How can large-scale conversion to organic agriculture contribute to sustainable food systems?

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Adrian Muller (adrian.mueller@fibl.org)

Tech & Bio 2019, Conférence «Comment accompagner un dévelopement important de l'agriculture biologique et quelles en seraient les conséquences?»

September 18 2019, Valence, France

How can large-scale conversion to organic agriculture contribute to sustainable food systems?

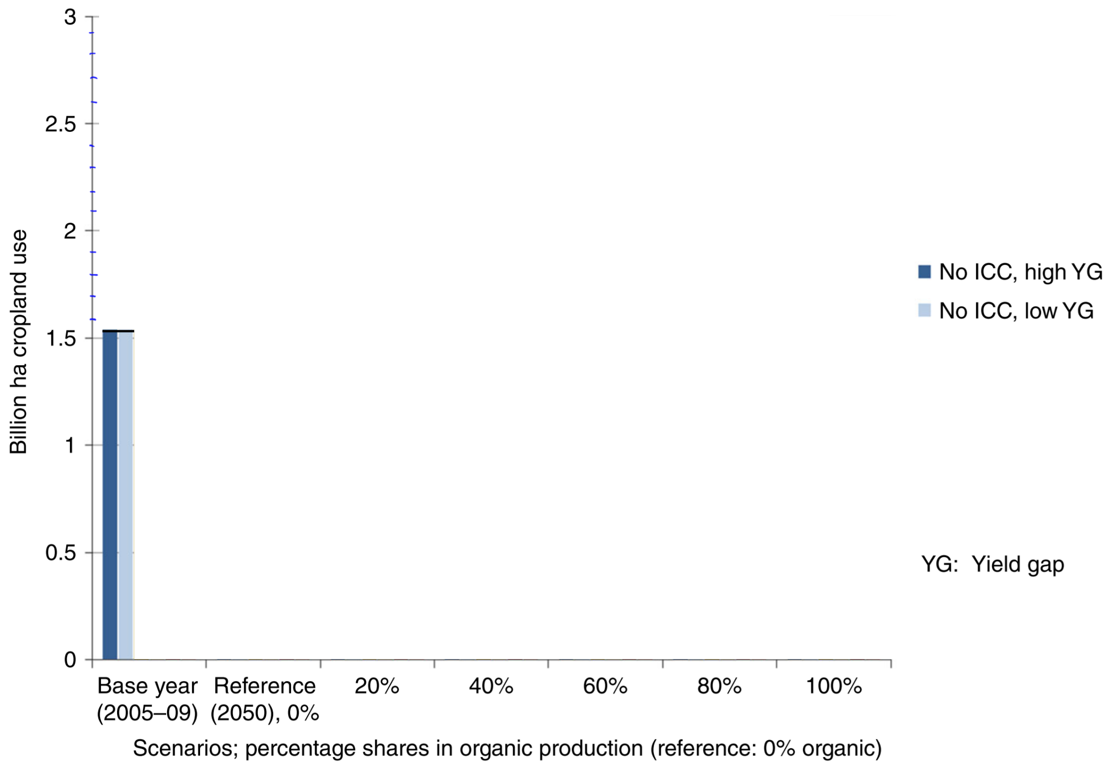
By embedding it in an encompassing food-systems perspective and not only focusing on sustainable production.

Consumption and processing are central as well.

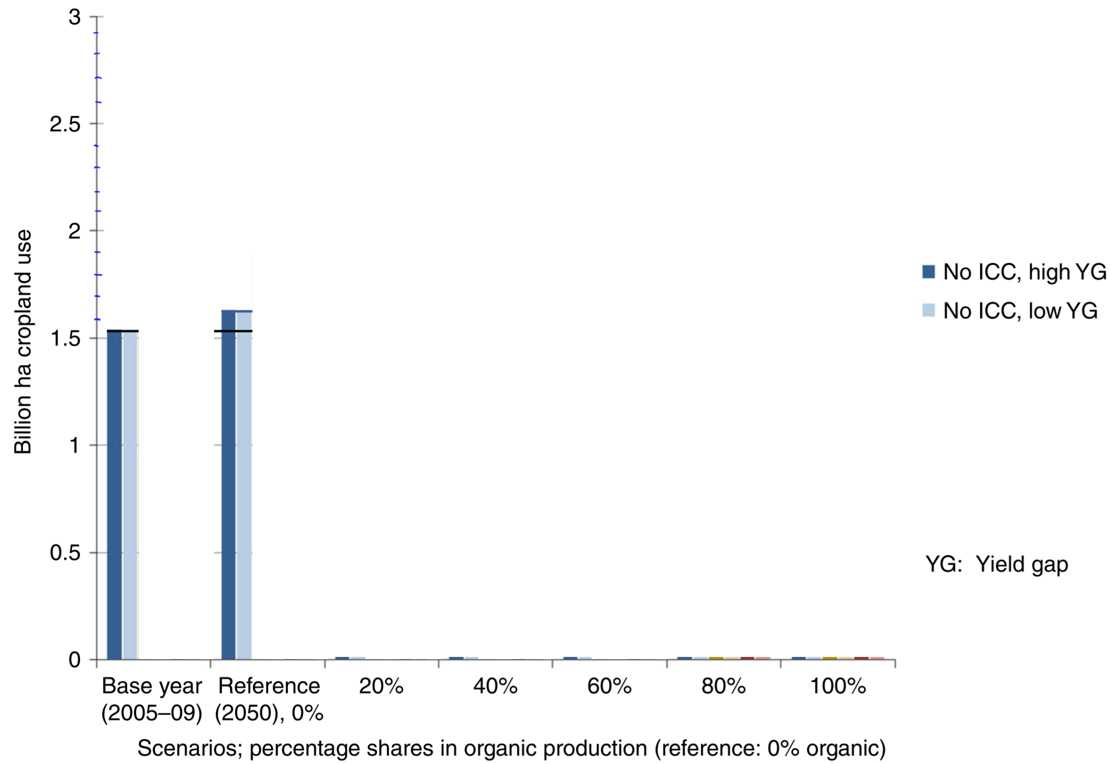
How can large-scale conversion to organic agriculture contribute to sustainable food systems?

Land use

Land use



Muller et al. 2017; Courtesy: R. Zürcher



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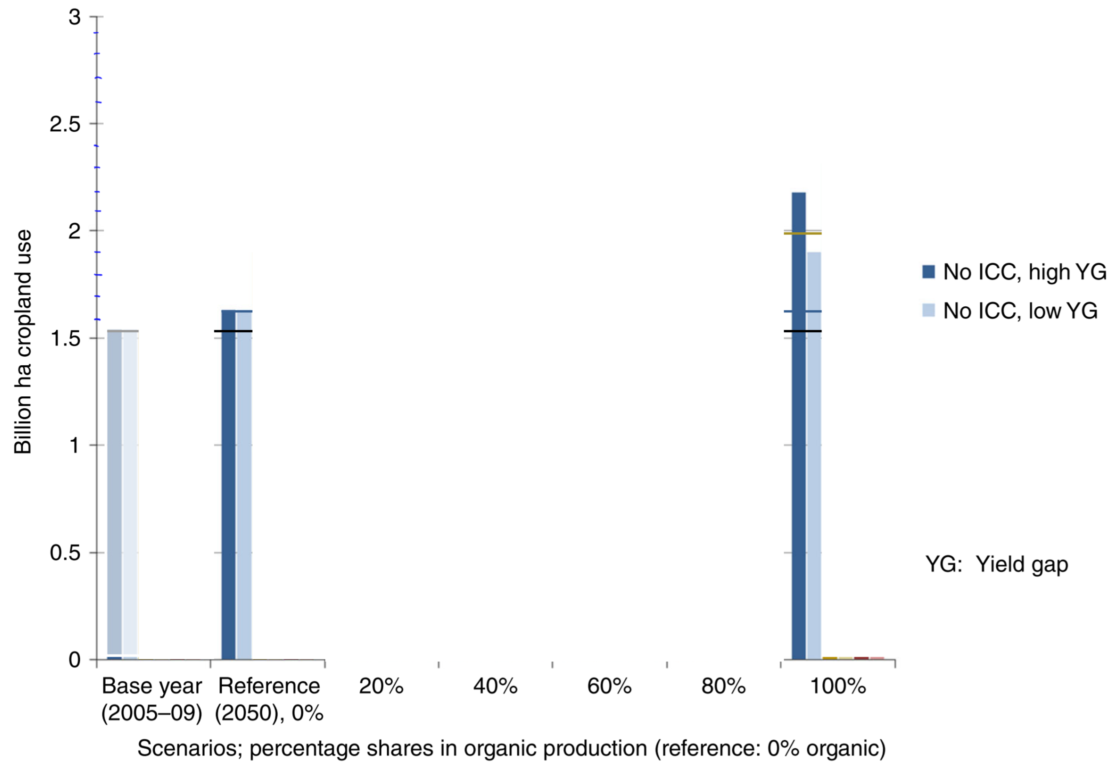

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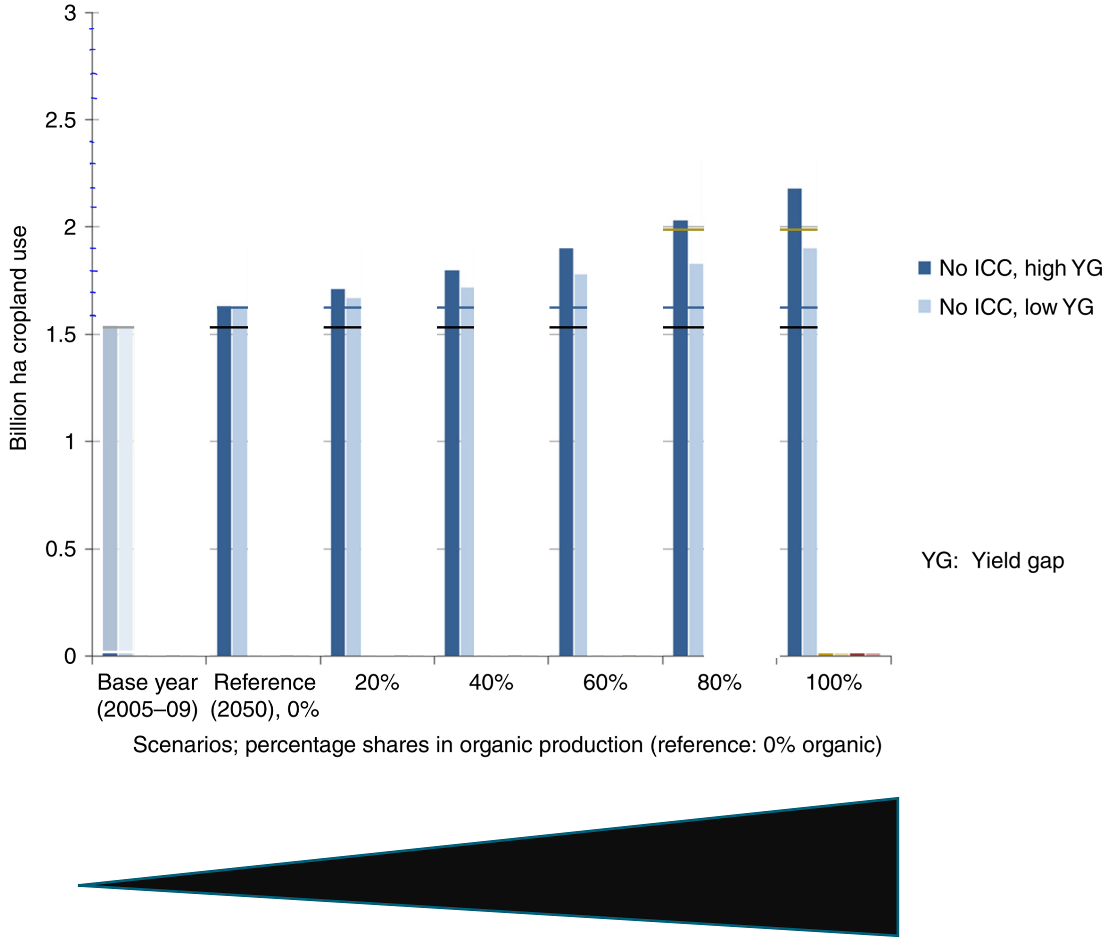


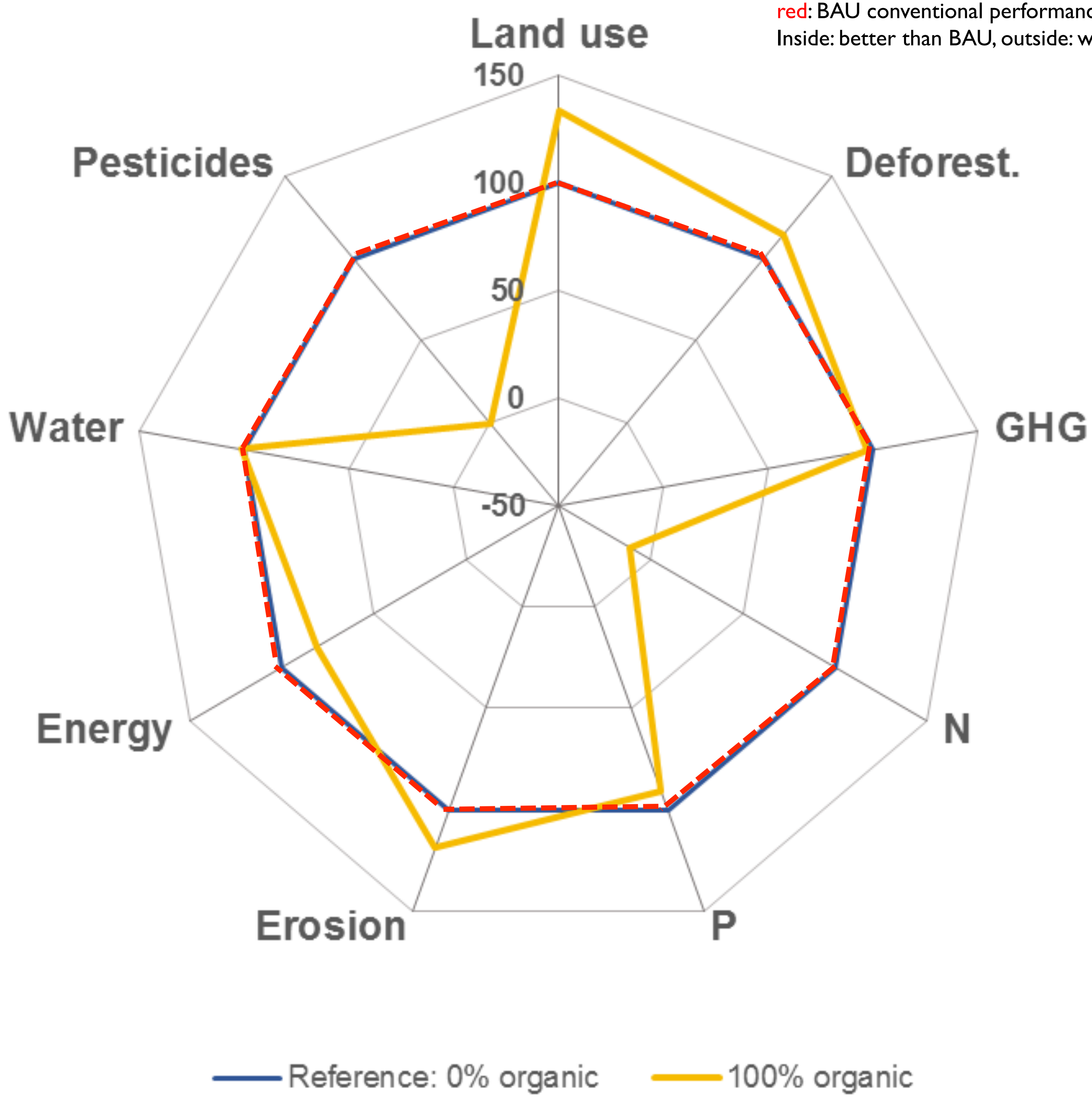
Muller et al. 2017; Courtesy: R. Zürcher

How can large-scale conversion to organic agriculture contribute to sustainable food systems?

Are land use and yields an interesting topic?

It relates to one sustainability indicator among many others.

TOTAL performance
red: BAU conventional performance 2050
Inside: better than BAU, outside: worse

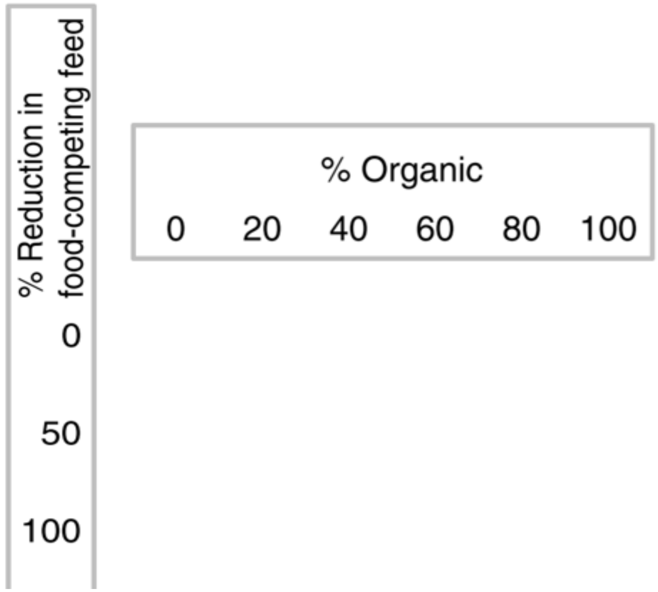


Muller et al. 2017

How much do we need to produce?

- Over 9 Billion people in 2050
- FAO: over 3000 kcal/cap/day
- High shares of animal protein in diets

Once more: Land use



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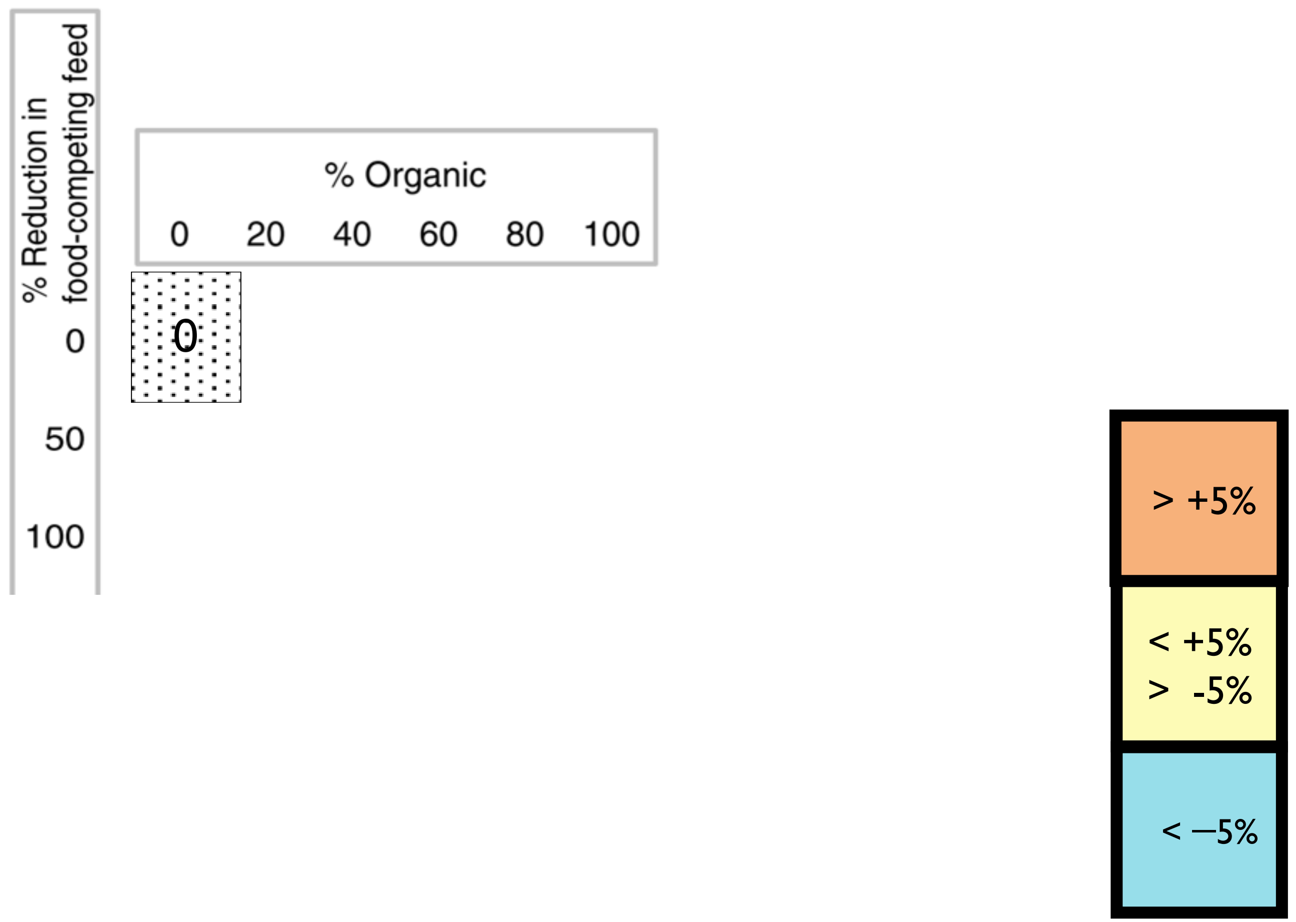

Muller et al. 2017; Courtesy: R. Zürcher

% Reduction in food-competing feed \ % Organic	0	20	40	60	80	100
0	0	5	10	17	25	33
50	–16	–12	–8	–4	2	8
100	–26	–24	–20	–16	–12	–8

> +5%

< +5%
> -5%

< –5%

Muller et al. 2017; Courtesy: R. Zürcher

Land use

% Reduction in food-competing feed \ % Organic	0	20	40	60	80	100
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> +5%

< +5%
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Muller et al. 2017; Courtesy: R. Zürcher

Land use

Climate change impact on yields: Zero | Medium | High

% Wastage reduction	% Reduction in food-competing feed	% Organic: 0	20	40	60	80	100
0	0	0	5	10	17	25	33
	50	−16	−12	−8	−4	2	8
	100	−26	−24	−20	−16	−12	−8
25	0						
	50						
	100						
50	0						
	50						
	100						

> +5%

< +5%
> -5%

<−5%

Muller et al. 2017; Courtesy: R. Zürcher

% Wastage reduction	% Reduction in food-competing feed	Climate change impact on yields: Zero — % Organic 0	20	40	60	80	100	Medium — % Organic 0	20	40	60	80	100	High — % Organic 0	20	40	60	80	100
0	0	0	5	10	17	25	33												
0	50	−16	−12	−8	−4	2	8												
0	100	−26	−24	−20	−16	−12	−8												
25	0	−6	−1	5	10	18	26	14	20	25	32	40	48	39	42	45	50	56	61
25	50	−22	−18	−13	−8	−4	−2	−4	0	5	9	14	21	18	20	22	25	27	32
25	100	−30	−27	−25	−21	−17	−13	−14	−11	−8	−5	−1	4	6	7	8	8	10	13
50	0																		
50	50																		
50	100																		

> +5%

< +5%
> -5%

<−5%

Muller et al. 2017; Courtesy: R. Zürcher

Climate change impact on yields

% Wastage reduction	% Reduction in food-competing feed	Zero: % Organic 0	20	40	60	80	100	Medium: % Organic 0	20	40	60	80	100	High: % Organic 0	20	40	60	80	100
0	0	0	5	10	17	25	33												
0	50	–16	–12	–8	–4	2	8												
0	100	–26	–24	–20	–16	–12	–8												
25	0	–6	–1	5	10	18	26	14	20	25	32	40	48	39	42	45	50	56	61
25	50	–22	–18	–13	–8	–4	–2	–4	0	5	9	14	21	18	20	22	25	27	32
25	100	–30	–27	–25	–21	–17	–13	–14	–11	–8	–5	–1	4	6	7	8	8	10	13
50	0																		
50	50																		
50	100																		

−1

> +5%

< +5%
> -5%

<−5%

Muller et al. 2017; Courtesy: R. Zürcher

Climate change impact on yields

% Wastage reduction	% Reduction in food-competing feed	Zero: % Organic 0	20	40	60	80	100	Medium: % Organic 0	20	40	60	80	100	High: % Organic 0	20	40	60	80	100
0	0	0	5	10	17	25	33	21	26	33	40	47	57	46	50	54	58	[illegible]	[illegible]
	50	−16	−12	−8	−4	2	8	2	7	10	16	22	27	25	26	29	32	[illegible]	[illegible]
	100	−26	−24	−20	−16	−12	−8	−9	−6	−3	1	5	9	12	13	14	15	[illegible]	[illegible]
25	0	−6	−1	5	10	18	26	14	20	25	32	40	48	39	42	45	50	[illegible]	[illegible]
	50	−22	−18	−13	−8	−4	−2	−4	0	5	9	14	21	18	20	22	25	[illegible]	[illegible]
	100	−30	−27	−25	−21	−17	−13	−14	−11	−8	−5	−1	4	6	7	8	8	[illegible]	[illegible]
50	0	−11	−7	−1	5	11	20	8	13	18	25	32	40	30	34	38	42	47	53
	50	−25	−23	−19	−14	−9	−4	−9	−6	−2	3	8	14	10	12	15	17	21	25
	100	−35	−32	−29	−25	−22	−18	−19	−17	−13	−10	−7	−3	−1	0	1	3	4	7

> +5%

< +5%
> -5%

<−5%

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Climate change impact on yields

% Wastage reduction	% Reduction in food-competing feed	Zero: % Organic 0	20	40	60	80	100	Medium: % Organic 0	20	40	60	80	100	High: % Organic 0	20	40	60	80	100
0	0	0	5	10	17	25	33	21	26	33	40	47	57	46	50	54	58	64	71
0	50	–16	–12	–8	–4	2	8	2	7	10	16	22	27	25	26	29	32	35	40
0	100	–26	–24	–20	–16	–12	–8	–9	–6	–3	1	5	9	12	13	14	15	17	20
25	0	–6	–1	5	10	18	26	14	20	25	32	40	48	39	42	45	50	56	61
25	50	–22	–18	–13	–8	–4	–2	–4	0	5	9	14	21	18	20	22	25	27	32
25	100	–30	–27	–25	–21	–17	–13	–14	–11	–8	–5	–1	4	6	7	8	8	10	13
50	0	–11	–7	–1	5	11	20	8	13	18	25	32	40	30	34	38	42	47	53
50	50	–25	–23	–19	–14	–9	–4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
50	100	–35	–32	–29	–25	–22	–18	–19	–17	–13	–10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

> +5%

< +5%
> -5%

<–5%

Muller et al. 2017; Courtesy: R. Zürcher

Land use

Climate change impact on yields: Zero

% Wastage reduction	% Reduction in food-competing feed	% Organic 0	20	40	60	80	100
0	0	0	5	10	17	25	33
0	50	−16	−12	−8	−4	2	8
0	100	−26	−24	−20	−16	−12	−8
25	0	−6	−1	5	10	18	26
25	50	−22	−18	−13	−8	−4	−2
25	100	−30	−27	−25	−21	−17	−13
50	0	−11	−7	−1	5	11	20
50	50	−25	−23	−19	−14	−9	−4
50	100	−35	−32	−29	−25	−22	−18

Climate change impact on yields: Medium

% Wastage reduction	% Reduction in food-competing feed	% Organic 0	20	40	60	80	100
0	0	21	26	33	40	47	57
0	50	2	7	10	16	22	27
0	100	−9	−6	−3	1	5	9
25	0	14	20	25	32	40	48
25	50	−4	0	5	9	14	21
25	100	−14	−11	−8	−5	−1	4
50	0	8	13	18	25	32	40
50	50	−9	−6	−2	3	8	14
50	100	−19	−17	−13	−10	−7	−3

Climate change impact on yields: High

% Wastage reduction	% Reduction in food-competing feed	% Organic 0	20	40	60	80	100
0	0	46	50	54	58	64	71
0	50	25	26	29	32	35	40
0	100	12	13	14	15	17	20
25	0	39	42	45	50	56	61
25	50	18	20	22	25	27	32
25	100	6	7	8	8	10	13
50	0	30	34	38	42	47	53
50	50	10	12	15	17	21	25
50	100	−1	0	1	3	4	7

- > +5%
- < +5% > -5%
- <−5%

Muller et al. 2017; Courtesy: R. Zürcher

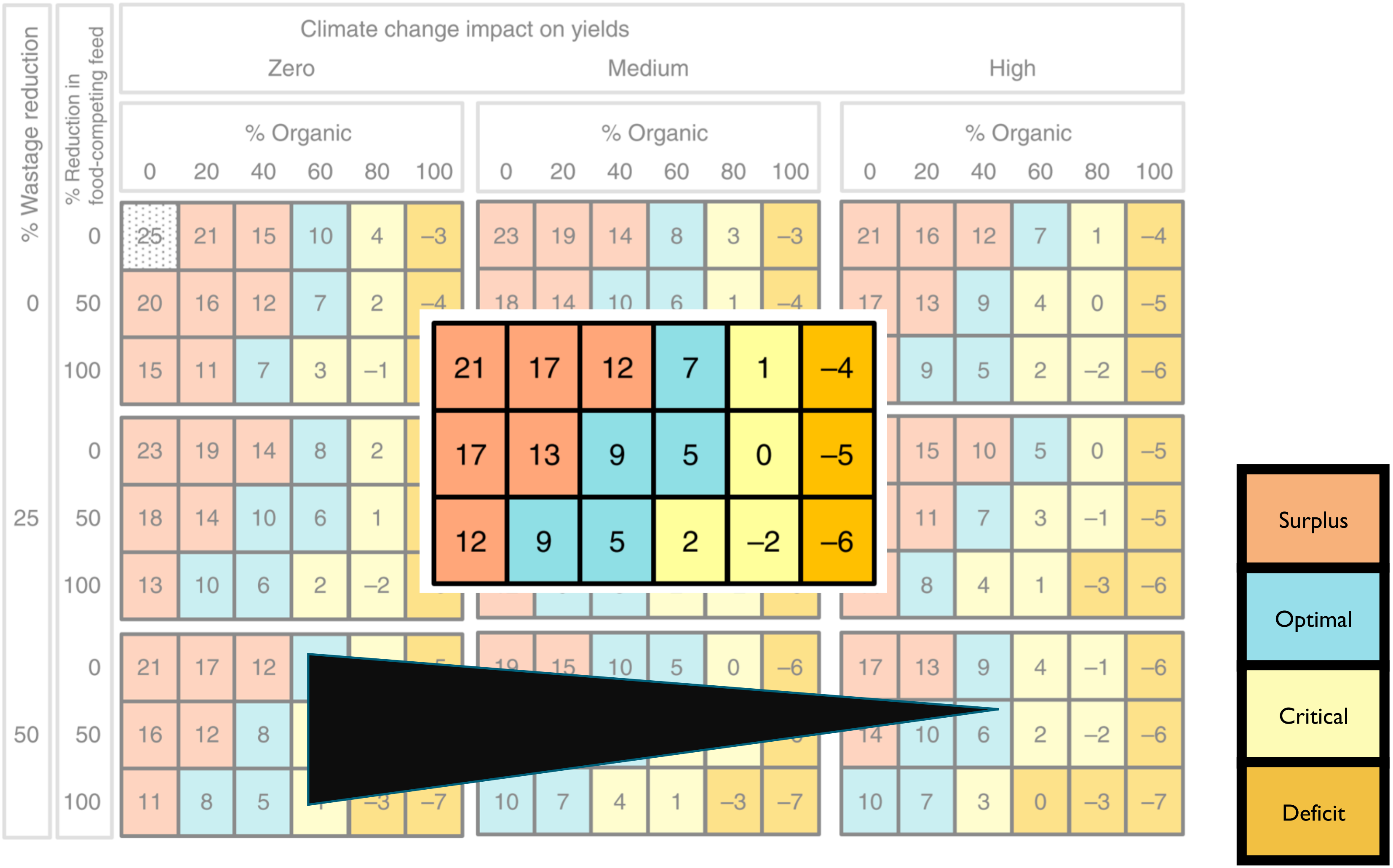
How can large-scale conversion to organic agriculture contribute to sustainable food systems?

Nutrient supply

Not only the products but also the fertilizers are grown on the areas

Adequate nitrogen supply could become a challenge

N surplus



Muller et al. 2017; Courtesy: R. Zürcher

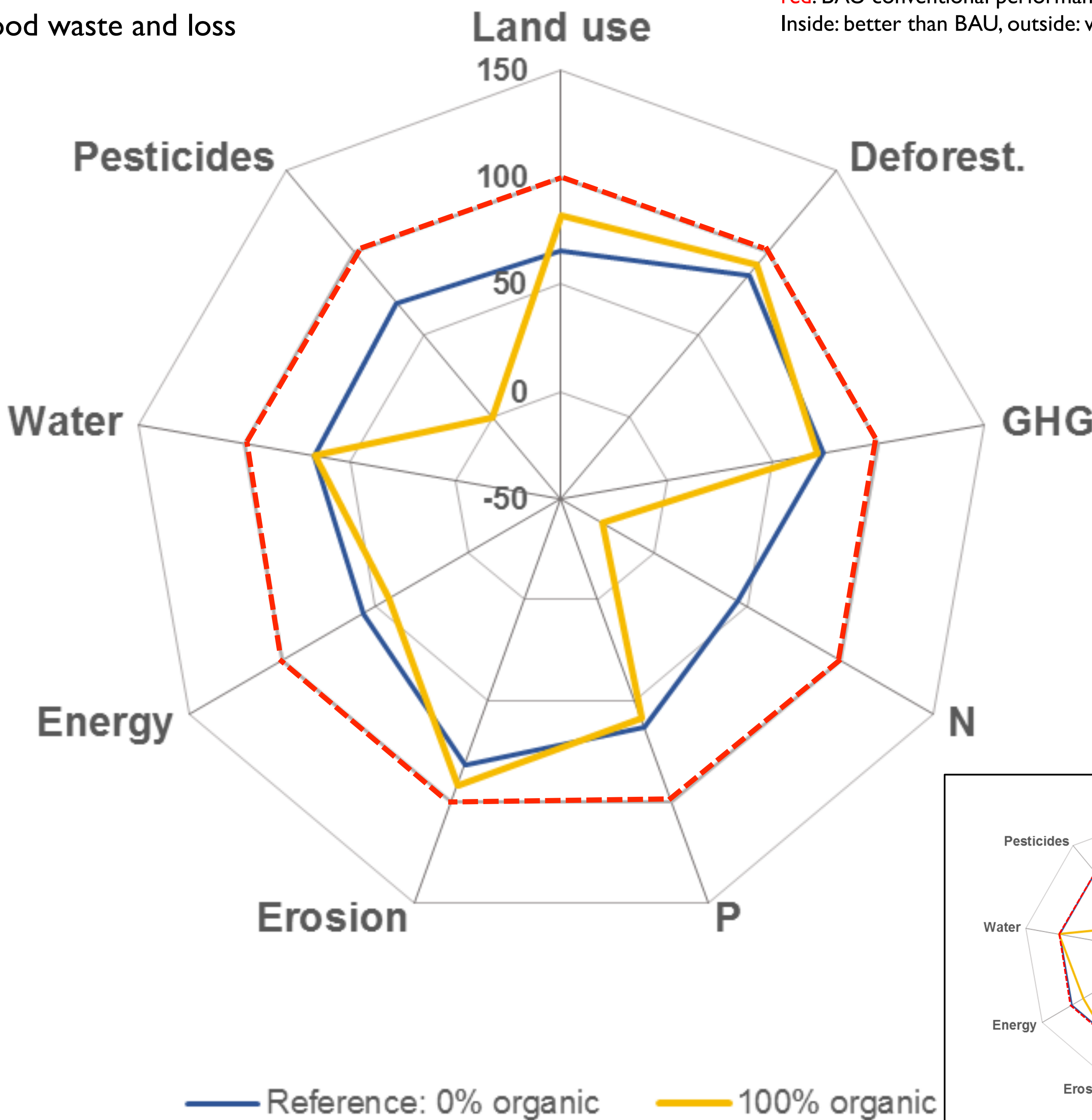
How can large-scale conversion to organic agriculture contribute to sustainable food systems?

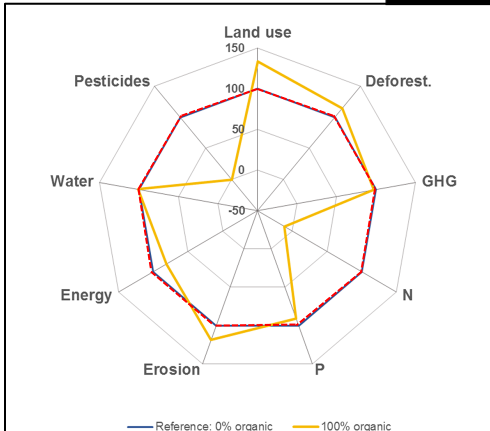
Again: land use and N-surplus

are only two sustainability indicators among many others

100% food competing feed
reduction
50% less food waste and loss

TOTAL performance
red: BAU conventional performance 2050
Inside: better than BAU, outside: worse



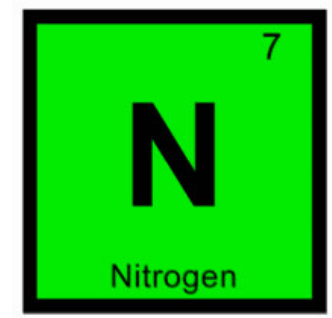


Muller et al. 2017

How can large-scale conversion to organic agriculture contribute to sustainable food systems?

Ultimately, we are not interested in this dichotomy of conventional versus 100% organic.

We look for encompassing sustainable solutions.



Climate change impact on yields

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	50	−16	−12	−8	−4	2	8	2	7	10	16	22	27	25	26	29	32	35	40
	100	−26	−24	−20	−16	−12	−8	−9	−6	−3	1	5	9	12	13	14	15	17	20
25	0	−6	−1	5	10	18	26	14	20	25	32	40	48	39	42	45	50	56	61
	50	−22	−18	−13	−8	−4	−2	−4	0	5	9	14	21	18	20	22	25	27	32
	100	−30	−27	−25	−21	−17	−13	−14	−11	−8	−5	−1	4	6	7	8	8	10	13
50	0	−11	−7	−1	5	11	20	8	13	18	25	32	40	30	34	38	42	47	53
	50	−25	−23	−19	−14	−9	−4	−9	−6	−2	3	8	14	10	12	15	17	21	25
	100	−35	−32	−29	−25	−22	−18	−19	−17	[illegible]	[illegible]	[illegible]	−3	−1	0	1	3	4	7

3

Climate change impact on yields

% Wastage reduction	% Reduction in food-competing feed	Zero, % Organic 0	20	40	60	80	100	Medium, % Organic 0	20	40	60	80	100	High, % Organic 0	20	40	60	80	100
0	0	25	21	15	10	4	−3	23	19	14	8	3	−3	21	16	12	7	1	−4
	50	20	16	12	7	2	−4	18	14	10	6	1	−4	17	13	9	4	0	−5
	100	15	11	7	3	−1	−5	13	10	7	3	−1	−5	12	9	5	2	−2	−6
25	0	23	19	14	8	2	−4	21	17	12	7	1	−4	19	15	10	5	0	−5
	50	18	14	10	6	1	−5	17	13	9	5	0	−5	15	11	7	3	−1	−5
	100	13	10	6	2	−2	−6	12	9	5	2	−2	−6	11	8	4	1	−3	−6
50	0	21	17	12	7	1	−5	19	15	10	5	0	−6	17	13	9	4	−1	−6
	50	16	12	8	4	0	−6	15	11	7	3	−1	−6	14	10	6	2	−2	−6
	100	11	8	5	1	−3	−7	10	7	[illegible]	[illegible]	[illegible]	−7	10	7	3	0	−3	−7

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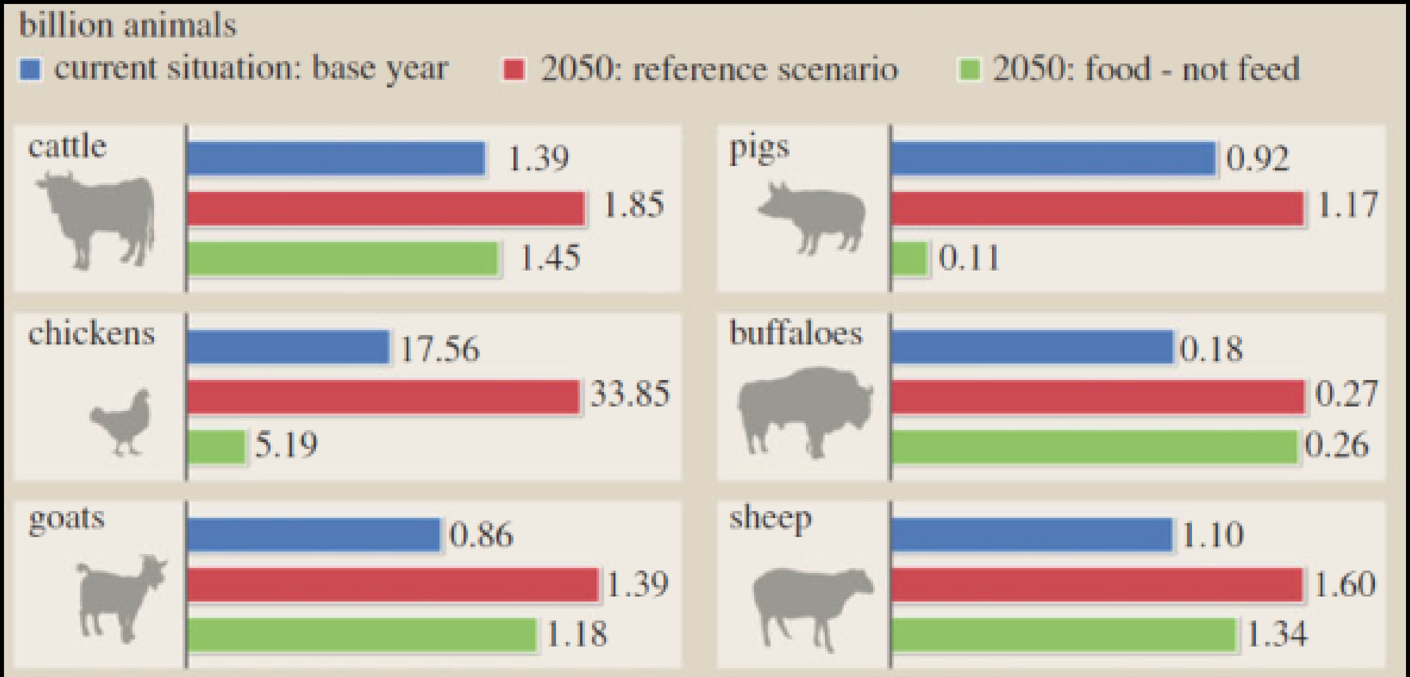
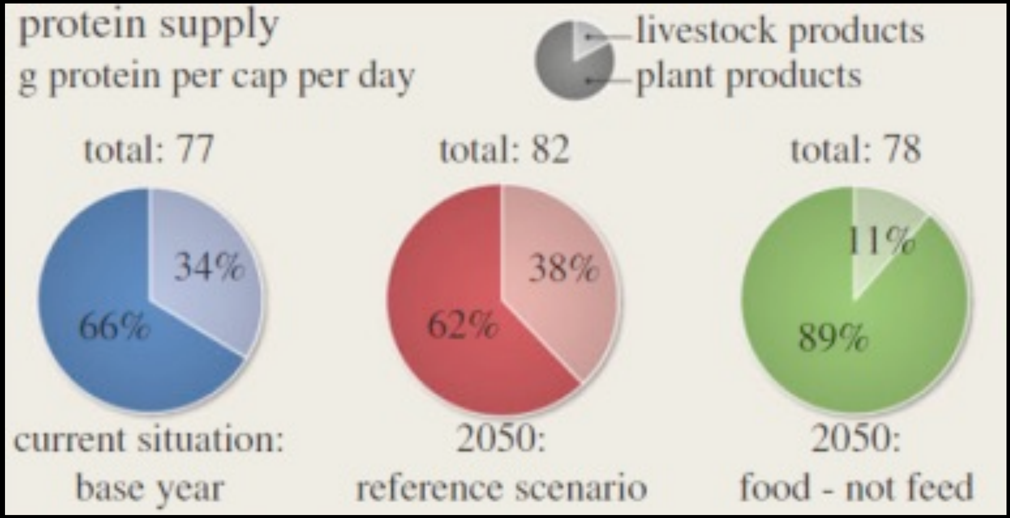
Muller et al. 2017; Courtesy: R. Zürcher

How can large-scale conversion to organic agriculture contribute to sustainable food systems?

Some further thoughts

Effects on consumption





Schader et al. 2015

How can large-scale conversion to organic agriculture contribute to sustainable food systems?

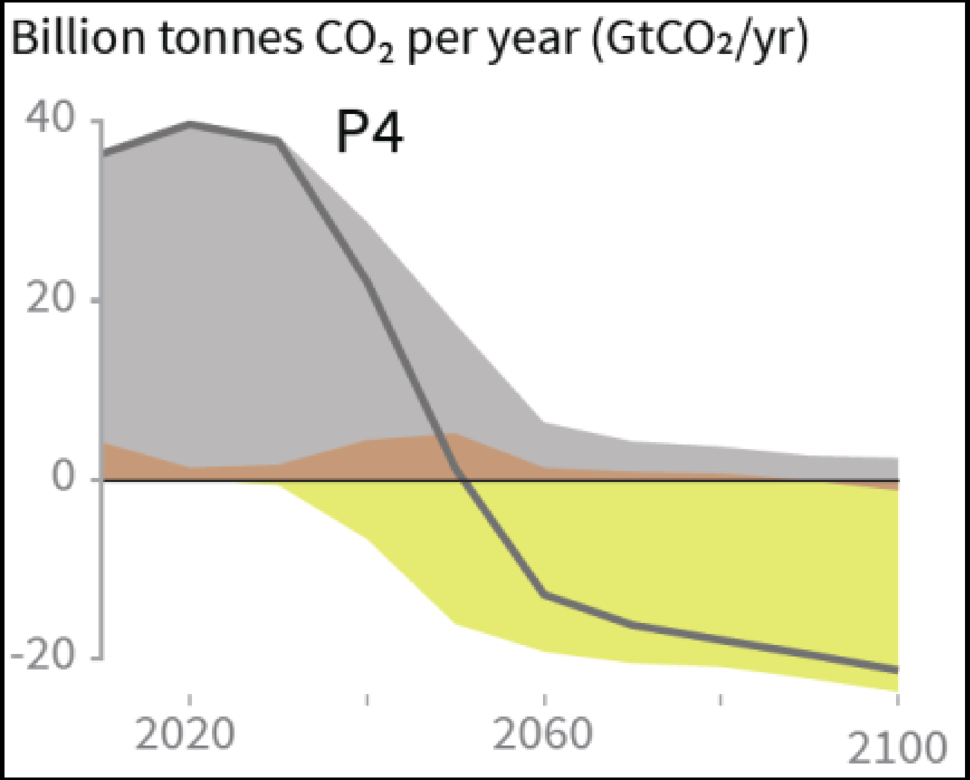
How do we measure sustainability?

- per unit produce
- per area
- total aggregate

How can large-scale conversion to organic agriculture contribute to sustainable food systems?

Link to other sectors

e.g. Energy:



IPCC SR1.5

The IPCC 1.5-degree scenarios with bioenergy and carbon capture and storage (BECCS) – till 2050:

- Change 800 mio ha grassland to cropland for Miscanthus
- 2.5 times as much mineral N fertilizer as today

Conclusions I

- **It is important to discuss how much we really need to produce:**
  - Animal products / waste

- **It is important how we measure sustainability:**
  - Per kg, per ha or in total; not only GHG emissions…
  - Land use and yield gaps must not dominate the discussion

- **Sustainable production cannot be discussed without addressing consumption and processing – i.e. without addressing the whole food system**
  - Efficiency – consistency – sufficiency

Conclusions II

- **It is important to discuss what «feeding the world» means:**
  - Animal products / waste
- **It is important how we measure sustainability:**
  - Per kg or per ha; not only GHG emissions…
  - Land use and yield gaps must not dominate the discussion
- **Sustainable production cannot be discussed without addressing consumption and processing – i.e. without addressing the whole food system**
  - Efficiency – consistency – sufficiency

- **Organic agriculture is a role model, but it is no panacea**
  - Trade-offs and synergies
  - 100% organic and "feeding the world" narratives are not the key aspects for discussions on sustainable agriculture and food systems

Conclusions III

- **It is important to discuss what «feeding the world» means:**
  - Animal products / waste
- **It is important how we measure sustainability:**
  - Per kg or per ha; not only GHG emissions…
  - Land use and yield gaps must not dominate the discussion
- **Sustainable production cannot be discussed without addressing consumption and processing – i.e. without addressing the whole food system**
  - Efficiency – consistency – sufficiency
- **Organic agriculture is a role model, but it is no panacea**
  - Trade-offs and synergies
  - 100% organic and "feeding the world" narratives are not the key aspects for discussions on sustainable agriculture and food systems
- **Keep an eye on the link to other sectors**
  - e.g. the energy sector: Bioenergy
- **Choose policy instruments wisely**
  - be e.g. critical towards CO_2-certificates or also a carbon tax on meat
  - rather go for a tax on external N sources

Merci pour votre attention

ADDITIONAL SLIDES

Policy levers to drive sustainability in food systems