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Poultry production impacts: enlarging the picture

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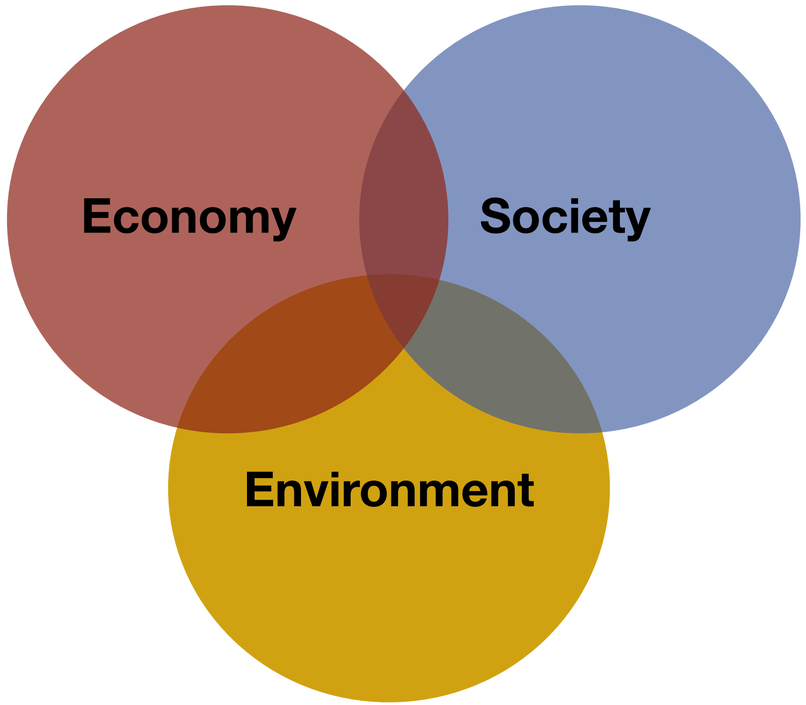
Outline

1. Measuring sustainability: what indicators really say
2. Sensitive "hot spots”
3. The choice of functional unit, i.e. production for whom/what purpose?

Sustainability: the typical “weak” representation

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
(Brundtland, 1987)



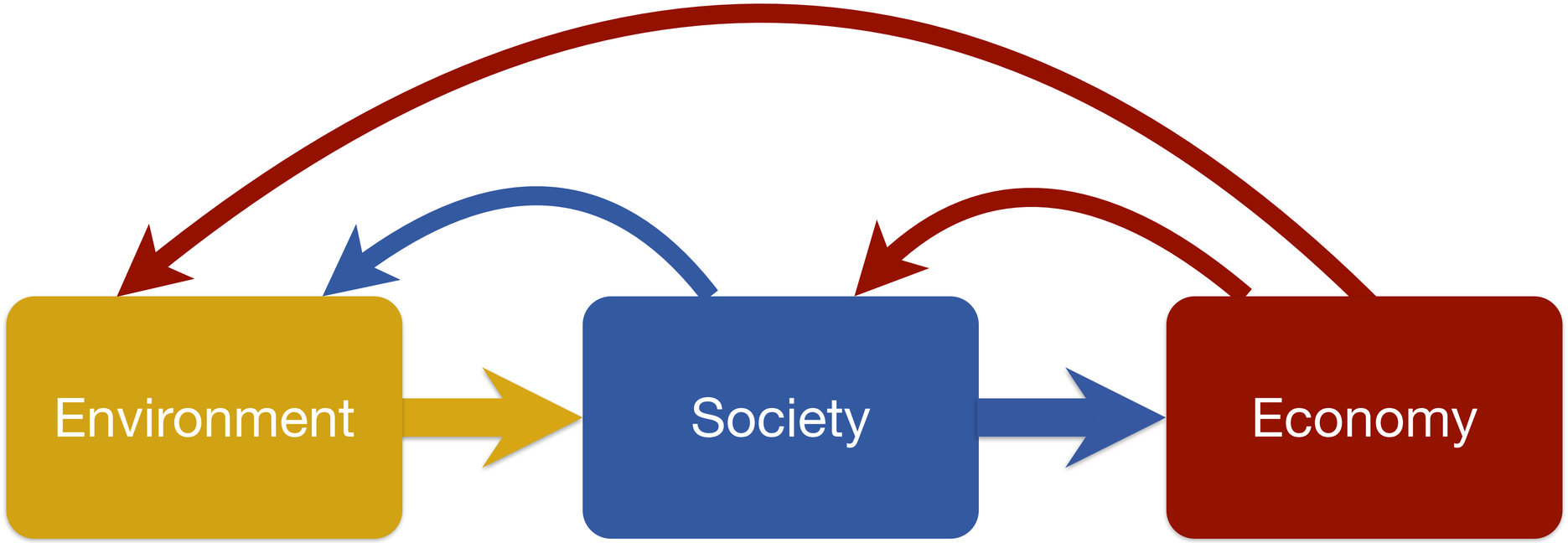
Sustainability: necessary conditions

Two necessary conditions for sustainability (H. Daly, 1990):

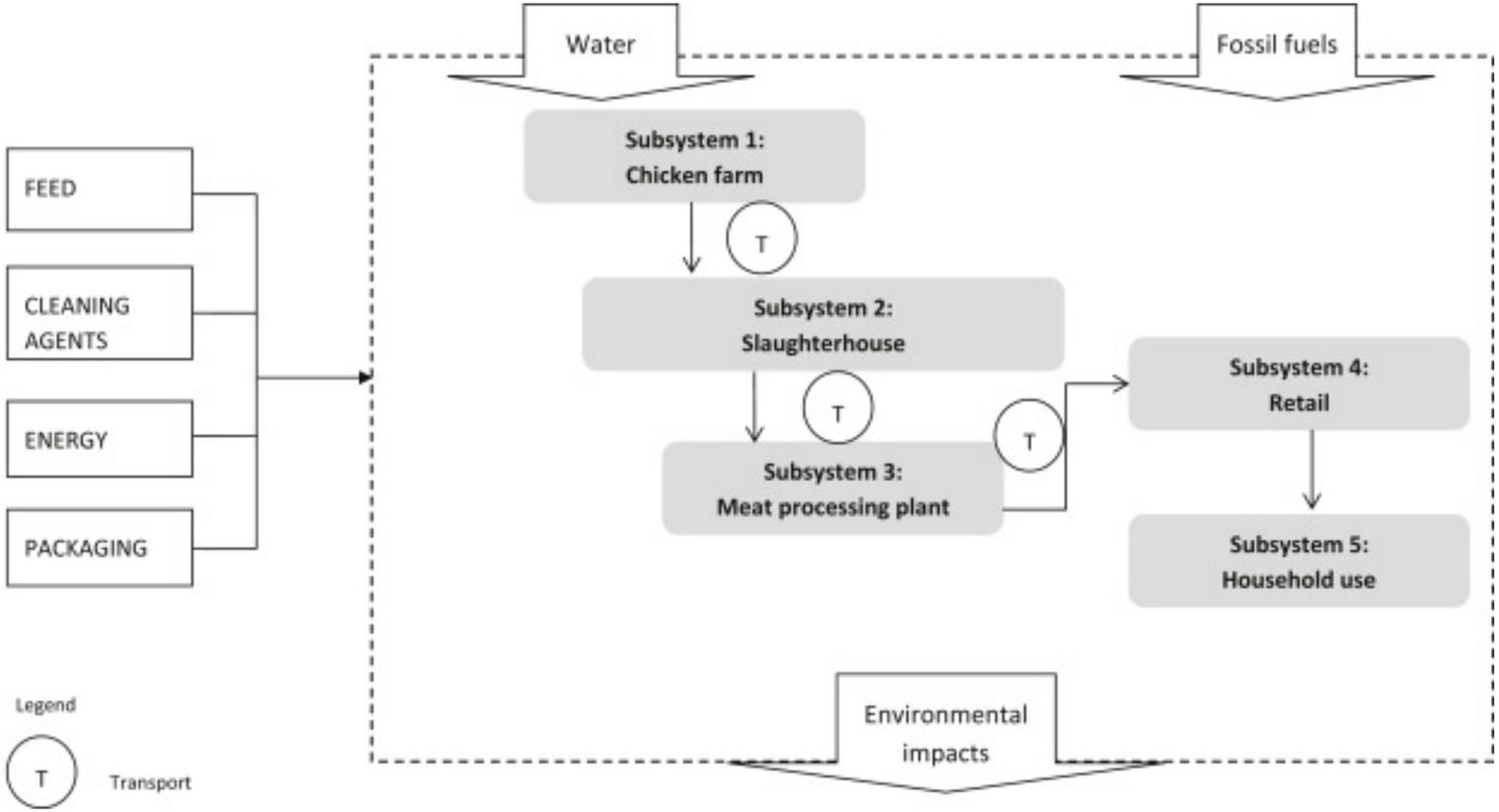
1. Resources should be used at a rate that allows their re-formation;

2. Wastes should be produced at a rate which allows the environment to absorb them.

Sustainability: a “cause-effect” input- state- output (ISO) representation

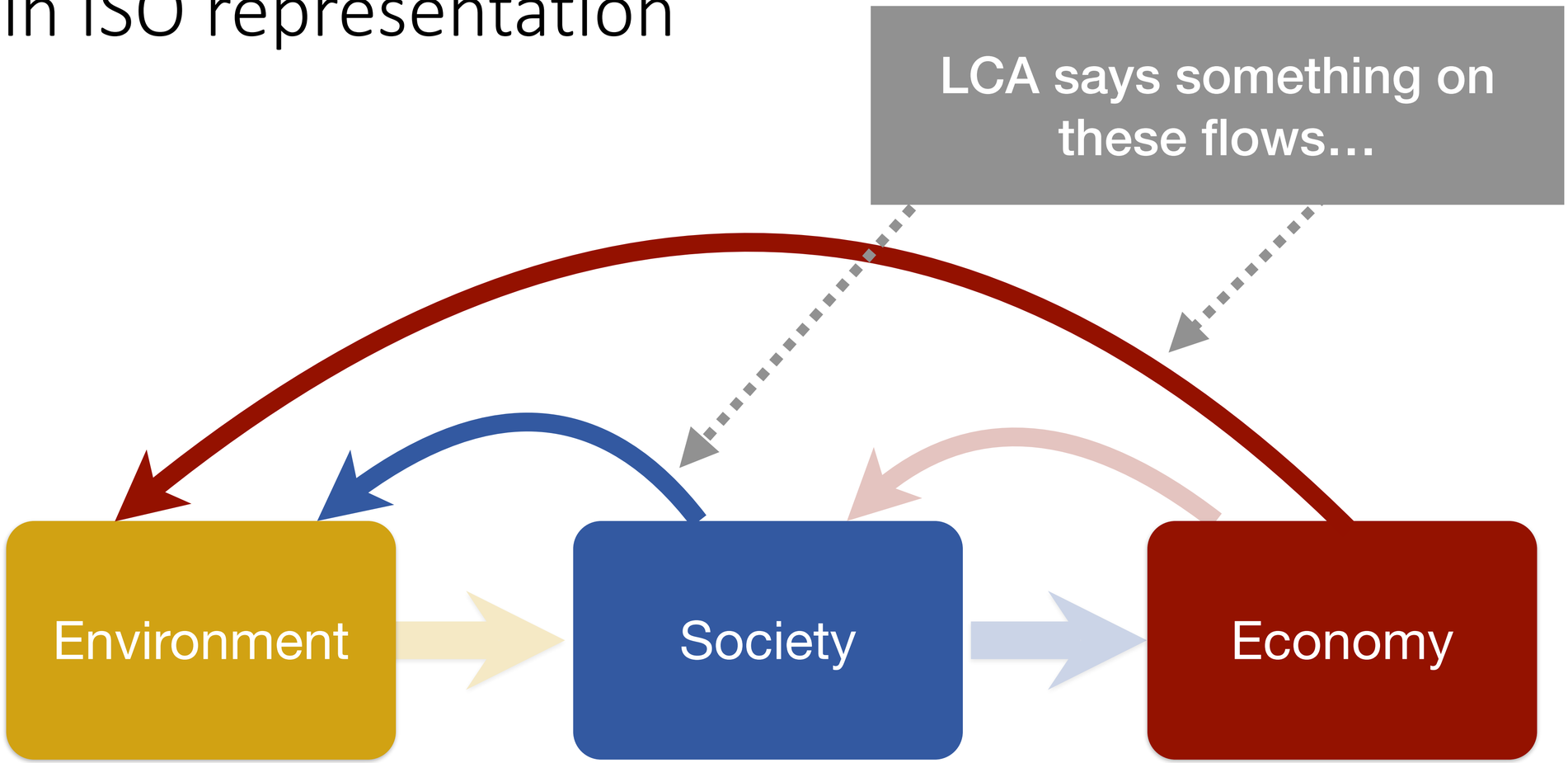


LCA: what is it?



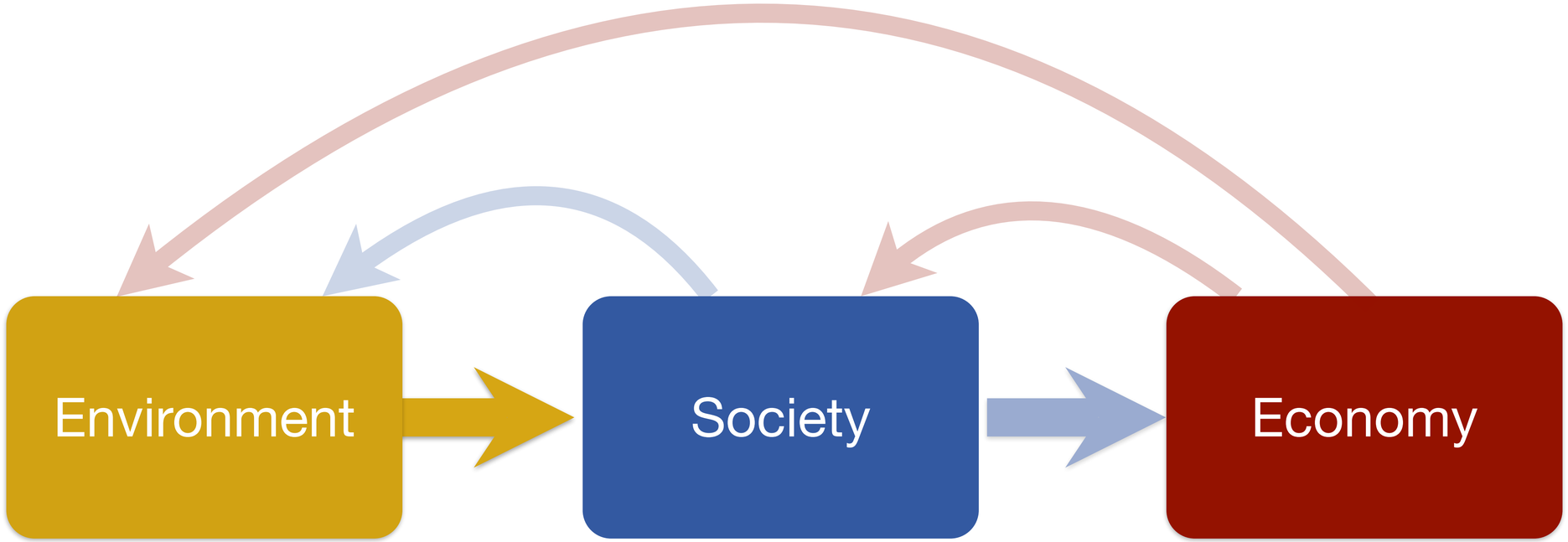
From: Skunca et al., 2018 Journal of Cleaner Production

LCA in ISO representation



… therefore assessing necessary condition 2 by H. Daly

What are possible candidates for assessing necessary condition 1?



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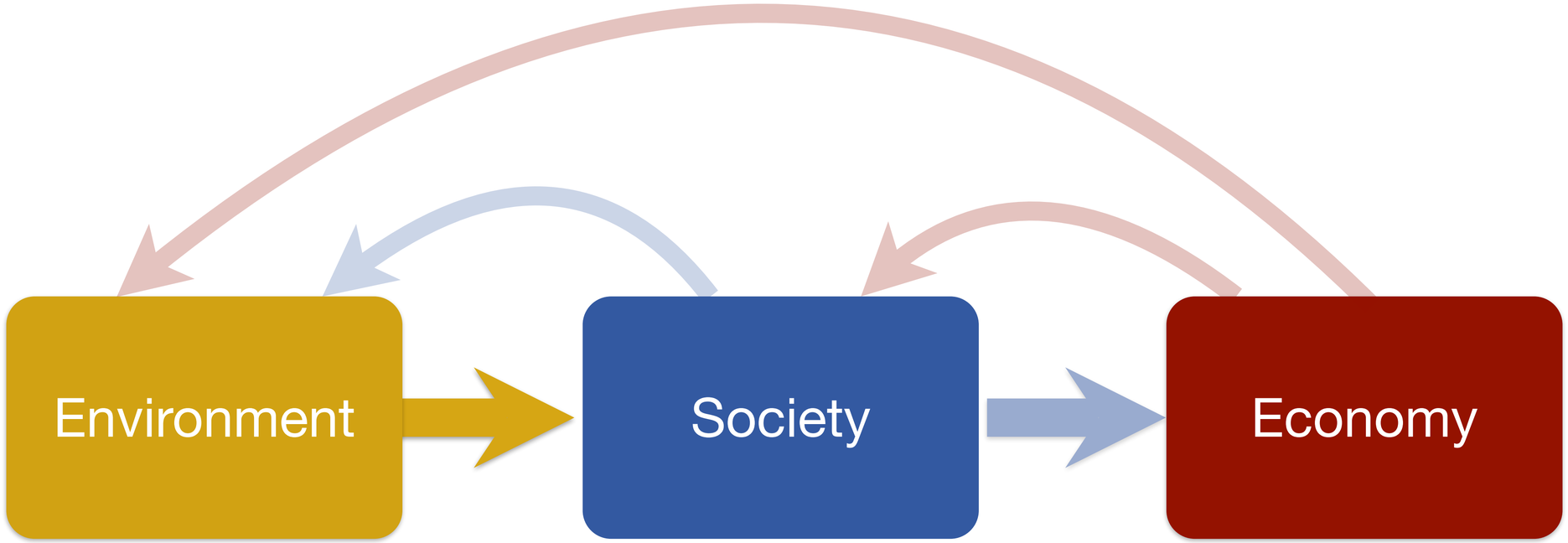
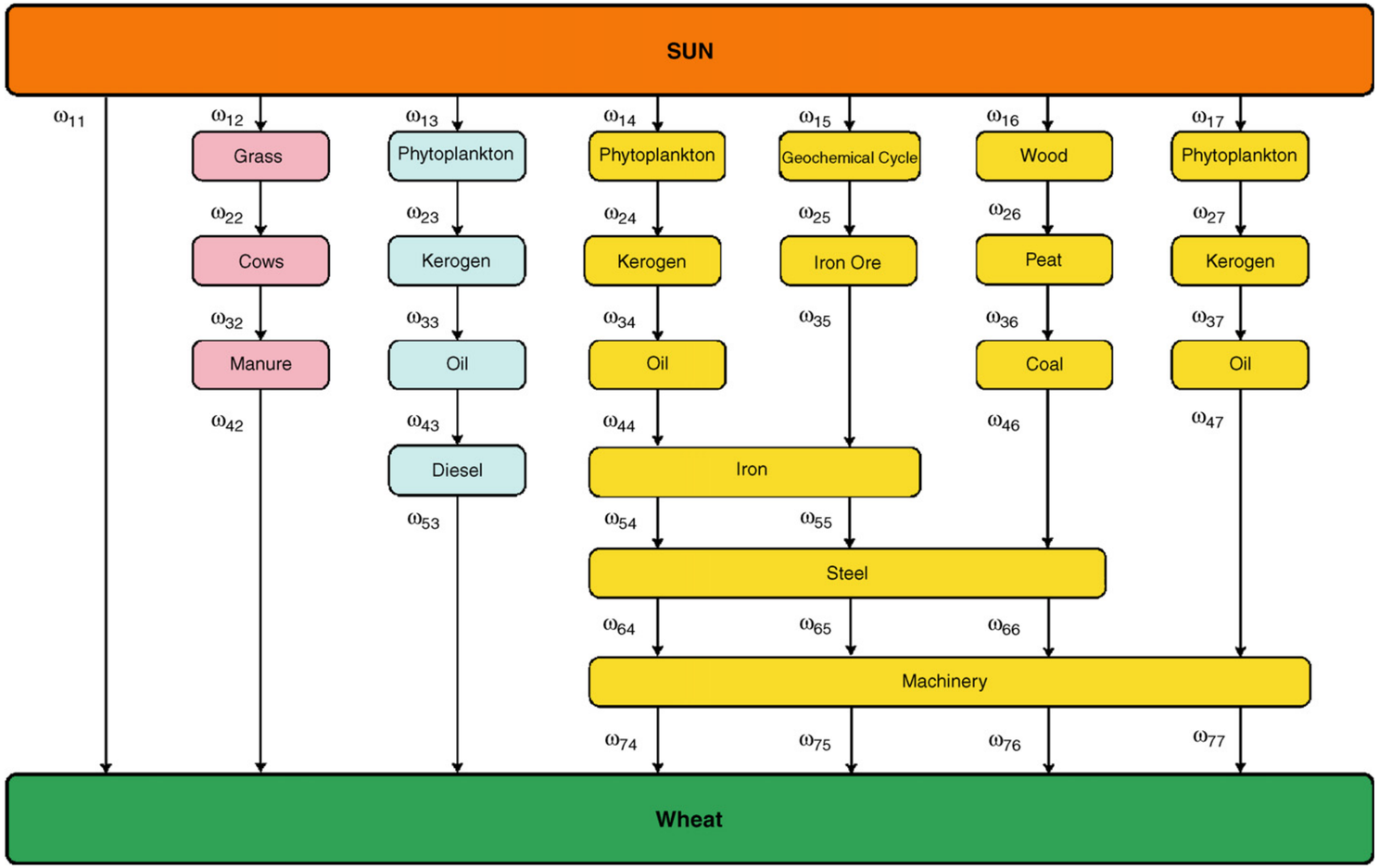


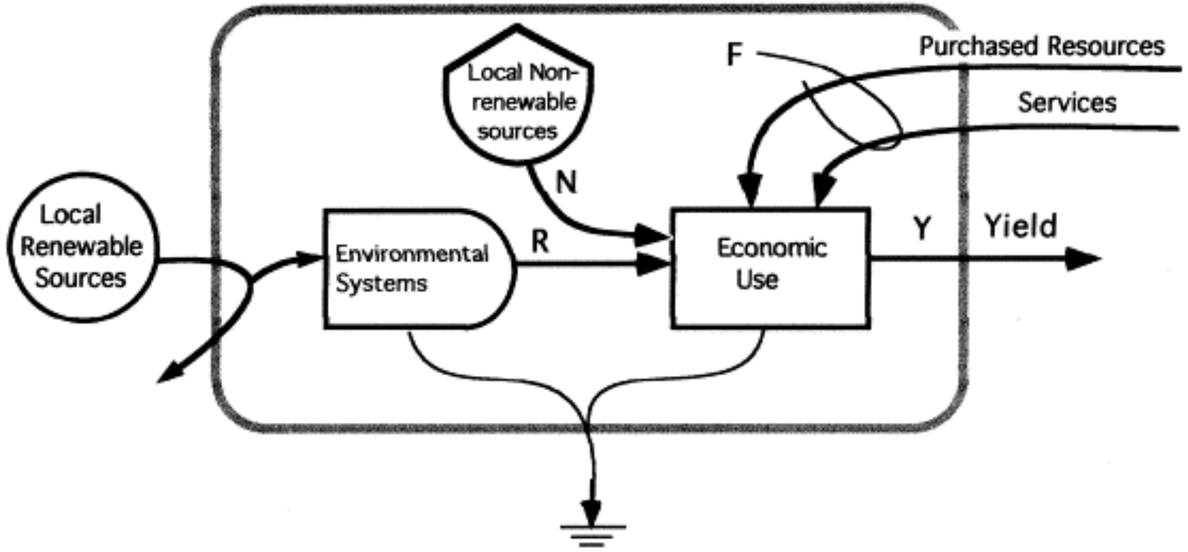
Ecological Footprint, Water Footprint, Emergy…

What is emergy

Emergy (i.e. “solar footprint”) is the amount of solar energy directly and indirectly required for the production of a product

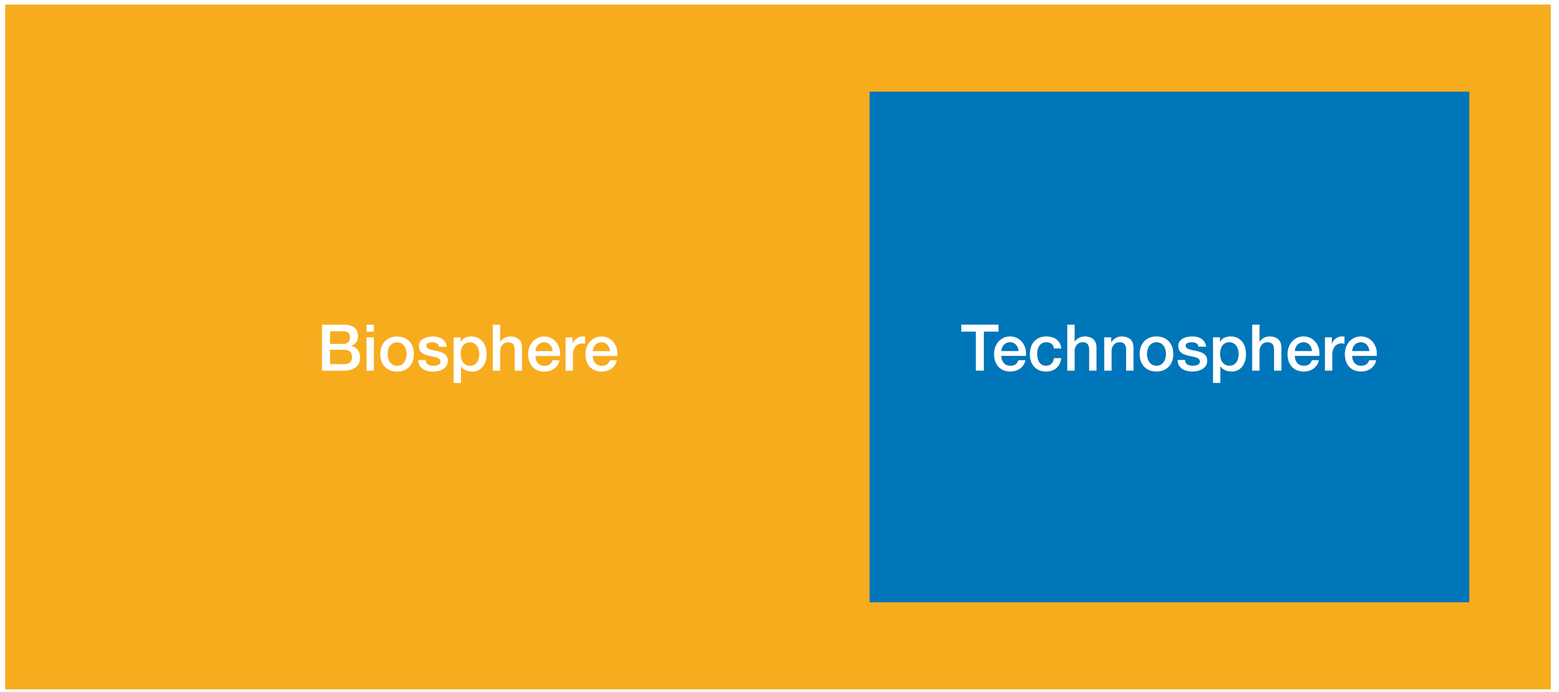


What emergy says

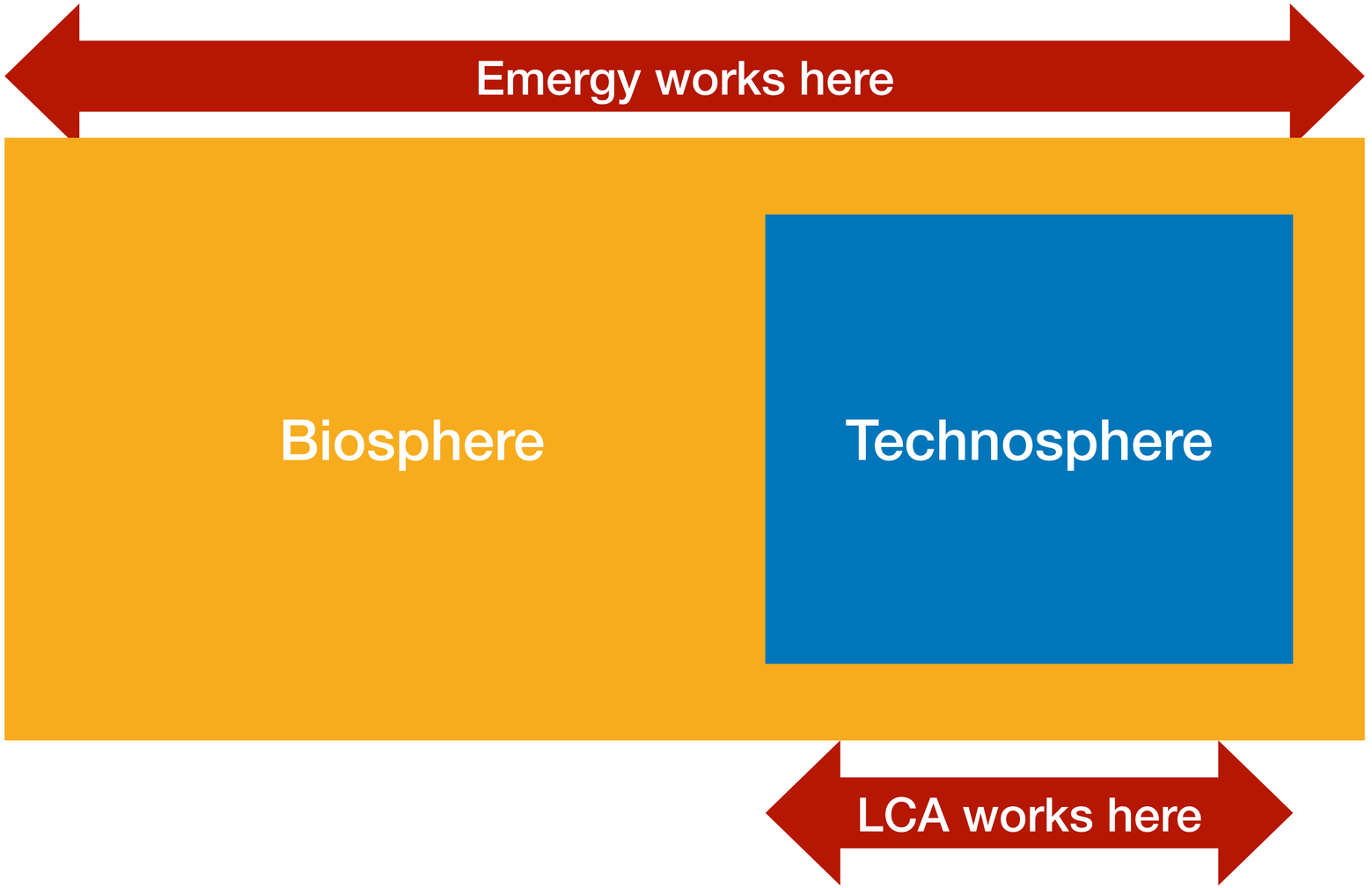


- UEV —> Inefficiency in transforming solar energy into a unit of final product
- %R —> Percentage of emergy that is renewable
- Emergy Investment Ratio —> Imports Emergy/Local
- Emergy Density —> Emergy flow per unit area

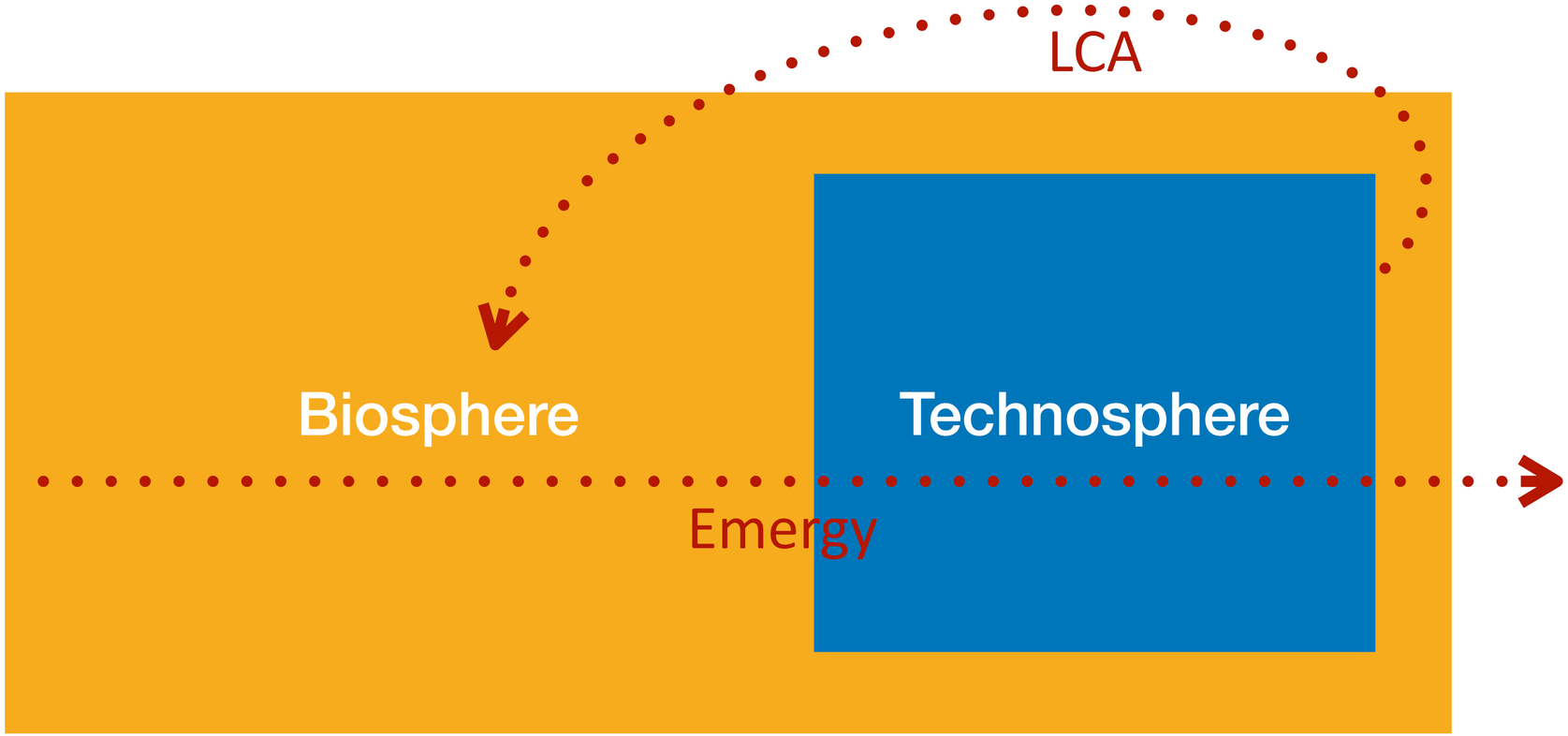
Differences



Differences



Complementarities



Results LCA

LCA applied to poultry shows very well its potentiality: apart from direct ones, chickens' impacts are mostly connected to feed production.

Typically impacts on climate (GWP) shows that fodder production is the highest contributors for broilers poultry. Manure is usually the most important item for Acidification Potential and Eutrophication Potential.

All these factors can be improved by the adoption of proper diets

Conventional broiler performs better than organic one.

Results Emergy

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Agriculture, Ecosystems and Environment 114 (2006) 343–350

Agriculture Ecosystems & Environment

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Sustainability of poultry production using the emergy approach: Comparison of conventional and organic rearing systems

Cesare Castellini [a,*], Simone Bastianoni [b], Claudio Granai [b], Alessandro Dal Bosco [a], Mauro Brunetti [c]

showed that all the emergy-based indicators are in favour of the organic farming system. In particular there is:

higher efficiency in transforming the available inputs in final product;
higher level of renewable inputs;
higher level of local inputs;
lower density of energy and matter flows.

Results: other Footprints

Contents lists available at ScienceDirect

Science of the Total Environment

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

The environmental footprints of the feeds used by the EU chicken meat industry

Fabio Sporchia [a,b], Alessandro Galli [c], Thomas Kastner [d], Federico M. Pulselli [b], Dario Caro [a,e,*]

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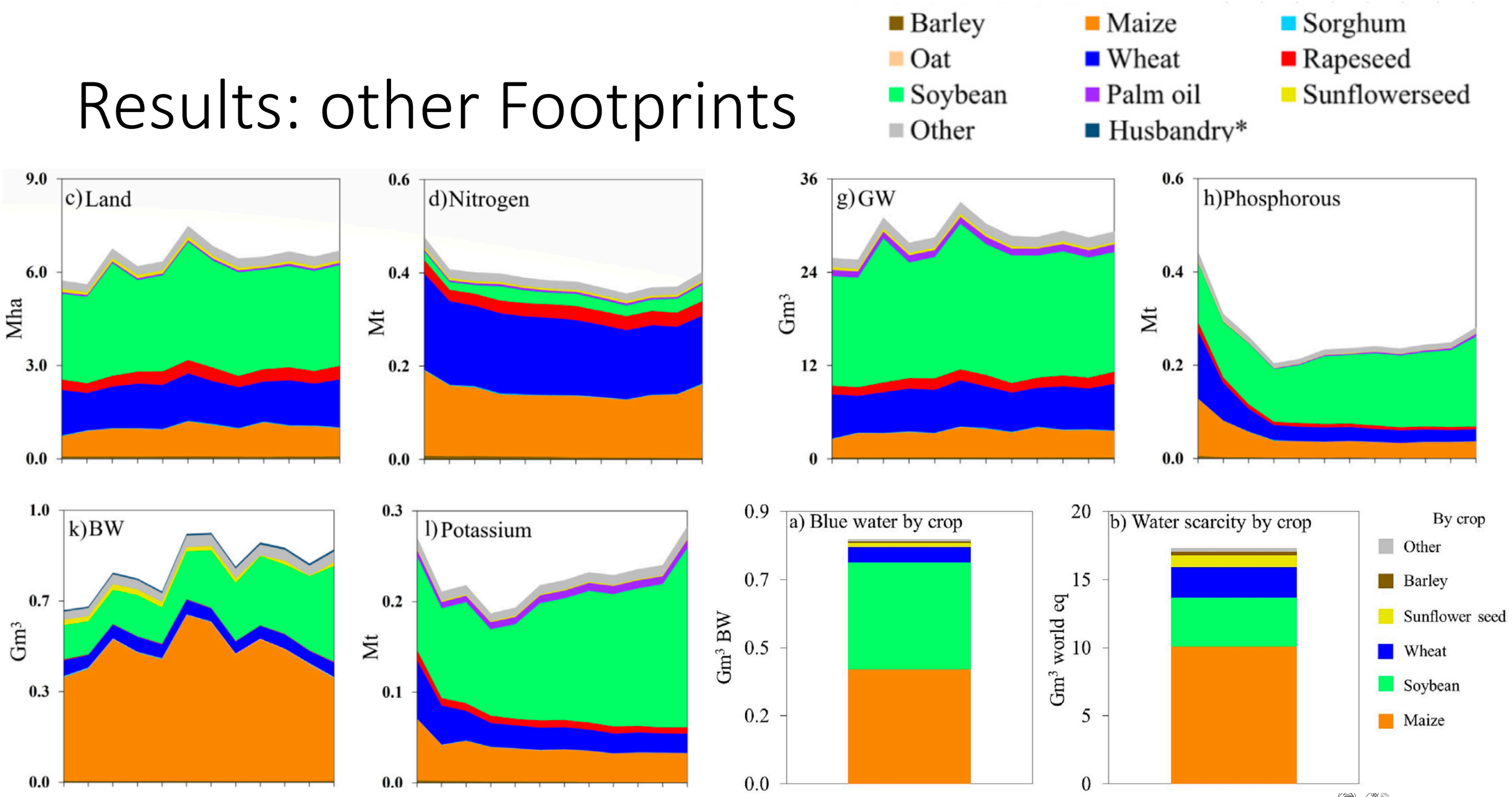
[b] Ecodynamics Group, Department of Physical Sciences, Earth and Environment, University of Siena, Italy
[c] Global Footprint Network, 18 Avenue Louis-Casai, 1219 Geneva, Switzerland
[d] Senckenberg Biodiversity and Climate Research Centre (SBIK-F), Frankfurt am Main, Germany
[e] European Commission, Joint Research Centre, Directorate Growth and Innovation, Circular Economy and Industrial Leadership Unit, Seville, Spain

HIGHLIGHTS

- We assess the environmental burden related to the EU chicken feed consumption.
- EU chicken meat industry causes environmental burden in foreign countries.
- The environmental footprint is not decoupled from production volumes.
- Sustainable intensification and revised trade pathways are key drivers.
- Future challenges require actions on multiple political ad technological aspects.

GRAPHICAL ABSTRACT

Results: other Footprints



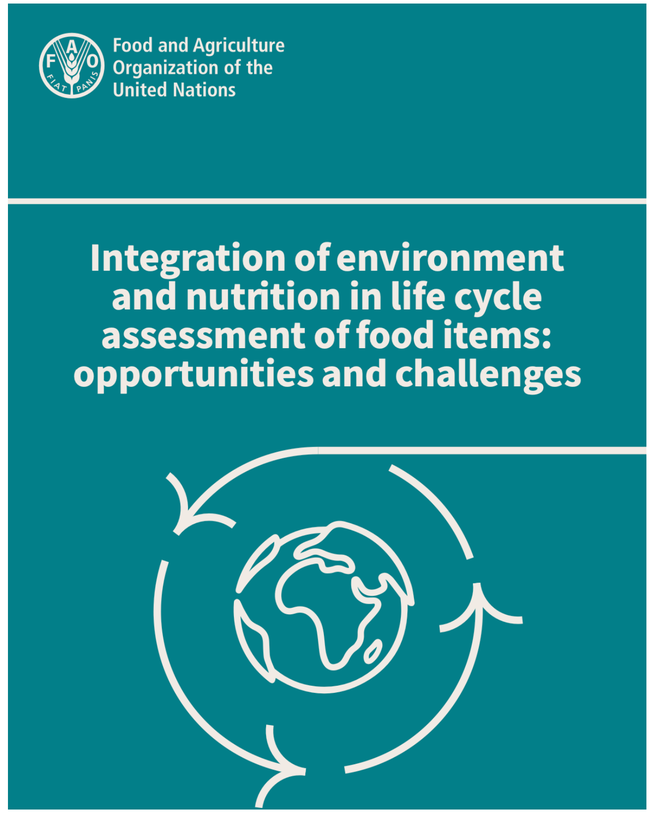
Different perspective according to the purpose

- “Fill the bellies” → FU in grams or Joules
- Provide nutritional elements → FU in grams of elements

Nutritional LCA (FAO, 2021)

"Tools such as life cycle assessment (LCA), which is often used by food system actors and policymakers, could provide a reliable basis for assessing and comparing sustainability in different contexts. **However, LCA methodologies also have some limitations and often fail to provide sufficient guidance on environmental and nutrition impacts** that users should be capturing when comparing the overall sustainability and health impacts of different food products. "

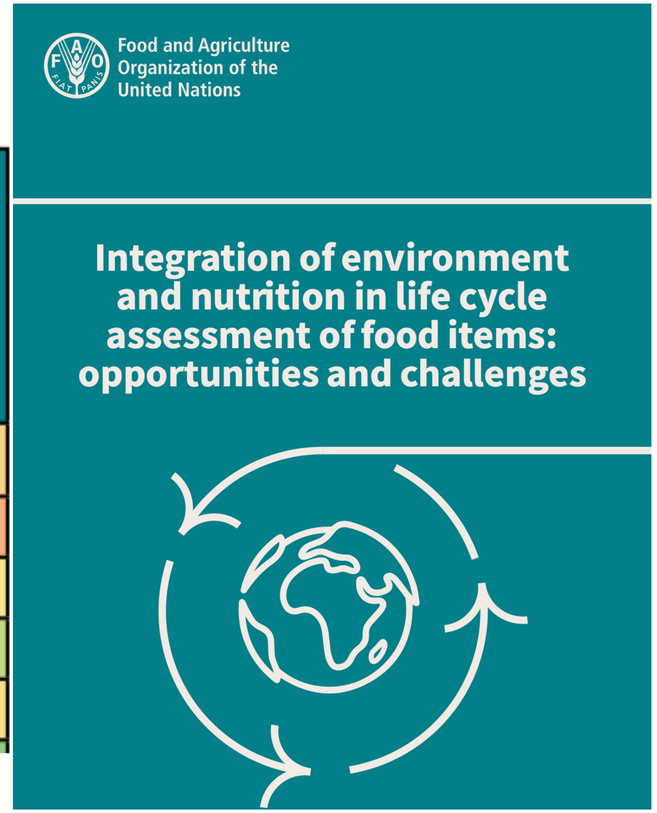
Jamie Morrison, Director, Food Systems and Food Safety Division FAO



Nutritional LCA (FAO, 2021)

Table 11: Examples of greenhouse gas emissions (kg CO_2e) of food items across a selection of functional units

Food item	Type of food	kg CO_2 e/ 100 g product	kg CO_2 eq/ serving size	kg CO_2 e/ 100 g dry weight	kg CO_2 e/ 100 kcal	kg CO_2 e/ 100 g protein	kg CO_2 e/ 100 mg calcium
Ham shoulder medium fat boiled	Red meat	1.08	0.16	3.95	0.81	6.60	9.04
Beef rump steak prepared	Red meat	3.13	2.35	9.01	2.15	10.70	21.46
Potatoes w/o skins boiled average	Starchy vegetables	0.09	0.05	0.42	0.11	4.86	1.24
Eggs (chicken) boiled average	Eggs	0.43	0.22	1.82	0.34	3.51	0.53
Chicken with skin prepared	Poultry	1.36	1.02	3.17	0.59	5.25	4.53



Conclusions

- LCA provides just a part of the information about environmental sustainability
- Emergy can be a perfect candidate to complement LCA information
- Always check Limiting Factors: if water is a LF, sustainability of poultry will be at risk because of maize and soybean
- Mind the denominator: are we comparing the same “stuff”? Nutritional LCA (but also emergy and footprints) can help answer this

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THANKS FOR YOUR ATTENTION!

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