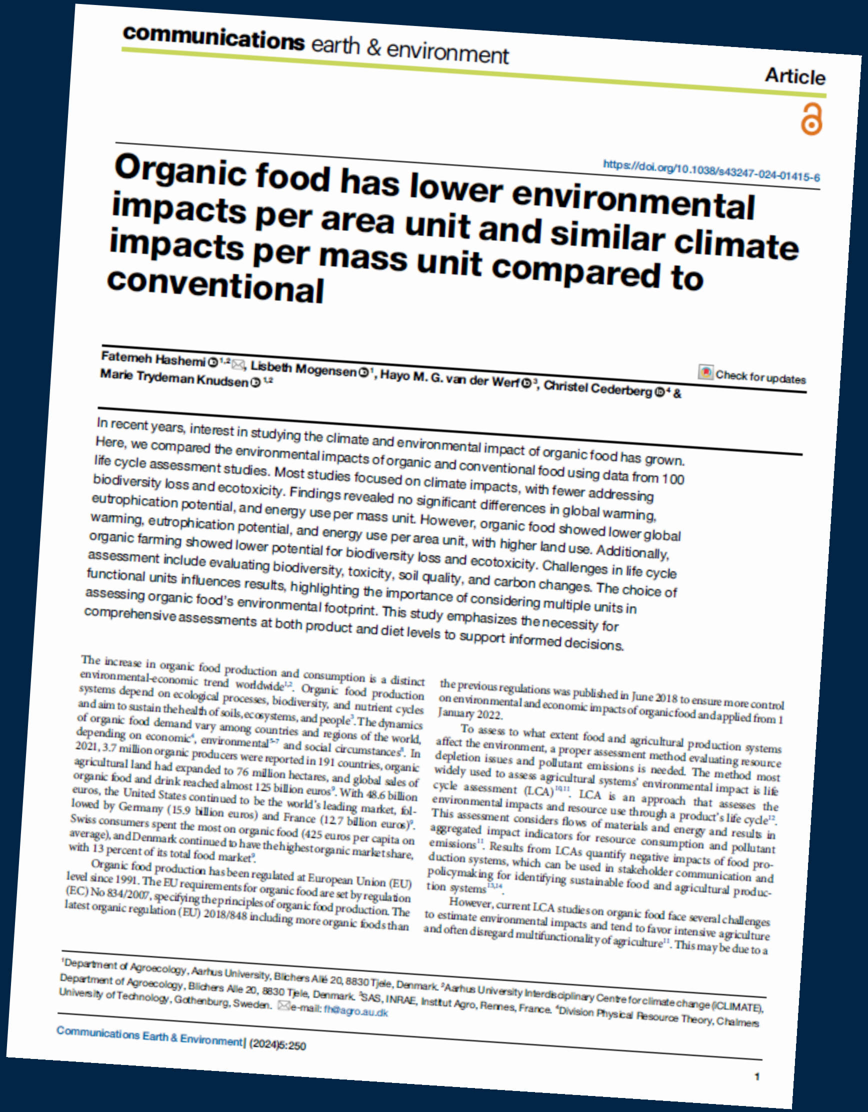
IF ORGANIC FARMING DISAPPEARED TOMORROW, WHAT WOULD WE LOSE IN THE FIGHT AGAINST CLIMATE CHANGE?

MARIE TRYDEMAN KNUDSEN
PROFESSOR, SEKTIONSLEDER



communications earth & environment

Article

https://doi.org/10.1038/s43247-024-01415-6

Organic food has lower environmental impacts per area unit and similar climate impacts per mass unit compared to conventional

Fatemeh Hashemi[1,2], Lisbeth Mogensen[1], Hayo M. G. van der Werf[3], Christel Cederberg[4] & Marie Trydeman Knudsen[1,2]

Check for updates

In recent years, interest in studying the climate and environmental impact of organic food has grown. Here, we compared the environmental impacts of organic and conventional food using data from 100 life cycle assessment studies. Most studies focused on climate impacts, with fewer addressing biodiversity loss and ecotoxicity. Findings revealed no significant differences in global warming, eutrophication potential, and energy use per mass unit. However, organic food showed lower global warming, eutrophication potential, and energy use per area unit, with higher land use. Additionally, organic farming showed lower potential for biodiversity loss and ecotoxicity. Challenges in life cycle assessment include evaluating biodiversity, toxicity, soil quality, and carbon changes. The choice of functional units influences results, highlighting the importance of considering multiple units in assessing organic food's environmental footprint. This study emphasizes the necessity for comprehensive assessments at both product and diet levels to support informed decisions.

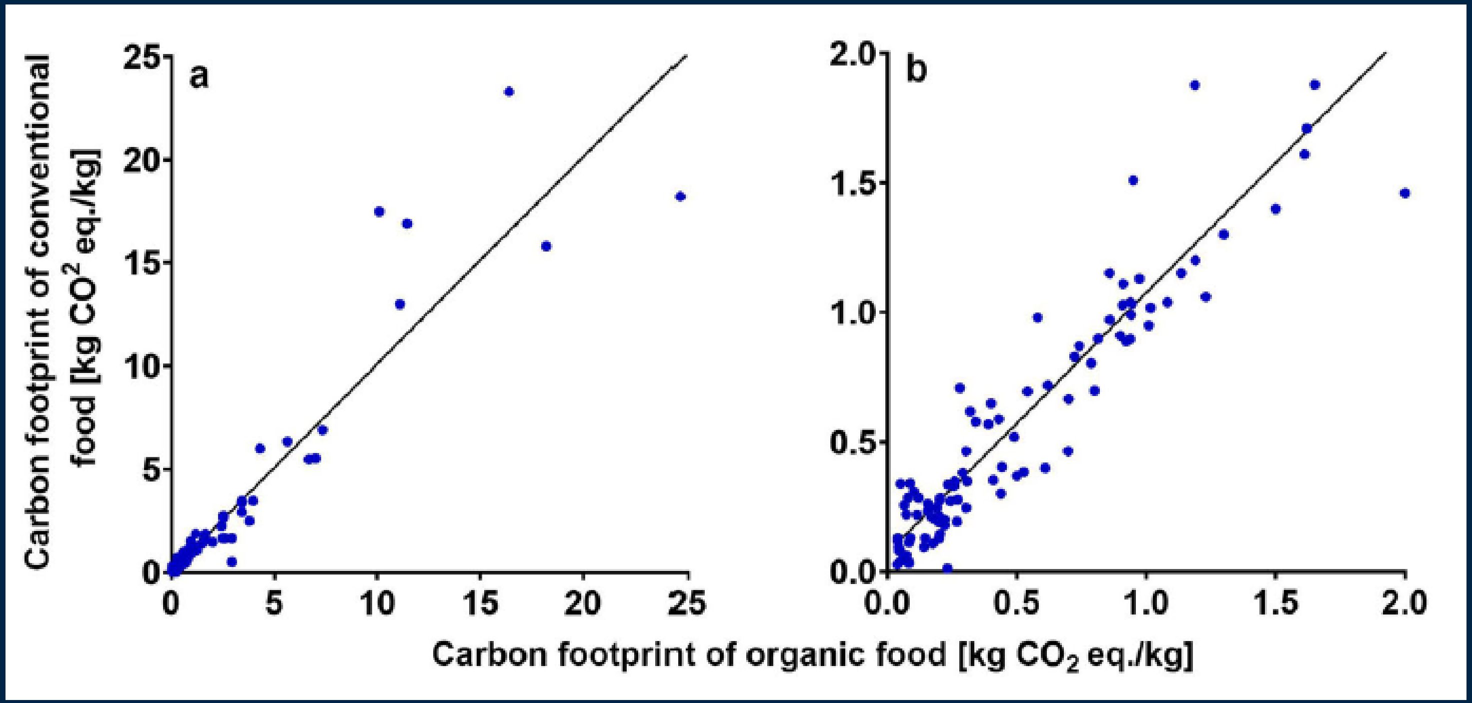
The increase in organic food production and consumption is a distinct environmental-economic trend worldwide[1,2]. Organic food production systems depend on ecological processes, biodiversity, and nutrient cycles and aim to sustain the health of soils, ecosystems, and people[3]. The dynamics of organic food demand vary among countries and regions of the world, depending on economic[4], environmental[5-7] and social circumstances[8]. In 2021, 3.7 million organic producers were reported in 191 countries, organic agricultural land had expanded to 76 million hectares, and global sales of organic food and drink reached almost 125 billion euros[9]. With 48.6 billion euros, the United States continued to be the world's leading market, followed by Germany (15.9 billion euros) and France (12.7 billion euros)[9]. Swiss consumers spent the most on organic food (425 euros per capita on average), and Denmark continued to have the highest organic market share, with 13 percent of its total food market[9].

Organic food production has been regulated at European Union (EU) level since 1991. The EU requirements for organic food are set by regulation (EC) No 834/2007, specifying the principles of organic food production. The latest organic regulation (EU) 2018/848 including more organic foods than the previous regulations was published in June 2018 to ensure more control on environmental and economic impacts of organic food and applied from 1 January 2022.

To assess to what extent food and agricultural production systems affect the environment, a proper assessment method evaluating resource depletion issues and pollutant emissions is needed. The method most widely used to assess agricultural systems' environmental impact is life cycle assessment (LCA)[10,11]. LCA is an approach that assesses the environmental impacts and resource use through a product's life cycle[12]. This assessment considers flows of materials and energy and results in aggregated impact indicators for resource consumption and pollutant emissions[11]. Results from LCAs quantify negative impacts of food production systems, which can be used in stakeholder communication and policymaking for identifying sustainable food and agricultural production systems[13,14].

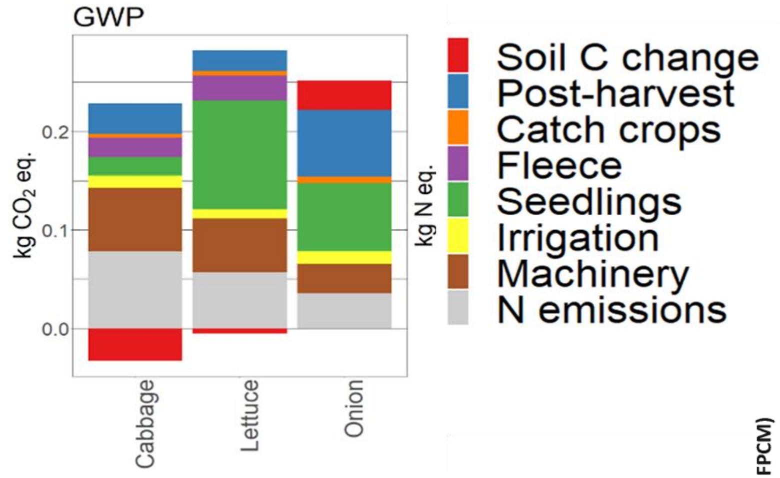
However, current LCA studies on organic food face several challenges to estimate environmental impacts and tend to favor intensive agriculture and often disregard multifunctionality of agriculture[11]. This may be due to a

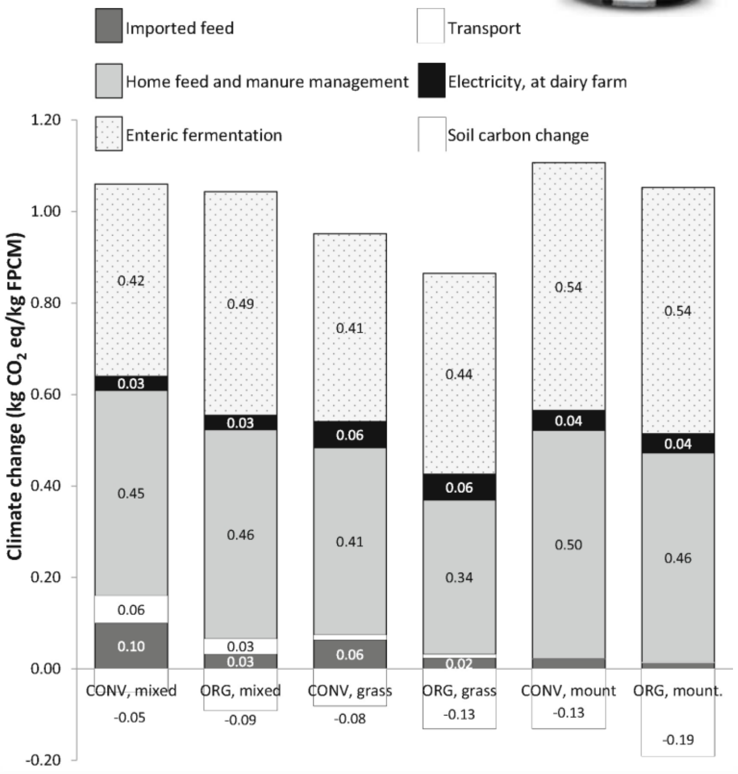
[1]Department of Agroecology, Aarhus University, Blichers Allé 20, 8830 Tjele, Denmark. [2]Aarhus University Interdisciplinary Centre for climate change (iCLIMATE), Department of Agroecology, Blichers Alle 20, 8830 Tjele, Denmark. [3]SAS, INRAE, Institut Agro, Rennes, France. [4]Division Physical Resource Theory, Chalmers University of Technology, Gothenburg, Sweden. e-mail: fh@agro.au.dk



Hashemi et al. (2024)

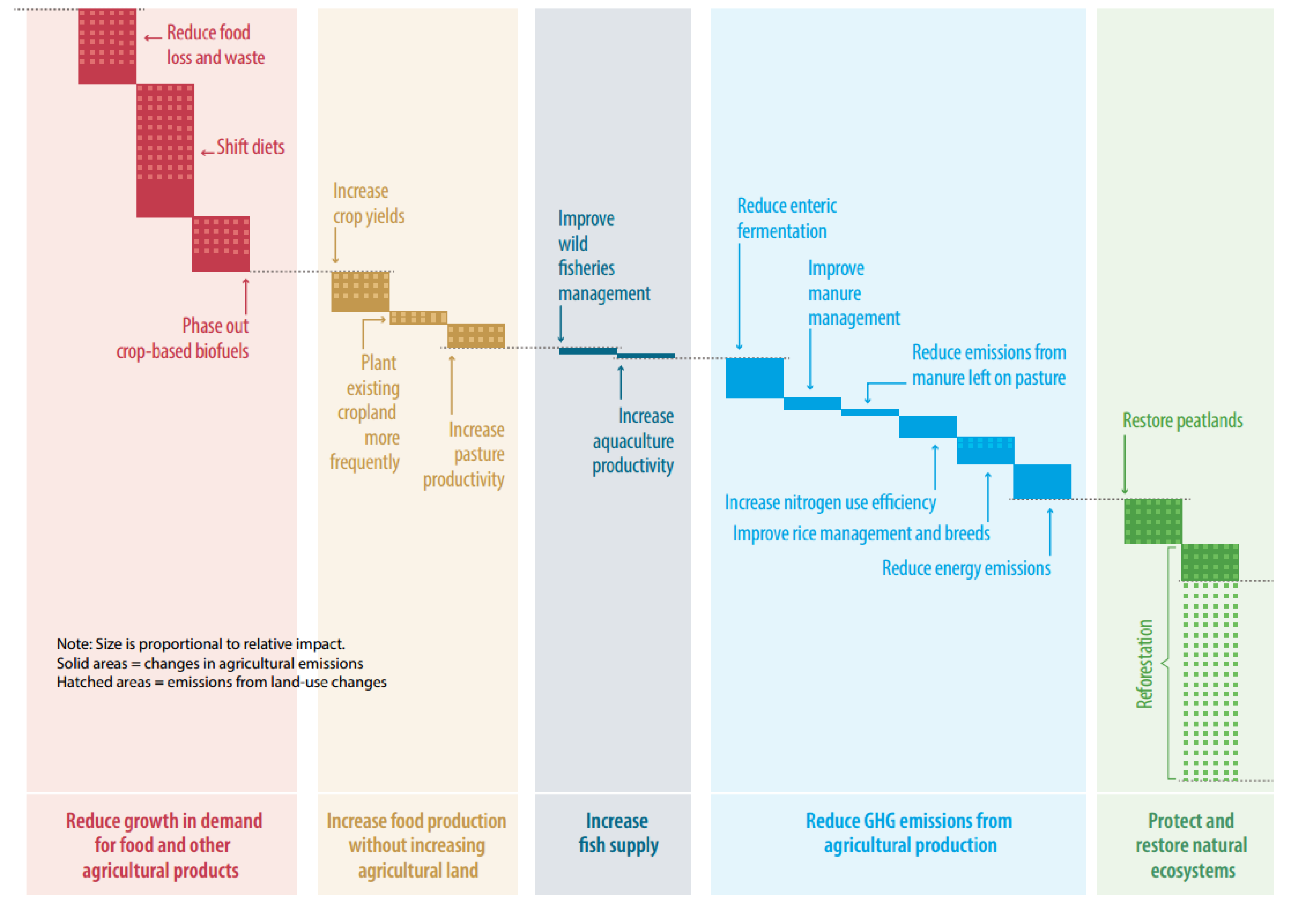
CLIMATE IMPACT (GHG EMISSIONS)





Jensen et al. (2024), Knudsen at el. (2019)

BEYOND PRODUCTION…



- Reduce food loss and waste
- Shift diets

(Baudry et al. 2017)

UN (2019)

CLIMATE RESILIENCE

van der Werf at el. (2019)


nature sustainability
PERSPECTIVE
https://doi.org/10.1038/s41893-020-0489-6

Check for updates

Towards better representation of organic agriculture in life cycle assessment

Hayo M. G. van der Werf[1], Marie Trydeman Knudsen[2] and Christel Cederberg[3]

WHAT INNOVATIONS OR POLICIES COULD ALLOW ORGANIC FARMING TO DELIVER EVEN MORE CLIMATE BENEFITS?

TWO MAIN CHALLENGES

No fossil pump ➡

Efficient use of resources (circularity)

Biomass for food, materials and energy + negative emissions and biodiversity

➡ Pressure on land use

➡ Diet change

Weather extremes (and other shocks) ➡

Need resilient systems – provide stable yields

➡ Build resilience in soils and microclimate (trees)

➡ Robust and diverse crop rotations (N_2 fixation)

MARIE TRYDEMAN KNUDSEN
PROFESSOR, SEKTIONSLEDER