and culturally-adapted diets, etc.)
- Co-creation of knowledge between farmers, scientists, NGOs and citizens promotes horizontal dialogue so that collective decisions can emerge on locally adapted transitions
- Methods and tools exist to facilitate stakeholder dialogue (including citizens)
- Innovations that account for farmer and citizen preferences and ethical values are more likely to put the animal production sector in a better position to cope with forthcoming sustainability challenges





Thank You



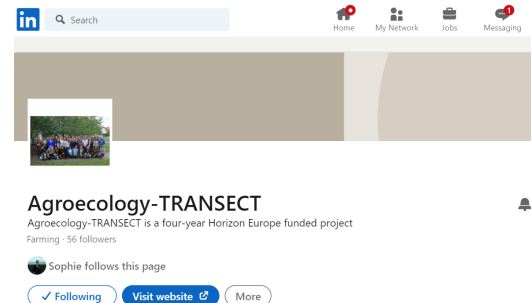
Agroecology-TRANSECT

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Trans-disciplinary approaches for systemic economic, ecological and climate change transitions. @HorizonEU project 2022-2026 #climate #biodiversity #resilience

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Welcome to Agroecology-TRANSECT

An exciting project exploring how nature friendly farming practices are working and developing across 11 countries in Europe and beyond, and how we can use them to accelerate change for the benefit of people, animals and the environment.

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