LIVSCYKLUSVURDERINGER OG KLIMAEFFEKTIVITET I LANDBRUGSSEKTOREN

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- Agronom og ph.d. i livscyklusvurderinger af fødevarer
- Klima- og miljømæssig bæredygtighed af fødevarer og landbrugssystemer, hvor jeg primært bruger livscyklusvurderinger (LCA).

VORES LCA OG SYSTEMANALYSE TEAM










PROJEKTER I VORES LCA TEAM

SYSTEMANALYSE og LIVSCYKLUSVURDERING (LCA) af:

- Klimavenlig, sund og bæredygtig kost (SustainOrganic, Kostrådsprojekt)
- Grøntsagsproduktion (ClimateVeg)
- Husdyrsproduktionssystemer (PATHWAYS, Pork 4.0, EFFORT, GroBeat, Kalv ved Ko)
- Cellulært kød og mælk (CleanPro)
- Skovlandbrug og integrerede landbrugssystemer (MIXED, OUTFIT)
- Bioraffinering og grønt protein (GreenEggs, GreenVALLeys, GrassTools)
- Alternative økologiske gødninger (ClimOptic)
- Tørvejorde og alternative vækstmedier (Peatwise, BioSubstrate)
- Alternativ emballage (SinProPack)
- Cirkulært landbrug og klimaregnskaber på bedriftsniveau (CIRKULÆR)
- Metodemæssig udvikling omkring f.eks. kulstoflagring og biodiversitet (MIXED etc.)

LINK TIL PROJEKTER

- SustainOrganic (Climate friendly and SUSTAINable ORGANIC food and diets) (Project leader) (https://icrofs.dk/en/research/danish-research/organic-rdd-4/sustainorganic/)
- ClimateVeg (Improving CLIMATE and environ. profile of Danish organic VEGetables) (WP leader) (https://icrofs.dk/en/research/danish-research/organic-rdd-4/climateveg/)
- ClimOptic (Climate optimized fertilization in organic cropping systems) (WP leader) (https://icrofs.dk/en/research/danish-research/organic-rdd-4/climateveg/)
- BioSubstrate (Biobased growth substrates for plant production) (WP leader) (https://www.teknologisk.dk/udvikling-af-biobaserede-vaekstsubstrater/42317)
- MIXED (Multi-actor and transdisciplinary development of efficient and resilient MIXED farming and agroforestry systems) (EU, WP leader) (https://projects.au.dk/mixed/)
- OUTFIT (Pig production in agroforestry systems) (WP leader) (https://icrofs.dk/forskning/dansk-forskning/organic-rdd-6/outfit/)
- Green VALLeys (Green biorefining for sustainable production of bioenergy from agriculture) (EU Interreg) (https://agrovast.se/eu-projekt/green-valleys/ and https://interreg-oks.eu/projektbank/projekt/greenvalleysgronabioraffinaderierforhallbarproduktionavbioenergifranjordbruket.5.6bfab613166f8796d0f80f16.html)
- GrassTools (Tools for improving grassland biomass production and delivering multiple ecosystem services) (new project launched today – no website yet! J)
- SinProPack (https://www.dti.dk/projects/project-grass-fiber-based-paper-for-sustainable-and-8220-to-go-and-8221-packaging-products/42898)
- CIRKULÆR (Systemanalysis of green biomass for food, feed and energy, Systemanalyse af grøn biomasse til fødevarer, foder og energi) (WP leader)
- KLIMAGRÆS (Soil carbon sequestration in grasslands)
- PATHWAYS (Pathways for transitions to sustainability in livestock husbandry and food systems, EU project) (https://cordis.europa.eu/project/id/101000395)

PROJEKTER I VORES LC

SYSTEMANALYSE og LIVSCYKLUSVURDERING

- Klimavenlig, sund og bæredygtig kost (Sus
- Grøntsagsproduktion (ClimateVeg)
- Husdyrproduktionssystemer (PATHWAYS, Pork ... EFFORT, Gr... ...ved Ko)
- Cellulært kød og mælk (CleanPro)
- Skovlandbrug og integrerede landbrugssystemer (MIXED, OUTFIT)
- Bioraffinering og grønt protein (GreenEggs, GreenVA
- Alternative økologiske gødninger (ClimOptic)
- Tørvejorde og alternative vækstmedier (...eatw
- Alternativ emballage (SinProPack)
- Cirkulært landbrug og klimaregnskaber på bed
- Metodemæssig udvikling omkring f.eks. kulstoflagring

Hvad er klima- og miljøpåvirkningen per ha og per kg produkt?

Hotspots og forbedringsmuligheder

Hvordan er det estimeret?

Hvad er de metodemæssige udfordringer?

Hvordan kan de løses?

MILJØPÅVIRKNING FRA FØDEVAREPRODUKTION

Klimapåvirkning

Næringsstofberigelse

Økotoxicitet

Jord og kulstoflagring

Biodiversitet

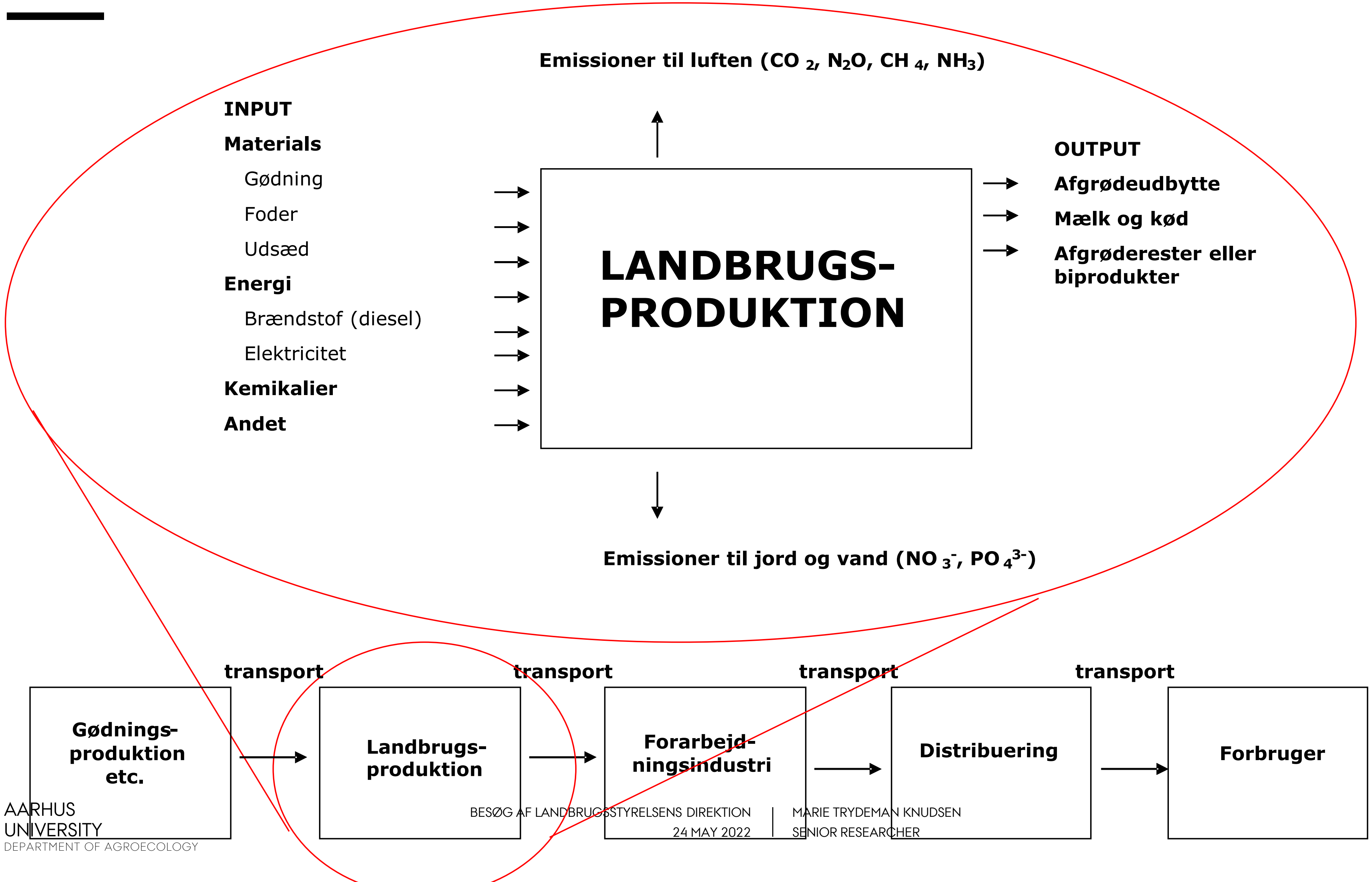
Dyrevelfærd

KLIMAPÅVIRKNING FRA FØDEVARER?

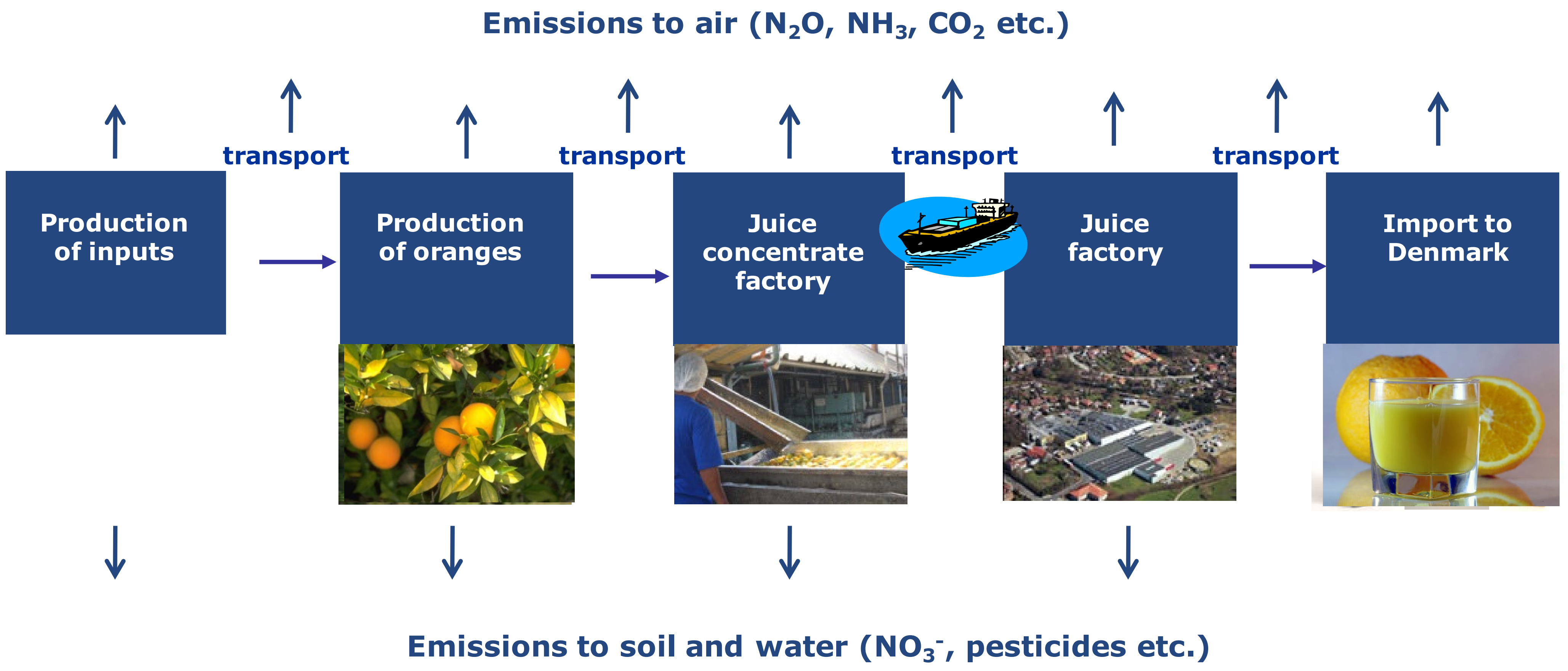
Klimapåvirkning

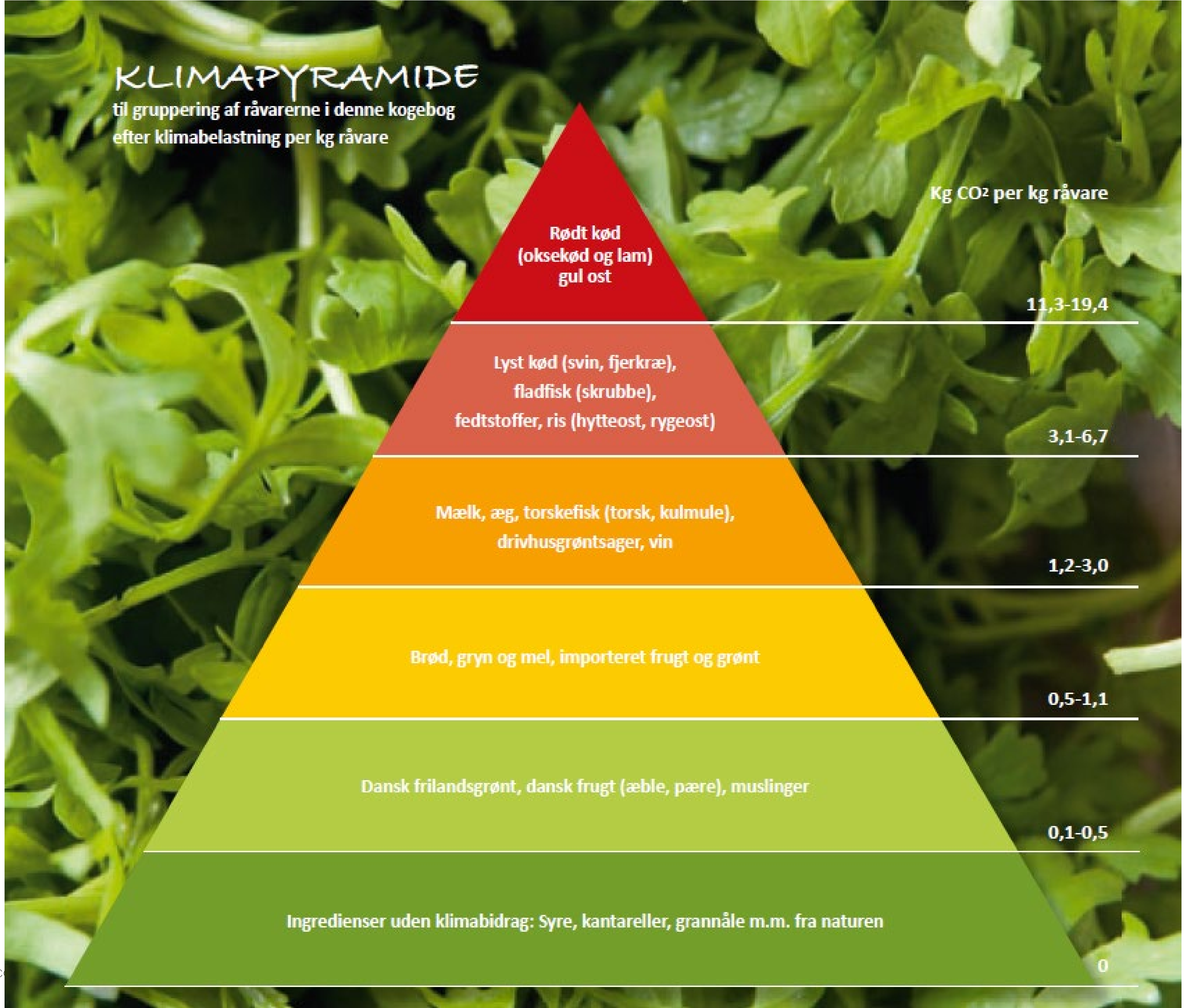
20-30% af vores totale klimaaftryk

LIVSCYKLUSVURDERING



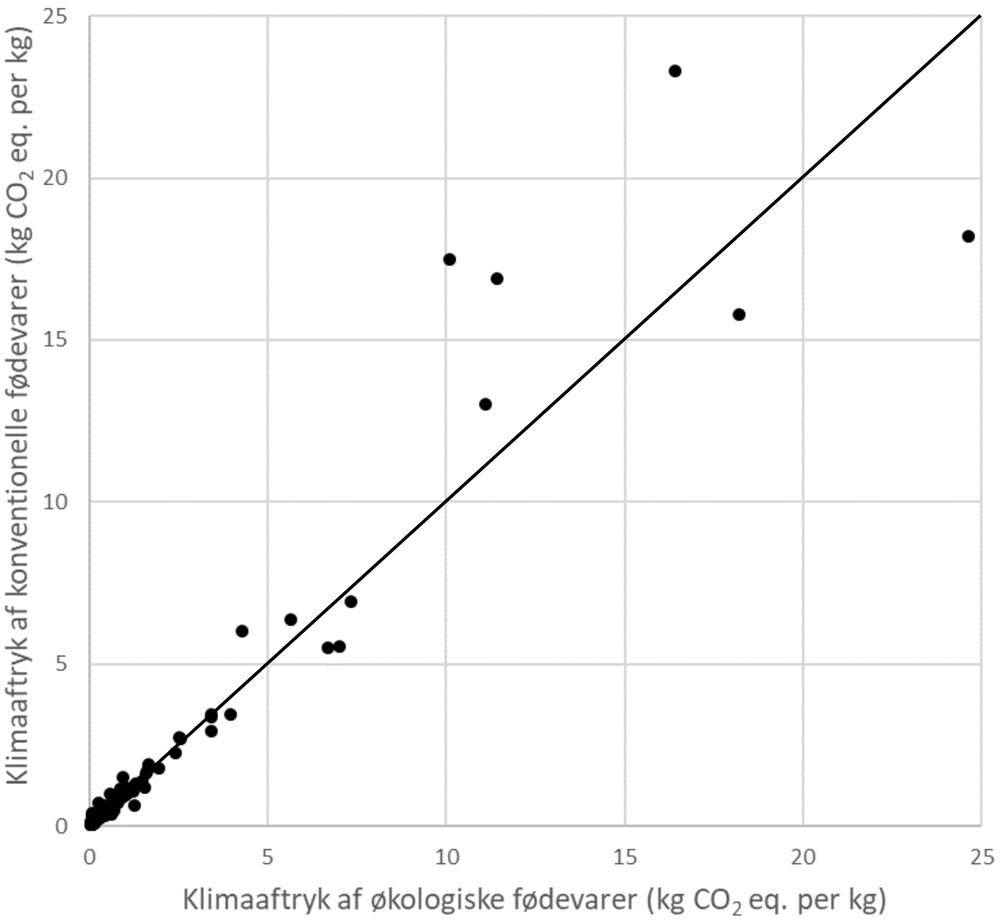
EKSEMPEL: LIVSCYKLUSVURDERING AF APPELSINJUICE



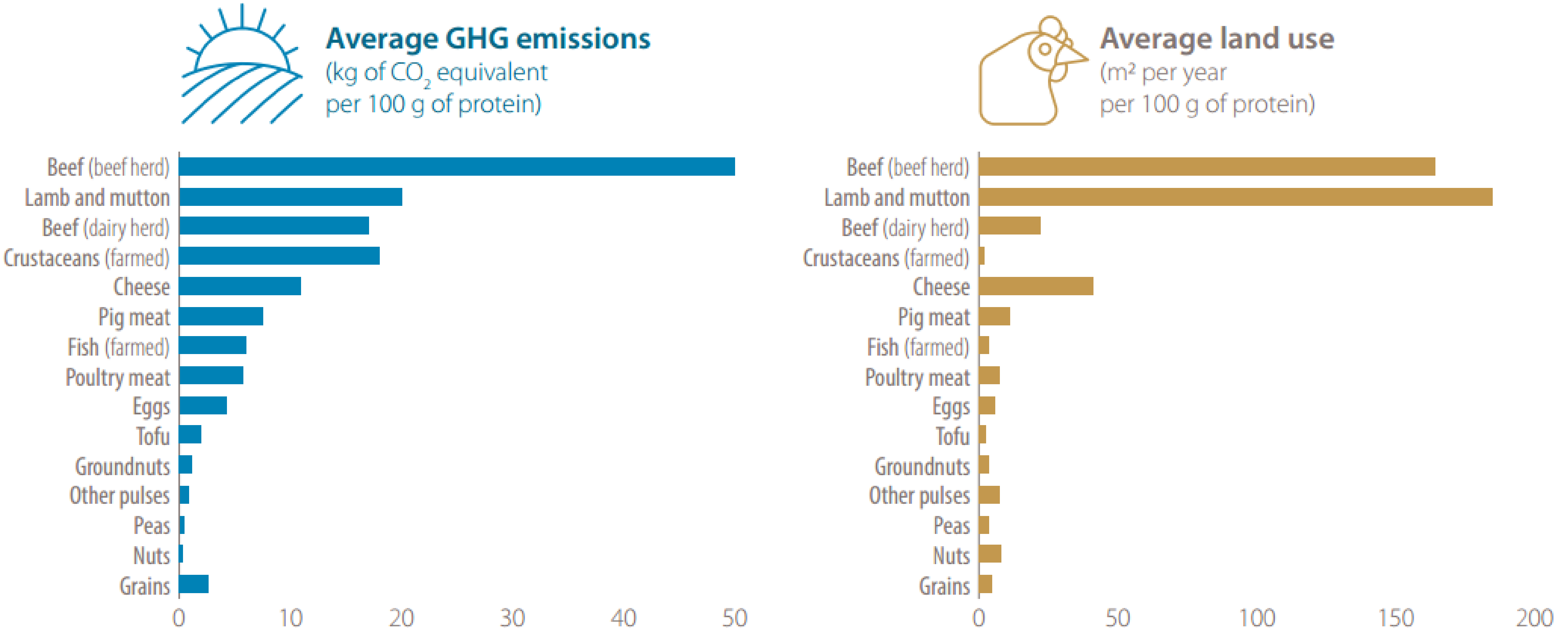

KLIMAPYRAMIDE
til gruppering af råvarerne i denne kogebog
efter klimabelastning per kg råvare
Kg CO_2 per kg råvare
Rødt kød
(oksekød og lam)
gul ost
11,3-19,4
Lyst kød (svin, fjerkræ),
fladfisk (skrubbe),
fedtstoffer, ris (hytteost, rygeost)
3,1-6,7
Mælk, æg, torskefisk (torsk, kulmule),
drivhusgrøntsager, vin
1,2-3,0
Brød, gryn og mel, importeret frugt og grønt
0,5-1,1
Dansk frilandsgrønt, dansk frugt (æble, pære), muslinger
0,1-0,5
Ingredienser uden klimabidrag: Syre, kantareller, grannåle m.m. fra naturen
0

KLIMAAFTRYK FRA FØDEVARER – PER KG
– BASERET PÅ REVIEW AF 50 VIDENSKABELIGE ARTIKLER

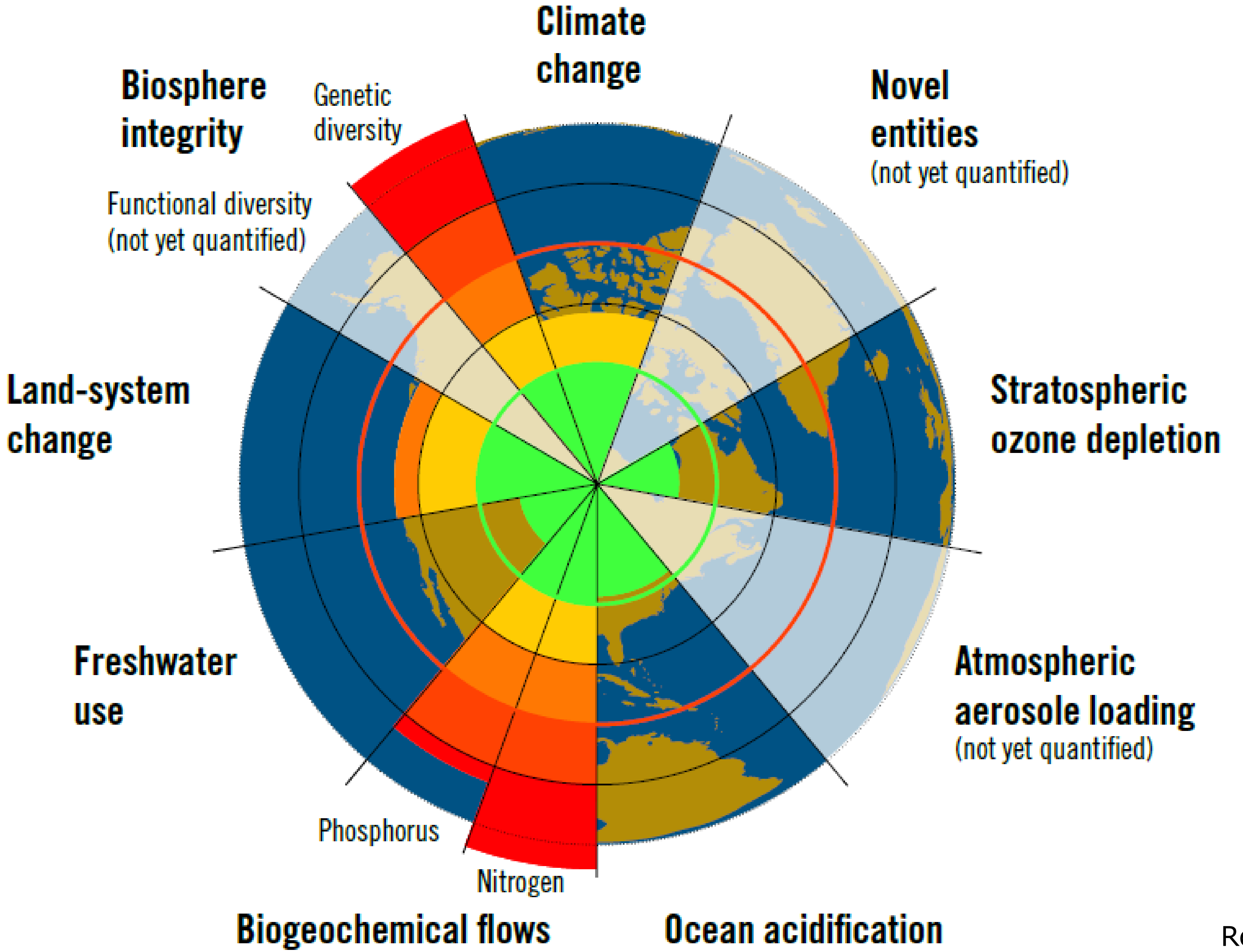
Klimaaftryk af økologiske og konventionelle fødevarer
(kg CO_2 eq. per kg)



KLIMAAFTRYK OG AREALFORBRUG FOR PROTEIN



UN (2019)



Rockström et al. (2015)


SUSTAINABLE DEVELOPMENT KNOWLEDGE PLATFORM
HOME
HIGH-LEVEL POLITICAL FORUM
STATES
SIDS
SDGS
TOPICS
UN SYSTEM
STAKEHOLDER ENGAGEMENT
PARTNERSHIPS
RESOURCES
ABOUT
SUSTAINABLE DEVELOPMENT GOALS
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS

MILJØPÅVIRKNING FRA FØDEVAREPRODUKTION

Klimapåvirkning

Næringsstofberigelse

Økotoxicitet

Jord og kulstoflagring

Biodiversitet

Dyrevelfærd

MILJØPÅVIRKNING FRA FØDEVAREPRODUKTION

Klimapåvirkning

Næringsstofberigelse

Økotoxicitet

Biodiversitet

Jord og kulstoflagring

Dyrevelfærd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Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro

An approach to include soil carbon changes in life cycle assessments

Bjørn Molt Petersen [a], Marie Trydeman Knudsen [b,*], John Erik Hermansen [a], Niels Halberg [c]

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Conventional
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Characterization factors for land use impacts on biodiversity in life cycle assessment based on direct m
European farmland in the 'Te

Marie Trydeman Knudsen [a,*], John E. H
Philippe Jeanneret [c], Jean-Pierre Sarth
Sebastian Wolfrum [i], Peter Dennis [j]

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HIGHLIGHTS

- New characterization factors (CF) for land use impacts on biodiversity in LCA
- Provides CFs for different land use types and management (organic or conventional)
- Shows significant differences in CFs between organic and conventional fields
- Compares the new characterization factors with other studies
- Useful for assessing land use impacts on biodiversity in agricultural LCA studies

GRA

CF for potential plant species loss

Journal of Cleaner Production 209 (2019) 1332–1341

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Journal of Cleaner Product

journal homepage: www.elsevier.com/loc

Freshwater ecotoxicity assessment of pesticide use in crop production:
Testing the influence of modeling choices

Nancy Peña [a,b,*], Marie T. Knudsen [d], Peter Fantke [c], Assumpció Antón [a],
John E. Hermansen [d]

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Ecotoxicity characterization
Life cycle impact assessment (LCIA)
Feed crops
Agriculture

ABSTRACT

Pesticides help to control weeds, pests, and diseases contributing, therefore, to food availability. Ho ever, pesticide fractions not reaching the intended target may have adverse effects on the environme and the field ecosystems. Modeling pesticide emissions and the link with characterizing associat impacts is currently one of the main challenges in Life Cycle Assessment (LCA) of agricultural systems. address this challenge, this study takes advantage of the latest recommendations for pesticide emissi inventory and impact assessment and frames a suitable interface for those LCA stages and the relat mass distribution of pesticide avoiding a temporal overlapping. Here, freshwater ecotoxicity impacts the production of feed crops (maize, grass, winter wheat, spring barley, rapeseed, and peas) in Denma were evaluated during a 3-year period, testing the effects of inventory modeling and the recent updat of the characterization method (USEtox). Potential freshwater ecotoxicity impacts were calculated in t functional units reflecting crop impact profiles per ha and extent of cultivation, respectively. Ecotoxic impacts decreased over the period, mainly because of the reduction of insecticides use (e.g., cyper methrin). Three different emission modeling scenarios were tested; they differ on the underlying as sumptions and data requirements. The main aspects influencing impact results are the interface between inventory estimates and impact assessment, and the consideration of intermedia processes, such as crop growth development and pesticide application method. Impact scores for AS2

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The importance of including soil carbon changes, ecotoxicity and biodiversity impacts in environmental life cycle assessments of organic and conventional milk in Western Europe

Marie Trydeman Knudsen [a,*], Teodora Dorca-Preda [a], Sylvestre Njakou Djomo [a], Nancy Peña [b], Susanne Padel [c], Laurence G. Smith [c], Werner Zollitsch [d], Stefan Hörtenhuber [d], John E. Hermansen [a]

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Ecotoxicity
LCA
Soil carbon

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]

The environmental effects of agriculture and food are much discussed, with competing claims concerning the impacts of conventional and organic farming. Life cycle assessment (LCA) is the method most widely used to assess environmental impacts of agricultural products. Current LCA methodology and studies tend to favour high-input intensive agricultural systems and misrepresent less intensive agroecological systems such as organic agriculture. LCA assesses agroecological systems inadequately for three reasons: (1) a lack of operational indicators for three key environmental issues; (2) a narrow perspective on functions of agricultural systems; and (3) inconsistent modelling of indirect effects.

Societal interest in sustainable agriculture and food is great and growing[1,2], leading to a demand for information about the environmental performance of agricultural systems, food products and overall food chains from almost all parts of society: policy makers, farmers, agribusinesses, public procurers, the media and consumers. From this diverse group of stakeholders, different questions arise, such as: 'is product A better or worse for the environment than product B? Does converting to this production system really decrease environmental impacts? Should this innovative management technology be encouraged from an environmental perspective?'

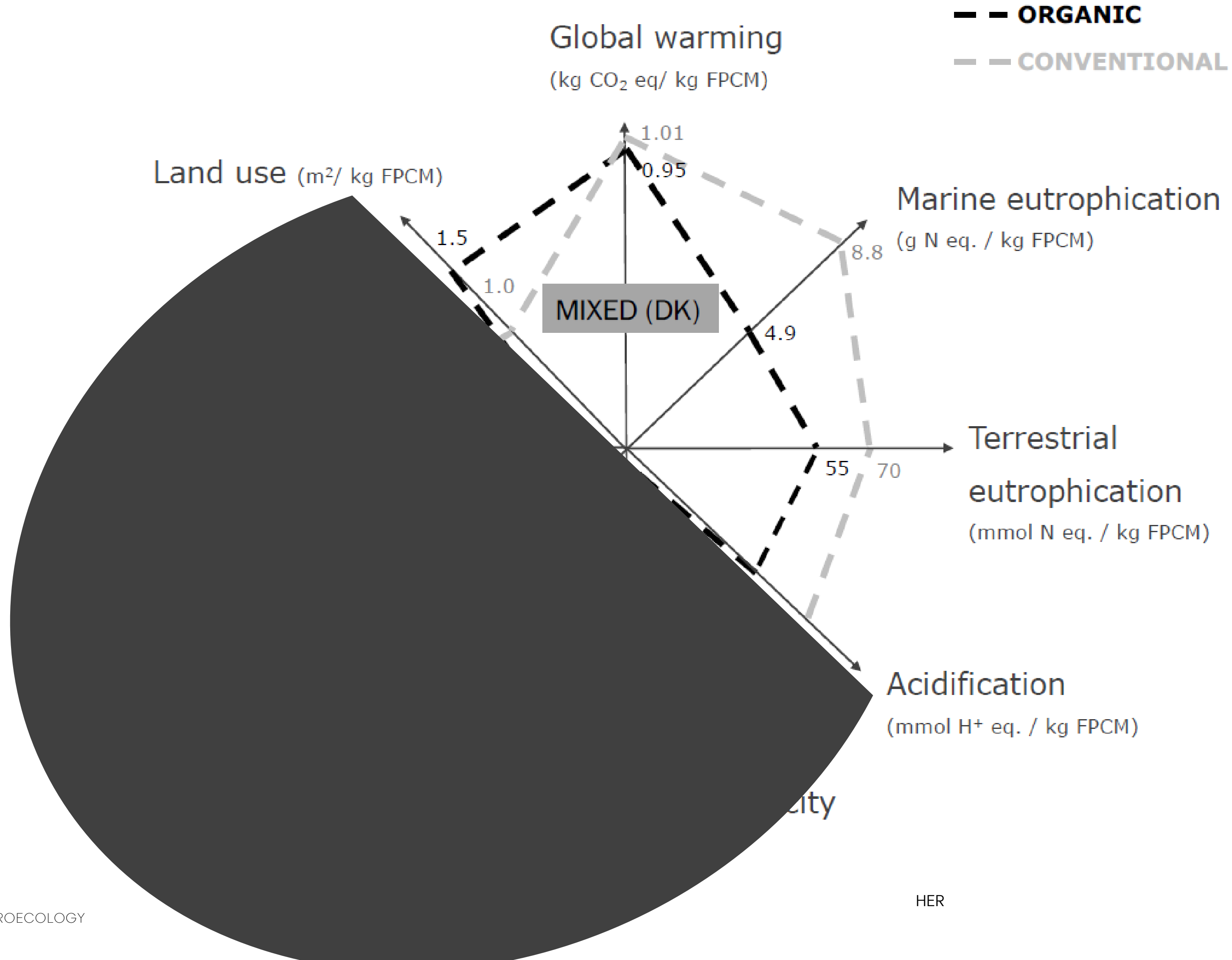
The method most widely used to answer such questions is life cycle assessment (LCA), whose use is now well established for assessing resource depletion issues and environmental and health impacts caused by production of agricultural products. LCA's basic principle[3] is to follow a product through its life cycle, defining a boundary between its 'product system' (the 'technosphere') and the surrounding environment. Energy and material flows crossing this boundary are related to the system's inputs (for example, resources) and outputs (for example, emissions to water and air). Resource consumption and pollutant emissions are then aggregated into impact indicators; LCA thus focuses on negative impacts rather than including positive impacts. The first LCAs were performed in the 1970s by Coca-Cola when it investigated consequences of switching from glass bottles to plastic bottles[4]. In the 1990s, application of LCA to agricultural systems began. From 1992 to 2018, the

approaches at multiple spatial and temporal scales[8]. Another example of a wider view of agriculture is the concept of agroecology (Fig. 2), recognized by United Nations (UN) institutions as a science and social movement in the transition to sustainable food systems and a pathway to achieving the UN's Sustainable Development Goals (SDGs)[9]. Organic agriculture includes many agroecological practices; its umbrella organization, International Federation of Organic Agriculture Movements (IFOAM) – Organics International, defines it as a "production system that sustains the health of soils, ecosystems and people" and "relies on ecological processes, biodiversity and cycles adapted to local conditions", ultimately basing it on four principles: health, ecology, fairness and care[10].

Willett et al.[1] highlight the urgency of transforming global food systems to meet the SDGs and the UN's Paris climate agreement; they propose planetary boundaries for six key Earth system processes (climate change, land-system change, freshwater use, nitrogen and phosphorus cycling, and biodiversity losses) on which food production and consumption have great impact. There is growing agreement on the need for changes in agri-food systems to make progress towards SDGs. Willett et al.[1] even call for a 'Great Food Transformation', which would require appropriate assessment tools and methods to examine the environmental performance of agriculture.

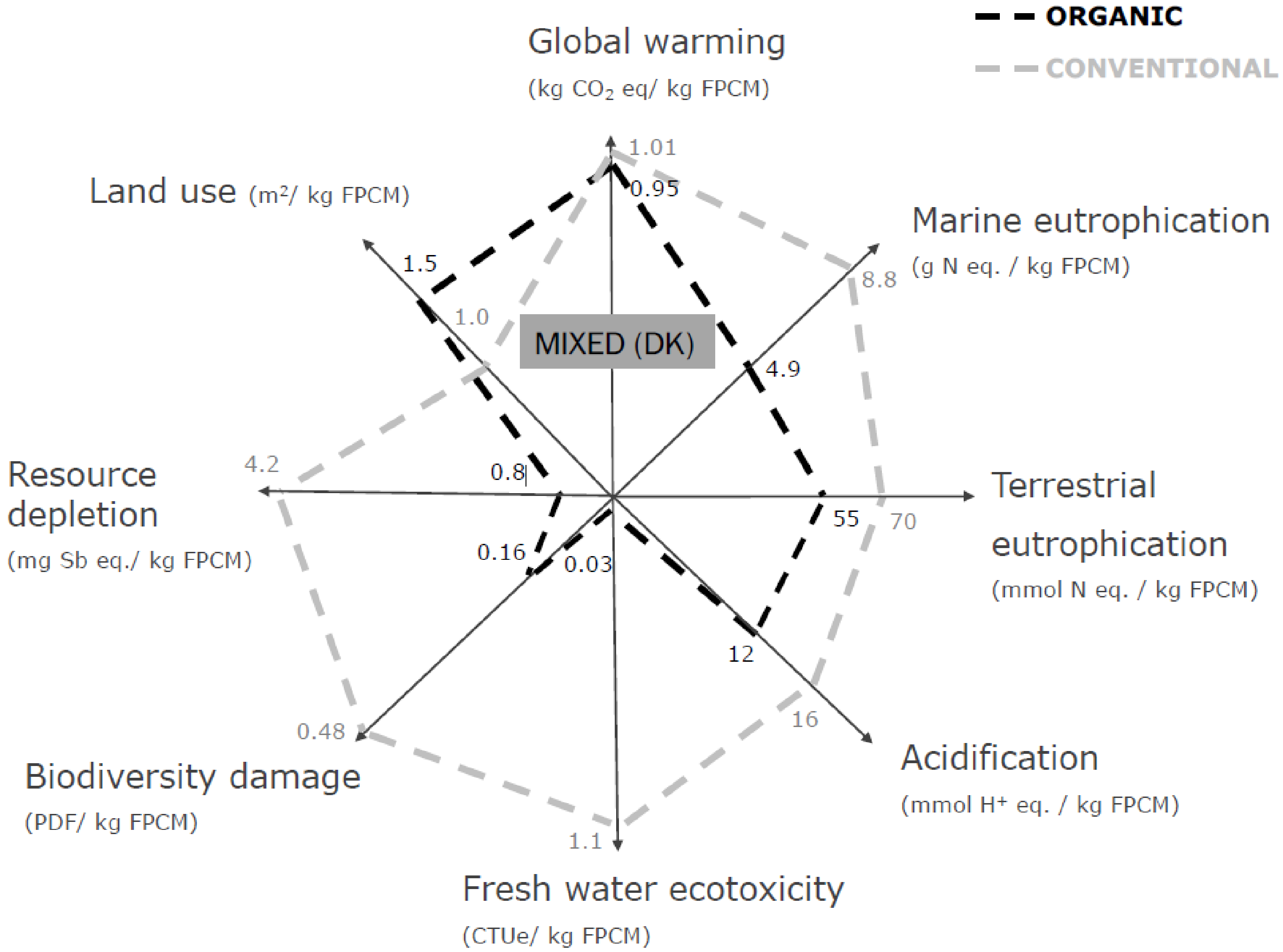
Here, we identify important deficiencies in LCA methodology when assessing agriculture based on agroecological principles, with examples of applying it to organic agriculture. We propose ways to

EFFEKTEN AF AT INDDRAGE ANDRE KATEGORIER (LCA AF MÆLK)



Knudsen et al. (2019)

EFFEKTEN AF AT INDDRAGE ANDRE KATEGORIER (LCA AF MÆLK)



Knudsen et al. (2019)

LCA-TANKEGANGEN

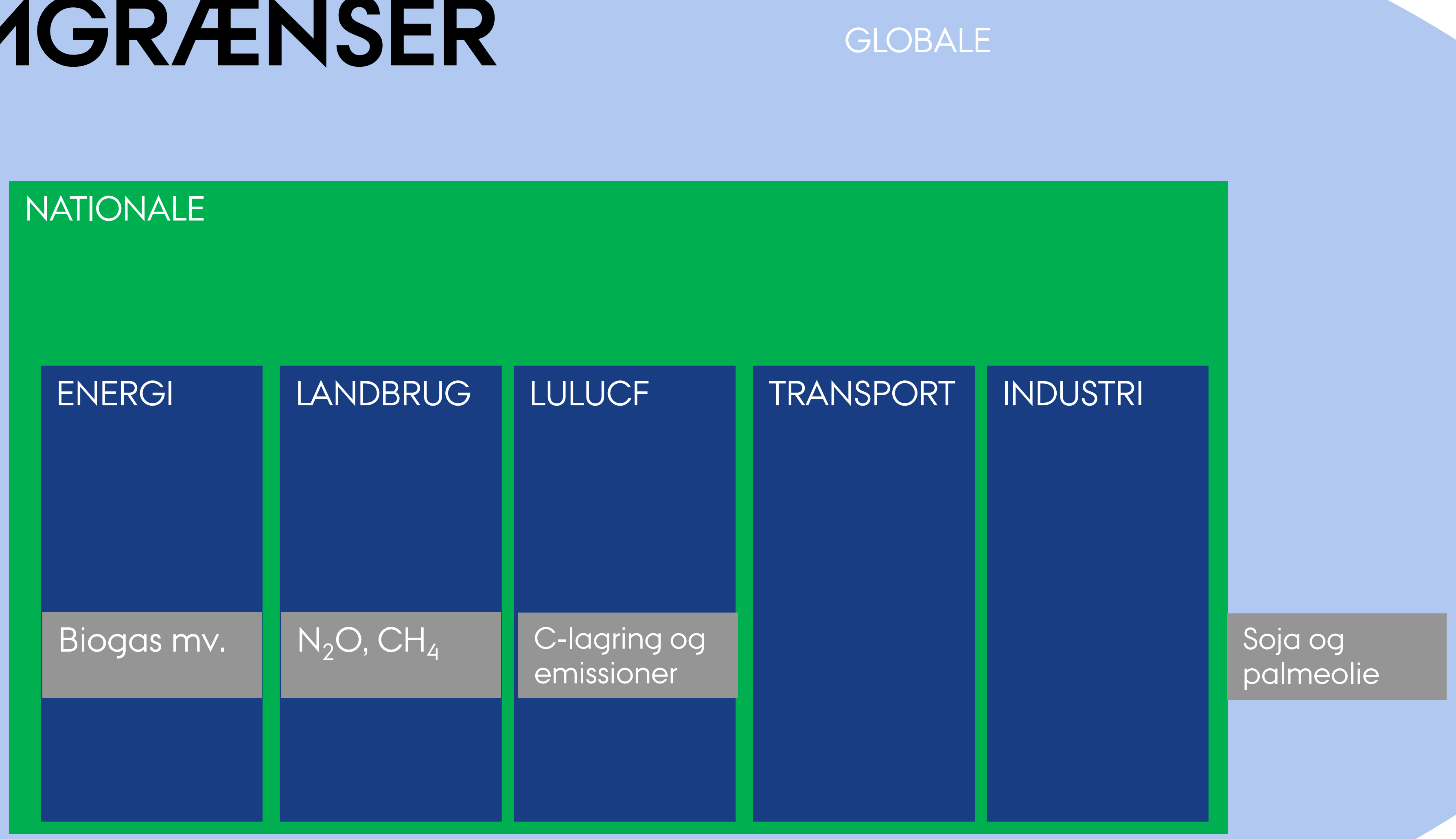
- At se på hele systemet – så man reducerer klima- og miljøpåvirkningen i systemet uden at skabe nye miljøproblemer andre steder i systemet

- Dokumentation af mulighederne for at skabe et klimaneutralt landbrug

- Identifikation af hotspots – størrelsen af emissioner og kulstoflagring i forhold til hinanden og set i sammenhæng med resten af systemet

- Sammenligning af forskellige systemer

SYSTEMGRÆNSER



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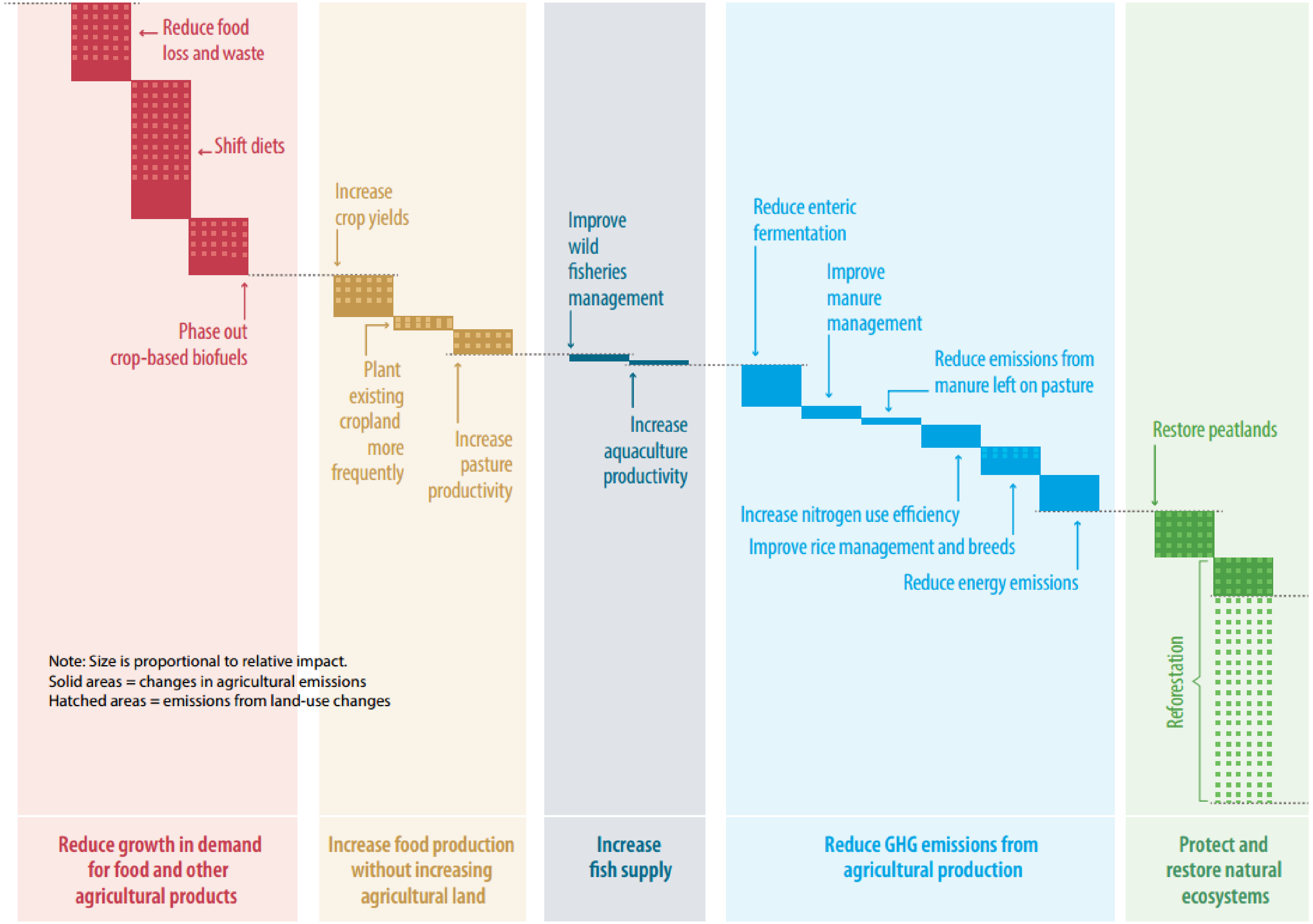
MULIGHEDER FOR AT REDUCERE EMISSIONER FRA FØDEVARESYSTEMET



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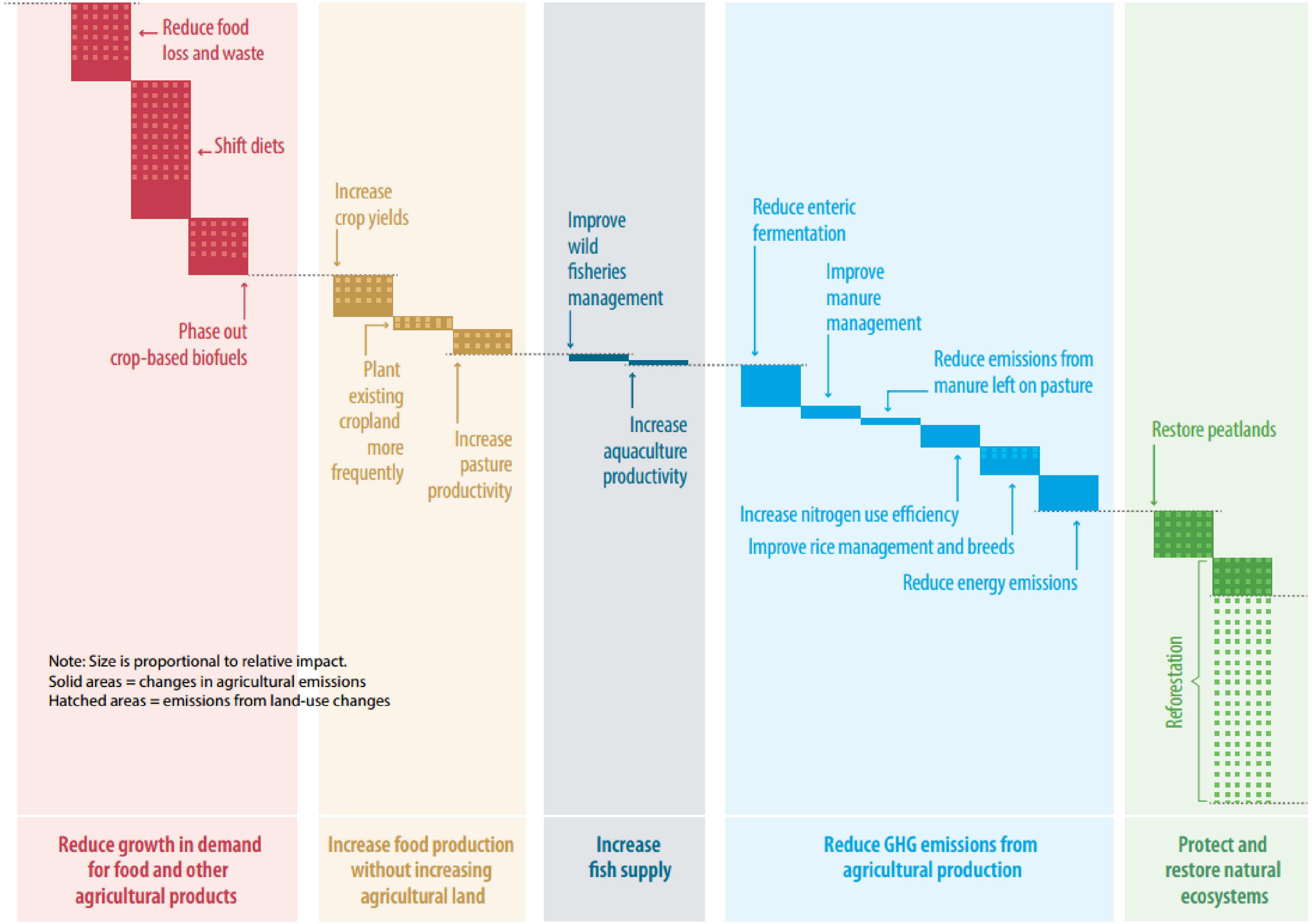
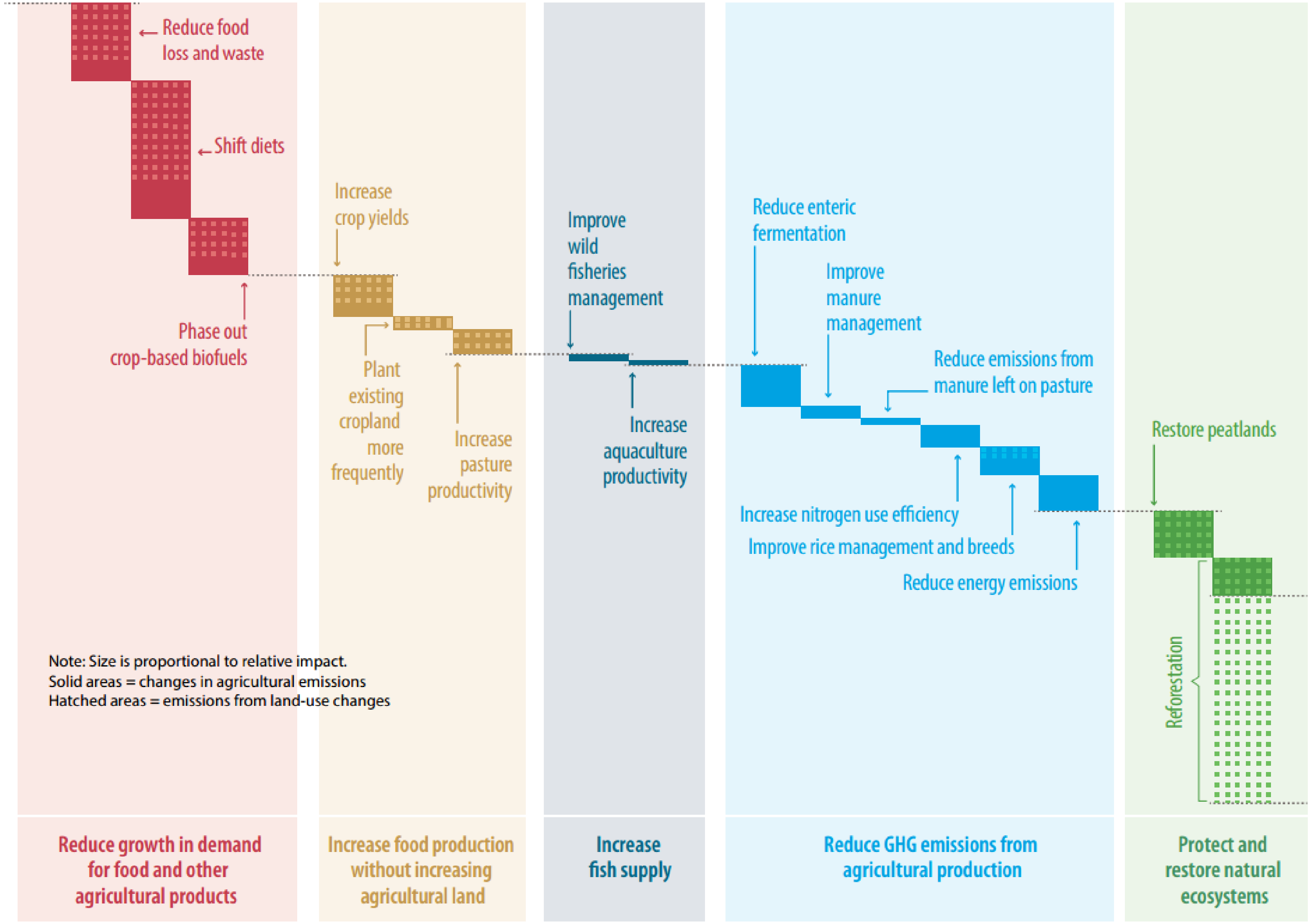
MULIGHEDER FOR REDUKTION I LANDBRUGET



- Reducere emissioner, mindske tab og øge N-udnyttelsen – højere udbytter
- Reducere energiforbruget og producere energi
- Binde CO_2 via træer og i jord – og udgå emissioner fra tørvejorde

UN (2019)

MULIGHEDER FOR REDUKTION I FØDEVAREFORBRUGET



UN (2019)

- Reducere forbruget af animalske produkter
- Reducere madspild

KONKLUSION

- Flere projekter omkring klima- og miljøaftryk fra landbrugsproduktionen – både indenfor grøntsagsproduktion og husdyrproduktion – og samlet på klimavenlig og bæredygtig kost.

- Ikke kun klimapåvirkning fra landbrugssystemet – kan være trade-offs med andre påvirkninger som biodiversitet, toxicitet eller dyrevelfærd – kan gå tabt i en optimering med fokus udelukkede på klima.

- Et klima- og miljøvenligt landbrug kræver samspil mellem de enkelte grene – mark, dyr, bioraffinering og biogas mv. – og hensyn til klima og øvrige bæredygtighedskriterier – hvilket kræver systemanalyse (LCA).

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