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The role of sustainable grassland management for food security and maintenance of natural resources

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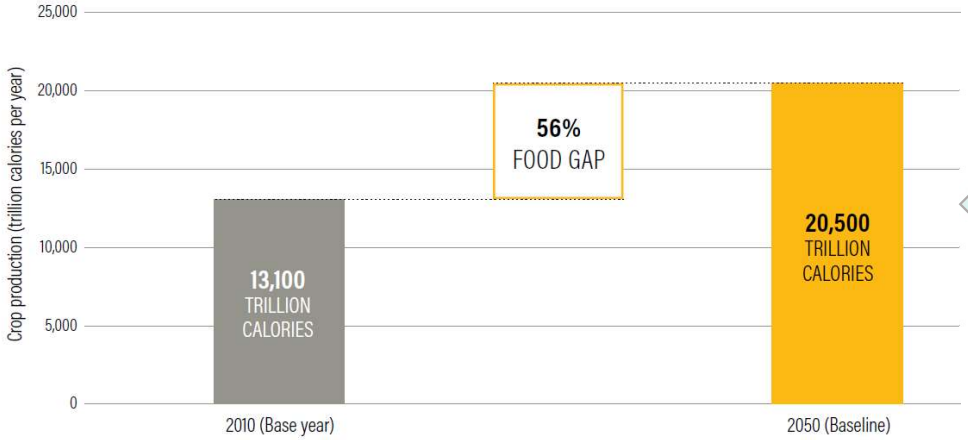
Contents

- Challenges of Foods Systems until 2050.
- Political and societal trends.
- Approach of the UNFSS 2021 to accelerate SDGs.
- The role of livestock, globally and regionally.
- Conclusions.

Human nutrition and carrying capacity of the planet

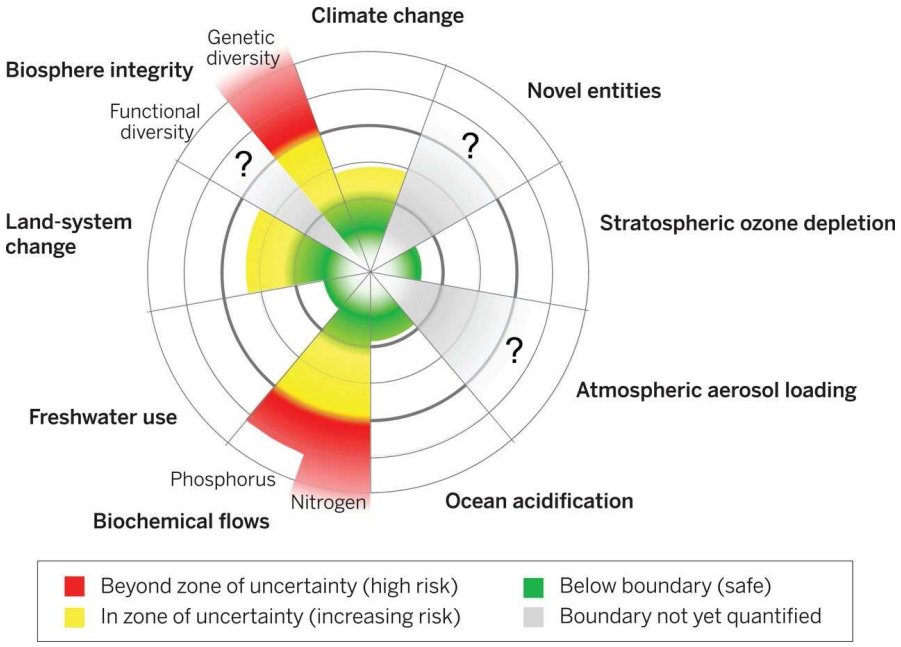


Note: Includes all crops intended for direct human consumption, animal feed, industrial uses, seeds, and biofuels.
Source: WRI analysis based on FAO (2017a); UNDESA (2017); and Alexandratos and Bruinsma (2012).

593 million hectare additionally needed

- 401 million ha grassland
- 192 million ha arable cropland

Pollution of the planet in terms of nitrogen, phosphorus & loss of biodiversity in the **"high risk"** range. Climate and land-system change increasing risk.



Steffen et al.: *Planetary boundaries: Guiding human development on a changing planet*. In: Science. Band 347, Nr. 6223, 2015, doi:10.1126/science.1259855

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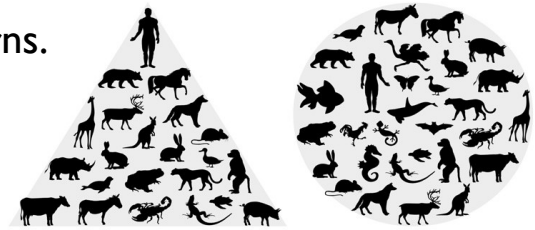
(Unsustainable) livestock

Preservation of the Earth system within safe boundaries

Political challenges: Paris Agreement (2015), reduction of livestock production and meat consumption part of the emission targets of many countries.

Societal challenges: Rising ethical concerns.



«Speciesism»

- The ability to use language conceptually.
- The ability to travel mentally through time.

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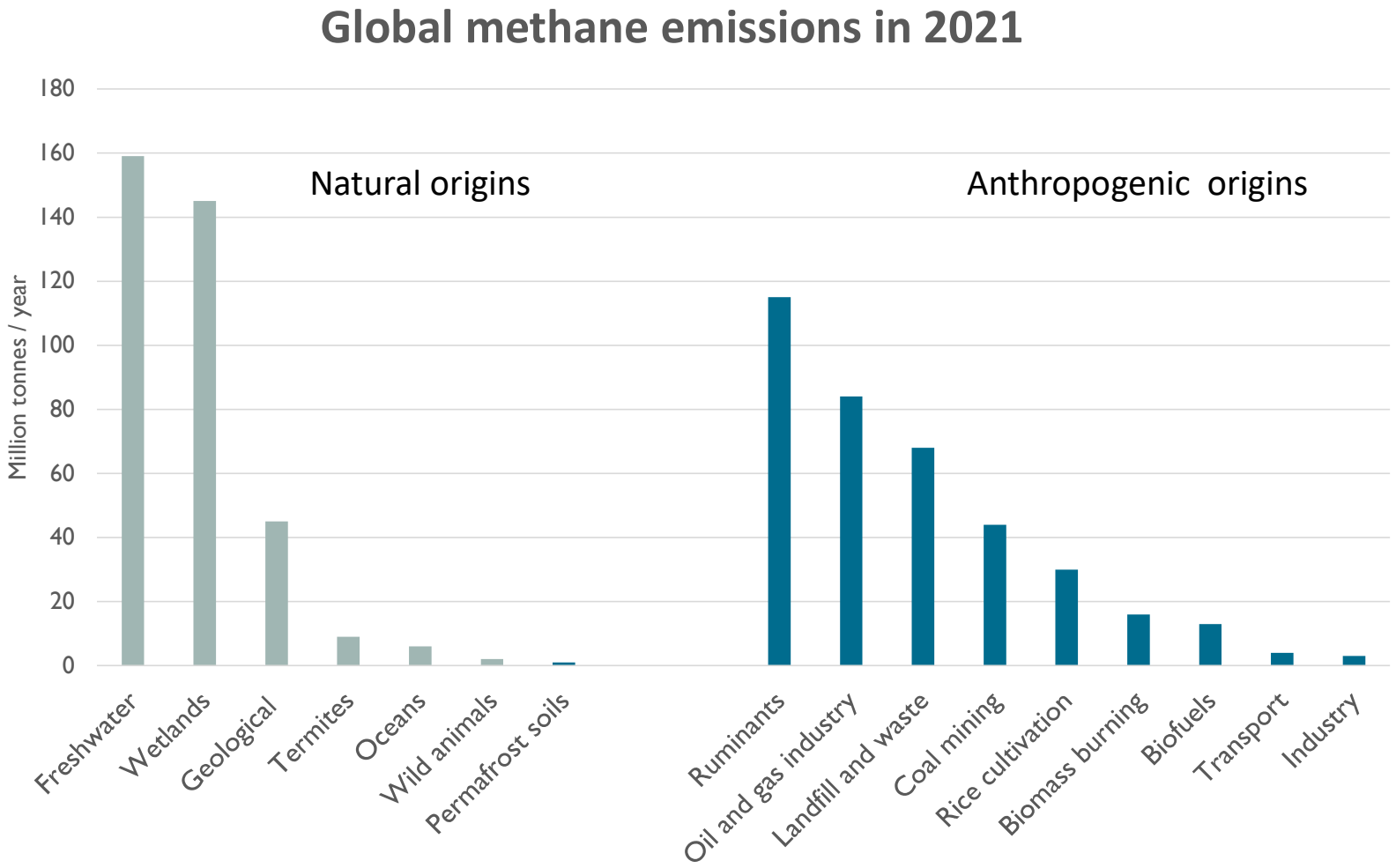
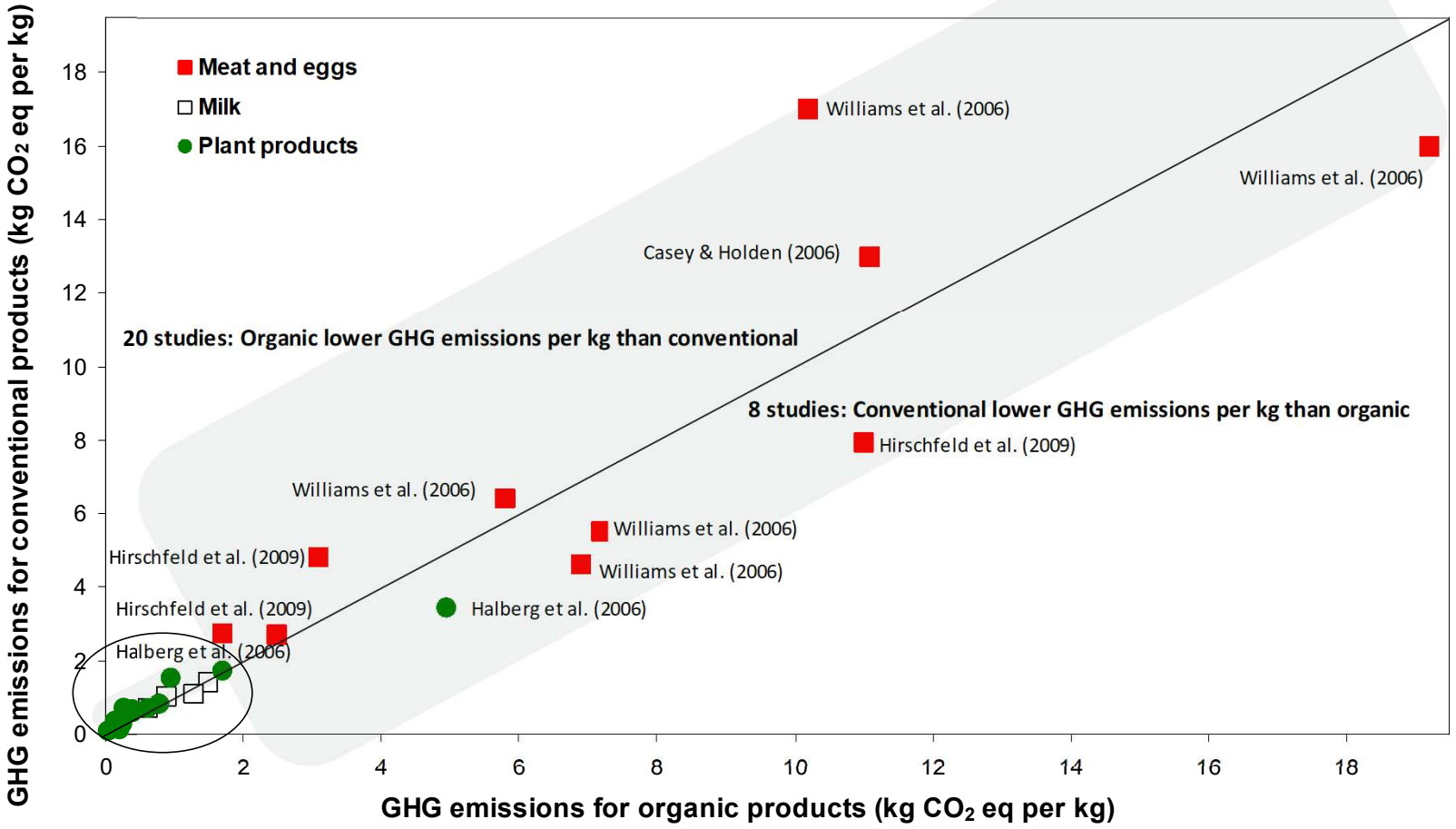


Origin of methane

GHG emissions low-input versus high input farming per kg



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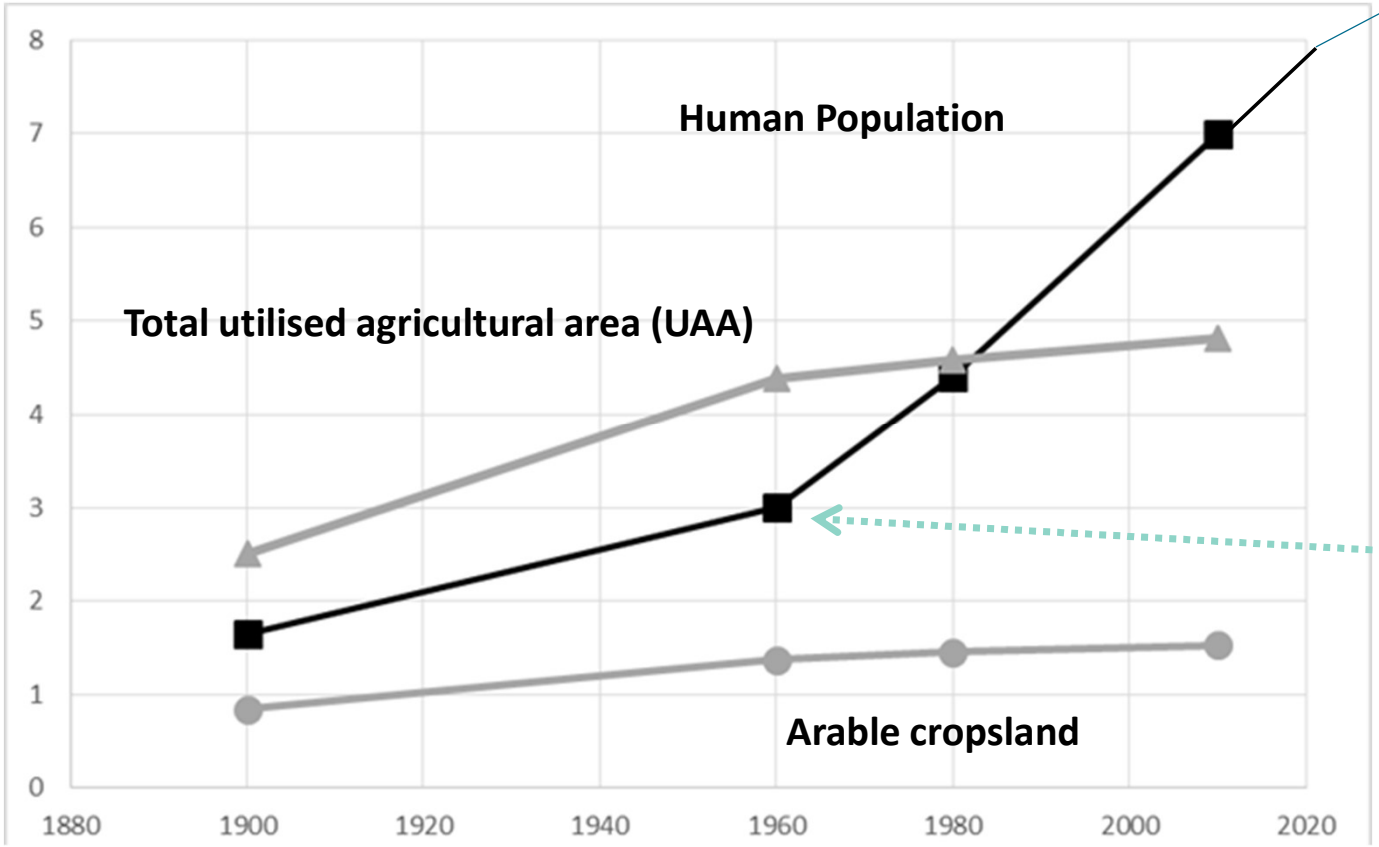
Trydeman Knudsen et al., 2010, Niggli et al., 2008

Achievement of the 20th century: Decoupling population growth from agricultural land growth.

FAO 2050
56 % Food GAP



+ 593 mio ha utilised agricultural area (UAA)
+ 401 mio ha grassland
+ 192 mio ha cropland

„Green Revolution“

- Nitrogen and phosphorus;
- Crop protection;
- Herbicides;
- Plant and animal husbandry;
- Irrigation;
- and other technical measures.

Recommendation of the UNFSS 2021: Boost nature-positive production

1. Protect natural systems from new conversion for food production

«Cuvette Centrale» Democratic Republic of the Congo

2. Sustainably manage existing food production systems

3. Restore and rehabilitate degraded systems for food production & ES

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Hodson de Jaramillo E., Niggli U., Kitajima K., Lal R. and Sadoff C. (2023): Boost Nature-Positive Production. In: Von Braun J., Afsana K., Fresco L. O., Hassan M.H.A. and Torero M. (eds.) (2023): Science and Innovations for Food Systems Transformation, Springer Open Access. https://doi.org/10.1007/978-3-031-15703-5_2

① Goal/objective

Productive farming systems that use, but do not consume/destroy, the natural resources of soil, water, air and biodiversity (natural capital).

② Ways to achieve this

- Numerous "soil-less" production systems.
- Improved techniques such as minimum tillage.
- Integrated Pest Management(IPM).
- Integrated Production (IP).
- Low Input Agriculture (LIA) or Precision Farming.
- Organic farming.
- Low External Input Sustainable Agriculture (LEISA).
- Organic farming & reduced tillage.
- (Organic) mixed cropping.(Organic) Agroforestry systems.
- (Organic) Successional agroforestry systems.
- Sustainable sufficiency food systems with a high proportion of plant proteins and 50% less food waste.

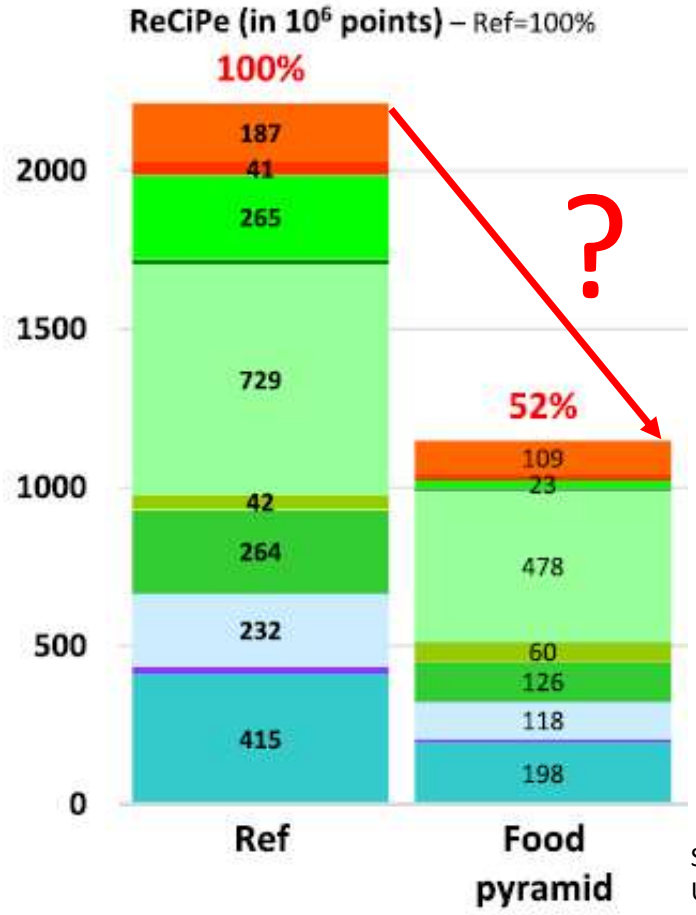
③ Knowledge we can mobilise

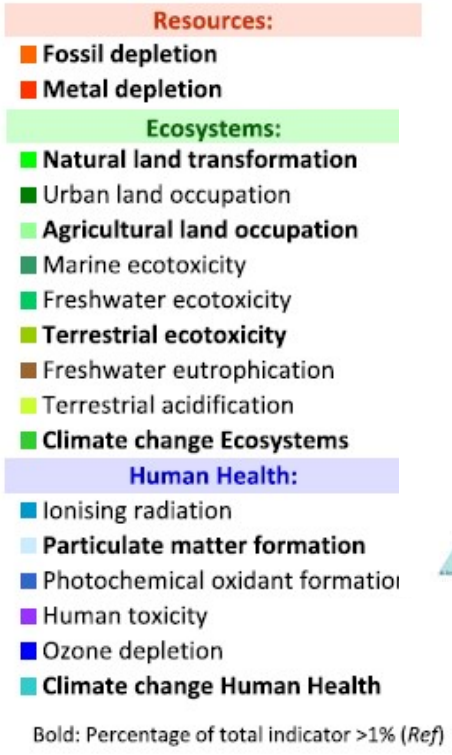
To do this, we need traditional knowledge, farming experience, farmer entrepreneurship and scientific innovation.

Comparison of the aggregated environmental impact (ReCiPe) between a reference scenario (=today's diet) and a food pyramid scenario (-69 % meat)

Scenario for Switzerland

- Levies/taxes on sugar, fat, meat (true cost health).
- Higher VAT.
- Children "School of food".
- Supply management in food retailing.
- Large "fear" campaigns.
- Advertising bans.
- Incentives or regulations for catering and gastronomy.
- Liability lawsuits.
- Subsidies for extreme animal rights activists.





Source: (von Ow et al., 2020), ReCiPe: Aggregierter Indikator zur Umweltwirkung Agroscope, Bundesamt für Landwirtschaft

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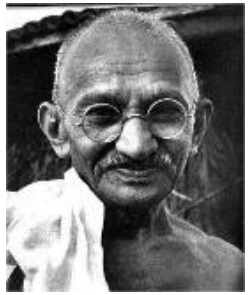
Vegane nutrition 100 %?

- Per unit area, legumes provide 2x more protein than milk and 20x more than meat.
- Meat has very high protein quality (lysine, threonine, methionine, B vitamins (B12), vitamins A, D, K2, iron, zinc, selenium, long-chain omega-3 fatty acids, etc.).

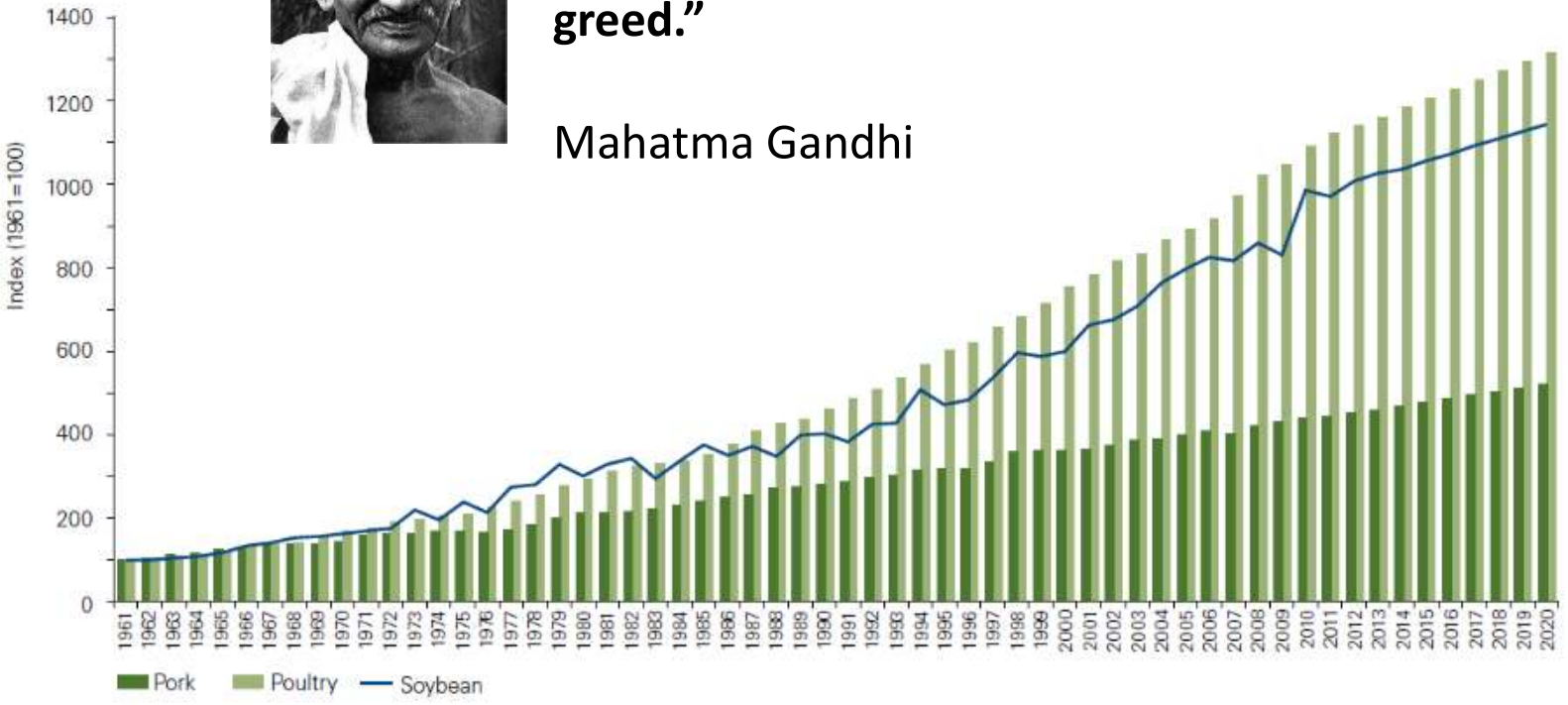
- What do we do with the permanent grassland and clover-grass in the crop rotation?
- What do we do with the byproducts of the processing industry (bran, press cake, pomace etc)?
- What do we do with the food waste?

The solution is sufficiency: but there is nothing to suggest that a sufficiency scenario will ever happen: Trends in global soybean, pig and chicken production 1961-2020



“The world has enough for everyone's need, but not enough for everyone's greed.”

Mahatma Gandhi



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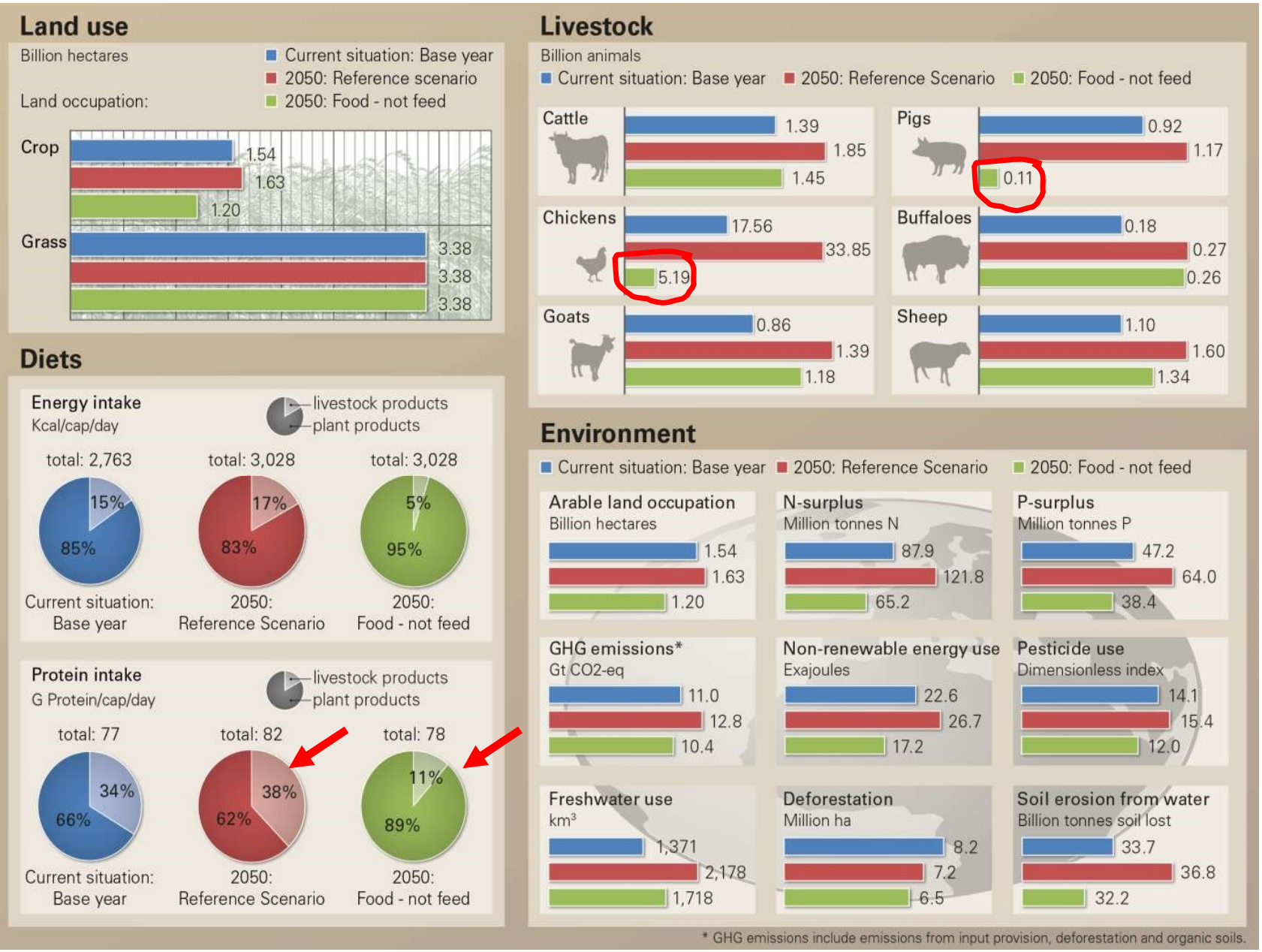
Source: FAOSTAT/FAPRI



Modelling of solutions

"Feed no Food (edible)"

Scenarios:

- Current situation
- 2050 Reference scenario
- 2050 Food – not feed

SOLm model of FiBL and FAO)

Schader C., Müller A., Scialabba N.E., Hecht J., Isensee A., Erb K.H., Smith P., Makkar H.P.S., Klocke P., Leiber F., Schwegler P., Stolze M. & Niggli U. (2015): Impacts of feeding less food-competing feedstuffs to livestock on global food system sustainability. **Journal of the Royal Society Interface** 12(113): 20150891.

Changes in arable land (2050)

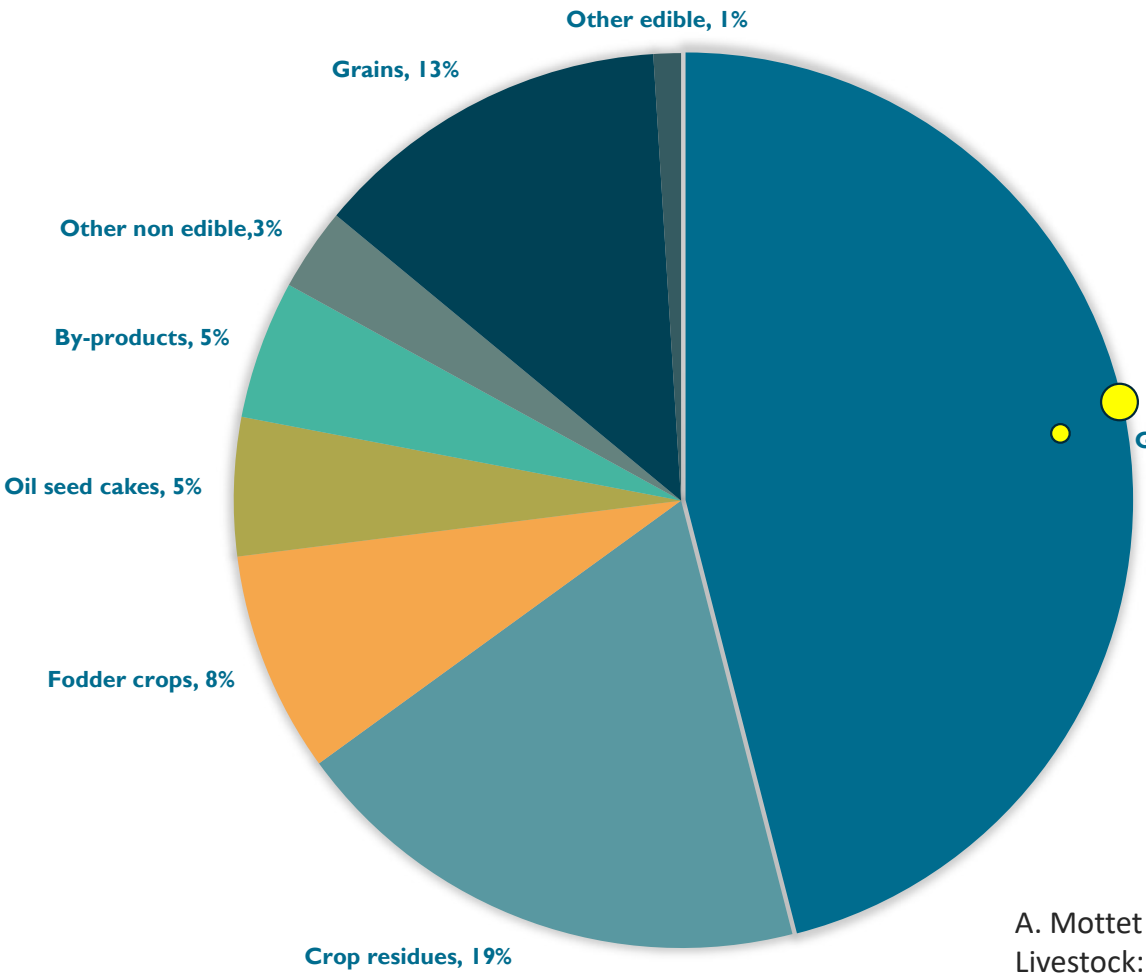
% Wastage reduction	% reduction in food-competing feed	Climate change impact on yields: zero — % organic 0	20	40	60	80	100	medium — % organic 0	20	40	60	80	100	high — % organic 0	20	40	60	80	100
0	0	0	5	10	17	25	33	21	26	33	40	47	57	46	50	54	58	64	71
	50	-16	-12	-8	-4	2	8	2	7	10	16	22	27	25	26	29	32	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	-13	-10	-7	-3	-1	0	1	3	4	7

Testing a combination of partial solutions:

- Organic 0-100 % land area
- Food Wastage 0-50 % reduction
- Cereal concentrates: 0-100 % reduction
- Global warming: zero, medium high negative impact on yields

Muller, A., Schader, C., El-Hage Scialabba, N., Hecht, J., Isensee, A., Erb, K.-H., Smith, P., Klocke, K., Leiber, F., Stolze, M. and Niggli, U., 2017, Strategies for feeding the world more sustainably with organic agriculture, **Nature** Communications October/2017.

Composition of the global livestock diet (6 billion tones dry matter)



Stores 63.5 Mt of CO_2
= 20 % of the worlds
soil organic carbon

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A. Mottet A, C. de Haan, A. Falcucci, G. Tempio, C. Opio, P. Gerber (2017) Livestock: On our plates or eating at our table? A new analysis of the feed/food debate. *Global Food Sec.* **14**, 1–8.

Grassland: hotspots of biodiversity and habitat quality

Biodiversity indicators

	Forest	Meadows	Cropland	Settle-ments	Alpine pastures	High mountains
Vascular plants	21 +/- 1	35 +/- 1	15 +/- 1	19 +/- 1	42 +/- 1	21 +/- 1
Mosses	15 +/- 1	6 +/- 1	1 +/- 0	5 +/- 1	19 +/- 1	13 +/- 1
Snails	9 +/- 1	6 +/- 1	3 +/- 1	6 +/- 1	3 +/- 1	3 +/- 1

Biodiversity monitoring Switzerland

➔ Agronomic solution: **Graduated intensity** of grassland management.

Consequence of climate change: overgrazing, soil depletion and erosion, hunger

Conclusions

- The challenge of feeding 9-10 billion people is huge;
- Sufficiency, veganism and organic contribute to solving the problem, but are unrealistic or overestimated;
- Grasslands - although inefficient in conversion - are an irreplaceable natural source of human protein and energy;
- Ruminants can convert non-edible biomass; therefore, dairy products are essential for food security.
- Sustainable grassland is an important carbon store and biodiversity hotspot.
- Meat consumption - mainly from monogastric animals - should be significantly reduced.