

DTU



START Annual Meeting, 20 March 2024

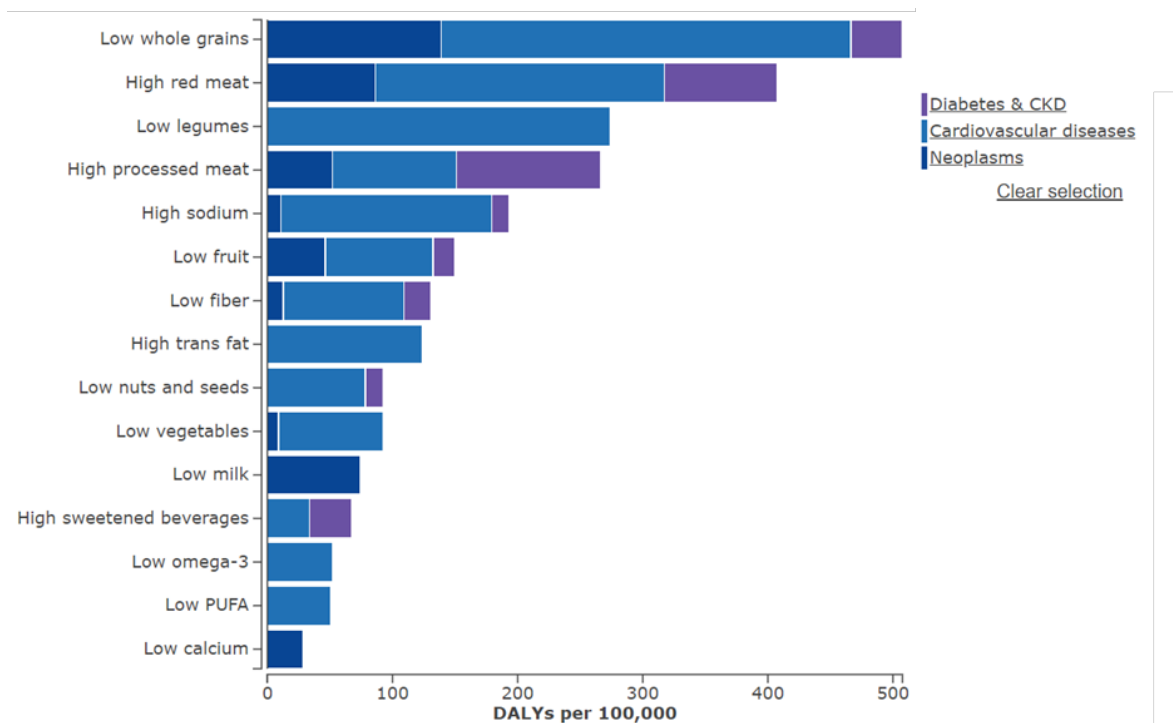
The overall impact of transitions towards plant-based diets

Sara M. Pires, smpi@food.dtu.dk

Transitions towards healthier and sustainable diets

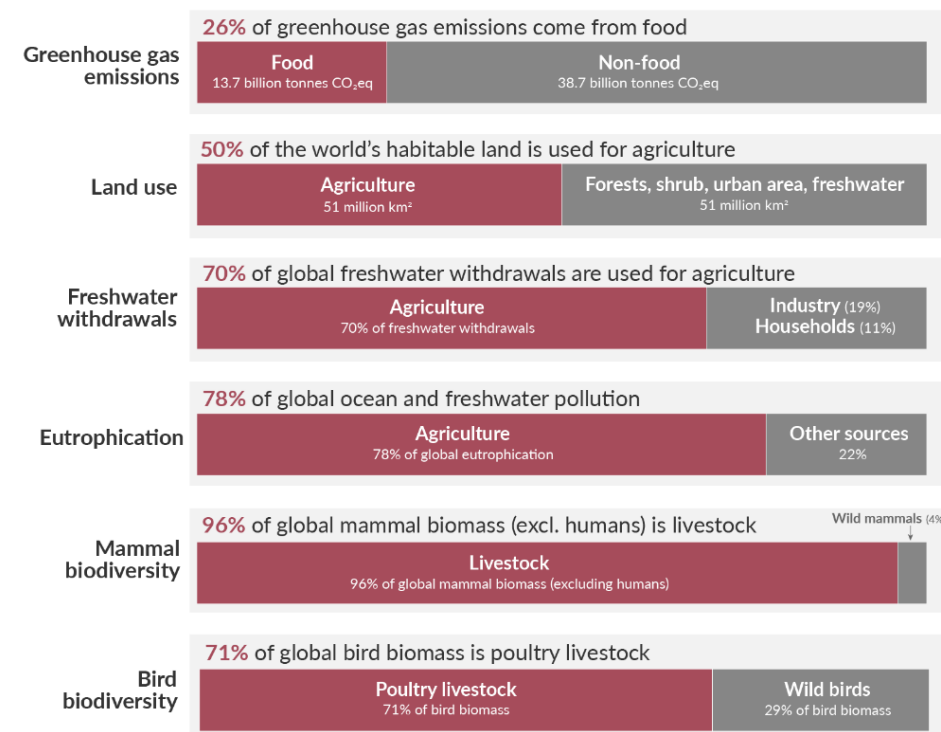
WHY?

Burden of disease of dietary risk factors in Denmark, 2019



Source: Global Burden of Disease Study, 2019

The environmental impacts of food and agriculture



Data sources: Poore & Nemecek (2018); UN FAO; UN AQUASTAT; Bar-On et al. (2018).
OurWorldinData.org – Research and data to make progress against the world's largest problems.

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Date published: November 2022

Source: Our World in Data

Transitions towards healthier and sustainable diets

WHY?



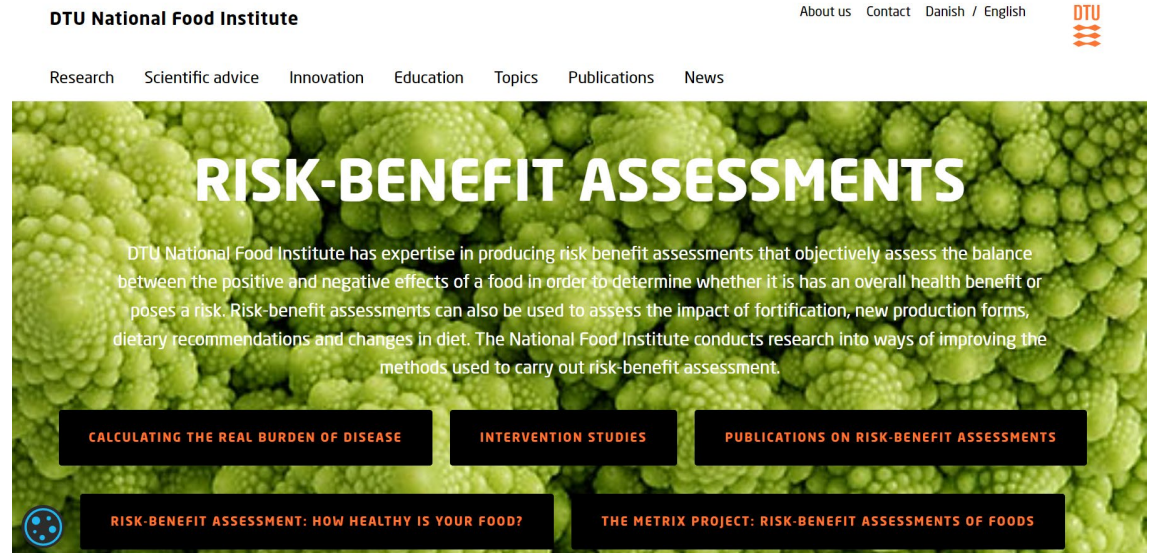
Transitions towards healthier and sustainable diets

The challenge?

Multiple **objectives**, different **metrics**, and different **points of view**

- The **health** impacts of dietary changes – **Risks** and **Benefits**
- The **environmental** impacts of transformations of food systems
- The **economic** impacts – positive and negative
- The **social** and **cultural** benefits and barriers

Measuring the overall **trade-offs**



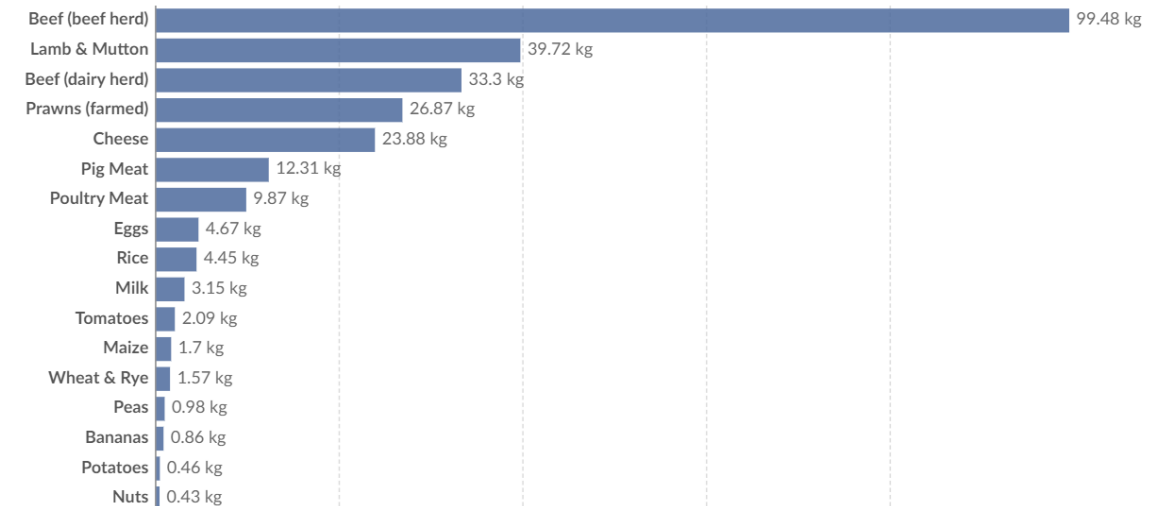
Integrated impact assessment of dietary transitions

*What is the integrated impact of replacing different amounts of **beef** consumption by equivalent amounts of **pulses** in Denmark?*

Greenhouse gas emissions per kilogram of food product

Emissions are measured in carbon dioxide-equivalents. This means non-CO₂ gases are weighted by the amount of warming they cause over a 100-year timescale.

Our World
in Data



ALTERNATIVA (“Alternative protein sources in the European diets – integrating health risk-benefit and sustainability)

Integrated impact assessment of dietary transitions

*What is the integrated impact of replacing different amounts of **beef** consumption by equivalent amounts of **pulses** in Denmark?*

Multi-criteria Decision Analysis (MCDA) approach

- Decision-support tool that tackles problems with a high degree of complexity
 - multiple, sometimes conflicting, objectives that are **valued differently** by different **stakeholders**
- Stakeholders appraise **alternatives** on **individual criteria** and combine this partial appraisal into one overall appraisal

ALTERNATIVA (“Alternative protein sources in the European diets – integrating health risk-benefit and sustainability)

Integrated impact assessment of dietary transitions

*What is the integrated impact of replacing different amounts of **beef** consumption by equivalent amounts of **pulses** in Denmark?*

The alternatives:

- Baseline: current consumption of red meat and pulses
- Alternative 1: **Replacing** of **25%** of **beef** by proportional amounts (gram to gram) of **pulses**
- Alternative 2: **Replacing** of **50%** of **beef** by proportional amounts of **pulses**
- Alternative 3: **Replacing** of **75%** of **beef** by proportional amounts of **pulses**
- Alternative 4: **Replacing** of **100 %** of **beef** by proportional amounts of **pulses**.

Integrated impact assessment of dietary transitions

*What is the integrated impact of replacing different amounts of **beef** consumption by equivalent amounts of **pulses** in Denmark?*

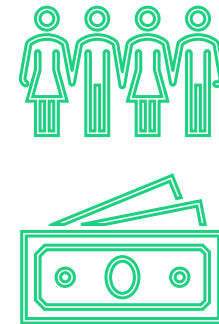
Health



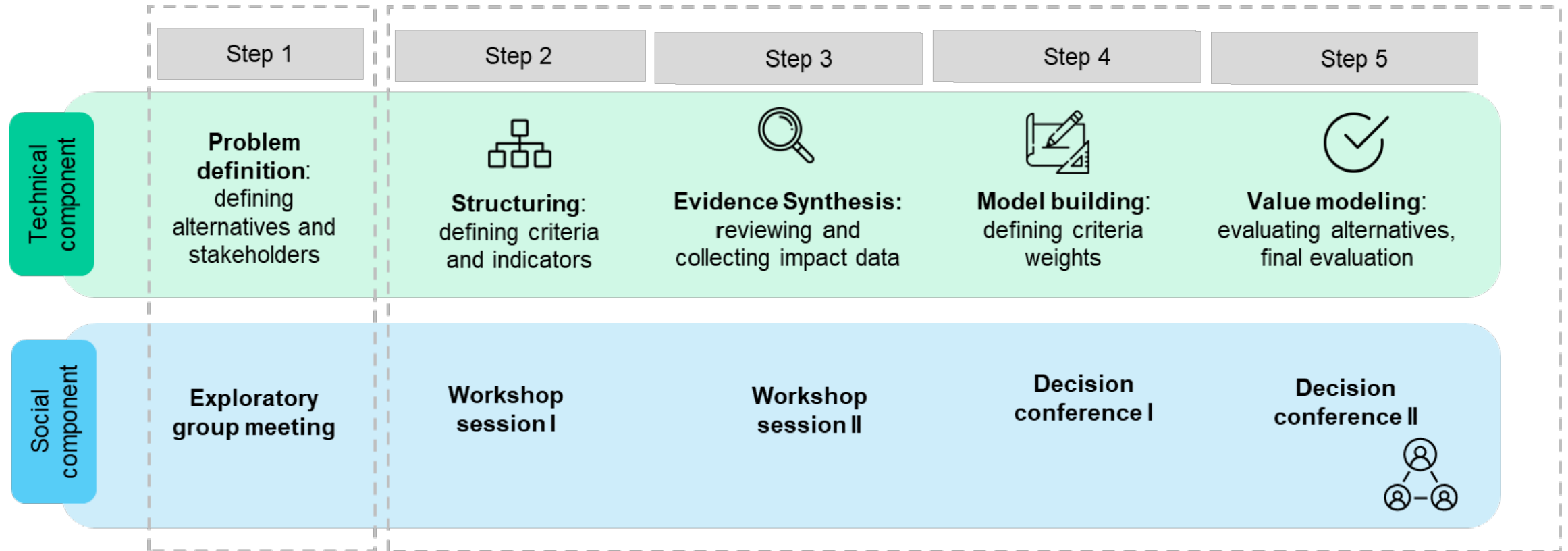
Environment



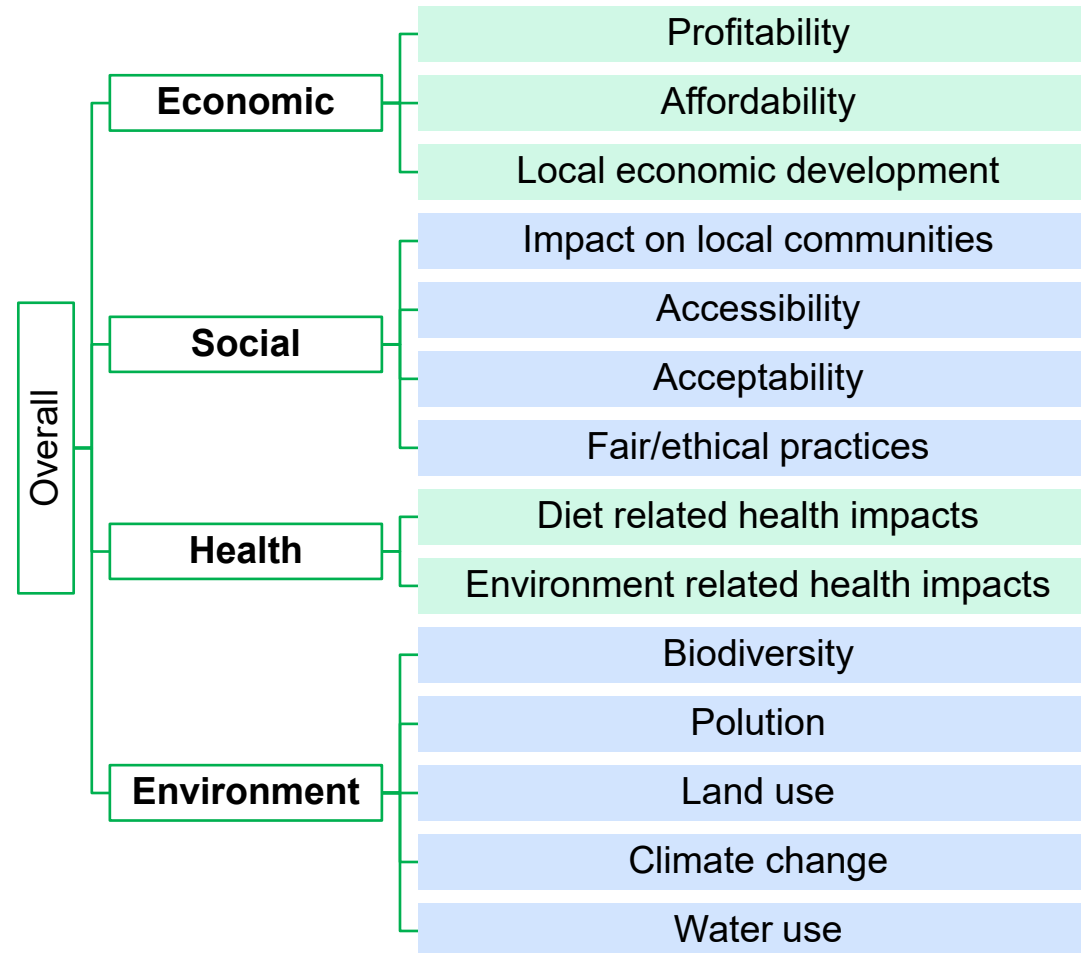
Socio-economic



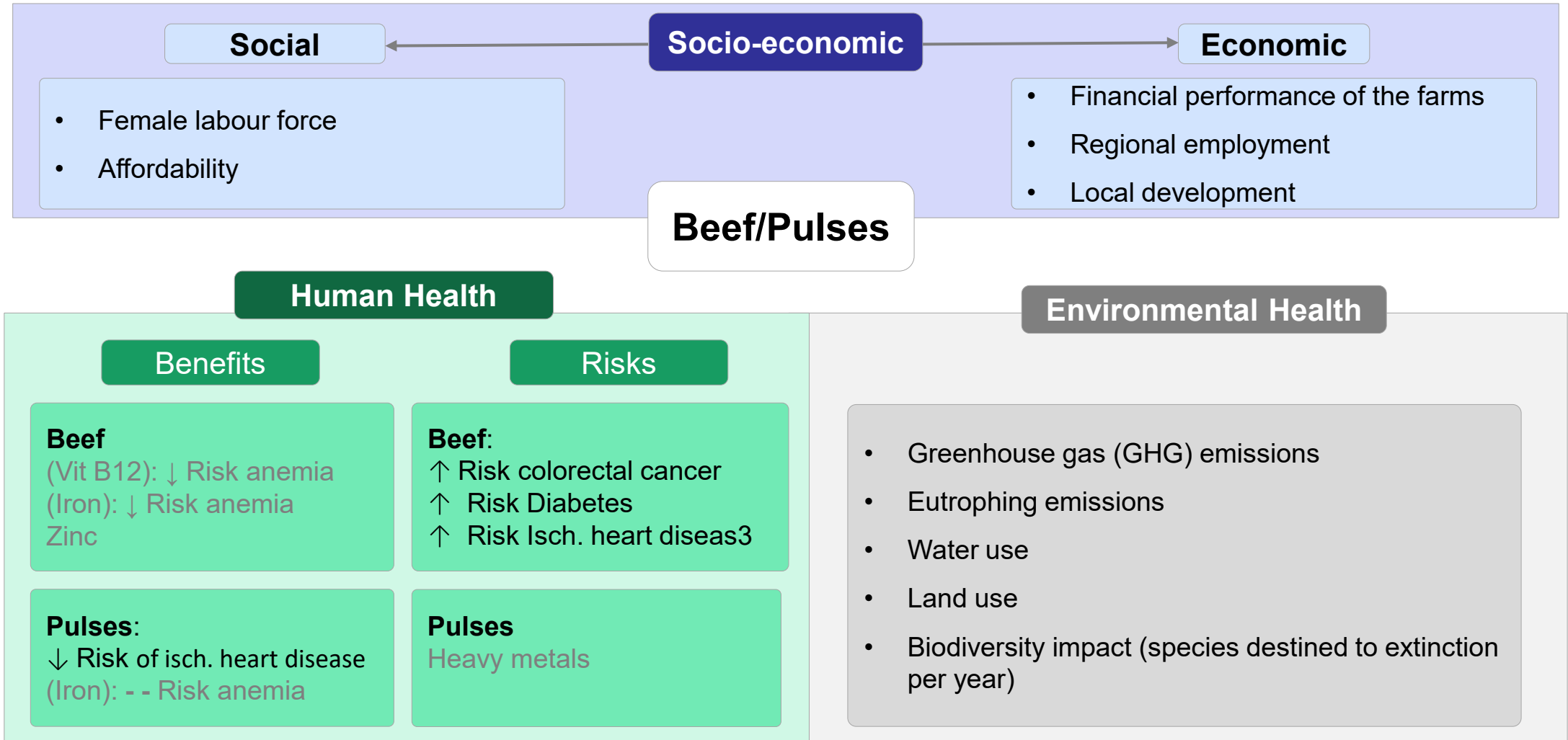
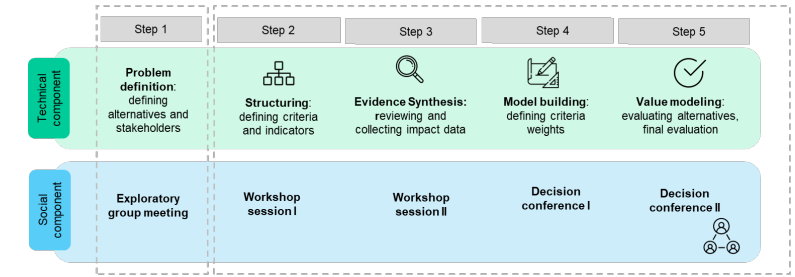
Multi-criteria process



Multi Criteria Selection

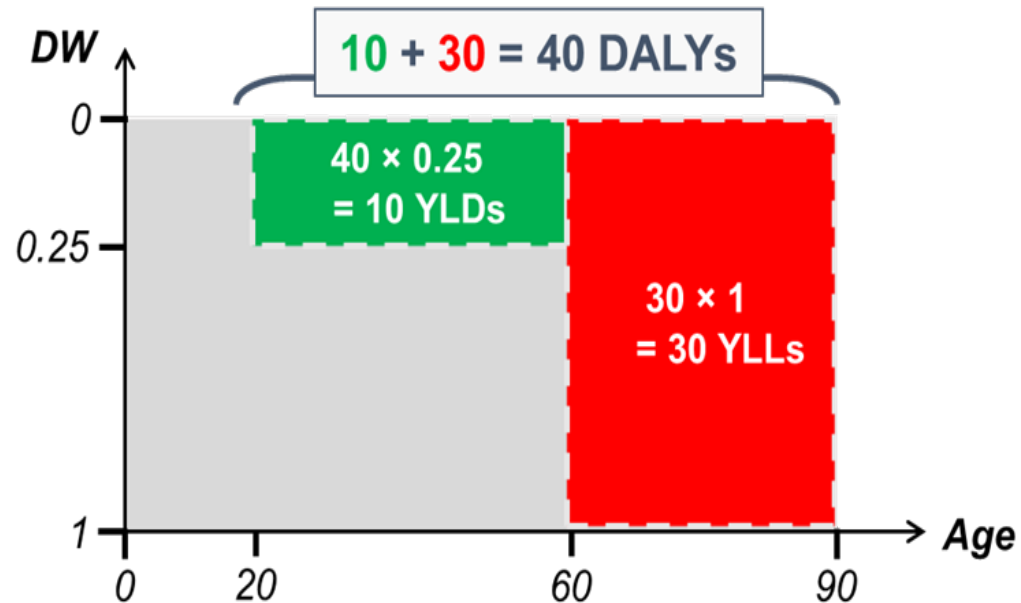


Evidence synthesis



Health impact of replacing beef with pulses

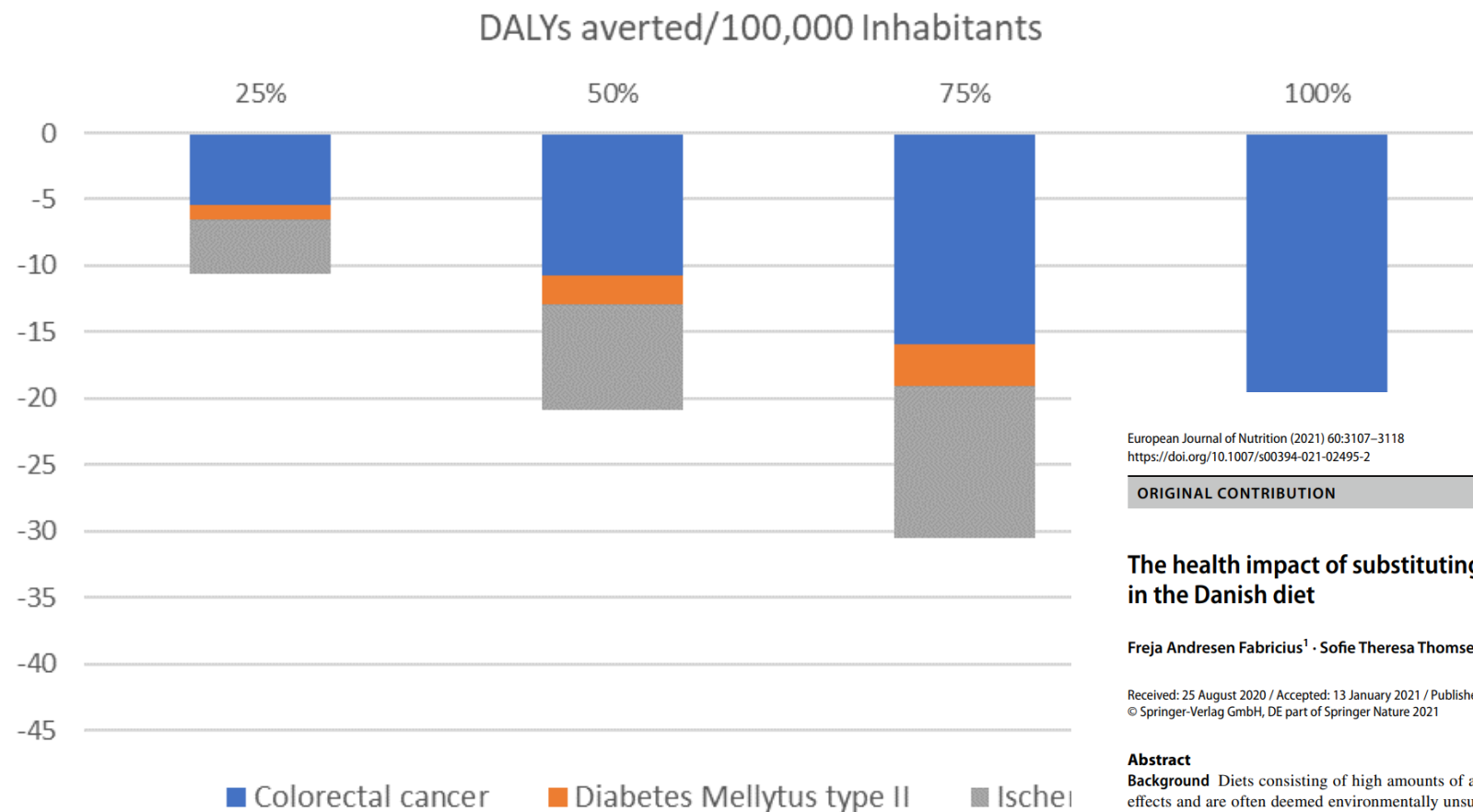
Disability Adjusted Life Years



$$\text{DALY} = \text{YLD} + \text{YLL}$$

- YLD = Years Lived with Disability
- YLL = Years of Life Lost

Health impact of replacing beef with pulses



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<https://doi.org/10.1007/s00394-021-02495-2>

ORIGINAL CONTRIBUTION



The health impact of substituting unprocessed red meat by pulses in the Danish diet

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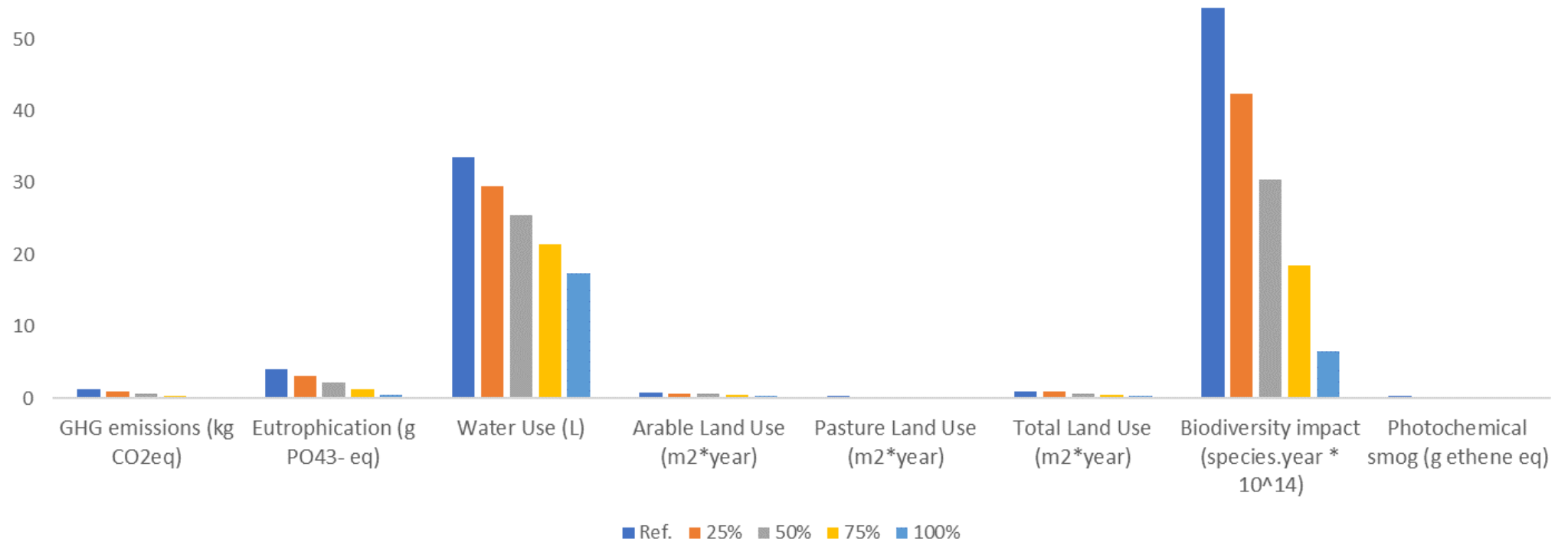
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Abstract

Background Diets consisting of high amounts of animal-based protein have been associated with adverse public health effects and are often deemed environmentally unsustainable. Therefore, replacing red meat by pulses has been proposed to reduce the adverse impact on human health and environment. However, unprocessed red meat is an important source of nutrients, such as vitamin B₁₂, iron, zinc and selenium, and the substitution may have negative impact on nutrient adequacy. **Method** Using a risk–benefit assessment (RBA) approach, we, therefore, estimated the health impact of substituting unprocessed red meat by pulses on the burden of non-communicable diseases in Denmark, using Disability-Adjusted Life Years (DALY). Furthermore, we assessed the impact of the substitution on nutrient adequacy.

Environmental impact of replacing beef with pulses

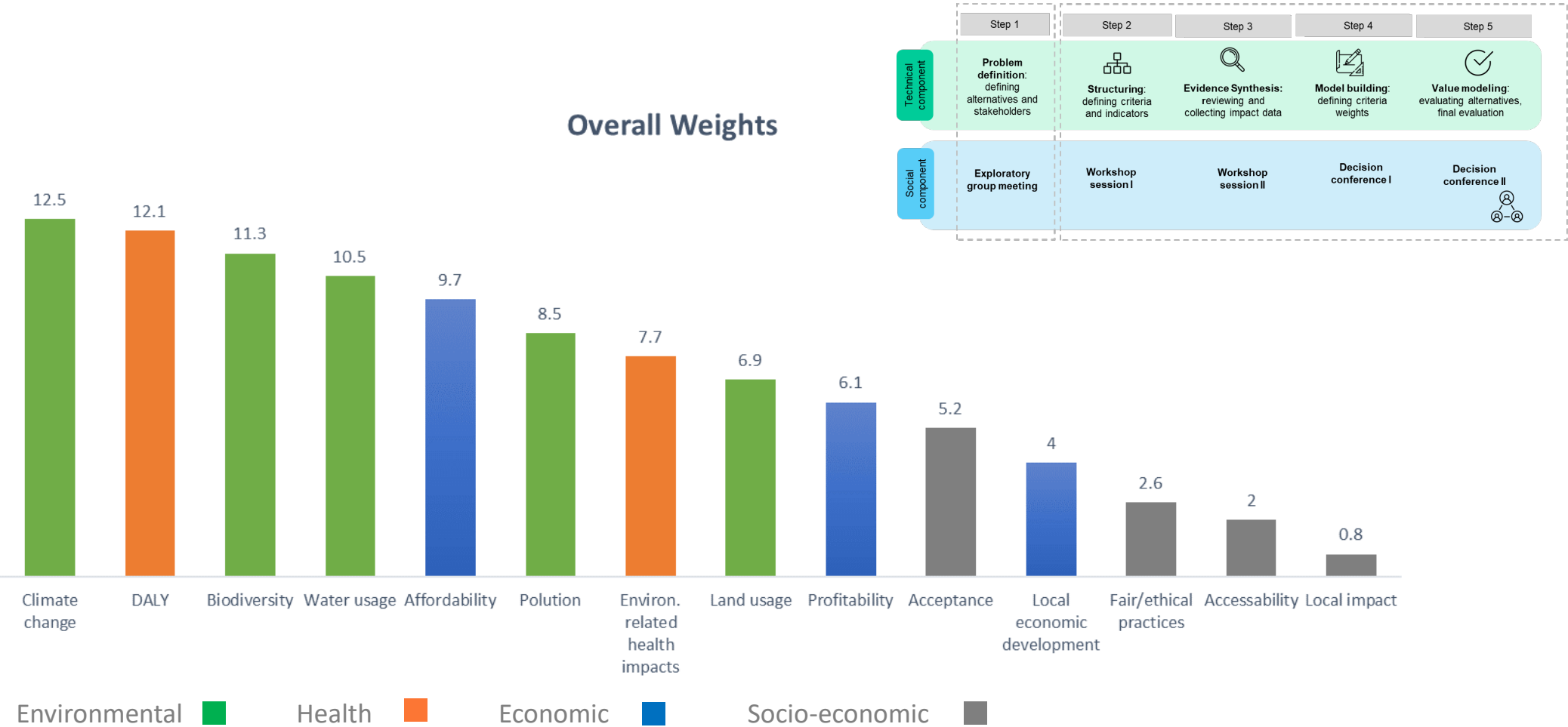
Environmental impacts associated to current and alternative consumption scenarios for beef and pulses in Denmark (DK)



Economic impact of replacing beef with pulses

“Collected evidence on most indicators of **competitiveness and profitability**, **resilience of the market** and **contribution to local sustainable development** demonstrated **negative** impacts of substitution of beef by pulses”

Integrated impacts of replacing beef with pulses



Integrated impacts of replacing beef with pulses

- Increasing substitution amounts – larger overall **positive impacts**
 - Health
 - Environment
 - Affordability
- **Negative impacts:** profit, acceptability

Alternatives Substitution	Overall	Profit	Affordability	Local economic development	Impact on local communities	Acceptability	Fair/ethical practices	DALY	Environ. related health impacts	Biodiversity	Climate change	Water usage	Land Usage	Pollution
0%	2.3	0	0	-66.7	0	100	0	0	10	-93.6	-111.1	64.8	133.3	25
25%	28.7	-19.8	160	-66.7	100	0	127.3	10.7	45	-54.5	-55.6	70.8	140	47.5
50%	43	-39.5	246.7	-66.7	100	-233	127.3	20.8	80	-9.5	0	76.8	153.3	70
75%	67.8	-60.8	323.3	-66.7	0	-233	127.3	30.5	115	24.4	66.7	82.9	166.7	92.5
100%	97.9	-83.8	396.7	-66.7	0	-233	127.3	39.7	145	61.3	122.2	88.9	173.3	125

What does this mean?

- **Positive impacts** of this dietary transition (replacing beef by pulses) outweighed negative ones
 - Health and environmental impacts – positive
 - Economic impacts – negative
- Possible to measure the **trade-offs** of this and other solutions
- Integrated evidence for **policies** that account for multiple interests

Take-home messages

Assessed the integrated health, environmental and socio-economic impacts of dietary transitions with a **comprehensive and interdisciplinary approach**

Socio-technical approach useful to integrate different **metrics and interests**

- Stakeholders, experts

Assessing policies and consumer trends/demand

- Useful tool for decision making by regulatory authorities that takes into **consideration multiple risks, benefits, and associated trade-offs**

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