Feeding cities at a time of climate urgency and global socioecological crisis

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MAF4SURE—Mediterranean Agroecosystems for Sustainability and Resilience under Climate Change

AGROECOSCALING—Boosting Ecological Transition: Scaling Up Best Agroecological Practices from Farms to Landscapes and Agrifood Chains.
TED2021-130333B-C32

AGROECOLAND—Agroecological Landscapes and Food Systems in Catalonia and the Balearic Islands: Past, Present and Future Transitions.
PID2021-123129NB-C41

Feeding cities at a time of socioecological crisis

1. Why is the agrifood system so important? Emissions, wastages, losses
2. The way out: an Agroecological Transition of the global Food System
3. To be part of the problem and part of the solution: carbon sequestration

How many transitions? It's not all about renewables: agroecological and food transitions are key…

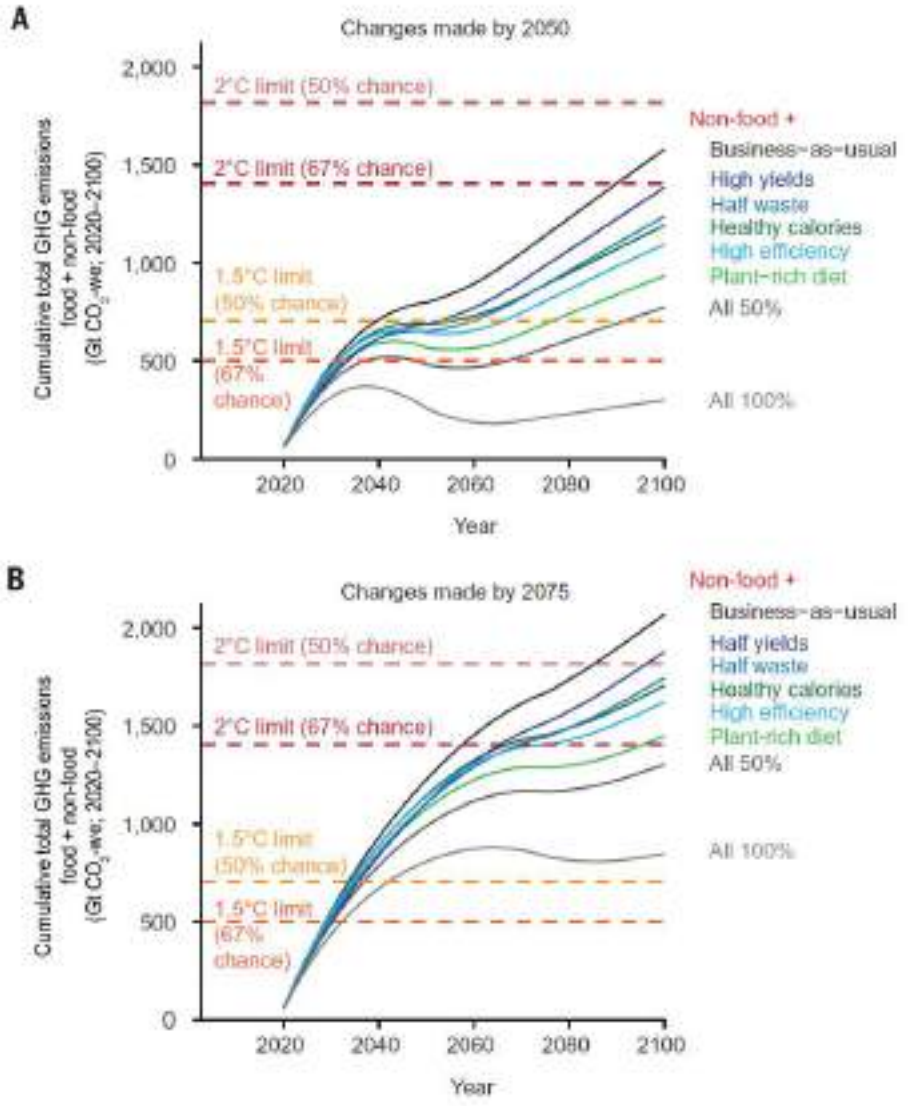

Fig. 2. Estimated GHG emissions from all human activities (food plus nonfood) for different food system changes and different rates of emissions reductions from fossil fuels and food systems. (**A** and **B**) Nonfood emissions are linearly reduced to zero from 2020 to 2050 (A) or from 2020 to 2075 (B). Solid curves show cumulative emissions from all human activities if different food system strategies were to be implemented. Fossil fuel emissions from within the food system are also assumed to be reduced at the same rate as for emissions from outside the food system. Horizontal dashed lines indicate maximum cumulative emissions from all sources (food and nonfood) compatible with a 50 or 67% likelihood of meeting the remaining 2° (red) and 1.5°C (orange) temperature targets.

Without changes in agricultural management and diets, it is impossible to limit climate change to 1.5°-2°

- «Even if fossil fuel emissions were to stop immediately, current trends in global food systems would prevent the achievement of the 1.5°C target and, by the end of the century, threaten the achievement of the 2°C target. ***Reaching the 1.5°C target requires rapid and ambitious changes in food systems, as well as in all non-food sectors***»

CLIMATE CHANGE https://science.sciencemag.org/content/370/6517/705/tab-pdf

Global food system emissions could preclude achieving the 1.5° and 2°C climate change targets

Michael A. Clark[1]*, Nina G. G. Domingo[2], Kimberly Colgan[2], Sumil K. Thakrar[2], David Tilman[3,4], John Lynch[5], Inês L. Azevedo[6,7], Jason D. Hill[2]

Clark *et al.*, *Science* **370**, 705–708 (2020) 6 November 2020

How much does the agrifood system contribute to climate change? It depends either on a sectoral or systemic view...

- **GHG emissionsf rom the agrifood system were *34% of the total* in 2015.**
- **Agriculture and land use changes accounted for 71%. *The rest (industry, packaging, transport, trade, consumption, waste management) are the ones that increase the most*.**

ARTICLES
https://doi.org/10.1038/s43016-021-00225-9
nature food
Check for updates

Food systems are responsible for a third of global anthropogenic GHG emissions

M. Crippa[1✉], E. Solazzo[1], D. Guizzardi[1], F. Monforti-Ferrario[1], F. N. Tubiello[2] and A. Leip[1✉]

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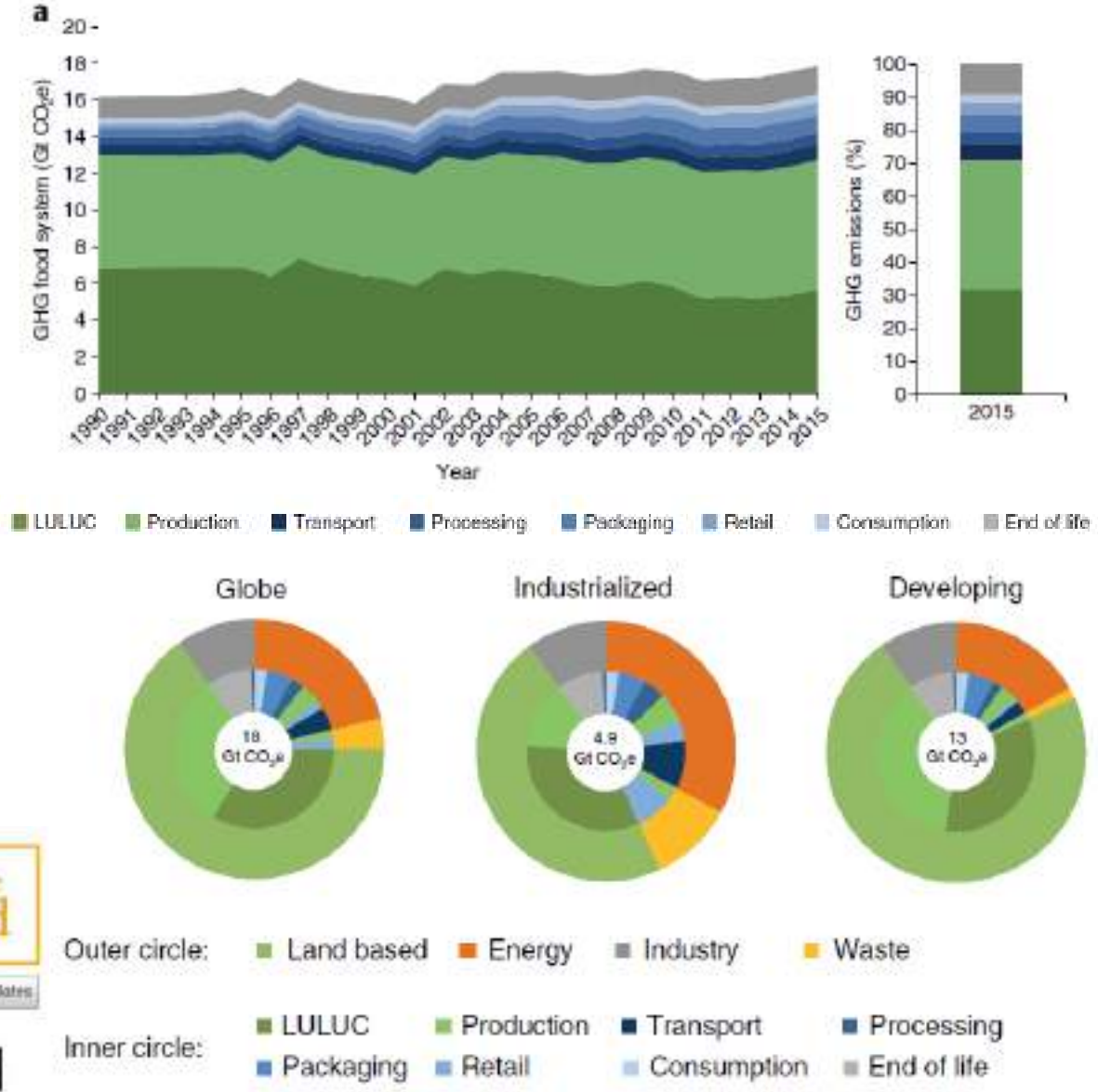
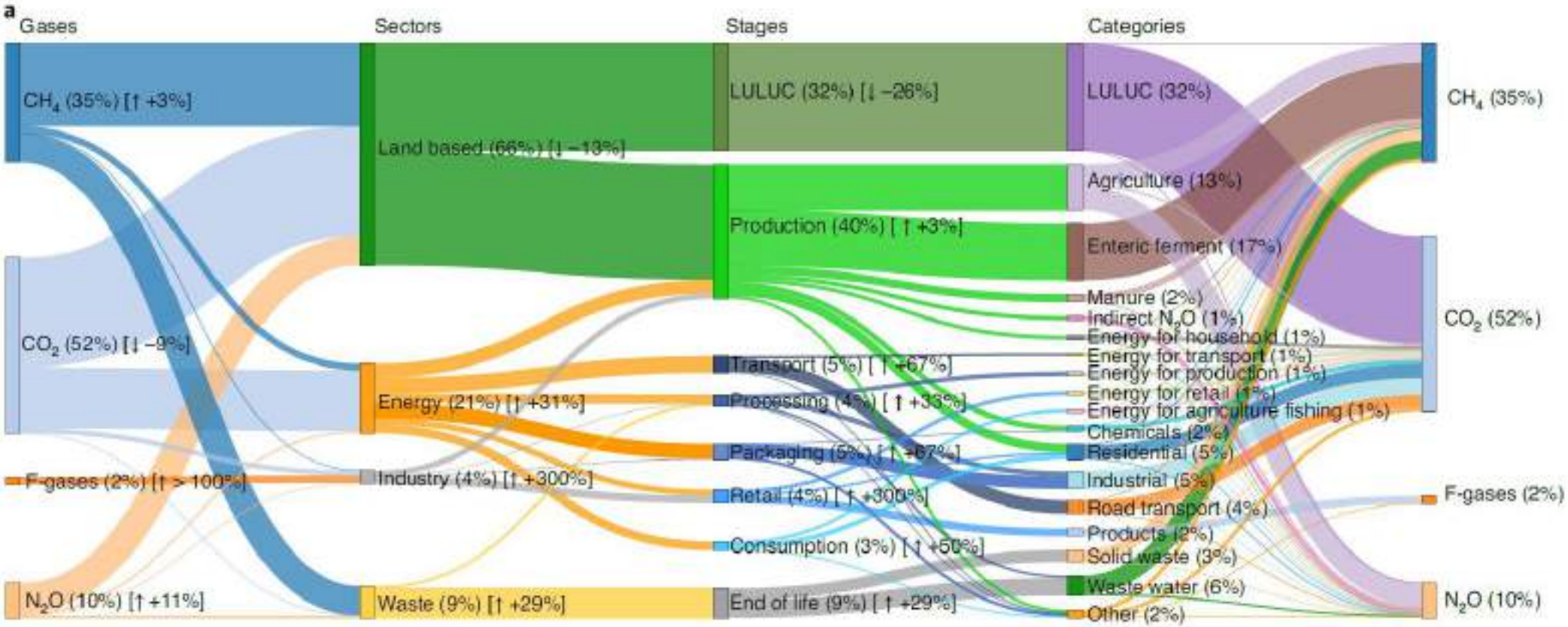


Fig. 1 | GHG emissions from the food system in different sectors in 2015. Total GHG emissions (including CO_2, CH_4, N_2O and F-gases) are expressed as CO_2e calculated using the GWP100 values used in the IPCC AR5, with a value of 28 for CH_4 and 265 for N_2O.



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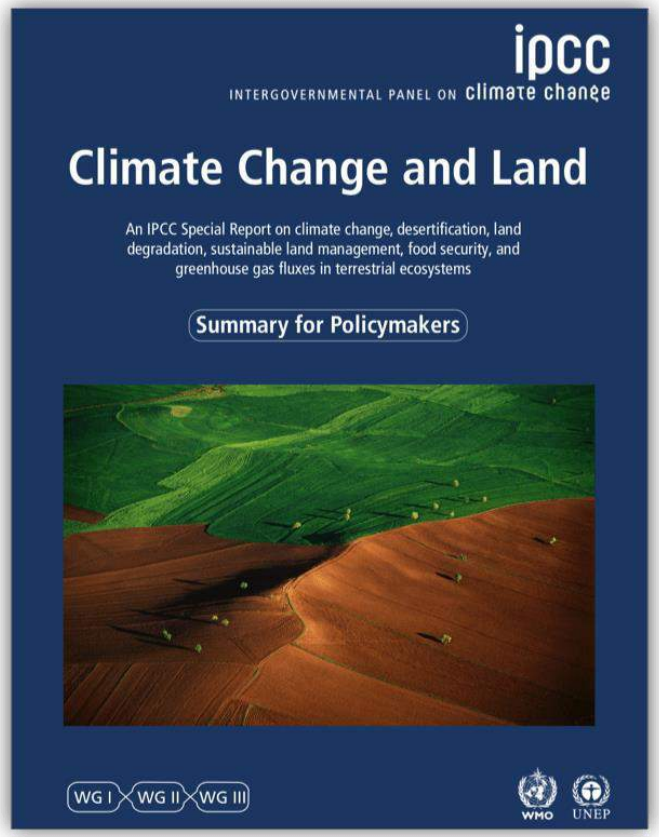
It a systemic problem that needs a system change!

The 2019 IPCC report on *Climate Change and Land*

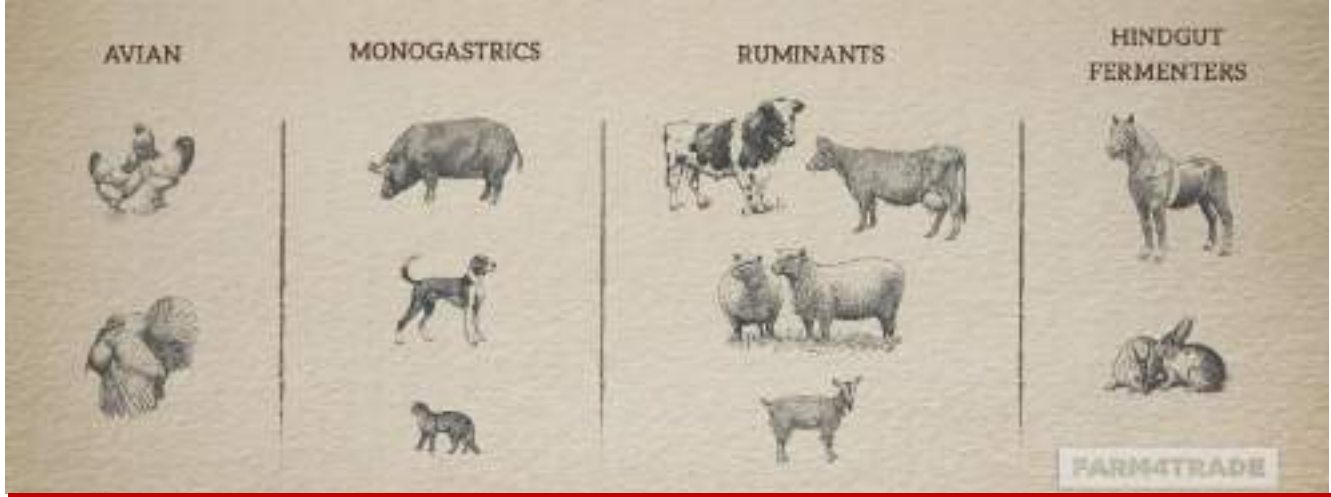
- Climate change affects **the four pillars of food security**: ***availability*** (yield and production), ***access*** (prices and ability to obtain food), ***use*** (nutrition and food preparation), and ***stability*** (resilience).
- ***One third of the food produced is wasted***.
- **Some food patterns** require more water and soil and **cause more GHG emissions**. ***Balanced diets based on plant-based foods*** (cereals, legumes, fruits and vegetables), ***and foods of animal origin produced sustainably*** in systems that generate low GHG emissions, **present greater opportunities for climate change mitigation and adaptation**.



https://www.ipcc.ch/srccl/

Beyond food waste: Systemic bioconversion losses

- We take **a systems view from primary production** of agricultural biomass through **to human food requirements**.
- **Quantities and losses over ten stages are calculated and compared** in terms of drymass, wetmass, protein and energy.
- Due to cumulative losses, **the share of global agricultural dry biomass consumed as food is just 25% of harvest biomass** (32% for energy and 28% for protein).
- Including human overconsumption (i.e., food consumption in excess of nutritional requirements), 48% of harvested crops were lost (53% of energy, 42% of protein).



The biggest *food loss* in the current AFGS is using for animal feed nearly half of the cereal harvested, instead of natural pastures (*ruminants*) or by-products and residues (*monogastrics*).

Agricultural Systems 153 (2017) 190–200

Contents lists available at ScienceDirect

Agricultural Systems

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

Losses, inefficiencies and waste in the global food system

Peter Alexander [a,b,*], Calum Brown [a], Almut Arneth [c], John Finnigan [d], Dominic Moran [b,e], Mark D.A. Rounsevell [a,c]

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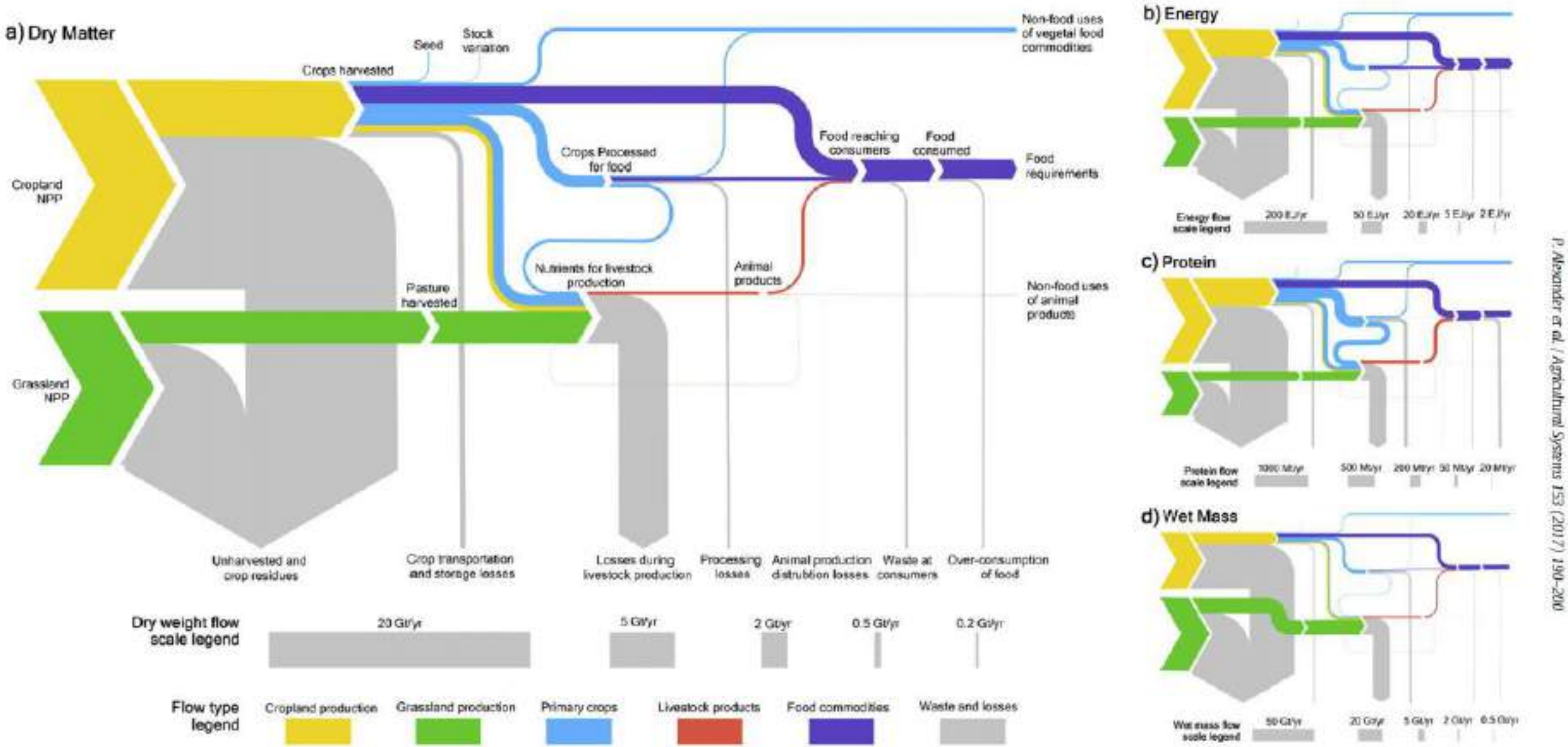
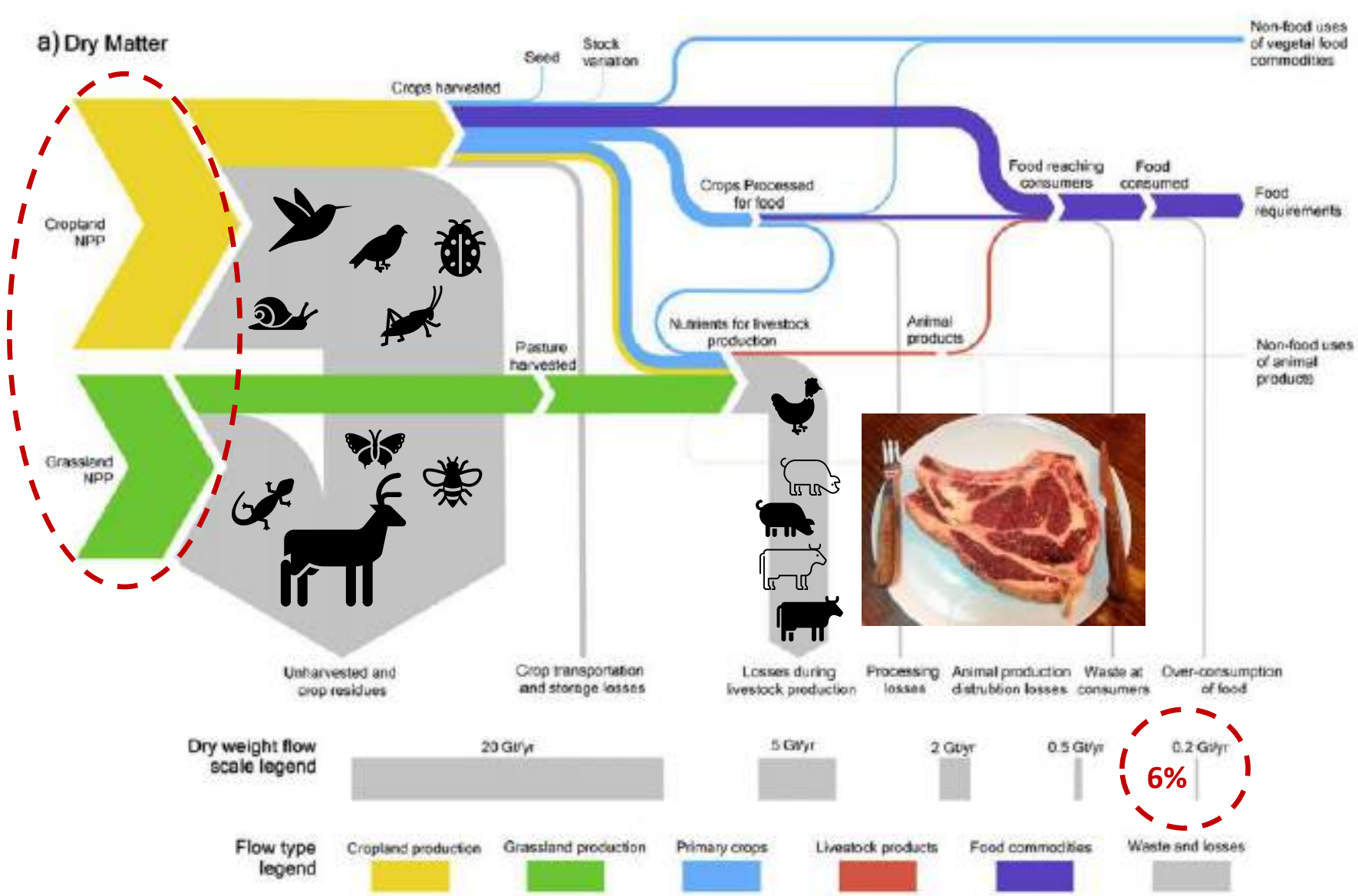
[a] Land Economy and Environment Research Group, SRUC, West Mains Road, Edinburgh EH9 3JG, UK
[c] Karlsruhe Institute of Technology, Institute of Meteorology and Climate Research, Atmospheric Environmental Research (IMK-IFU), Kreuzeckbahnstr. 19, 82467 Garmisch-Partenkirchen, Germany
[d] The Centre for Australian Weather and Climate Research – A partnership between CSIRO and the Bureau of Meteorology, CSIRO Marine and Atmospheric Research, Canberra, Australia
[e] Environment Department, University of York, University Rd, York YO10 5DD, UK

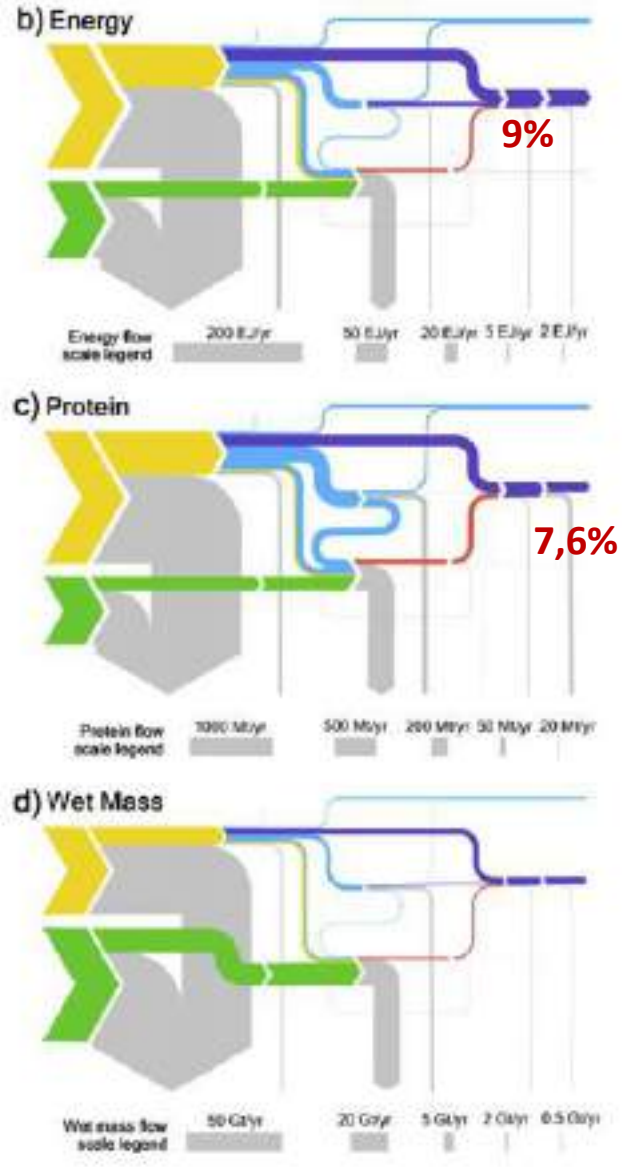


P. Alexander et al. / Agricultural Systems 153 (2017) 190–200

Fig. 2. Main flows in the global food system in 2011 from plant growth to human consumption, in: a) dry matter, b) energy, c) protein mass, and d) wet mass. Arrows denote the transfer from one process to another, and their width is proportional to the amount of mass or energy per year. Two flows are shown from harvested crops to livestock production, one for primary food crops (light blue) another for forage crops (yellow). The aggregate size of the cropland and grassland net primary production (NPP) flows are displayed as equivalent sizes across the four panels. The loss and waste flows include a substantial proportion of unharvested biomass and manure that will break down in the soil, providing nutrients for subsequent production.

https://doi.org/10.1016/j.agsy.2017.01.014



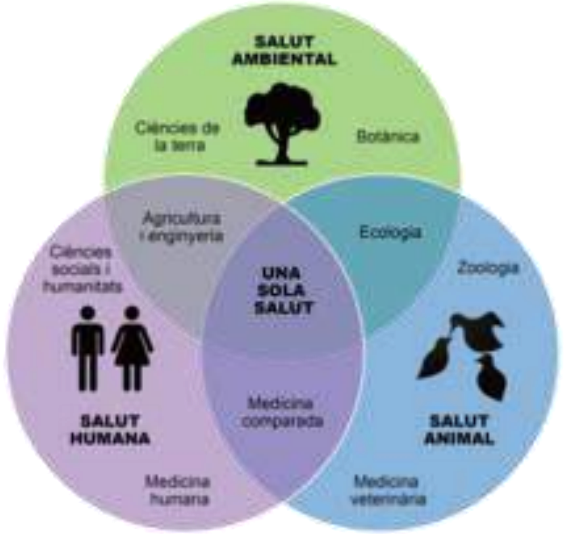


P. Alexander et al. / Agricultural Systems 153 (2017) 190–200

Of all the biomass produced by photosynthesis in cropland and pastures, only 6% of dry weight, 9% of energy and 7.6% of protein end up being consumed on the plate.

https://doi.org/10.1016/j.agsy.2017.01.014

Diet matters!



https://nofrakkingconsensus.com/wp-content/uploads/2019/01/PIIS0140673618317884.pdf

Food in the Anthropocene: the EAT–*Lancet* Commission on healthy diets from sustainable food systems

Walter Willett, Johan Rockström, Brent Loken, Marco Springmann, Tim Lang, Sonja Vermeulen, Tara Garnett, David Tilman, Fabrice DeClerck, Amanda Wood, Malin Jonell, Michael Clark, Line J Gordon, Jessica Fanzo, Corinna Hawkes, Rami Zurayk, Juan A Rivera, Wim De Vries, Lindiwe Majele Sibanda, Ashkan Afshin, Abhishek Chaudhary, Mario Herrero, Rina Agustina, Francesco Branca, Anna Lartey, Shenggen Fan, Beatrice Crona, Elizabeth Fox, Victoria Bignet, Max Troell, Therese Lindahl, Sudhvir Singh, Sarah E Cornell, K Srinath Reddy, Sunita Narain, Sania Nishtar, Christopher J L Murray

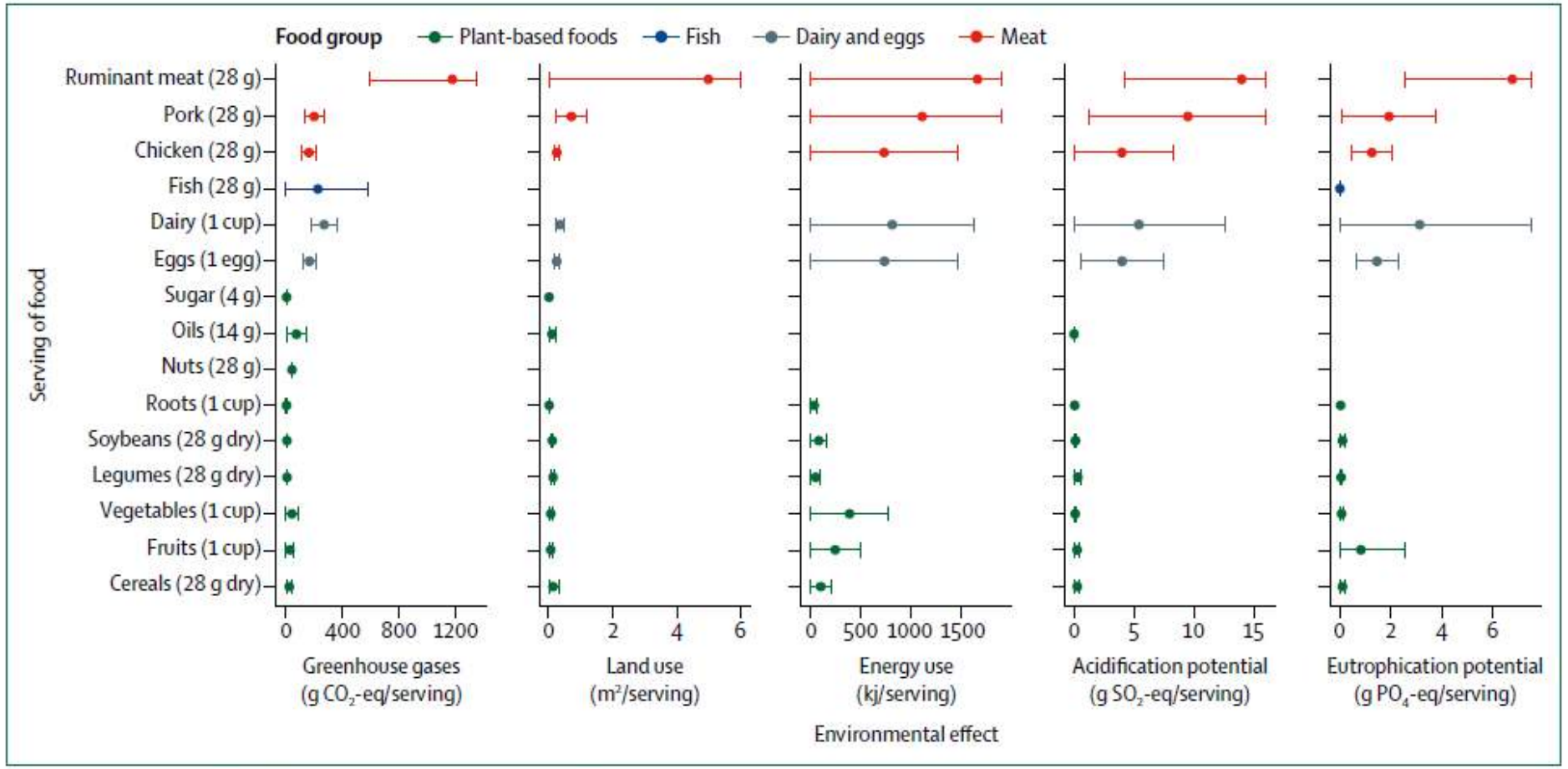


Figure 4: **Environmental effects per serving of food produced**
Bars are mean (SD).[5,216] Some results are missing for fish due to lack of data for some impact categories (eg, land use stemming from plant-based feeds in aquaculture). This was, however, accounted for in the global food systems modeling framework used in Section 3. CO_2=carbon dioxide. Eq=equivalent. PO_4=phosphate. SO_2=sulphur dioxide.

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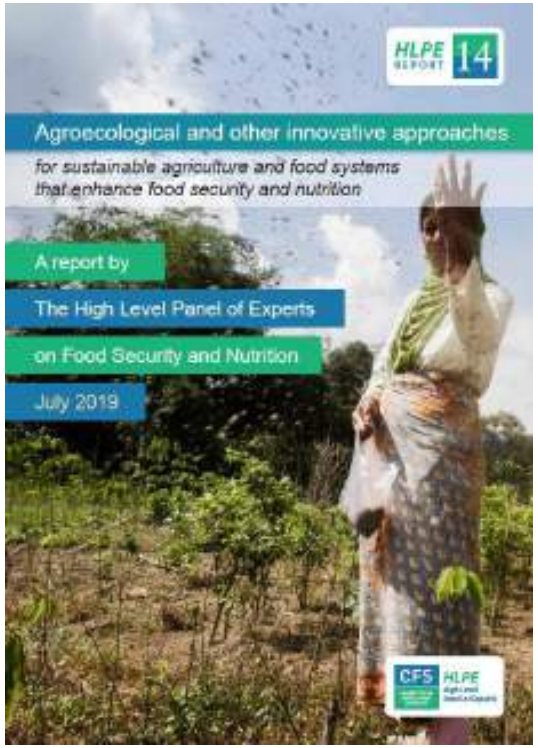
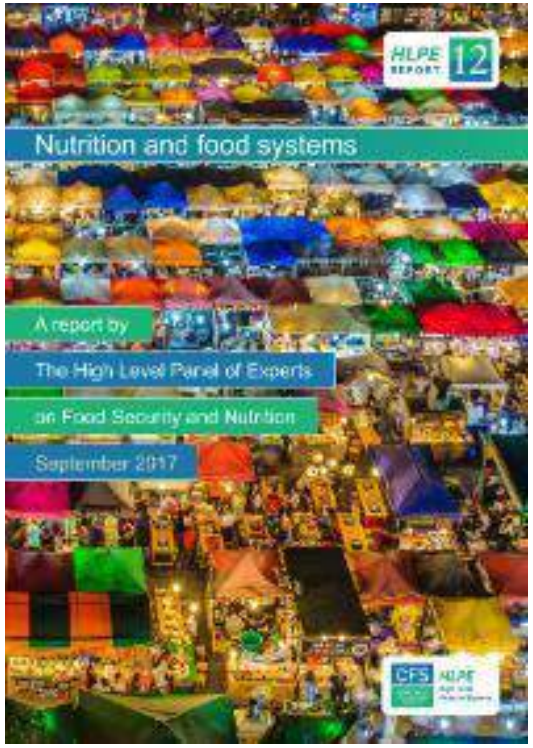
The United Nations Committee on Food Security (CFS) & HLPE reports on Agroecology and Food Systems Change



HLPE (2019). ***Agroecological and other innovative approaches for sustainable agriculture and food systems that enhance food security and nutrition***. Rome: FAO. http://www.fao.org/3/ca5602en/ca5602en.pdf).

https://www.fao.org/fileadmin/templates/cfs/Docs2021/Documents/Policy_Recommendations_Agroecology_other_Innovations/2021_Agroecological_and_other_innovations_EN.pdf



HLPE (2017). ***Nutrition and food systems.*** Rome: FAO. https://www.fao.org/3/i7846e/i7846e.pdf).

Scaling Up Agroecology: A 2018 FAO's Initiative

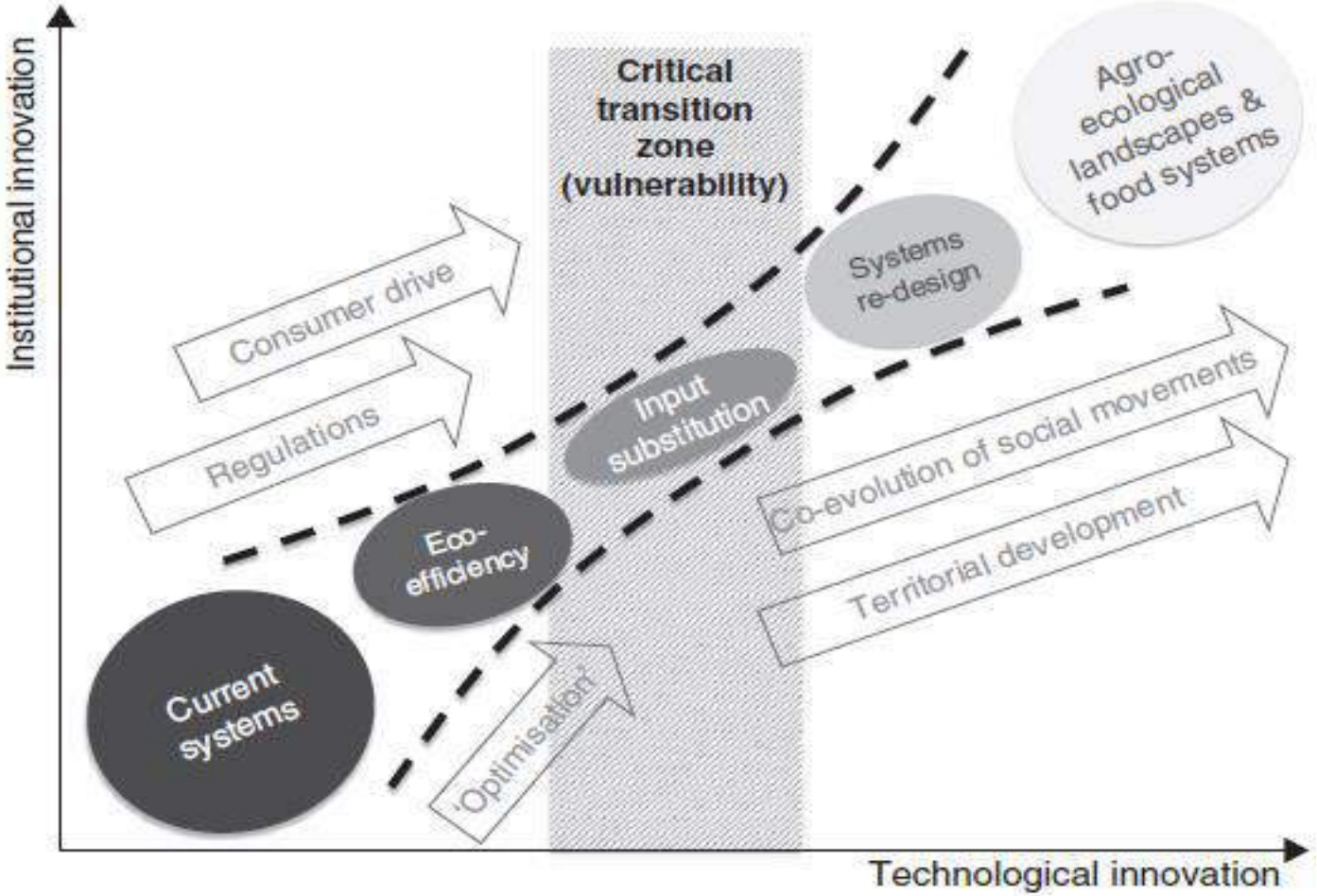
Font: FAO SCALING UP AGROECOLOGY INITIATIVE TRANSFORMING FOOD AND AGRICULTURAL SYSTEMS IN SUPPORT OF THE SDGS

- To achieve the SDGs of the UN 2030 Agenda, Scaling Up Agroecology is key,
- ***jumping from a bit of organic farming here and there to building new integrated agroecological territories (or agroecology-based food territories)***.

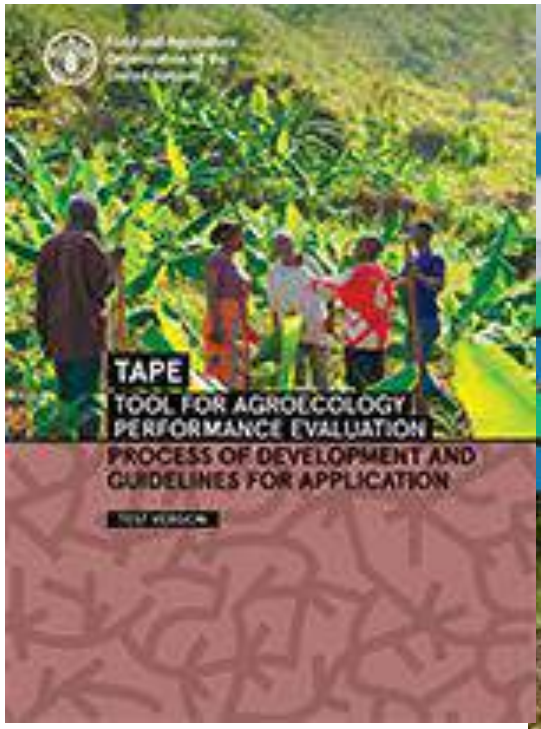
http://www.fao.org/agroecology/home/es/

Sustainable agroecological landscapes need relocation of shorter agri-food chains with healthier diets

Agroecology Knowledge Hub
https://www.fao.org/agroecology/home/en/



Tittonell, P. (2014). Ecological intensification of agriculture—sustainable by nature. *Current Opinion in Environmental Sustainability*, 8:53–61. https://doi.org/10.1016/j.cosust.2014.08.006

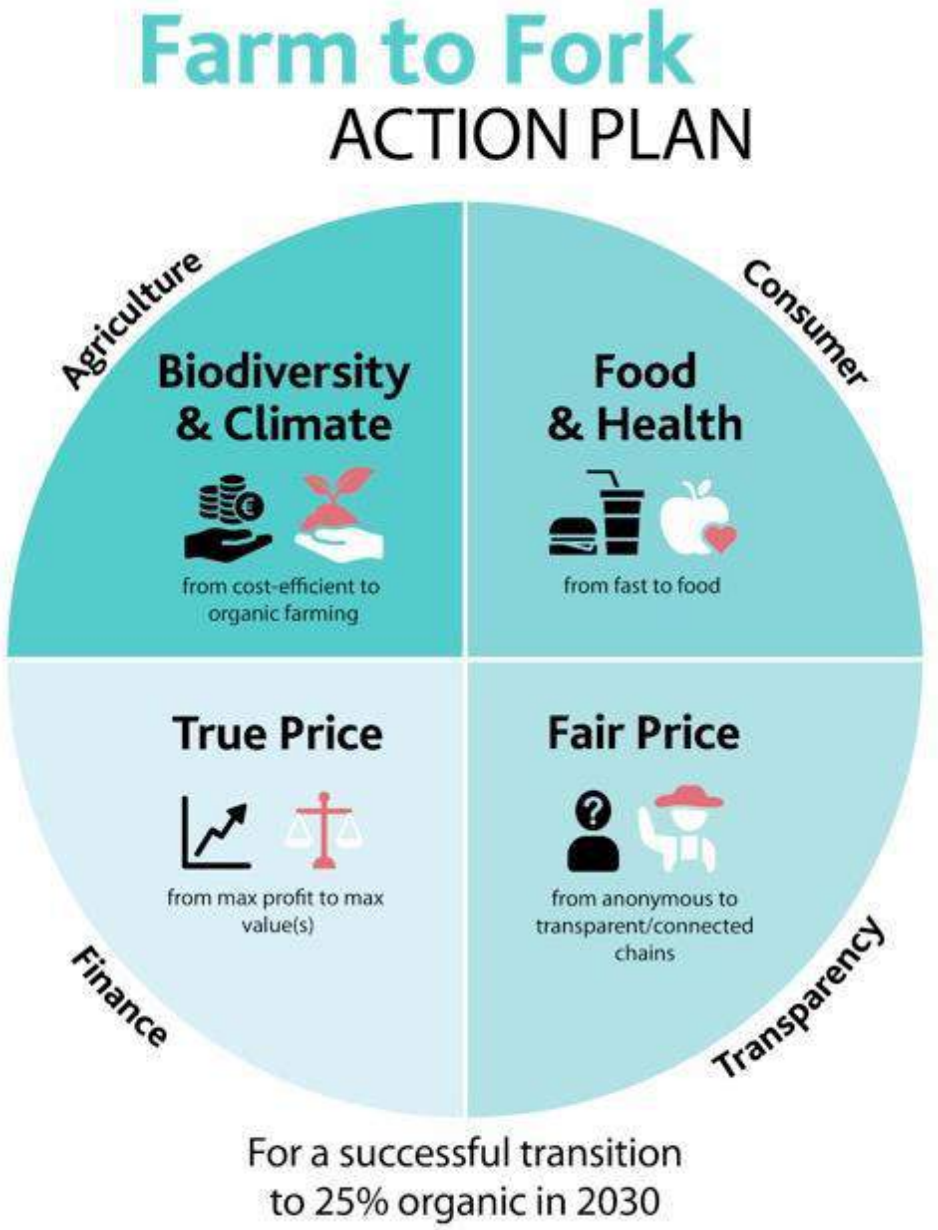


https://www.fao.org/agroecology/tools-tape/en/

HLPE (2019. Agroecological and other innovative approaches for sustainable agriculture and food systems that enhance food security and nutrition. Rome: HPLE—FAO. http://www.fao.org/3/ca5602en/ca5602en.pdf).

Beyond Farm to Fork:
An agroecological transition for Europe

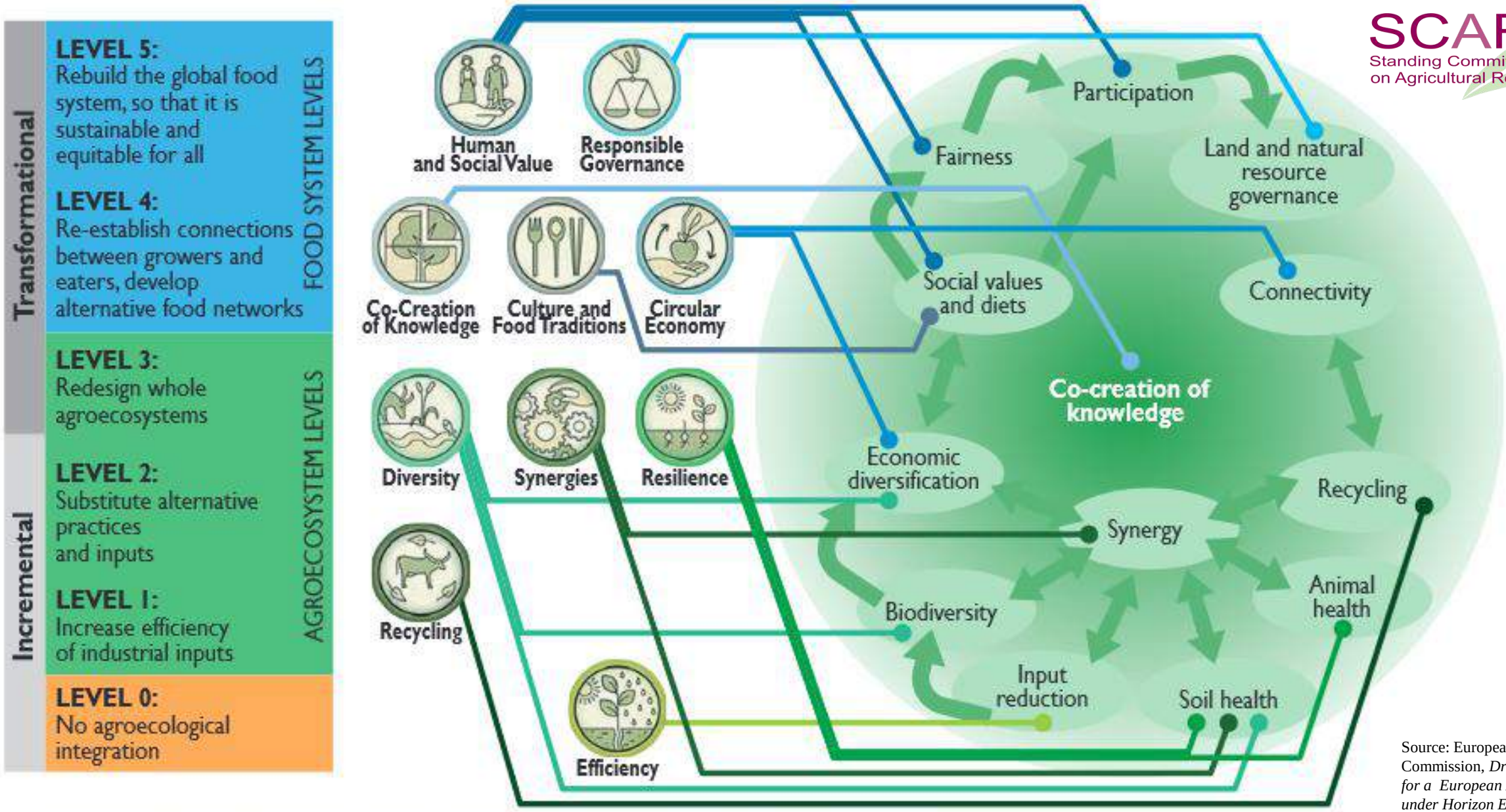
European Commission, *Draft proposal for a European Partnership under Horizon Europe Accelerating farming systems transition: agroecology living labs and research infrastructures*- Version 30.03.2022
https://ec.europa.eu/info/research-and-innovation/research-area/agriculture-and-forestry/ecological-approaches-and-organic-farming/partnership-agroecology_en



European Commission, *Draft proposal for a European Partnership under Horizon Europe Accelerating farming systems transition: agroecology living labs and research infrastructures*- Version 30.03.2022

https://ec.europa.eu/info/research-and-innovation/research-area/agriculture-and-forestry/ecological-approaches-and-organic-farming/partnership-agroecology_en

SCAR
Standing Committee
on Agricultural Research



▲ *Linking FAO's 10 elements, Gliesmann's 5 levels of food system transformation and the 13 HLPE principles*
Correspondence based on Wezel et al., *2020. Agroecological principles and elements and their implications for transitioning to sustainable food systems. A review.* Agronomy for Sustainable Development, *(2020) 40: 40.*

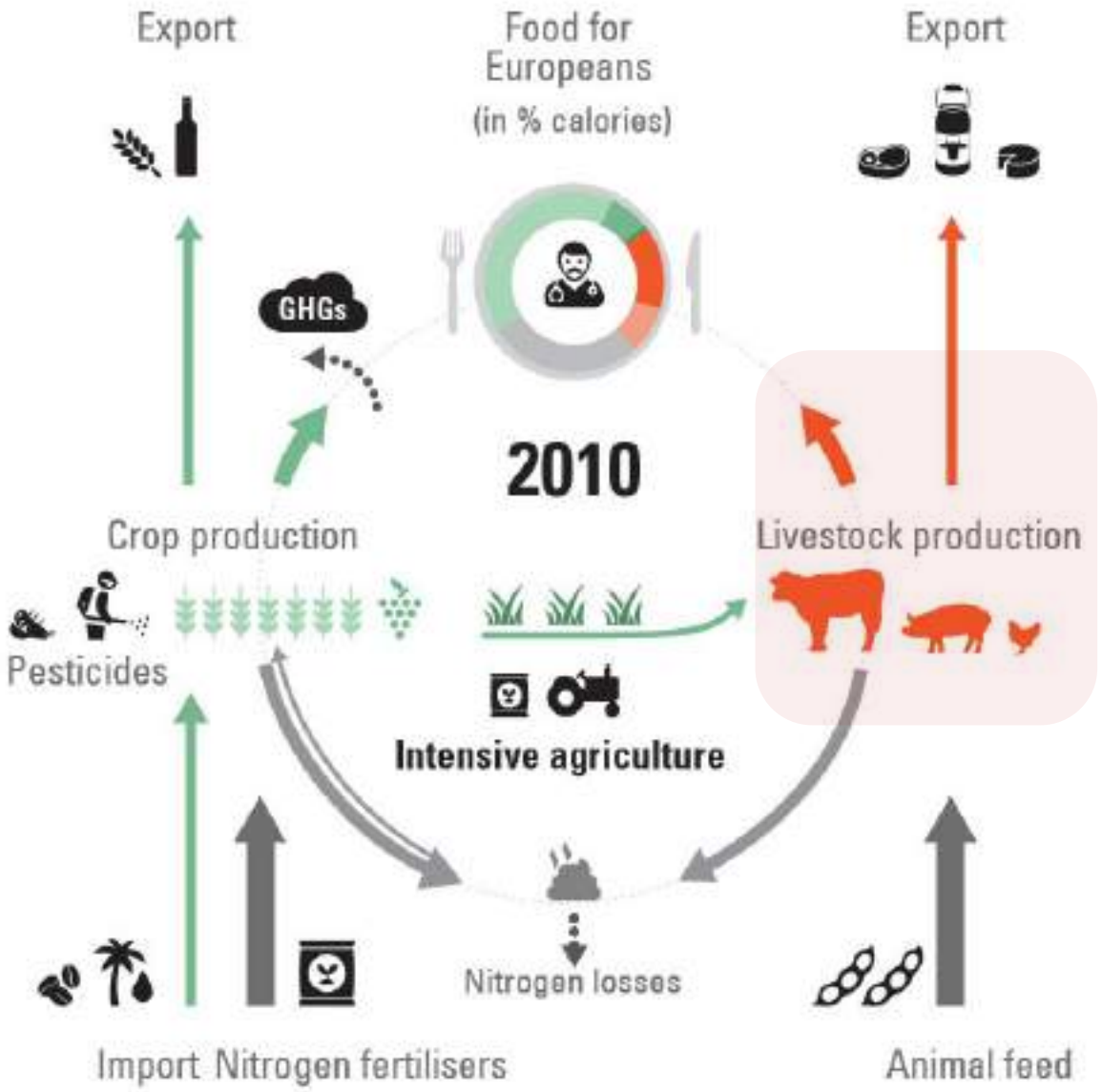
Source: European Commission, *Draft proposal for a European Partnership under Horizon Europe Accelerating farming systems transition: agroecology living labs and research infrastructures*- Version 30.03.2022

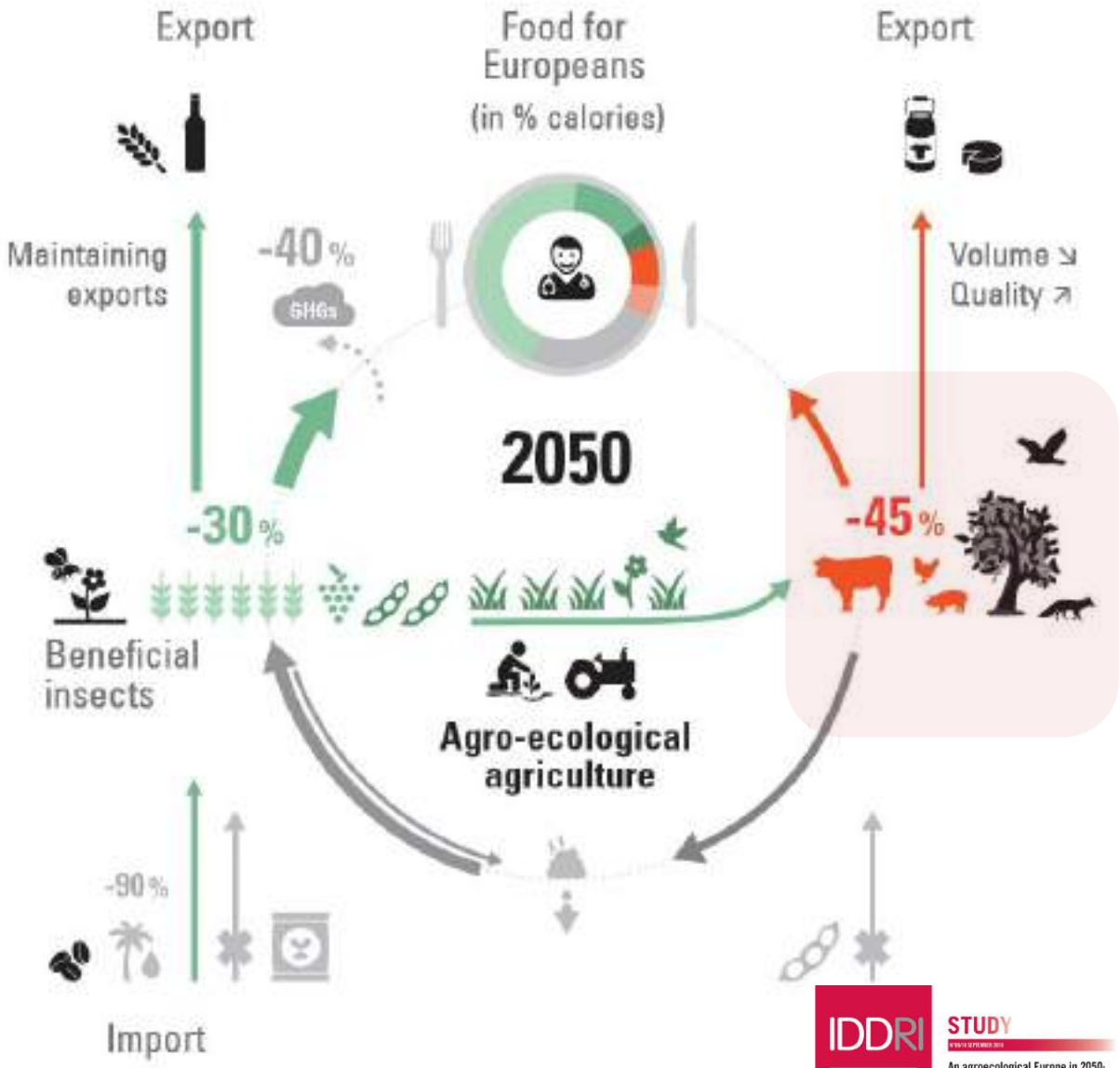
Is that possible? What about yield gaps?: The IDDRI 2018 scenario for an Agroecology Europe in 2050

- Despite **assuming a 35% yield drop** (in Kcal) per unit of land compared to 2010, this scenario
- **can provide healthy food to 530 million Europeans** while:
- *maintaining EU's exports*,
- *reducing EU's food footprint*,
- *cutting 40% GHG emissions of AGFS*, and
- *improving biodiversity* ***without requiring more land***.

Poux, X., Aubert, P.-M. (2018). An agroecological Europe in 2050: multifunctional agriculture for healthy eating. Findings from the Ten Years For Agroecology (TYFA) modelling exercise. Paris: *Iddri-AScA, Study N°09/18*). https://www.iddri.org/en/publications-and-events/study/agroecological-europe-2050-multifunctional-agriculture-healthy-eating

With a demitarian diet for 2050...





https://www.iddri.org/en/publications-and-events/study/agroecological-europe-2050-multifunctional-agriculture-healthy-eating

IDDRI
STUDY
An agroecological Europe in 2050: multifunctional agriculture for healthy eating
Findings from the Ten Years For Agroecology (TYFA) modelling exercise

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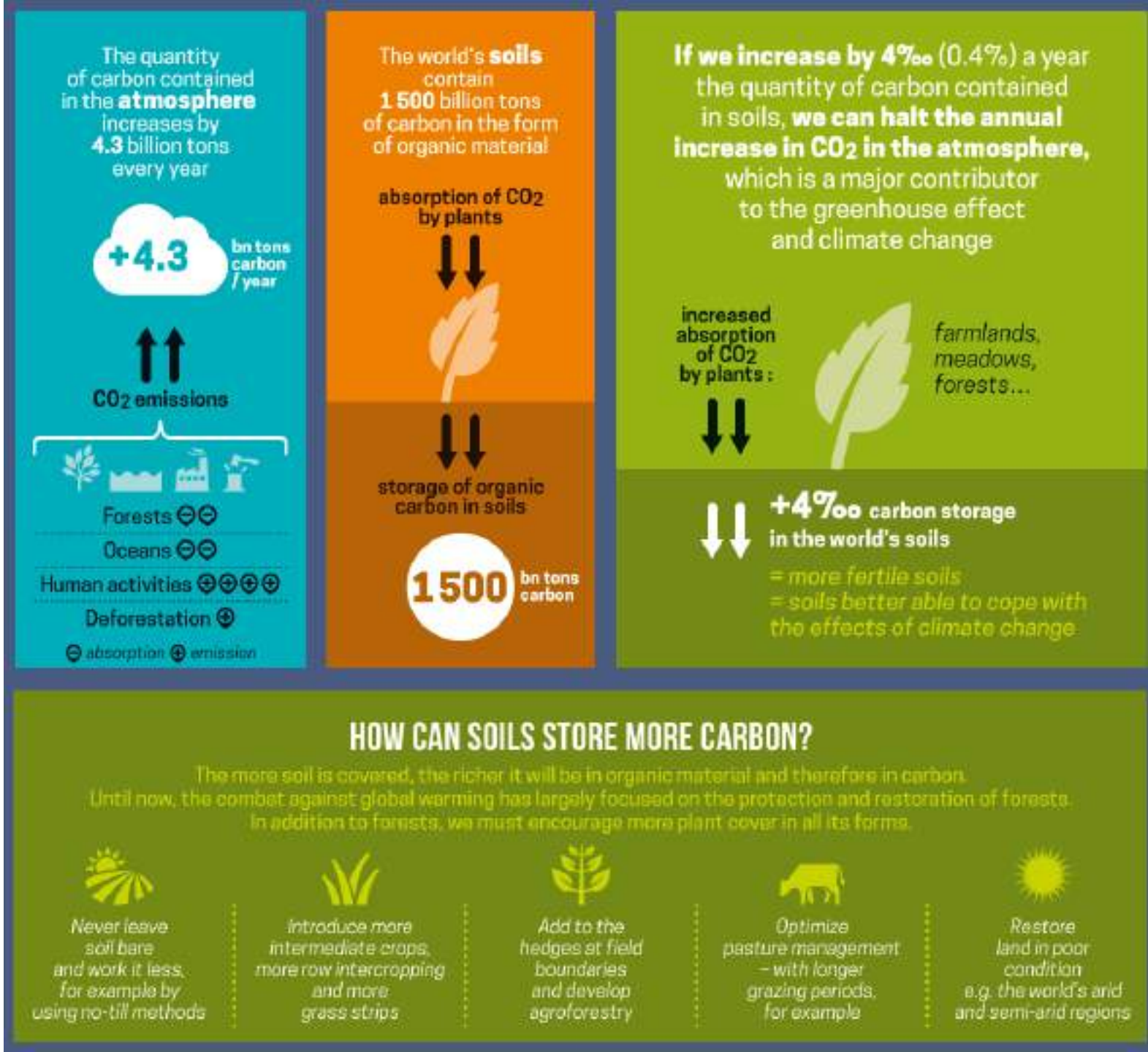
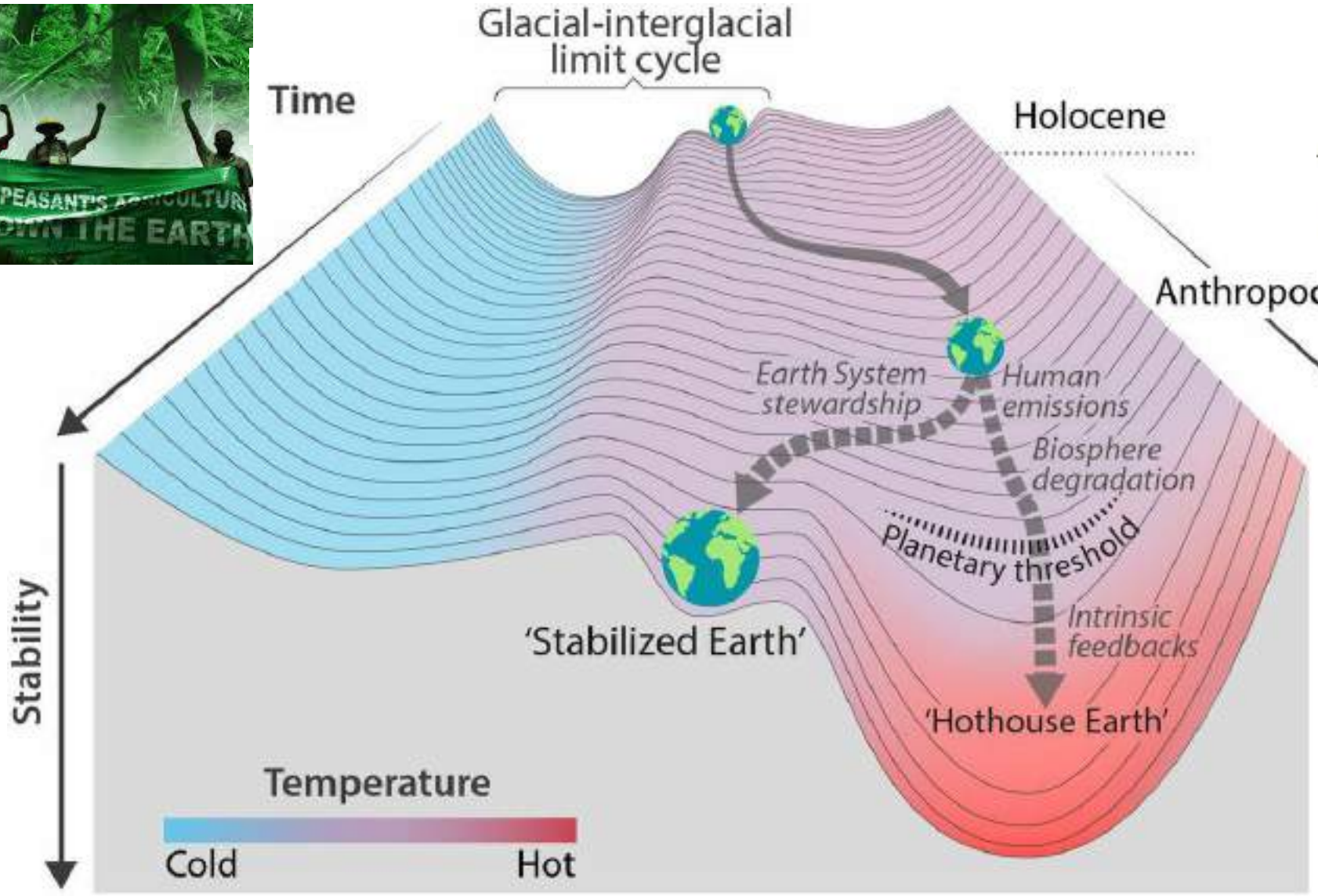
Agroecology can cool the Earth

- In addition to reducing GHGs, **agroecology can cool the Earth System** by ***sequestering carbon in the soil***, as proposed by **the 4 per 1000 initiative.**

https://4p1000.org/?lang=en



Agroecology can cool the Earth. To what extent is still unknown…

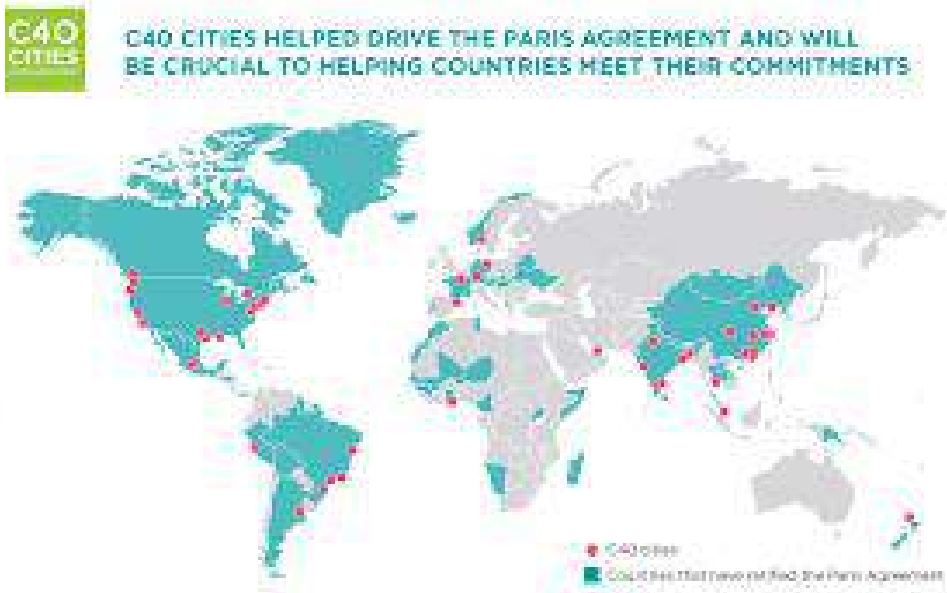


Steffen, W., Rockström, W., Richardson, K., et al. (2018). **Trajectories of the Earth System in the Anthropocene**. *Proceedings of the National Academy of Sciences USA* 115 (33), 8252-8259. https://doi.org/10.1073/pnas.1810141115

PNAS

So *let's advance towards agroecology-based food territories* reconnecting edible cities with farmers!

C40 CITIES
CLIMATE LEADERSHIP GROUP



MILAN URBAN FOOD POLICY PACT

Edible Cities Network