Research Institute of Organic Agriculture FiBL
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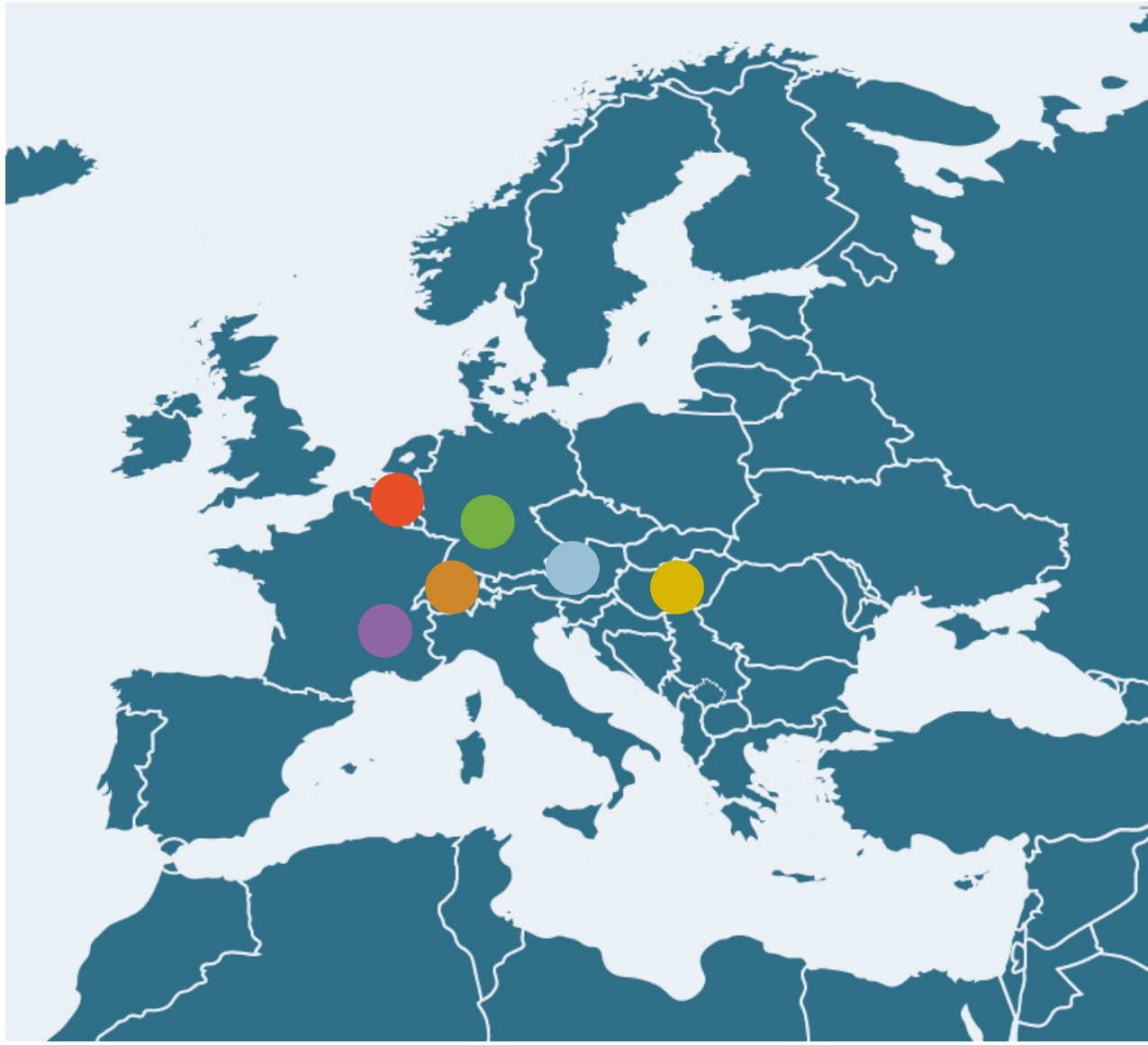
The Research Institute of Organic Agriculture FiBL

Climate Change and Carbon Sequestration

02.05.2024, Webinar. Lin Bautze (lin.bautze@fibl.org)

FiBL group

- **FiBL Switzerland**
  Founded 1973
  290 employees
- **ÖMKI Hungary**
  Founded 2011
  22 employees
- **FiBL Germany**
  Founded 2000
  65 employees
- **FiBL France**
  Founded 2016
  7 employees
- **FiBL Austria**
  Founded 2004
  36 employees
- **FiBL Europe**
  Founded 2017
  7 employees



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FiBL Switzerland with sites in Frick & Lausanne

- Founded in 1973
- 290 employees
- Research, consulting, continuing education and development cooperation
- Research in modern infrastructure at the Frick site and on over 150 Swiss organic farms

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Departments of FiBL Switzerland

- Soil Sciences
- Crop Sciences
- Livestock Sciences
- Food System Sciences
- International Cooperation
- Extension, Training & Communication
- Suisse Romande
- Finances, Resources & Administration

Department of Soil Sciences

Main areas of work

- Soil fertility & climate
- Nutrient management & symbioses
- Cultivation techniques in arable farming
- Long-term trials such as the DOK trial in Therwil

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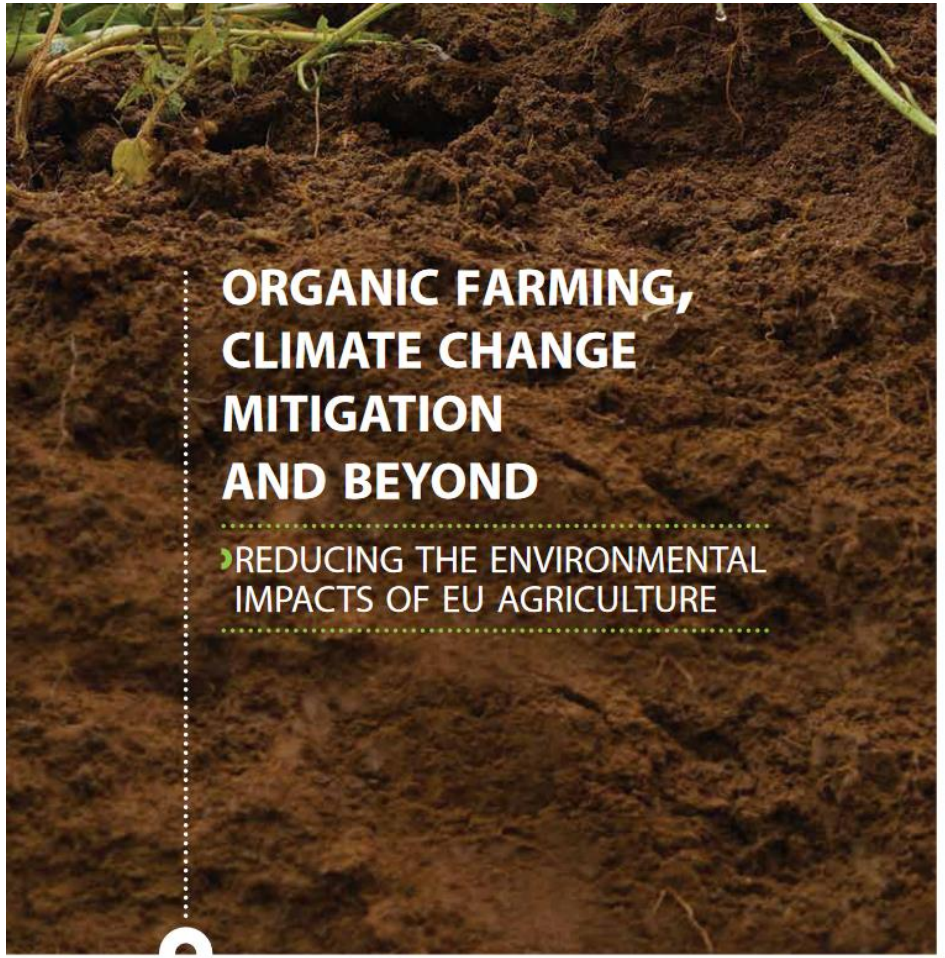
DOK trial (long-term trial since 1978)

biodynamic (D), organic-biological (O) and conventional (K) cultivation of arable crops

Recording the climate impact of the use of recycled fertilisers

Organic Agriculture and Climate Change

- no synthetic fertilizers (production, spreading..)
- reduced emissions of livestock feed
- higher C-sequestration potential (Gattinger et al., 2012),



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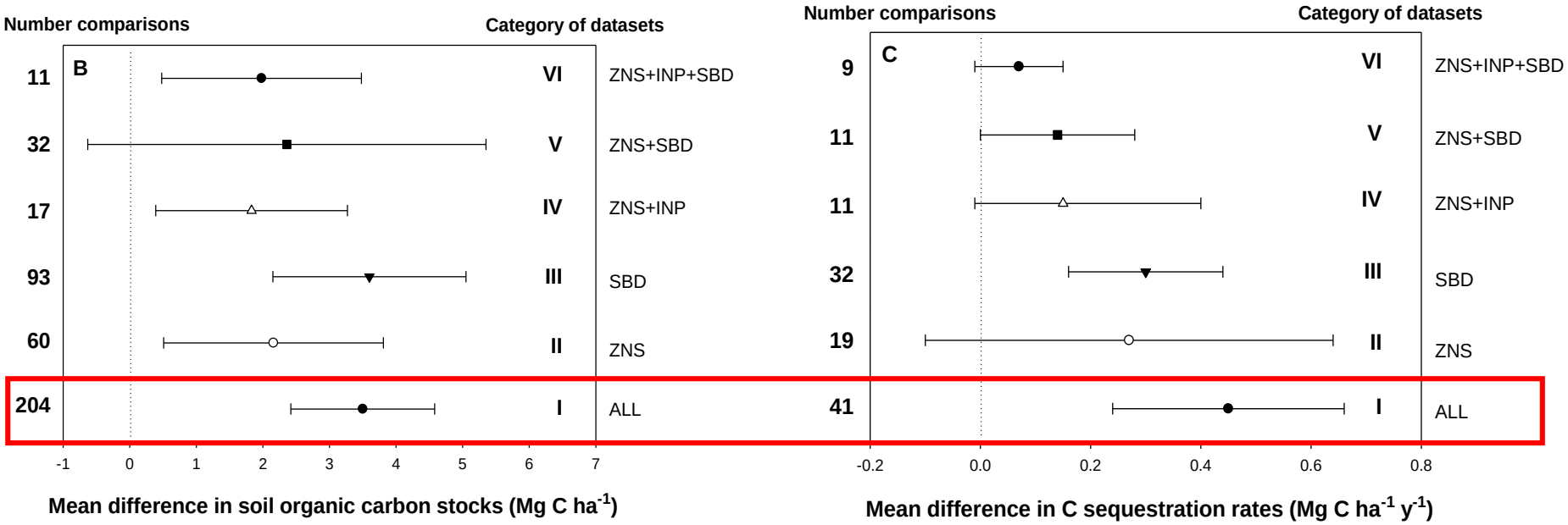
Global Meta-Analysis: C-sequestration organic vs. conventional



Higher C-storage (3.50±1.08 Mg C ha^{-1}) in top soils (0-20 cm) under organic management.

Net-sequestration of 450 kg C ha^{-1} y^{-1} across all organic soils. Lower potential for „zero net input systems“ (≤ 1.O GVE ha^{-1}): 70 – 270 kg C ha^{-1} y^{-1}.

Gattinger, A., Müller, A., Haeni, M., Skinner, C., Fliessbach, A., Buchmann, N., Mäder, P., Stolze, M., Smith, P., El-Hage Scialabba, N., Niggli, U. (2012) Enhanced top soil carbon stocks under organic farming. Proceedings of the National Academy of Sciences - PNAS, 109 (44), pp. 18226-18231.

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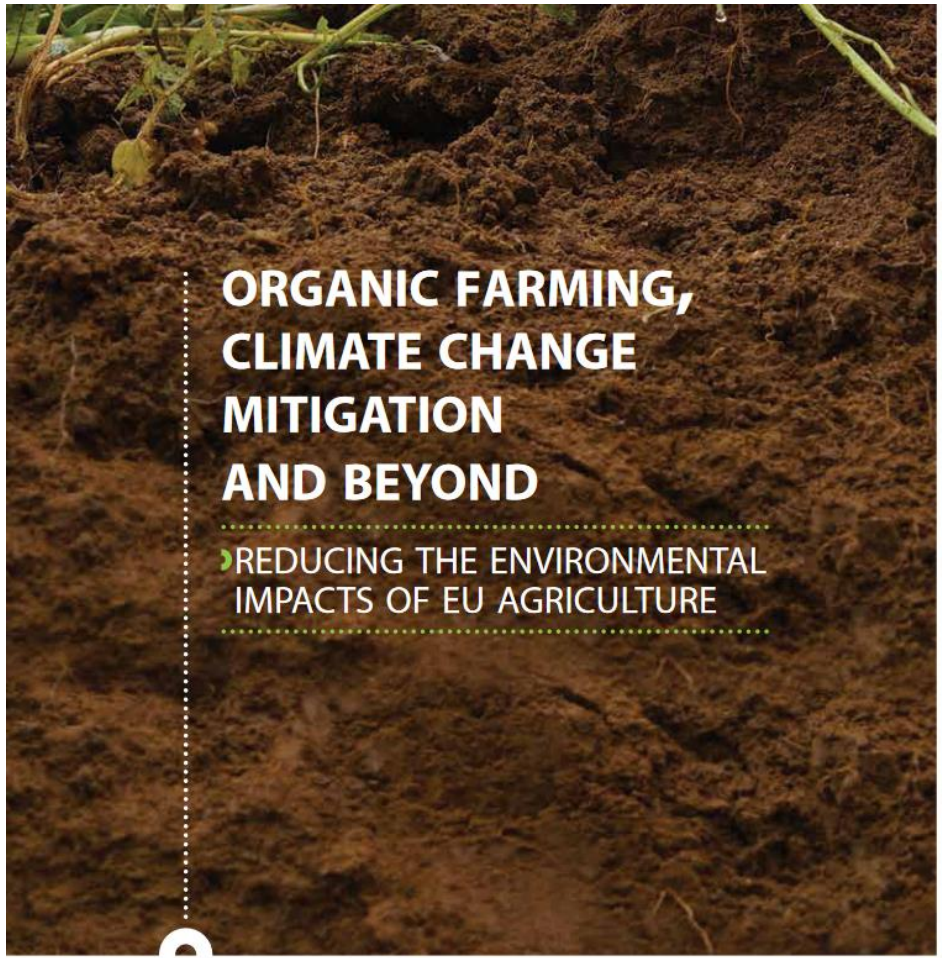
Organic Agriculture and Climate Change

- no synthetic fertilizers (production, spreading..)
- reduced emissions of livestock feed
- higher C-sequestration potential (Gattinger et al., 2012)
- lower area N2O emissions (Skinner et al., 2014)



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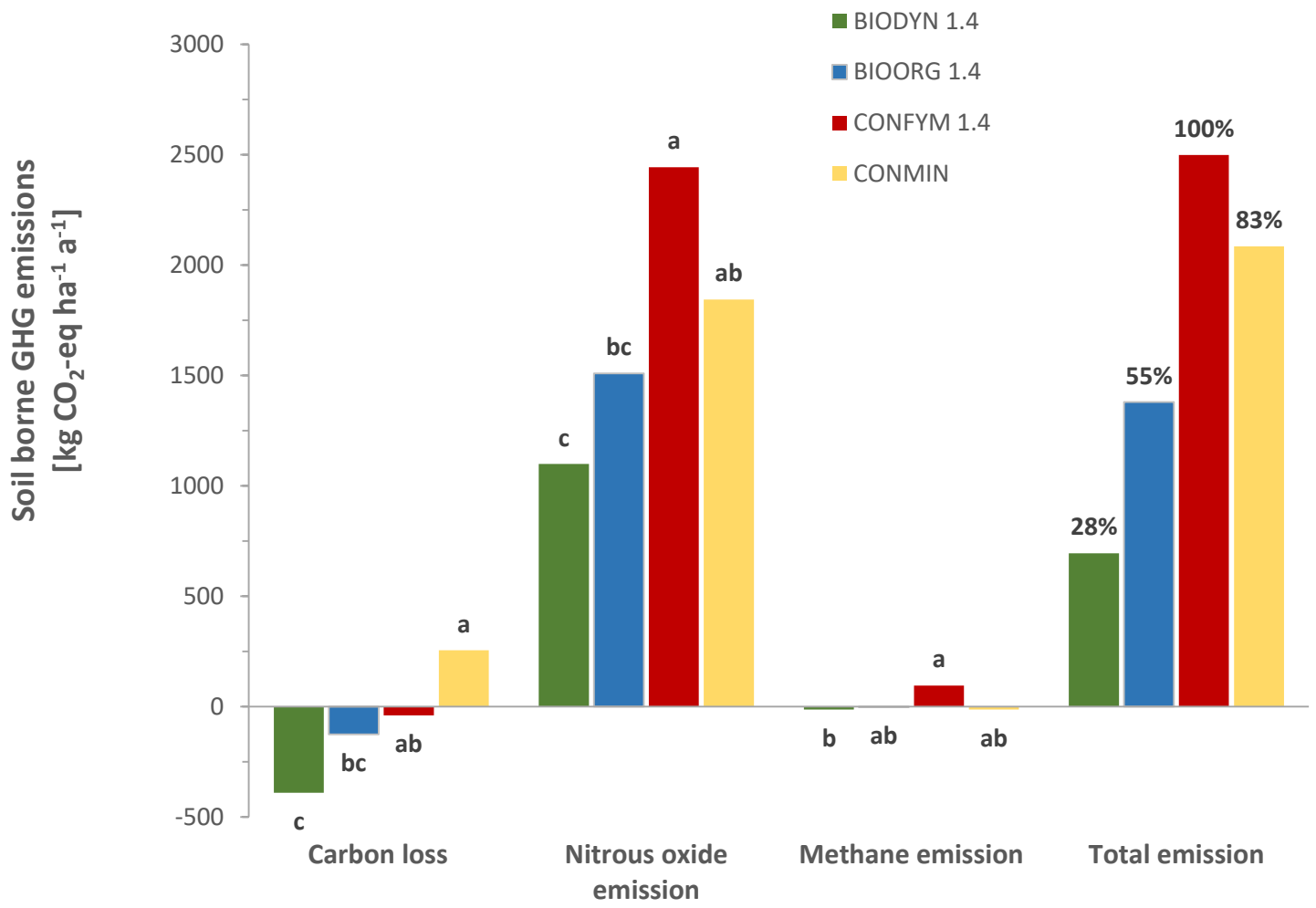
DOK-trial: Synthesis climate effect of organic agriculture



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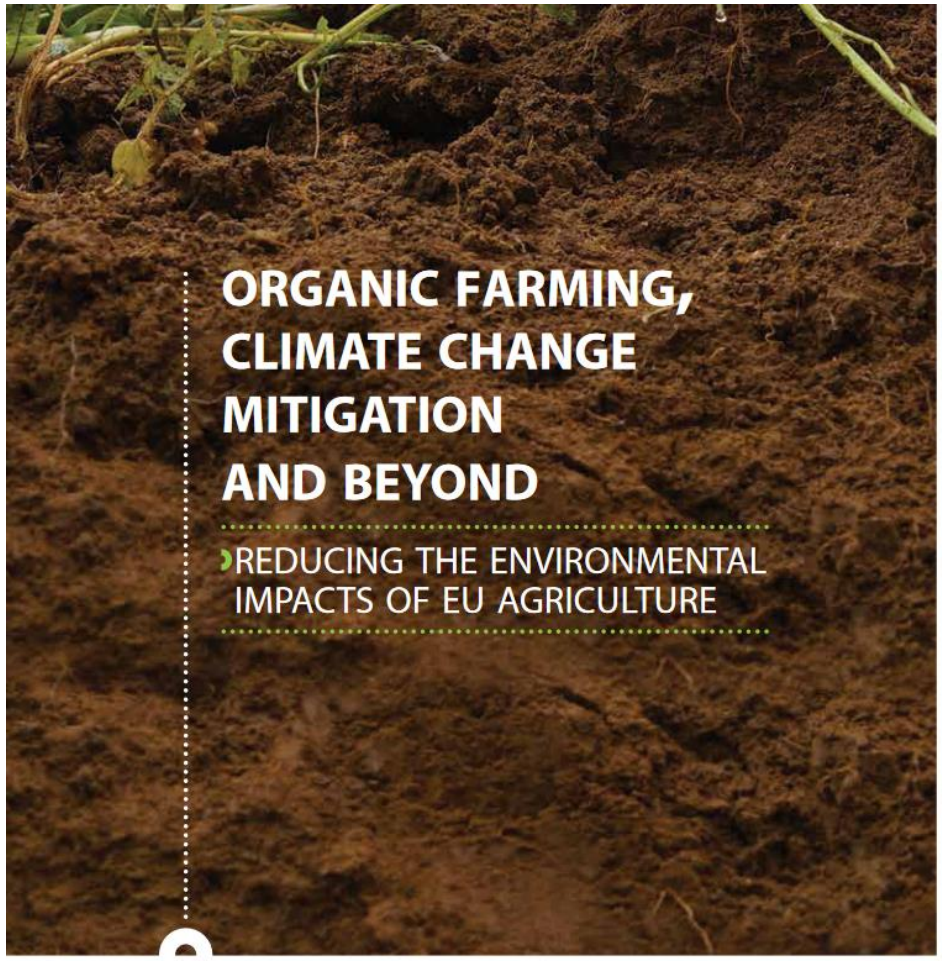
Krause

Organic Agriculture and Climate Change

- no synthetic fertilizers (production, spreading..)
- reduced emissions of livestock feed
- higher C-sequestration potential (Gattinger et al., 2012)
- lower area N2O emissions (Skinner et al., 2014)

→ **17% of EU agriculture emissions could be avoided by organic agriculture** (Muller et al. 2016)



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Expanding Boundaries

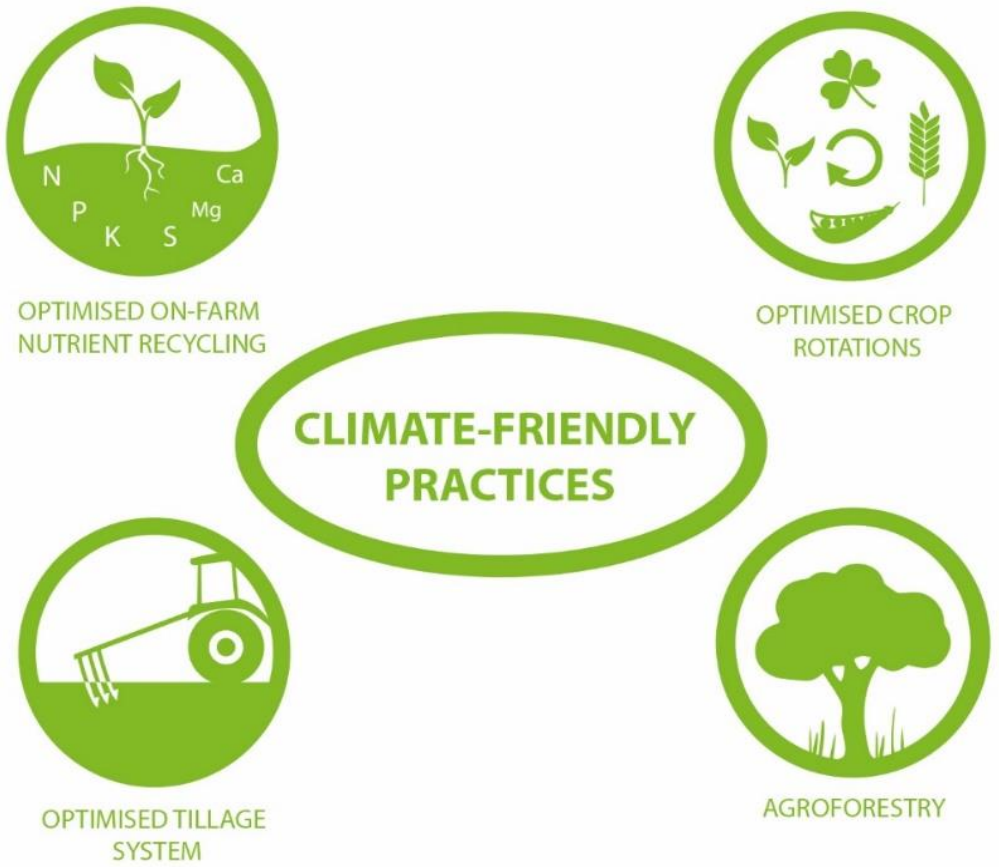
Direct vs. Indirect emissions in agriculture:

- land use change (LUC)
- livestock feed and embedded deforestation
- production of agrochemicals / inputs
- transport, storage of products
- food waste

Reducing Emissions in Organic Agriculture

SOLMACC Projekt (2013-2018)
https://solmacc.eu/

- 3 countries, 12 farms, 48 measures
- successful collaboration between farmers, advisors and researchers



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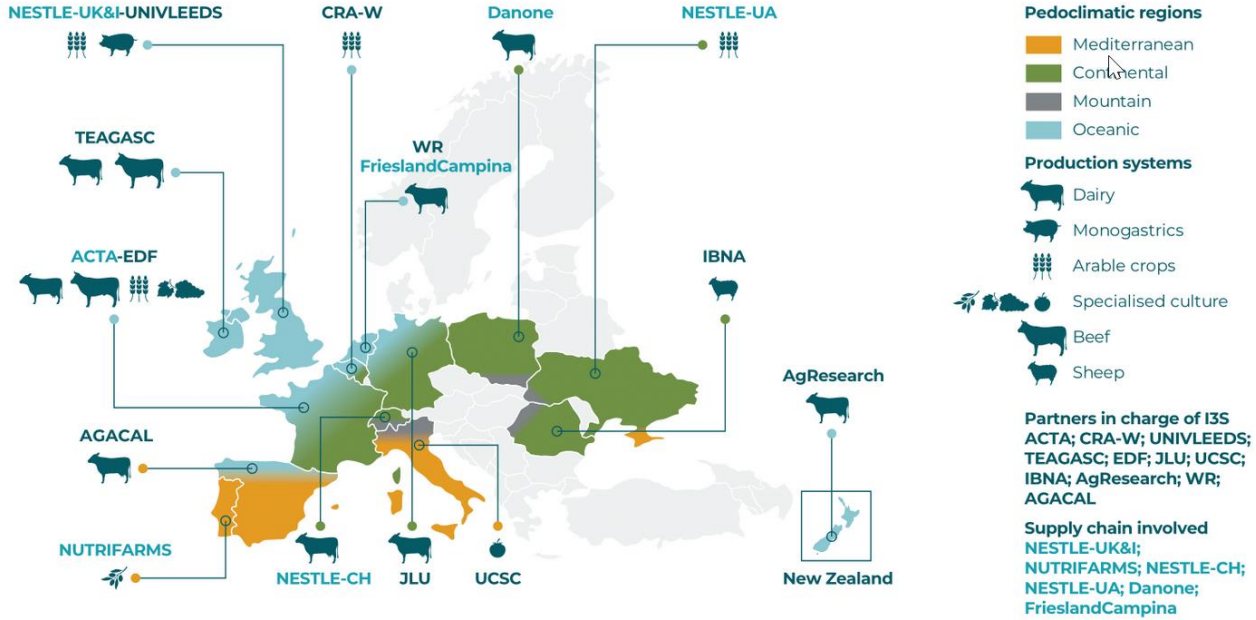
ClieNFarms (2022-2025)

https://clienfarms.eu/

*Demonstrate, evaluate and improve technical, organisational and financial solutions **at the farm level** that will contribute to achieving **climate-neutrality** of European agriculture by 2050.*



- Life cycle assessments
- Soil data with satelite images
- Demonstration of practices

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Climate Farm Demo

2022-2029

https://climatefarmdemo.eu/

*A European-wide Network of **Pilot Farmers** implementing and **demonstrating** Climate Smart Solutions for a **carbon neutral Europe**.*

- More than 80 partners
- More than 1'500 farms
- More than 4'500 demo events

→ Goal of 20% organic farms

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Make Changes and Benefits Visible

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
1	QUALITATIVE COMPARISON	Cool Farm Tool	DECIDE	Agrosfär	FARM CARBON CALCULATOR	KLIR	FaST-Navigator	Cap2er (Level 2)	ANCA	CONVIS	Biocode	Spanish Carbon Footprint Tool Scope 1+2	CARBON F&L	AGNAV	SANDY	GES&VIT	BOVID CO2 / ARDICARBON	CAP'2ER Grandes Cultures (Crops)	EkonMod	Klimrek	Agrecalc	GEEP	ES GREEN TOOL	TEKLA
2	Methodology available ?	3	2	3	3	2	3	3	3	2	1	2	0	1	2	0	0	2	0	?	1	2	2	2
3	Upfront level of transparency of emission factor data	3	3	3	3	3	3	3	3	3	2	3	0	2	2	/	0	3	?	3	1	3	3	3
4	Does the tool include CH4 emissions from enteric fermentation ?	2	2	3	1.5	2	2	3	3	2	2	/	/	2.5	2	/	1	/	2	1.5	2	1	1.5	1.5
5	Does the tool include CH4 emissions from other sources (manure management, rice)?	1.5	2	2	2	2	2	2	2	2	2	0	/	2	2	/	2	/	2	2	2	2	1	2
6	Does the tool include N2O emissions from effluent managment ?	1.5	2	1	2	2	2	2	2	1.5	2	/	/	2	2	/	2	/	2	1.5	2	2	1	2
7	Does the tool include N2O emissions from soil ?	1	2	1	2	1	3	2	1	1.5	2	1	2	2	3	1	1	2	0	1.5	2	/	1	?
8	Does the tool include indirect N2O emissions ?	1.5	2	1.5	2	2	1	1	1	1.5	2	2	1	0	2	1	1	2	0	1.5	1	/	1	?
9	Does the tool include direct CO2 emissions - electricity	3	3	3	3	2.5	3	3	3	1	3	3	3	3	2	3	3	3	0	2	3	3	2.5	3
10	Does the tool include direct CO2 emissions - fuel consumption	3	3	3	3	0	3	3	3	2	3	3	3	2	2	2	3	3	0	1	3	2	3	3
11	Does the tool include indirect(external) CO2 emissions	3	3	3	3	1	2	2	2	/	3	0	3	3	/	3	3	3	0	/	3	3	3	3
12	Are GHGs of external manure processing calculated?	?	0	0	3	0	0	0	3	0	0	/	/	0	1	/	?	/	0	0	0	0	0	0
13	Are GHGs of external fertiliser production calculated?	3	3	3	3	1	3	3	3	3	2	0	3	2	2	3	?	3	0	1	3	/	2	3
14	Are GHGs of food/feed exported calculated?	?	2	3	3	0	0	0	0	0	0	/	/	0	1	/	?	/	0	0	0	/	3	0
15	Are GHGs of feed&bedding imported calculated?	3	2	3	3	2	3	3	3	3	3	/	/	2	2	/	?	/	0	2	3	3	3	3
16	Is uncertainty addressed? Is there a publication in which uncertainty of the tool is studied ?	2	0	1	3	0	3	0	0	1	1	0	0	1	0	0	0	1	0	0	0	0	?	?
17	Does the tool include land use change? For loss of carbon storage Tier from IPCC ?	1	1	1	1	0	1	1	2	1	0	0	0	0	3	0	?	3	0	0	1	/	1	1
18	Does the tool include carbon sequestration in soils?	1	1.5	0	3	0	1	1	3	2	1	0	1	1	2.5	3	?	3	0	0	1	/	1.5	1.5
19	Does the tool include carbon sequestration in biomass? (Production with trees)	1	1	0	2.5	0	1	0	0	0	0	1	1.5	0	3	0	?	0	0	0	1	/	0	0
20	Does the tool include an organic matter balance? (like Nitrogen Balance not only the sequestration).	0	0	0	0	0	0	0	3	0	0	0	0	0	0	3	?	2	0	?	?	/	?	?
21	Does the tool include land use change? For N2O emissions after destroying grassland/perrenial crop	?	0	1	0	0	0	1	2	2	0	0	0	0	3	0	?	3	0	0	?	/	?	1
22	Is fuel consumption calculated based on farm activities?	3	1	3	3	0	3	1.5	2	2	3	3	/	1	3	2.5	?	3	0		3	/	1	1
23	GWP (Global Warming Potential) (how they count N2O/CH4/CO2 as CO2 eq)	3	2	3	2	3	?	3	0	?	3	2	2	3	3	2	3	2	0	2	3	3	1	1

CLIMATE FARM DEMO

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Make Changes and Benefits Visible

	Practice No.	Measure	Level	Category	Sub-category	Is the practice suitable for organic farming?	Mitigation and Adaptation	For adaptation levers, adaptation to which risk
165	246	Establish agroforestry (20% fruit trees) (ha/yr)	Plot/crops	Production/system and land use change		Organic	AM	Drought
166	247	Establish agroforestry (20% nut trees trees) (ha/yr)	Plot/crops	Production/system and land use change		Organic	AM	Drought
167	248	Recycling of silage film: for silage bales (per bale)	Plot/crops	Production/system and land use change		Organic	M	
168	249	Recycling of silage film: for silo / silo sausage (per kg)	Plot/crops	Production/system and land use change		Organic	M	
169	250	Adapting plot size and shape	Plot/crops	Soil management		Organic	A	Excessive water
170	251	Adapting soil tillage to the slope	Plot/crops	Soil management		Organic	A	Excessive water
171	252	Choosing substrate which improve total soil water availability (horti	Plot/crops	Soil management		Organic	A	Drought
172	253	Maintaining a seeded or spontaneous grass cover (perennial crops)	Plot/crops	Soil management		Organic	A	Heat
173	254	Maintaining or creating embankments	Plot/crops	Soil management		Organic	A	Excessive water
174	255	Mulching (mulch film /kg)	Plot/crops	Soil management		Organic	A	Drought
175	256	Mulching (plant residues / kg)	Plot/crops	Soil management		Organic	A	Drought
176	257	Mulching (wood chips and bark mulch / kg)	Plot/crops	Soil management		Organic	A	Drought
177	258	Planting exported cover crops	Plot/crops	Soil management		Organic	A	Excessive water
178	259	Planting non-exported cover crops	Plot/crops	Soil management		Organic	A	Excessive water
179	260	Adding organic matter to the soil	Plot/crops	Soil management		Organic	AM	Excessive water
180	261	Implanting a permanent cover crop (field crops)	Plot/crops	Soil management		Organic	AM	
181	262	Incorporate crop residues into the soil	Plot/crops	Soil management		Organic	AM	

→ Various solutions are available!

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Common Discussion points…buisness case soil

Compensate farmers….a good idea, but:

- different soil potential
- additionality
- permanence
- potentially creates new emissions
- leakage effects

ELSEVIER

Journal of Environmental Management

Volume 330, 15 March 2023, 117142

Research article

Carbon farming: Are soil carbon certificates a suitable tool for climate change mitigation?

Carsten Paul [a], Bartosz Bartkowski [b], Cenk Dönmez [a i], Axel Don [c], Stefanie Mayer [d], Markus Steffens [e], Sebastian Weigl [a], Martin Wiesmeier [d f], André Wolf [g], Katharina Helming [a h]

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https://doi.org/10.1016/j.jenvman.2022.117142

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Highlights

- Soil-based carbon certificates are sold as voluntary emission offsets.
- Private certification schemes provide financial incentives for carbon farming.
- However, they are not a suitable tool for climate change mitigation.
- Permanence, additionality and monitoring are not ensured; leakage effects may occur.

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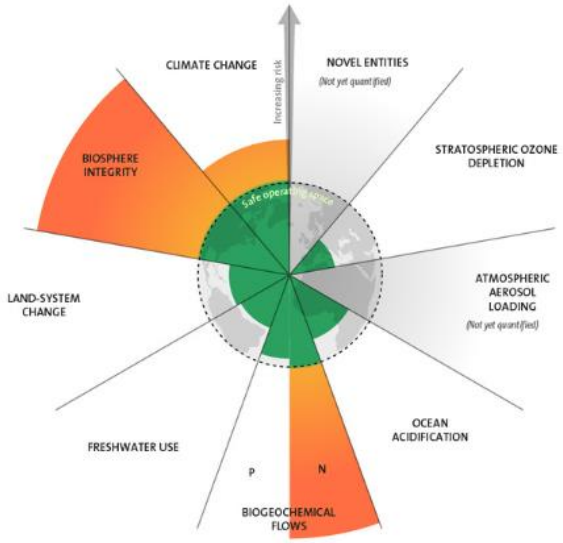
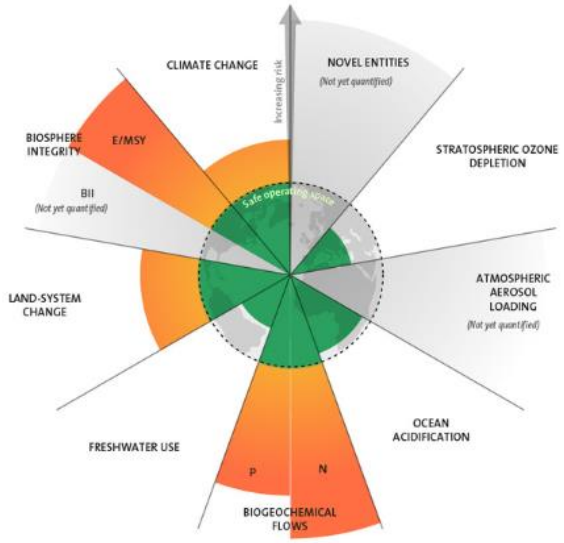
Don’t forget….

2009



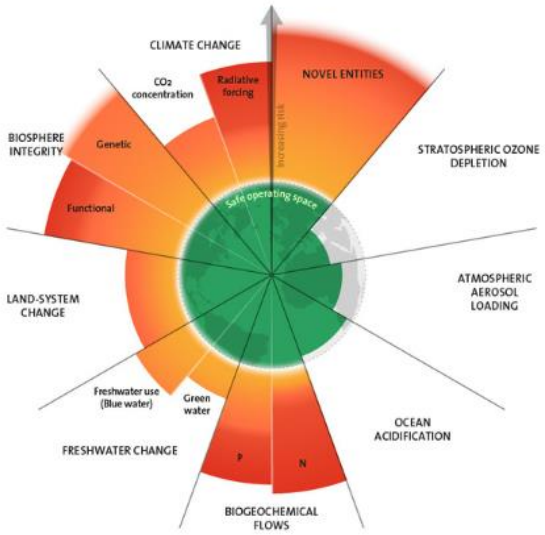
7 boundaries assessed,
3 crossed

2015



7 boundaries assessed,
4 crossed

2023



9 boundaries assessed,
6 crossed

https://www.stockholmresilience.org/research/planetary-boundaries.html

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Organic Agriculture and Climate Change

Co-benefits:

- Biodiversity
- Water management
- Animal health
- Income
- Local structures, such as Community Supported Agriculture (CSAs)
- …..

Make Changes and Benefits Visible

Challenges that come along with carbon sequestration:

- How to compare results? Between farms and tools?
- How to deal with different system boundaries? No tool covers all!
- How to deal with data gaps and long-term effects (e.g. biochar)?
- How to represent differences from organic farming?

Conclusions and Open Questions

- Reduce emissions by engaging various actors
- Don't forget other sustainability issues

- There are many different solutions, but farmer's need support for context-specific selection and suitable tools and we need to be aware are we talking policy, business or both

- **Communication and finding a common language is key to engage!**

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