atf animal task force
A European Public-Private Partnership

EAAP
European Federation of Animal Science

Joint session
of the Animal Task Force & the EAAP Commission on Livestock Farming Systems:
Livestock farming systems for the next generation: can we imagine the future?

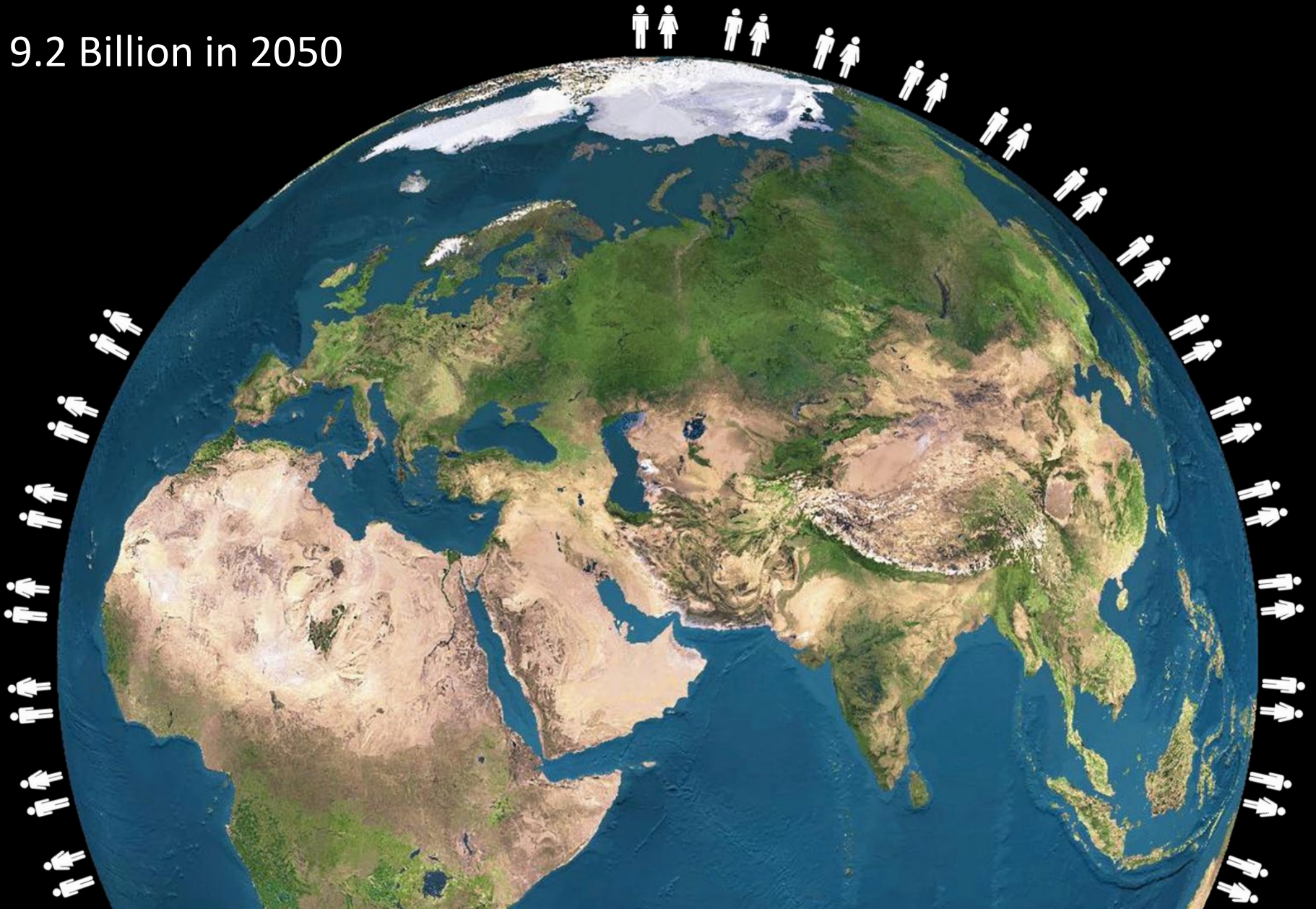
"Challenge voice–Thinking the future food systems"

Dr Wolfram Simon,

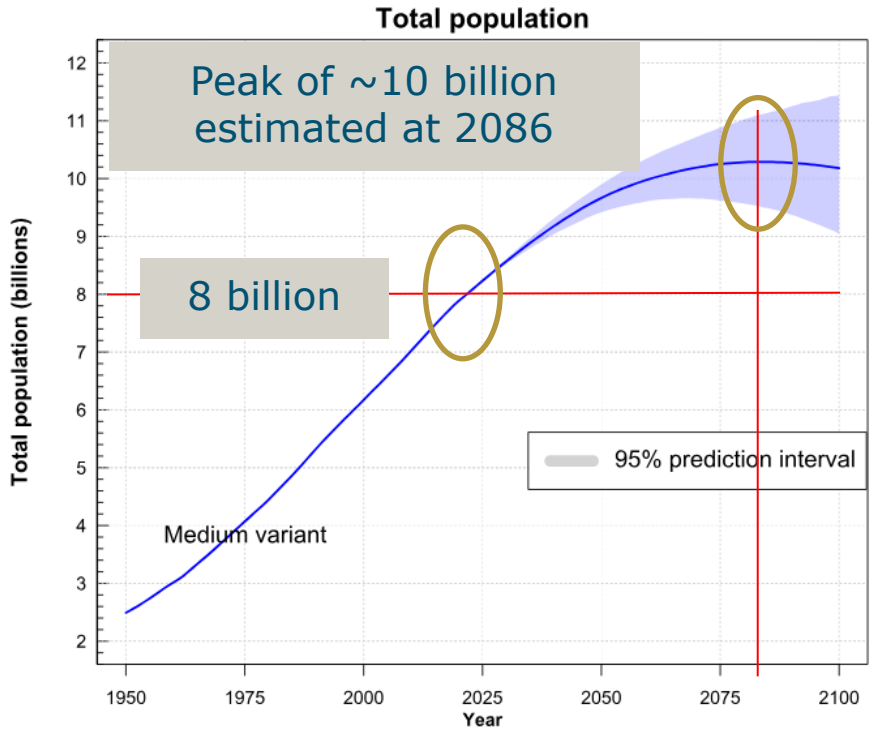
Prof Dr Hannah van Zanten

Planet Earth

9.2 Billion in 2050



Population growth

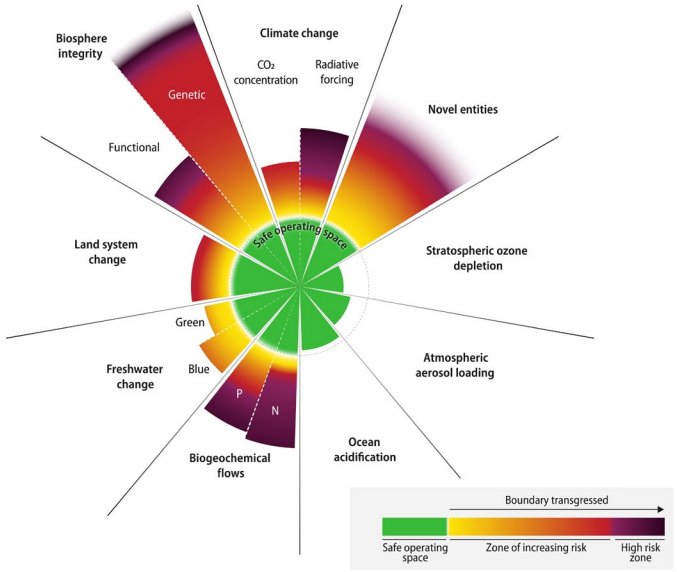


+2bn

Impacts and failures of the food system

Environmental impact

- Land use/biodiversity
- Greenhouse gas emissions
- Nitrogen cycle



Food and nutrition insecurity

- Malnutrition is a big problem
  - Obesity
  - Undernutrition
  - Dietary risks

Linearity/inefficiencies

- 1/3 of Food is lost
- Decoupling animal from feed production
- Feed-food competition

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What are circular principles?

1. Safeguarding and regenerating the health of our (agro)ecosystems

Sustainable fisheries

Halting finite resources

Restoring soil carbon stocks

Enhancing biodiversity

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Circular Food Systems

nature food
PERSPECTIVE
https://doi.org/10.1038/s43016-021-00340-7
Check for updates

Principles, drivers and opportunities of a circular bioeconomy

Abigail Muscat[1], Evelien M. de Olde[1], Raimon Ripoll-Bosch[1], Hannah H. E. Van Zanten[2], Tamara A. P. Metze[3], Catrien J. A. M. Termeer[3], Martin K. van Ittersum[4] and Imke J. M. de Boer[1]

2. Use biomass streams for basic human needs

Healthy foods

Fuel, Fiber

nature food
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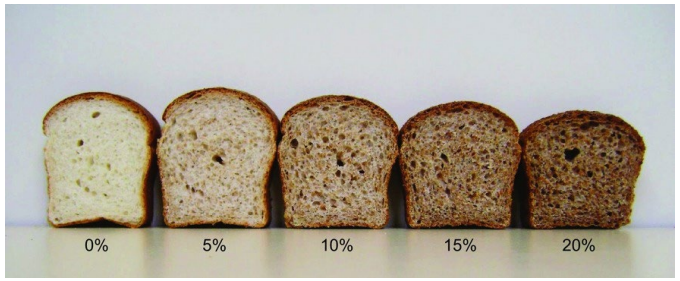
3. Avoiding non-essential products and the waste of essential ones

Food waste

Overconsumption

By-products



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4. Utilizing and recycling losses of (agro)ecosystems

Crop residues

Human excreta

Livestock on leftovers

nature food PERSPECTIVE
https://doi.org/10.1038/s43016-021-00340-7
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5. Using technologies to e.g. produce renewable energy

Sustainable energy sources

Future foods

Aim

Exploring the potential to reduce environmental impacts when combining the protein transition and circularity on a regional and global scale

How to redesign **food production**?

How to redesign **human diets**?

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Circular Food Systems

Capturing the global complexity

Methodology: Circular Food system model (CiFoS)

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Circular
Food
Systems

Potential to reduce environmental impacts

Land use reduction
Average: 68%

Emission reduction
Average: 70%

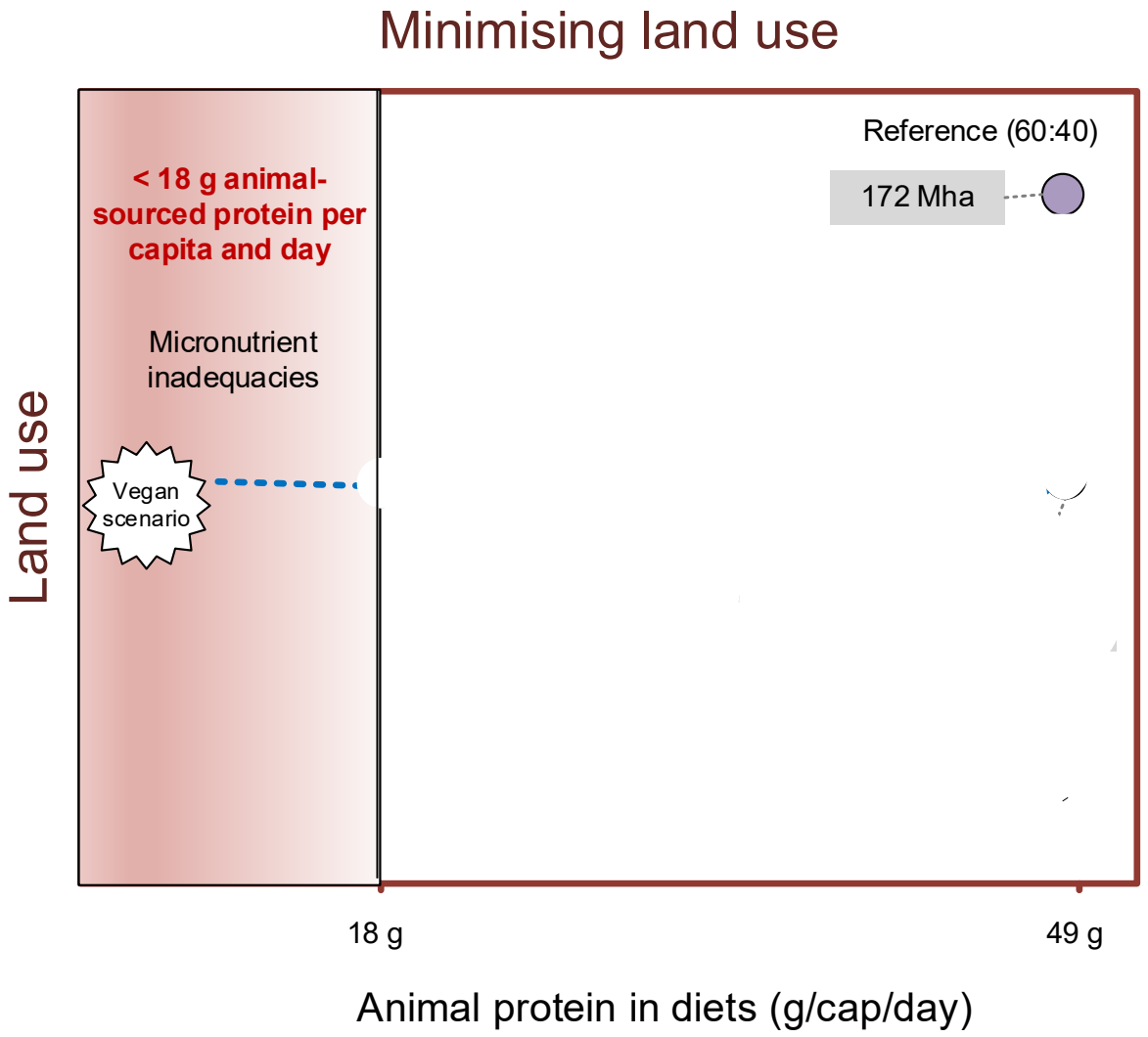
Synthetic fertiliser reduction: up to 95%

Nitrogen use efficiency increase: 0.17 to 0.53

Sources of change

Circularity vs Protein transition

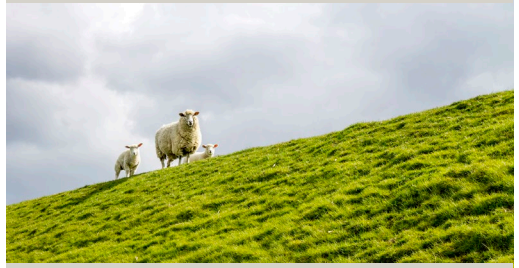
- **Resource allocation:** The biggest reduction comes from optimizing resources *(not only **circularity** principles)*
- **Protein transition** also has an effect (especially for min Land use) but not the largest



https://doi.org/10.1038/s43016-024-00975-2

Synthesis of production changes to reduce impacts

Crop production



- Reduction of **feed crops**
- Reduction of **grassland** use
- Increase in **vegetables**

Animal production

- **Animals reduced** by average of 51%
- **Beef cattle**: Most reduced animal type
- **Fish** was increased
- **Dairy** stays relevant (50% decrease)

Minimizing land use
- Focus on cereals instead of legumes
- land sparing, intensification
- trade increase

Minimizing greenhouse gas emissions
- Increase of pulses, oil crops
- Chickens increase

Minimizing synthetic fertilizers
- Increase of pulses, oil crops
- Pigs favoured as efficient manure producers

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Synthesis of dietary changes to reduce impacts

Dietary strategies

- **Reduction** of total and animal protein intake
- **Reduction** of red meat, dairy, eggs, fish and chicken
- **Increase** of vegetables, nuts and seeds

Indicator	Current	Optimal land use	Optimal emission	
Total protein	82g	55g	65g	→ EU
Animal sourced protein	49g	33g	33g	→ EU
Animal-to-plant protein	60:40	40:60	40:60	→ EU

Nutrient inadequacy below 18 g animal proteins

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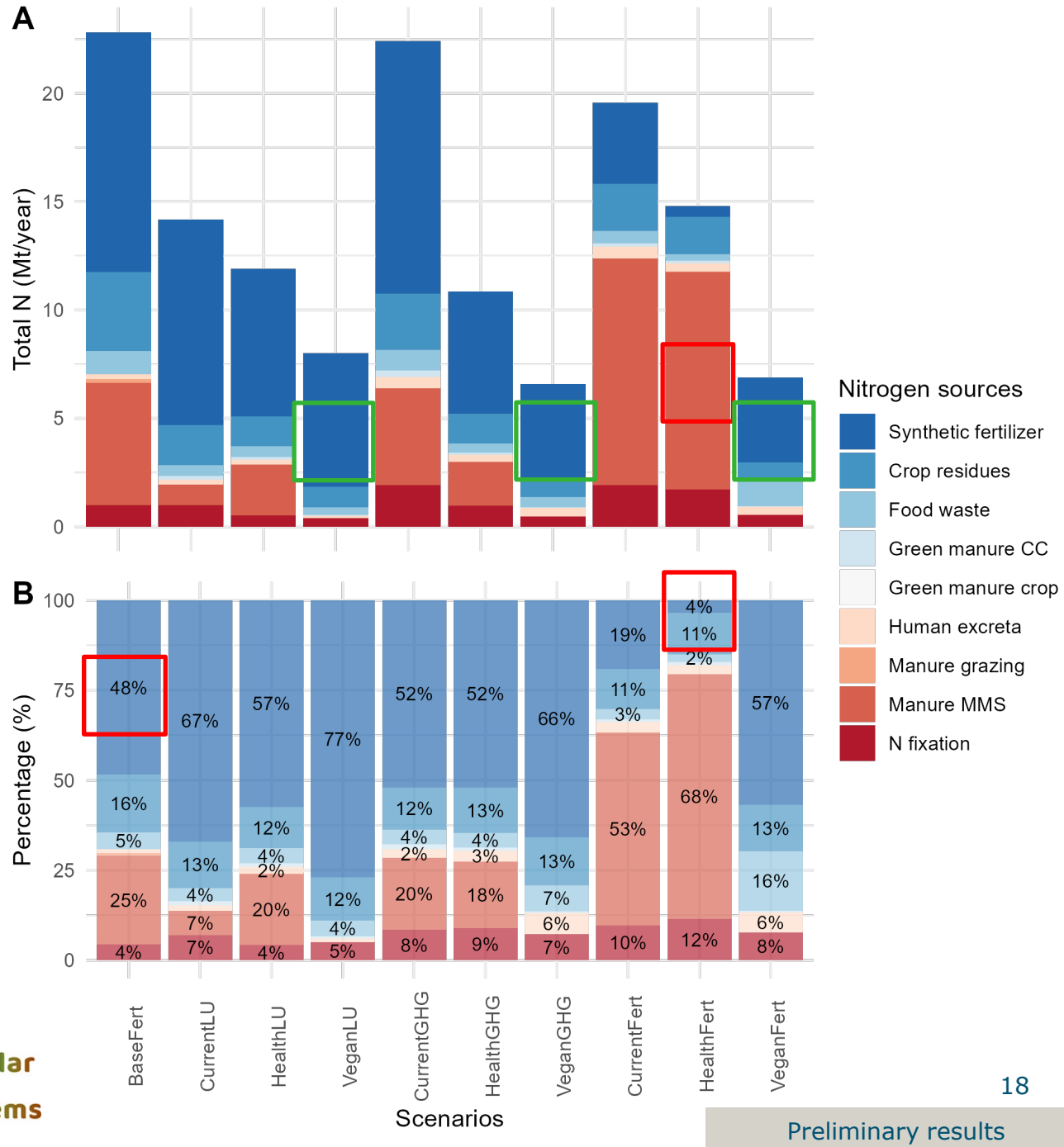
Nitrogen fertilization in food systems per diet

- **Currently**: ~50% synthetic fertilizer
- **Synthetic fertilizer cannot be entirely removed**
- **Huge NUE gains:** up to 50% NUE
  - Trade-off with NH3 emissions
- **Vegan scenarios** least total nitrogen applied
  - **BUT:** Only under the assumption of nutrient supplementation/fortification



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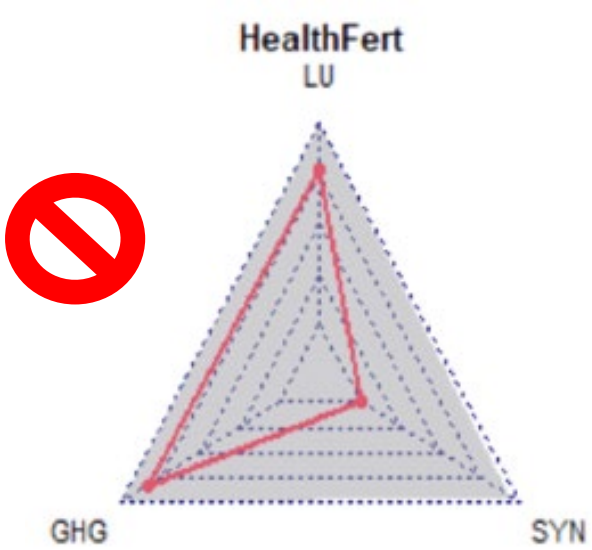
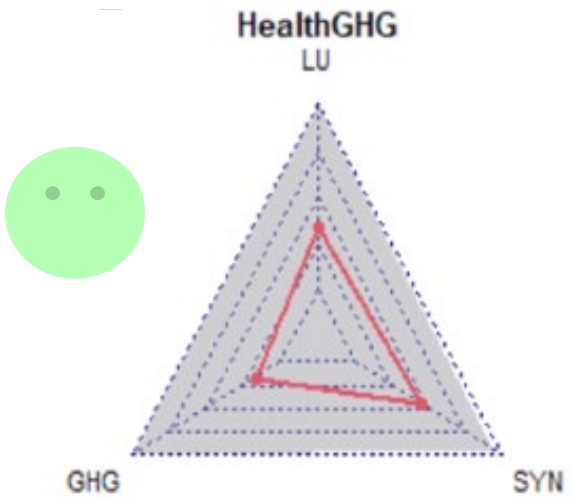
Circular Food Systems

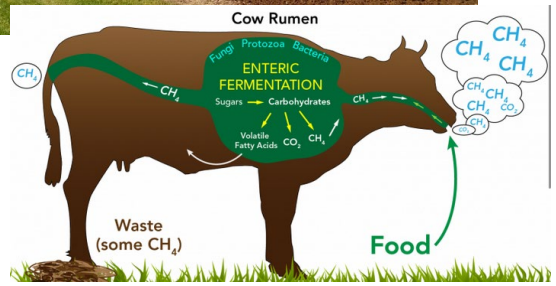
Preliminary results

Synergies and trade-offs between impacts





- **Synergies**: between minimizing land use, emissions, and total nitrogen
- **Trade-offs when minimizing synthetic fertilizers**



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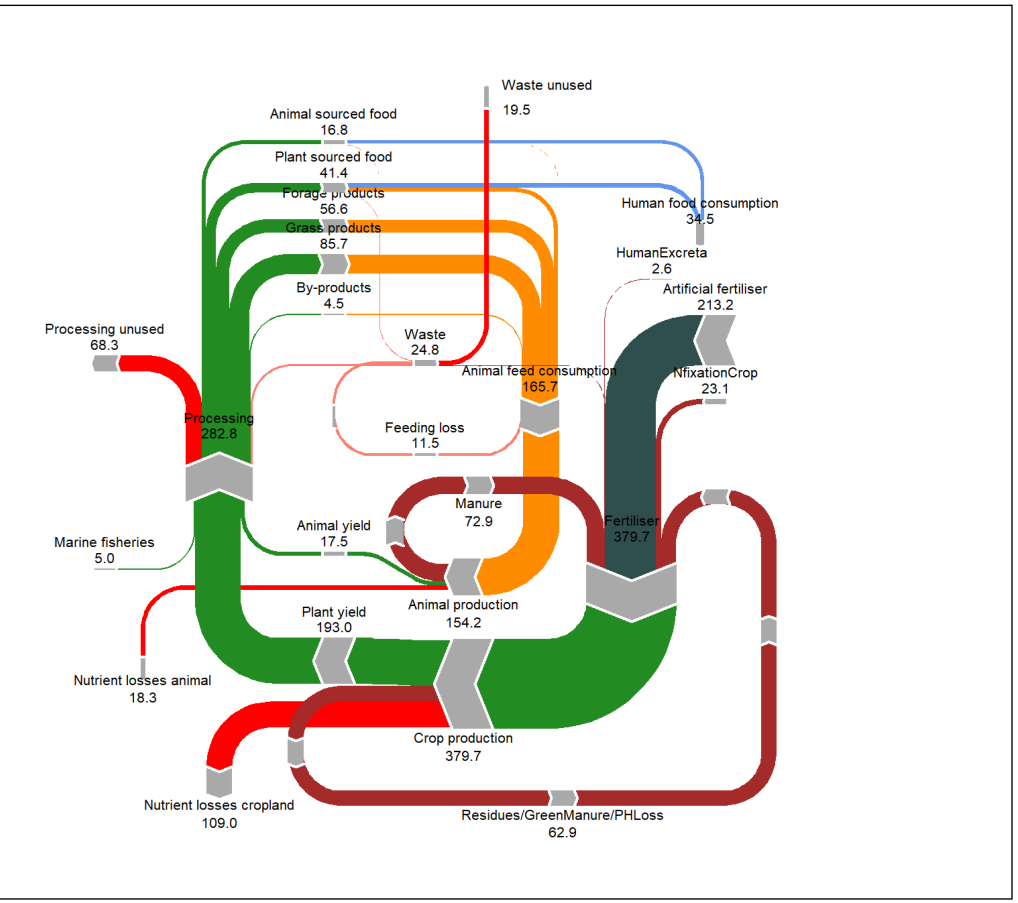
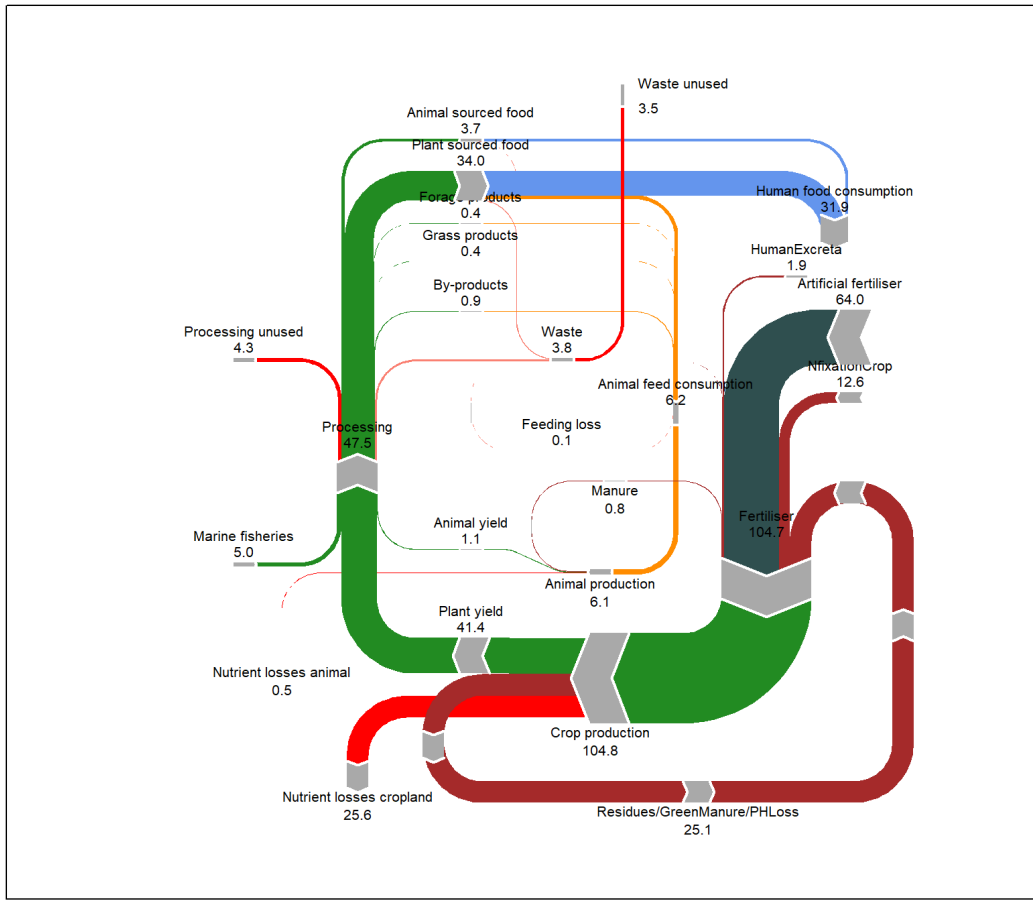
Overview: Nitrogen flows (preliminary)

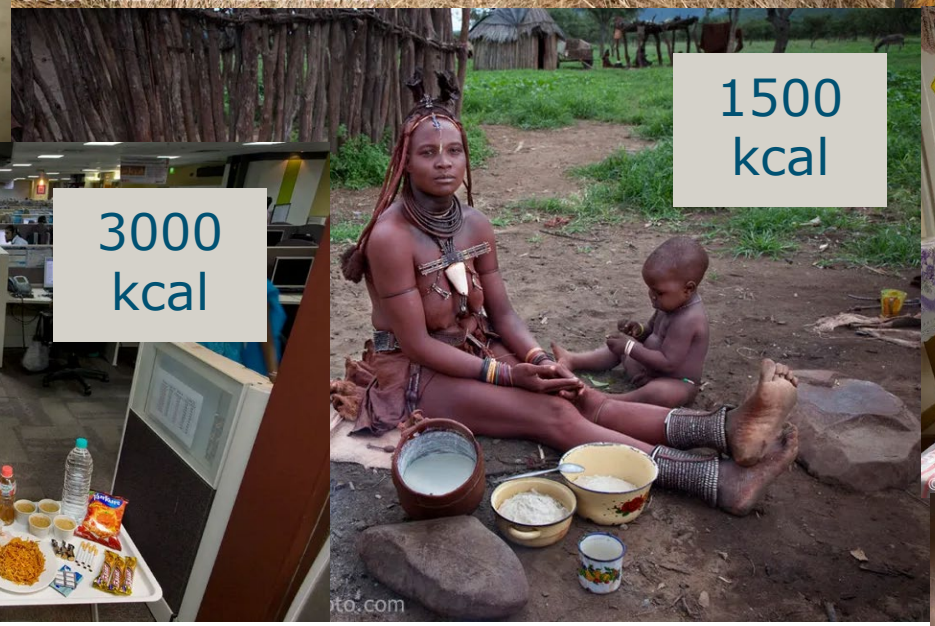


Circularity effect = optimizing resource allocation

Dietary shift: Plant sourced food

Food production change





Regional aspects of food system redesign is key


Thank you!

Synthesis of dietary changes to reduce impacts

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- **Reduction** of red meat, dairy, eggs, fish and chicken
- **Increase** of vegetables, nuts and seeds

Indicator	Current	Optimal land use	Optimal emission	Optimal fertilizer
Total protein	82g 76g	55g 55g	65g 63g	→ EU → Global
Animal sourced protein	49g 33g	33g 28g	33g 10g	→ EU → Global
Animal-to-plant protein	60:40 43:57	40:60 51:49	40:60 17:83	→ EU → Global

Nutrient inadequacy below 10-18 g animal proteins

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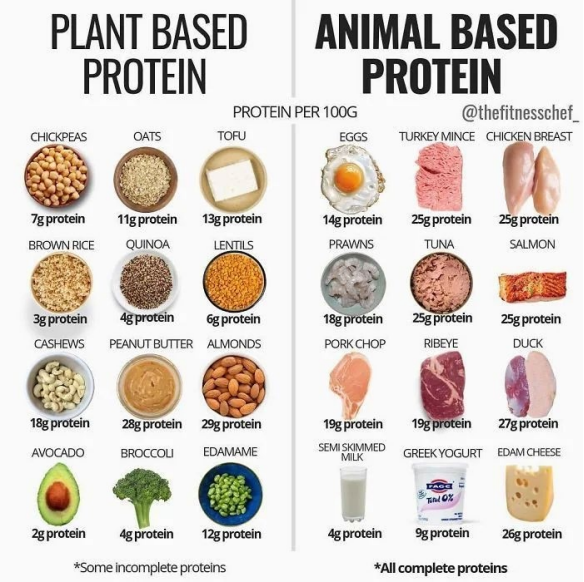
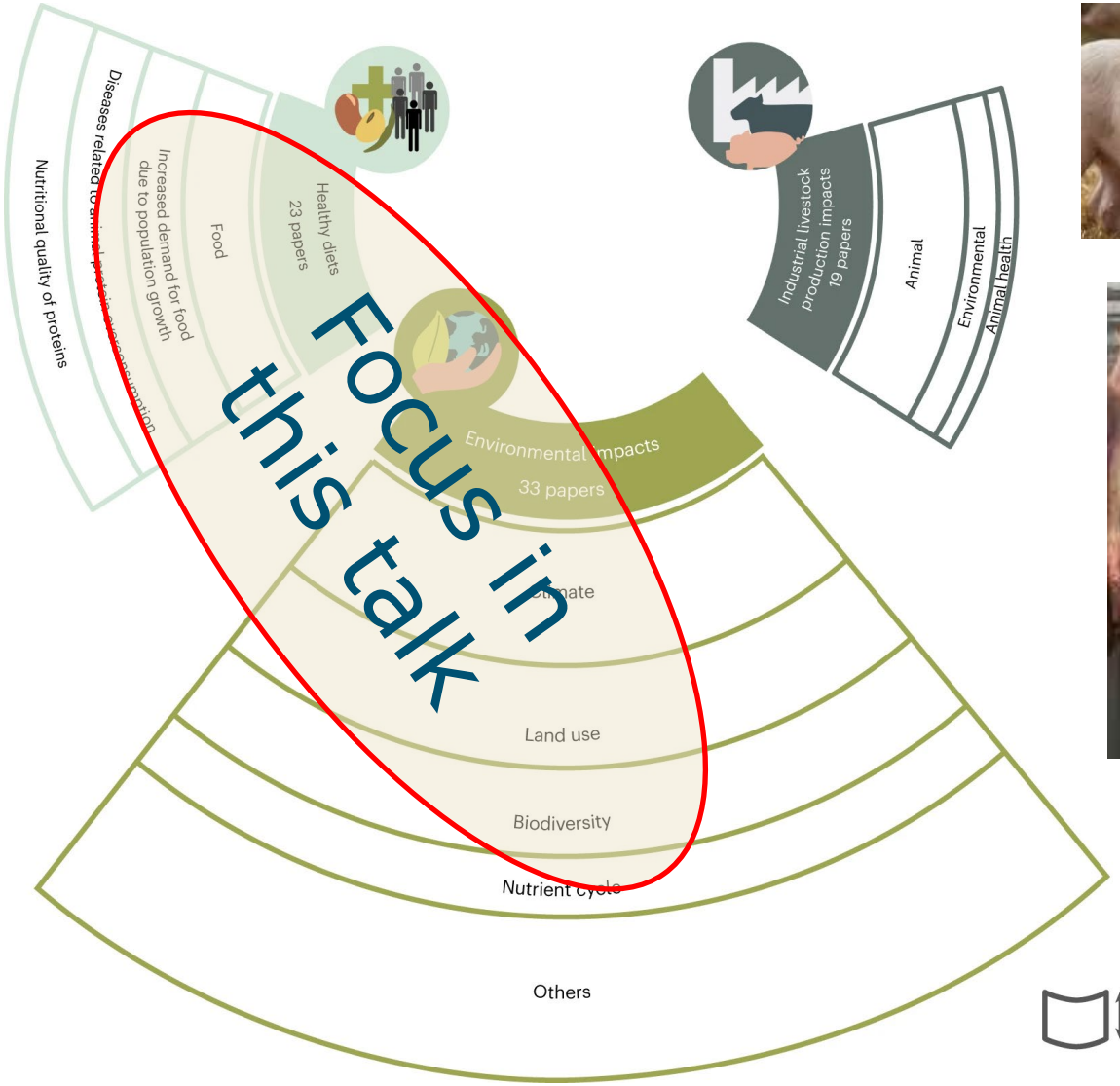
Why do we need a protein transition?



Animal products → beneficial and negative impacts on human health



(Duluins and Baret, 2024)