UP FARMING

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Erasmus+

PIEMONTE - GALICIA

PART 1 + PART 2

# Updating sustainability application & communication in the livestock farming sector

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# AIMS AND SCOPE

✓ explain what means sustainability

✓ how to know and evaluate the sustainability of a complex system as a livestock farm (identification of critical and strengths points)

✓ how communicate the sustainability

Tools for technical assistance by a farm consultant who must be able to identify the key points to advise the farmer to improve and measure its sustainability and communicate with the stakeholders

# PROGRAMME AND TIMETABLE

| | 17 Monday | 18 Tuesday | 19 Wednesday | 20 Thursday | 21 Friday |
|---|---|---|---|---|---|
| 9,00-10,40 | Course presentation by CIA Piemonte | E. Dinuccio CCP and mitigation strategies | S. Blanc Theory and practice of the LCA method | FARMS VISITS | FFREE DAY |
| 10,40-11,00 | Break | Break | Break | | |
| 11,00-12,40 | D. Biagini Introducing sustainability | S. Blanc Theory and practice of the LCA method | D. Biagini Communicate sustainability | | |
| 12,40-14,00 | Lunch | Lunch | Lunch | Stupinigi visit and Lunch | |
| 14,00-15,40 | S. Blanc Theory and practice of the LCA method | S. Blanc Theory and practice of the LCA method | E. Dinuccio CCP and mitigation strategies | FARM VISITS | |
| 15,40-15,50 | Break | Break | Break | | |
| 15,50-17,30 | E. Dinuccio CCP and mitigation strategies | D. Biagini How measure sustainability | E. Dinuccio CCP and mitigation strategies | | |
| During farm transfer | | | | D. Biagini CCP and mitigation strategies | |

Teaching tasks:

- ✓ explain sustainability
  - D. Biagini
- ✓ evaluate sustainability
  - S. Blanc
  - D. Biagini
- ✓ improve sustainability
  - E. Dinuccio
  - D. Biagini
- ✓ communicate sustainability
  - D. Biagini


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# SUSTAINABILITY AND ENVIROMENTAL IMPACT

## Sustainability

«Meeting the needs of the present without compromising the ability of future generations to meet their own needs»
while ensuring a balance between economic growth, environmental care and social well-being

(Bruntland Report-WCED, 1987)

## Environmental impact

“Environmental changing that involves system of relationships among human, natural, chemical-physical, climate, landscape, architectonic, cultural, agricultural and economic factors as result of the implementation of plans, programs or projects during their achievement, management and abandonment so as malfunctions”

(art. 5 D.Lgs. 152/2006)

# SUSTAINABLE DEVELOPMENT


Concept introduced by the WCED Brundtland Report in 1987

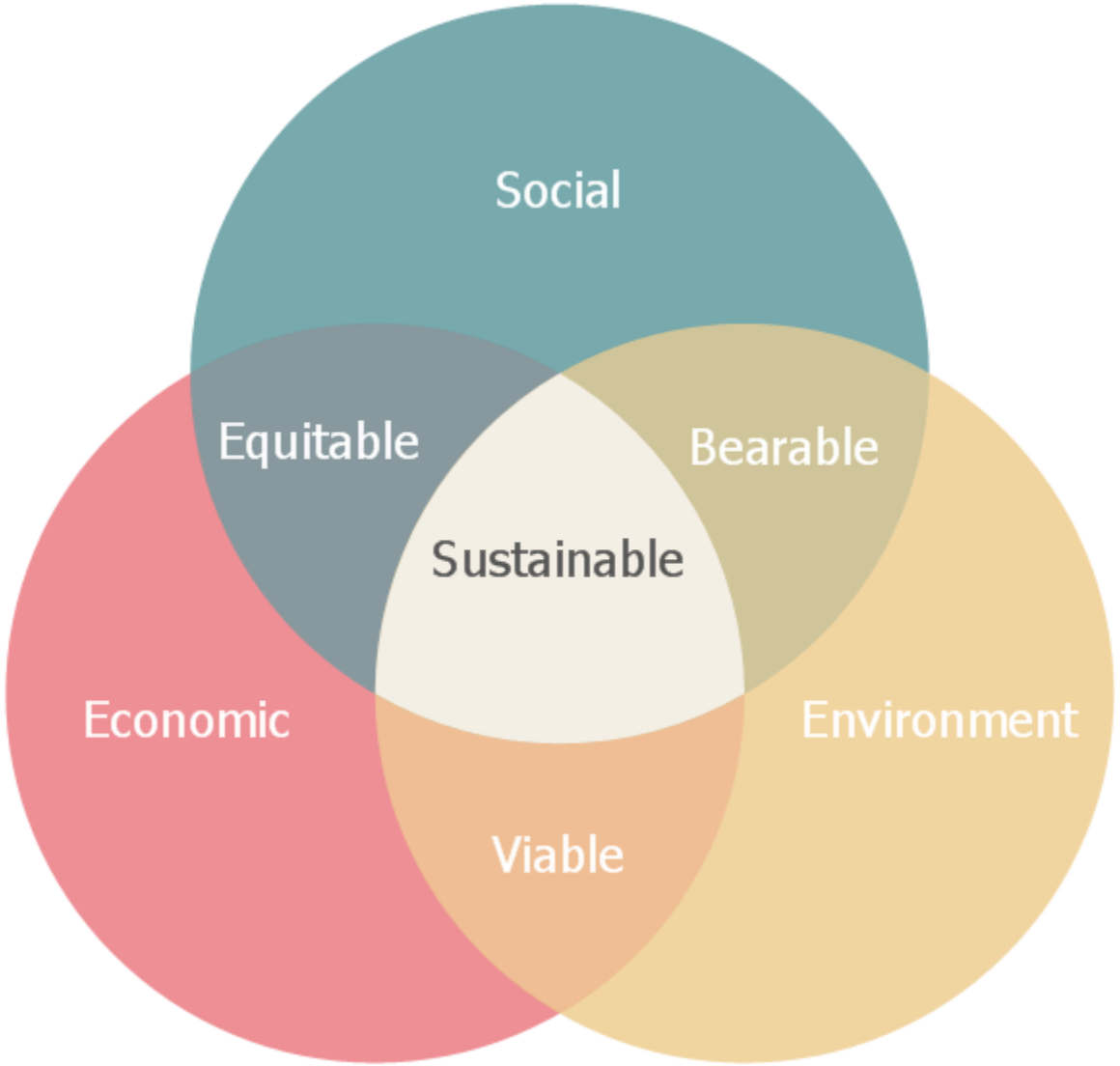
After 2 years

recorded more than 60 different definitions

After 4 years

300 definitions of the word sustainability

# SUSTAINABILITY




Obtained by the concurrence of 3 components:

**Economic**
(e.g. savings, wages, infrastructures, …)

**Social**
(e.g. healt, culture, education, …)

**Environment**
(e.g. air, water, landscape, biodiversity, …)

# SUSTAINABILITY vs UNSUSTAINABILITY (1)

How to answer the question "How are you?"

## FINE

- ✓ At most, states of mind are expressed that describe non-objective conditions, which are presumed to be transitory

## BAD

- ✓ “I have high cholesterol”
- ✓ "I have heachache”
- ✓ “... the triglycerides...”
- ✓ “I have high blood pressure

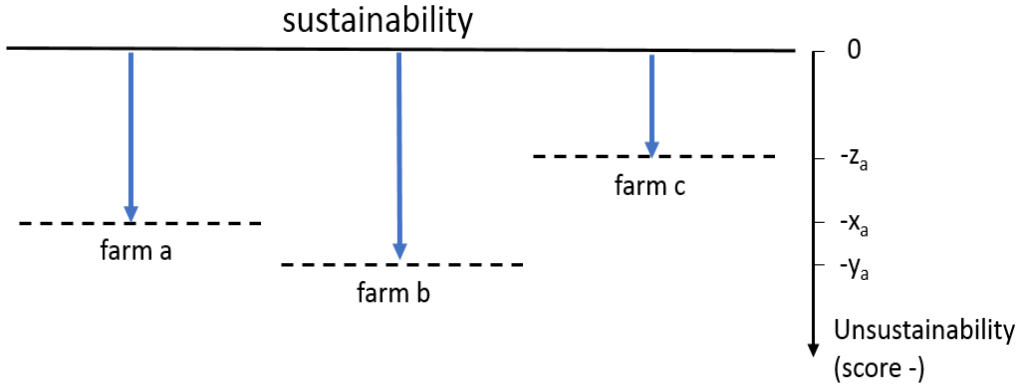
# SUSTAINABILITY vs UNSUSTAINABILITY (2)

Sustainability cannot be measured because it is not a physical phenomenon; sustainability is an ideal state

We can then reverse the problem and measure unsustainability, as the distance from the ideal state of sustainability

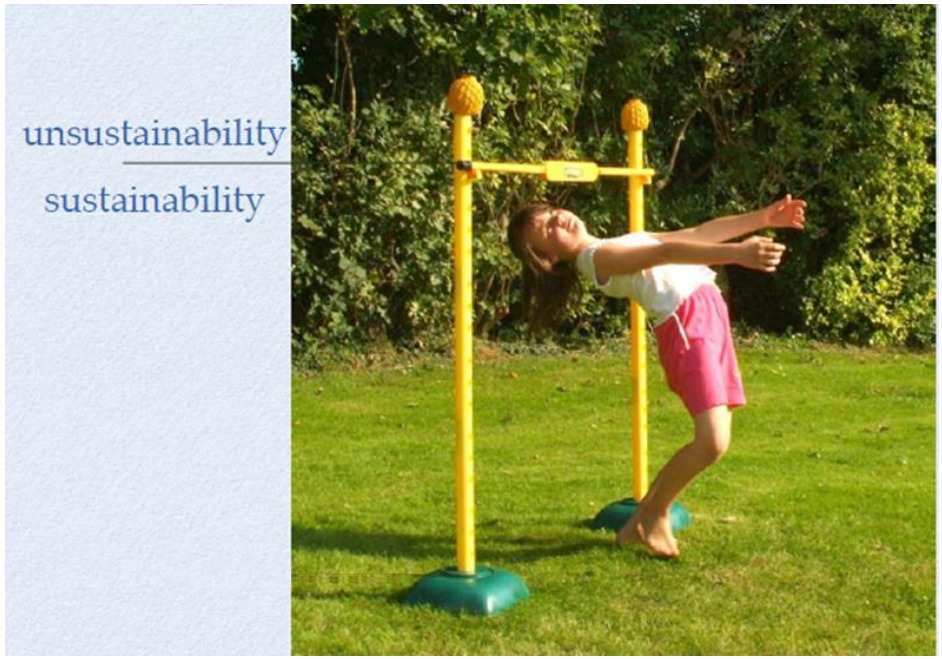
PROBLEM: how to measure unsustainability (and how to reduce it)?

It is necessary to use different approaches to highlight different aspects of unsustainability



# HOW MEASURE SUSTAINABILITY

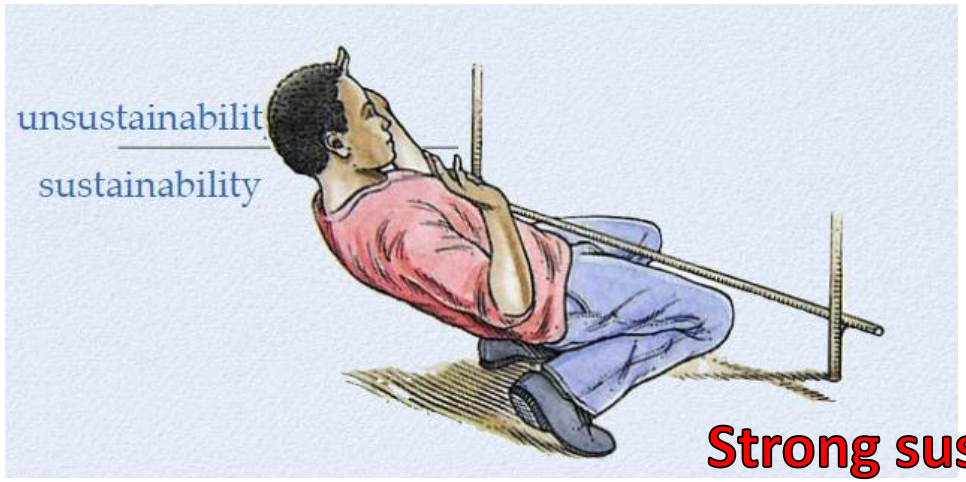
## Weak sustainability




Sustainability is a political choice

We do not measure sustainability
but unsustainability

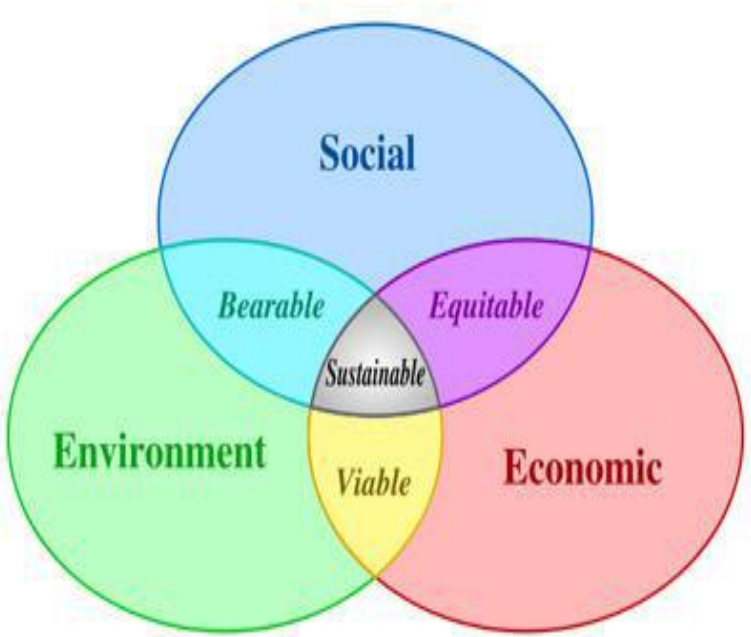
We have several methods that measure
single sustainability component



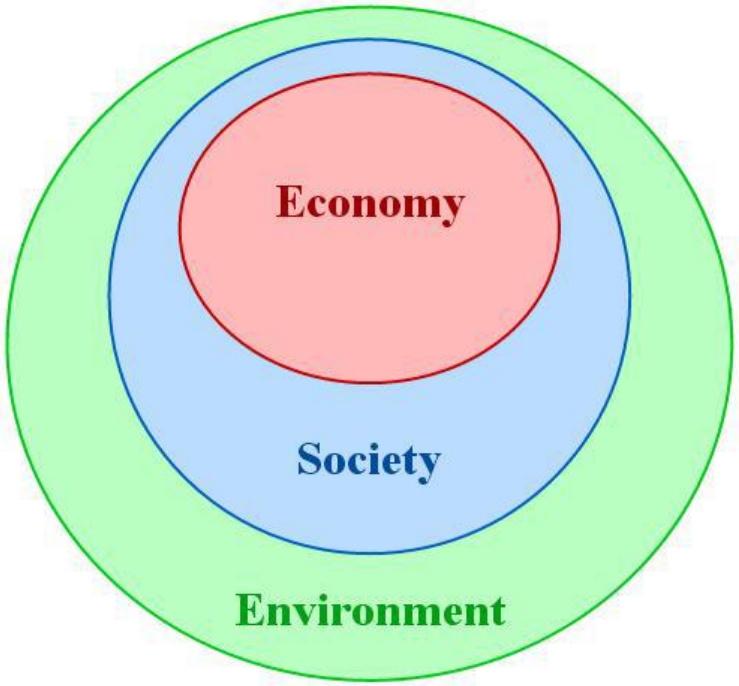

**Strong sustainability**

# SUSTAINABILTY IS VARIABLE

## Weak sustainability



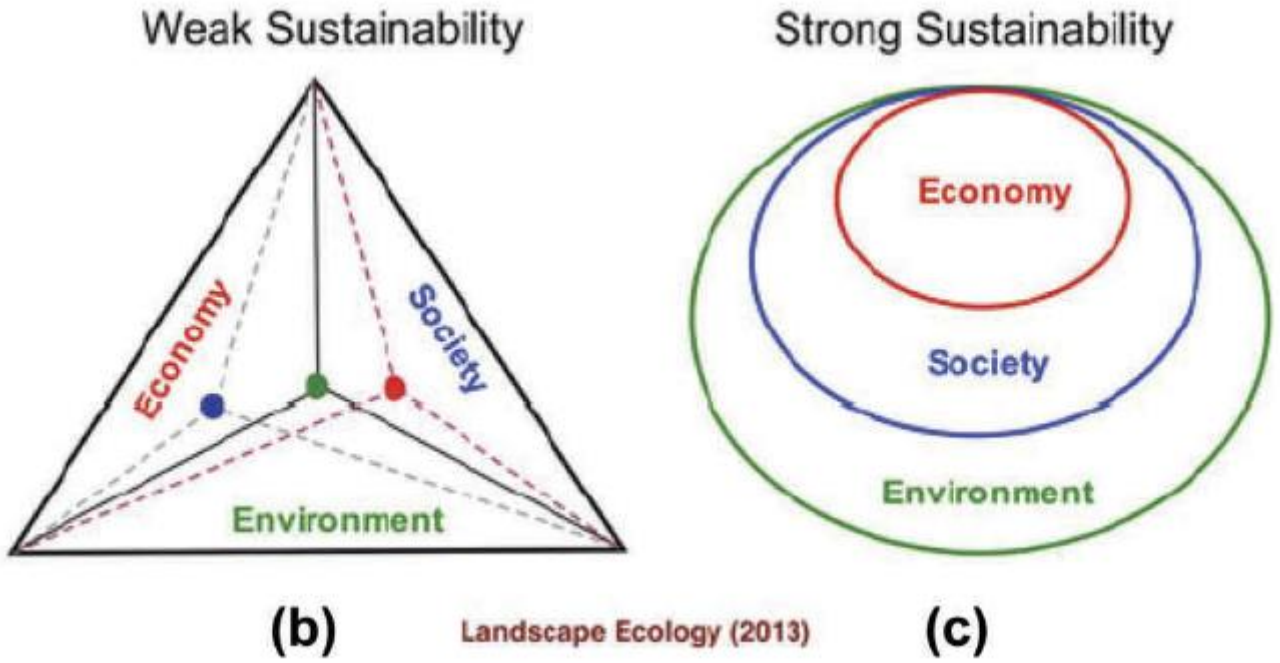

## Strong sustainability




$$J = \underbrace{[W(T)[A_T, Z_T, T]e^{-rT}]}_{(a)} + \underbrace{[\int_0^T Yt\,[\tilde{A}o, Ut, \dot{Zt}, t]e^{-rt}dt}_{(b)}$$

# SUBSTITUTABILITY

Allows the substitutability of natural capital and produced capital




Not allows the substitutability of natural capital and produced capital

The three situations in (b), point **blue**, **green** or **red**, are equally sustainable because the perimeter and the area of the triangle do not change: the sum of environmental, economic, and social capital does not decrease

In (c) situation the gains in the human-built (Social and Economic) cannot come at the expense of natural capital while still allowing for development that does not reduce natural capital levels

# INDICATORS

## Weak sustainability

Specific indicators

To accomplish this goal, sustainability researchers generally select environmental, social, and economic sub-indicator sets:

$\text{Sub-index}_1$
$\text{Sub-index}_2$
…
$\text{Sub-index}_n$

SUSTAINABLE INDEX = (Sub-index1 + Sub-index2 +… Sub-indexn) / n

≠ by

## Strong sustainability

Specific indicators

SUSTAINABLE INDEX = Δenvironmental

where ΔEnvironmental represents the change in the Environmental sub-SI over a time gap
If natural capital is increased over the considered period the sustainability score is positive and if natural capital decreases over the same period, the sustainability score is negative

# ENVIRONMENTAL SETS OF SUB-INDICATORS

| AREA | FUNCTION OR DISFUNCTION |
|---|---|
| **Environmental** | Pollution of water-soils<br>Eutrophication<br>Production of GHGs<br>Production of other gasses<br>Release of odours<br>Acid rain, acidification of the soil<br>Land erosion<br>Desertification<br>Fires, avalanches<br>Use of production by-product residuals<br>Energy accumulated as biomass<br>Groundwater reserves<br>… |

# INDEXES AND UNIT OF MEASURE

Example for the production of Green House Gases (GHG)

| Industrial designation or common name | Chemical formula | GWP for 100-year time horizon | | |
|---|---|---|---|---|
| | | Second assessment report (SAR) | 4th assessment report (AR4) | 5th assessment report (AR5) |
| Carbon dioxide | $CO_2$ | 1 | 1 | 1 |
| Methane | $CH_4$ | 21 | 25 | 28-34(1) |
| Nitrous oxide | $N_2O$ | 310 | 298 | 265 - 298(1) |

(1) Il secondo valore si riferisce al GWP calcolato considerando i climate-carbon feedbacks (cc fb)

Example for acidification

| Acid producer (in air) | $SO_2$ equivalence factor |
|---|---|
| 1 kg HCl | 0.88 kg eq $SO_2$ |
| 1 kg HF | 1.60 kg eq $SO_2$ |
| 1 kg $NO_2$ | 0.70 kg eq $SO_2$ |
| 1 kg $SO_2$ | 1.00 kg eq $SO_2$ |
| 1 kg $H_2S$ | 1.88 kg eq $SO_2$ |
| 1 kg $NH_4$ | 0.89 kg eq $SO_2$ |
| 1 kg $NH_3$ | 0.93 kg eq $SO_2$ |

Example for eutrophication

| Nutrient | $PO_4$ equivalence factor |
|---|---|
| 1 kg Nitrogen oxides (NOx, air) | 0.13 kg eq $PO_4$ |
| 1 kg Total nitrogen (water) | 0.42 kg eq $PO_4$ |
| 1 kg Total phosphorous (water) | 3.07 kg eq $PO_4$ |
| 1 kg Chemical $O_2$ demand (COD) | 0.022 kg eq $PO_4$ |
| 1 kg $NH_3$ | 0.35 kg eq $PO_4$ |
| 1 kg $NH^{4+}$ | 0.33 kg eq $PO_4$ |
| 1 kg $NO^{3-}$ | 0.095 kg eq $PO_4$ |
| 1 kg $NO^{2-}$ | 0.13 kg eq $PO_4$ |

# TERRITORIAL SETS OF SUB-INDICATORS

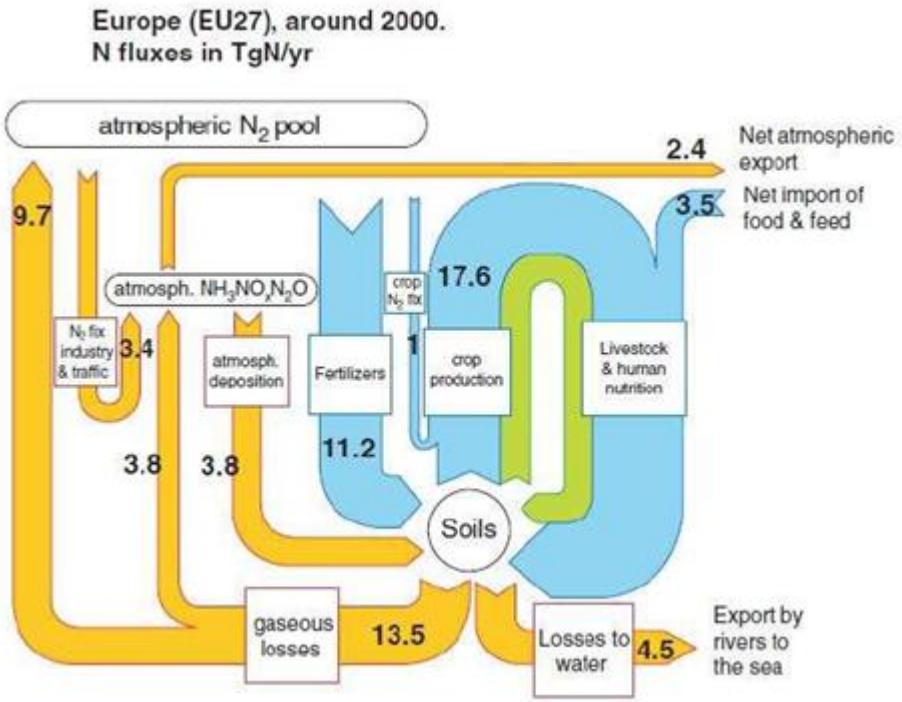
| AREA | FUNCTION OR DISFUNCTION |
|---|---|
| **Territorial** | Green territorial<br>Landscape value<br>Rural development<br>Monitoring of the territory<br>Conditions of minor-roads<br>Hydrogeological instability<br>Organic balance of the soil<br>Biotic balance<br>Biodiversity<br>Germplasm reserve<br>Monitoring of wildlife species<br>… |

# SOCIAL AND ECONOMIC SET OF SUB-INDICATORS

| AREA | FUNCTION OR DISFUNCTION |
|---|---|
| **Social-economic and cultural** | Study of the scientific knowledge<br>The health of men and animals<br>Triggering of the tourist demand<br>Local culture, history and art<br>Traditional foodstuffs<br>Setting up or abandonment of economic activities<br>Emigration-immigration<br>Services available for the local population<br>Cohesion and social wellbeing<br>Distributed income<br>Development of the local supply chain<br>Maintenance of traditions<br>… |

# SCALES

- ✓ Global (planetary)
- ✓ Continental
- ✓ Single nation
- ✓ Local (a territory)
- ✓ Sector-specific
- ✓ Individual (farm) ← Most important spatial unit to implement sustainable action
- ✓ Plot (production process)




because of:

i) the possibility of implementing improvement actions in a quick way;

ii) the elevated accuracy of the measurement of the phenomena that this scale can guarantee;

iii) it being the economic and legal unit legislators refer to, also concerning the payment of subsidies and income supplements

# NECESSARY CONDITIONS FOR SUSTAINABILITY

1. The resources must be used at a rate that allows their renewal (sustainable yield);

2. The waste should be produced at a rate that allows their absorption by the environment

(H.Daly, 1990)

Aspetti per i quali un sistema può essere insostenibile:

✓ excessive use of resources (at least one indicator for resource categories)

✓ excessive production of pollutants (at least one indicator for pollutant categories)

! A systemic approach is therefore needed

# SYSTEMIC APPROACHES

Purpose: use the same approach for different sectors to allow a comparative assessment

Problem: approach born for industrial assessment showed limits of adaptability and all-encompassing vision of all aspects (positive and negative) for biologic system assessment (e.g. agriculture)

Examples: Life Cycle Assessment (LCA)

Ecological Footprint (EF)

Carbon Footprint (CF)

Water Footprint (WF)

Global Footprint

Nitrogen footprint

.....

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# ENVIRONMENTAL EVALUATION METHODS

## Based on resources consumption

- ✓ Environmental space (Opshoor, 1995)
- ✓ Ecological Footprint (Rees, Wackernagel, 1996)
- ✓ Water footprint (Hoekstra, 2002)
- ✓ NPP (Net Primary Productivity Vitousek, 1986)
- ✓ HANPP (Human Appropriation Net Primary Productivity, IFF Austria)

## Based on system metabolism

- ✓ Material Flow Analysis (Wuppertal Institut, IFF, 2000)
- ✓ eMergy (Odum, 1996)
- ✓ exergy (Jorgensen,1998)
- ✓ Energy Flow Analysis (IFF)

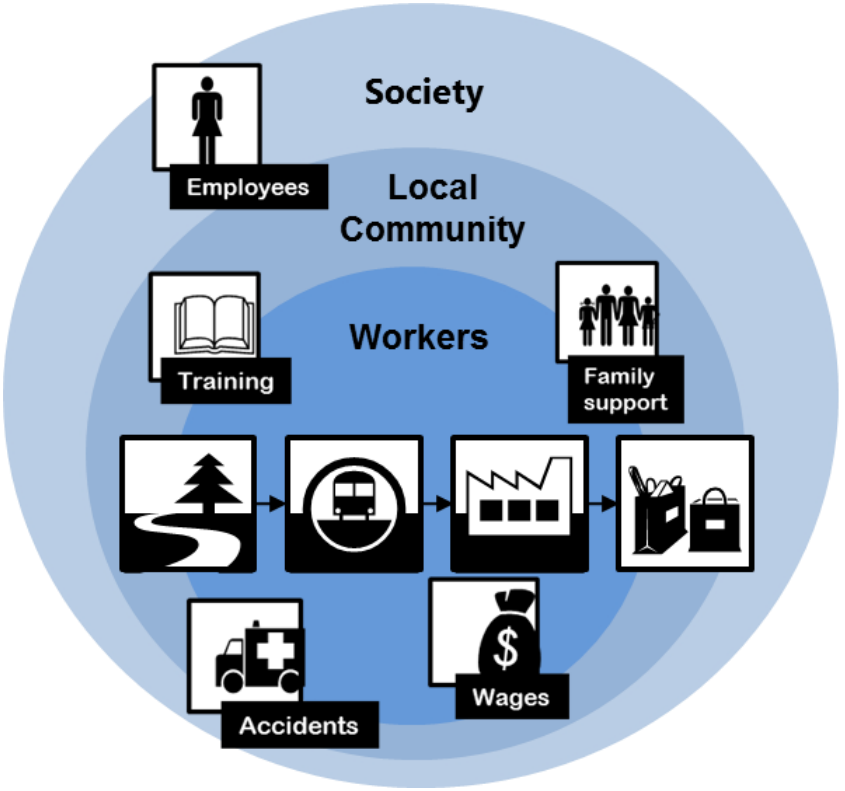

## Based on impact

- ✓ Life Cycle Assessment (LCA)
- ✓ Carbon footprint


# SOCIAL EVALUATION METHODS

## Social Life Cycle Assessment (S-LCA)

is a method (follows the ISO 14040 framework) that can be used to assess the social and sociological aspects of products, their actual and potential positive as well as negative impacts along the life cycle. This looks at the extraction and processing of raw materials, manufacturing, distribution, use, reuse, maintenance, recycling and final disposal. S-LCA makes use of generic and site-specific data, can be quantitative, semi-quantitative or qualitative




Complements the environmental LCA

## Others

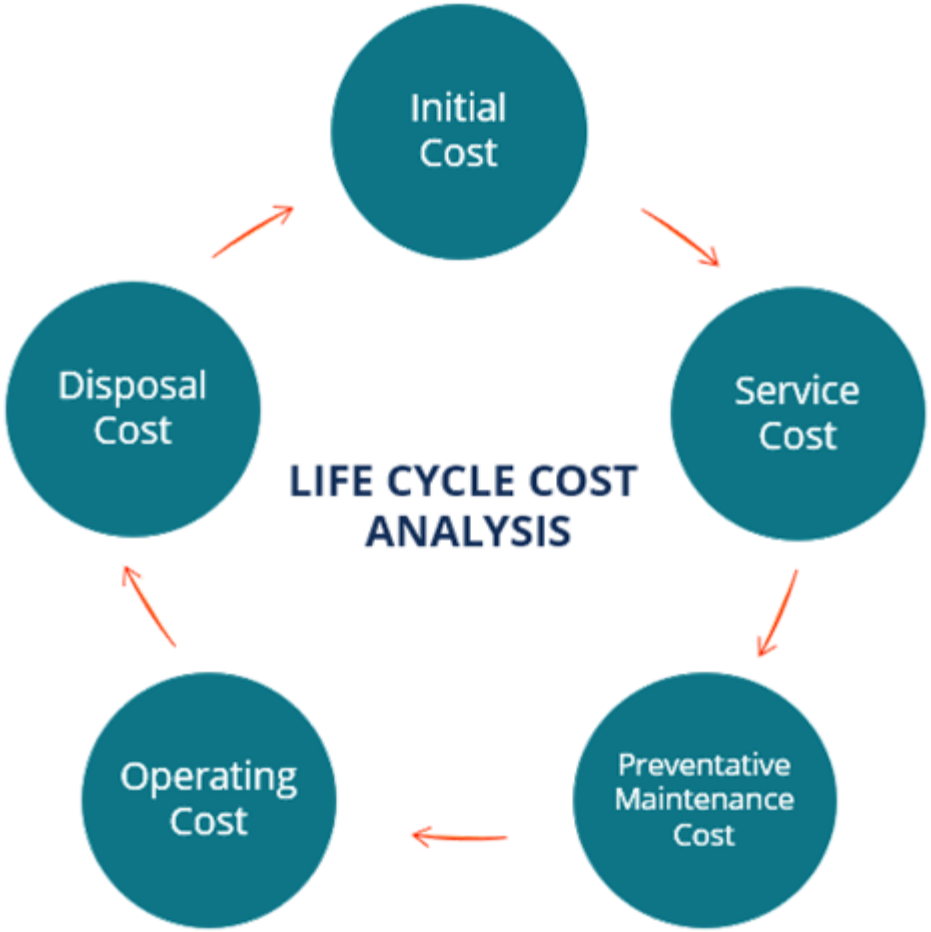
Sustainable livelihoods, Human and social capital measurement, Participatory processes …

# ECONOMIC EVALUATION METHODS

## Life Cycle Costing (LCC)

allows the evaluation costs along the entire life cycle of the product, from production to disposal
The costs that should generally be included in this analysis are:
Purchase and installation; Costs during the using phase (electricity, gasoline, gas, water, training, service provided and maintenance); Disposal costs

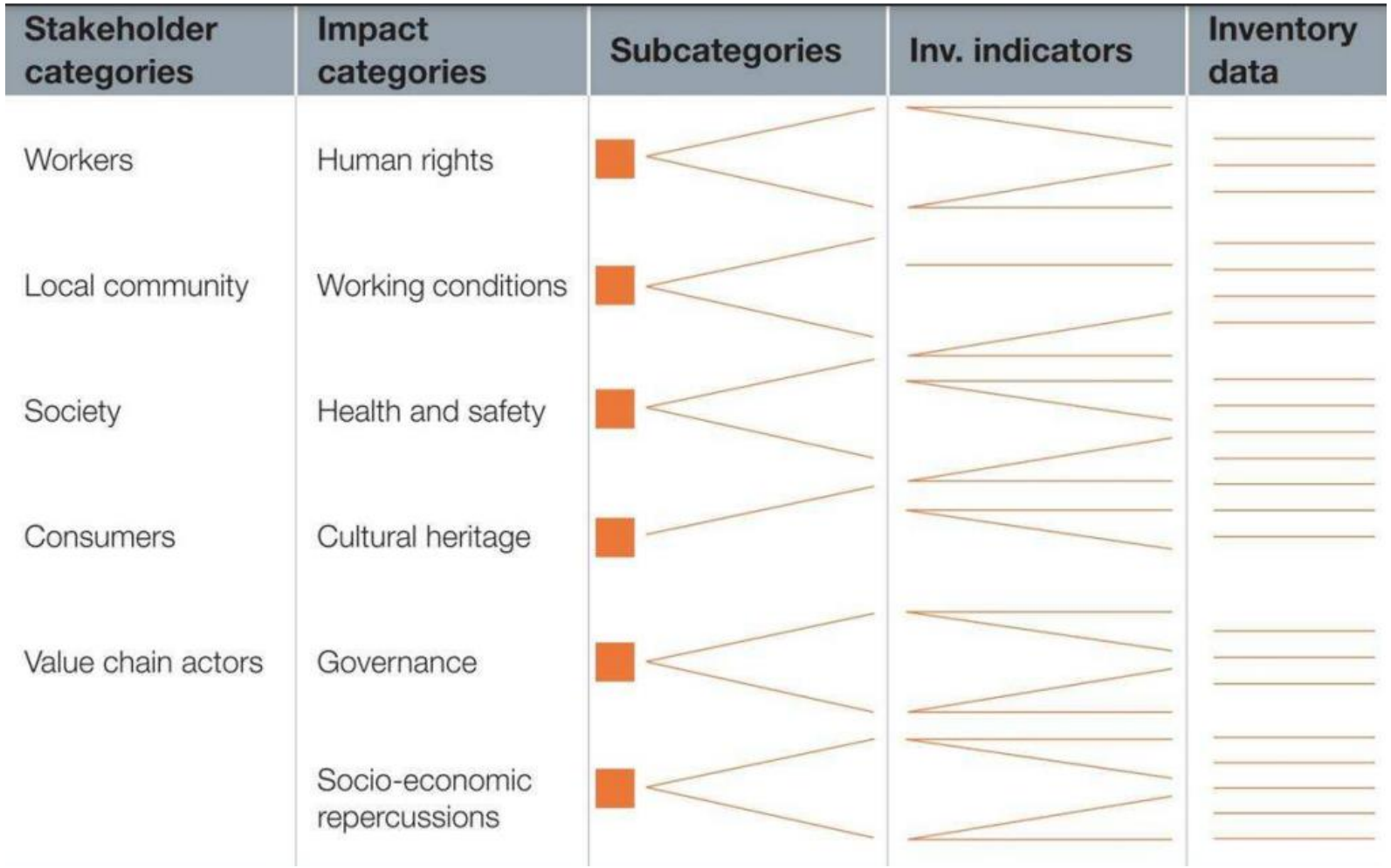
LCC = Purchase cost + Maintenance and repair cost + Water consumption + Energy consumption + Replacement cost- residual value + Disposal cost




## Others

Cost/benefit analysis, Modelling, Regressions, scenarios, …

# SOCIAL AND ECONOMIC INDICATORS



# SOCIAL AND ECONOMIC INDICATORS

| Sustainability Dimension S: SOCIAL WELL-BEING | | |
|---|---|---|
| Themes | Sub-Themes | Default Indicators |
| S1 Decent Livelihood | S 1.1 Quality of Life | S 1.1.1 Right to Quality of Life |
| | | S 1.1.2 Wage Level |
| | S 1.2 Capacity Development | S 1.2.1 Capacity Development |
| | S 1.3 Fair Access to Means of Production | S 1.3.1 Fair Access to Means of Production |
| S2 Fair Trading Practices | S 2.1 Responsible Buyers | S 2.1.1 Fair Pricing and Transparent Contracts |
| | S 2.2 Rights of Suppliers | S 2.2.1 Rights of Suppliers |
| S3 Labour Rights | S 3.1 Employment Relations | S 3.1.1 Employment Relations |
| | S 3.2 Forced Labour | S 3.2.1 Forced Labour |
| | S 3.3 Child Labour | S 3.3.1 Child Labour |
| | S 3.4 Freedom of Association and Right to Bargaining | S 3.4.1 Freedom of Association and Right to Bargaining |
| S4 Equity | S 4.1 Non Discrimination | S 4.1.1 Non Discrimination |
| | S 4.2 Gender Equality | S 4.2.1 Gender Equality |
| | S 4.3 Support to Vulnerable People | S 4.3.1 Support to Vulnerable People |
| S5 Human Safety and Health | S 5.1 Workplace Safety and Health Provisions | S 5.1.1 Safety and Health Trainings |
| | | S 5.1.2 Safety of Workplace, Operations and Facilities |
| | | S 5.1.3 Health Coverage and Access to Medical care |
| | S 5.2 Public Health | S 5.2.1 Public Health |
| S6 Cultural Diversity | S 6.1 Indigenous Knowledge | S 6.1.1 Indigenous Knowledge |
| | S 6.2 Food Sovereignty | S 6.2.1 Food Sovereignty |

| Sustainability Dimension C: ECONOMIC RESILIENCE | | |
|---|---|---|
| Themes | Sub-Themes | Default Indicators |
| C1 Investment | C 1.1 Internal Investment | C 1.1.1 Internal Investment |
| | C 1.2 Community Investment | C 1.2.1 Community Investment |
| | C 1.3 Long Ranging Investment | C 1.3.1 Long Term Profitability |
| | | C 1.3.2 Business Plan |
| | C 1.4 Profitability | C 1.4.1 Net Income |
| | | C 1.4.2 Cost of Production |
| | | C 1.4.3 Price Determination |
| C2 Vulnerability | C 2.1 Stability of Production | C 2.1.1 Guarantee of Production Levels |
| | | C 2.1.2 Product Diversification |
| | C 2.2 Stability of Supply | C 2.2.1 Procurement Channels |
| | | C 2.2.2 Stability of Supplier Relationships |
| | | C 2.2.3 Dependence on the Leading supplier |
| | C 2.3 Stability of Market | C 2.3.1 Stability of Market |
| | C 2.4 Liquidity | C 2.4.1 Net Cash Flow |
| | | C 2.4.2 Safety Nets |
| | C 2.5 Risk Management | C 2.5.1 Risk Management |
| C3 Product Quality and Information | C 3.1 Food Safety | C 3.1.1 Control Measures |
| | | C 3.1.2 Hazardous Pesticides |
| | | C 3.1.3 Food Contamination |
| | C 3.2 Food Quality | C 3.2.1 Food Quality |
| | C 3.3 Product Information | C 3.3.1 Product Labelling |
| | | C 3.3.2 Traceability System |
| | | C 3.3.3 Certified Production |
| C4 Local Economy | C 4.1 Value Creation | C 4.1.1 Regional Workforce |
| | | C 4.1.2 Fiscal Commitment |
| | C 4.2 Local Procurement | C 4.2.1 Local Procurement |

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# CANDIDATE METHODS TO MEASURE (UN)SUSTAINABILITY

| | Systems | Threshold | Complete | Scientifically strong |
|---|---|---|---|---|
| Emergy | + | = | + | = |
| Ecological Footprint | + | + | = | - |
| (Extended) Exergy | = | - | - | + |
| Material Flow Accounting | - | - | = | - |
| Life Cycle Asessment | - | - | = | + |

# ASSESSMENT PROBLEMS

Each component of the sustainability is measured with specific methods

Each method adopt a specific unit of measure

Each pollutant or resource are measured with specific unit of measure

It is impossible to sum different quantity expressed with different unit of measures to obtain a final index of sustainability

How measure and communicate the level of sustainability of a farm?

# LIFE CYCLE ASSESSMENT (LCA)

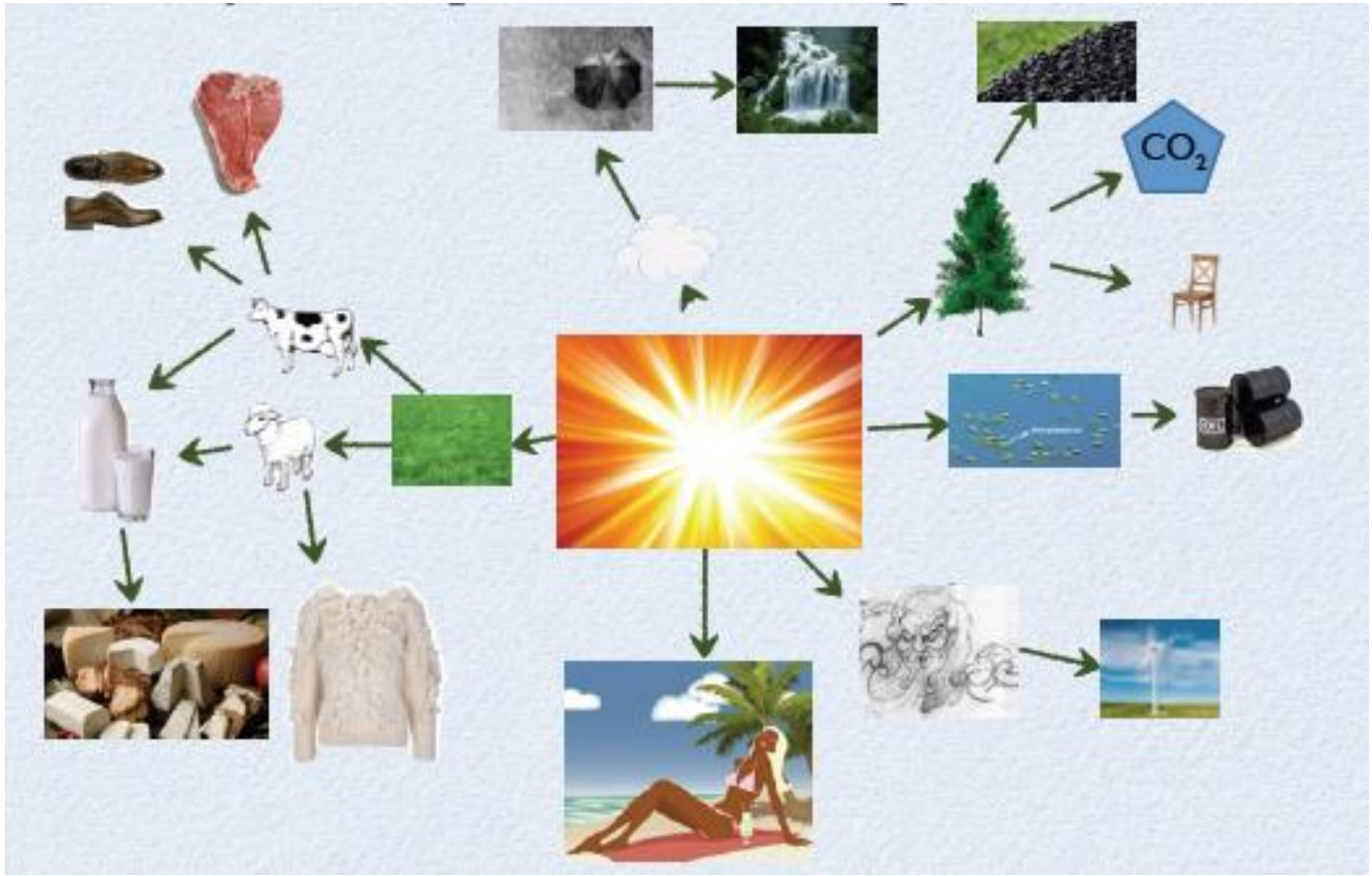
The method will be analyzed thoroughly by prof. Blanc, as it is considered a reference method

Compared to other evaluation methodologies, it is characterized by:

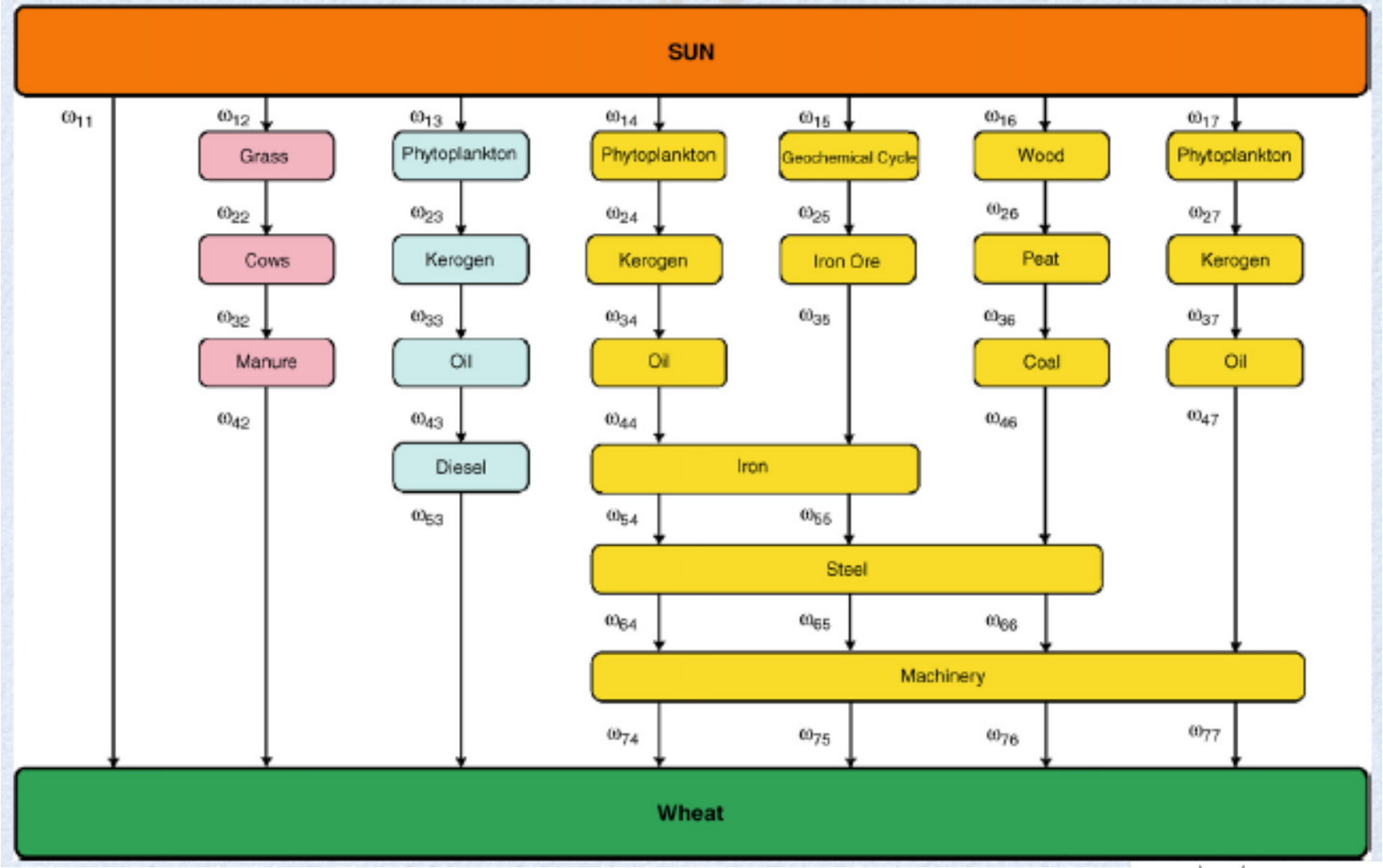
- ✓ Consider the entire production chain of a product or service ("from cradle to grave");
- ✓ Examine several environmental impact categories (all potential impact types);
- ✓ Consider not only direct effects on the environment, but also indirect ones;
- ✓ Starting from each process inputs determine their impacts according to the belonging category (carbon ftp., acidification pot., euthrophication pot., etc.)
- ✓ Comply with an official methodology codified by ISO standards (ISO 14040 and ISO 14044) and the results must be verified by peer reviwer

# THE EMERGY METHOD

Solar Emergy is the solar energy available, used directly and indirectly for the production of goods and services



# THE EMERGY ASSESSMENT



# CRITICISM OF EMERGY

Introduction of a theory based on energetic value to replace other theories based on value (e.g. economic value)

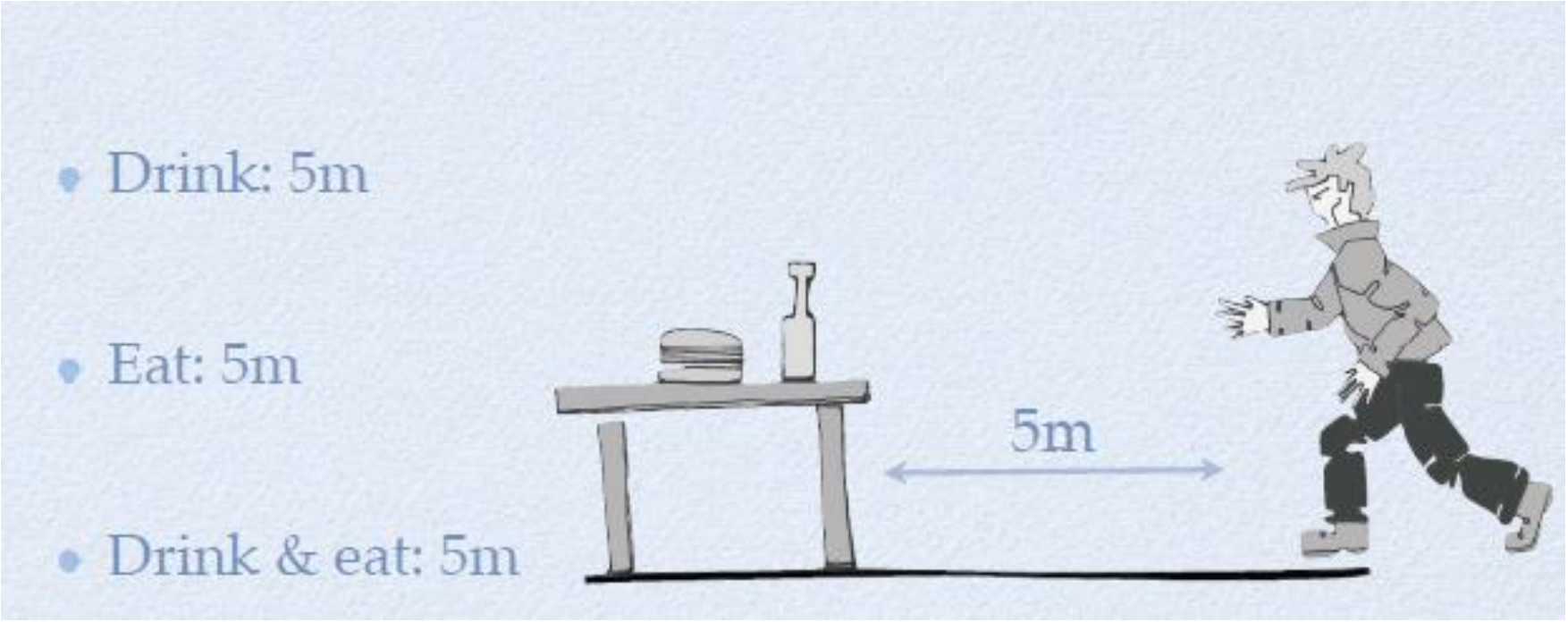
The idea that a calorie of sunlight is not equivalent to a calorie of fossil fuel or electricity for some must be evaluated according to criteria absent in the emergy procedure

Economists criticize the combination of anthropogenic and ecological views, as they neglect the market value determined by availability and demand

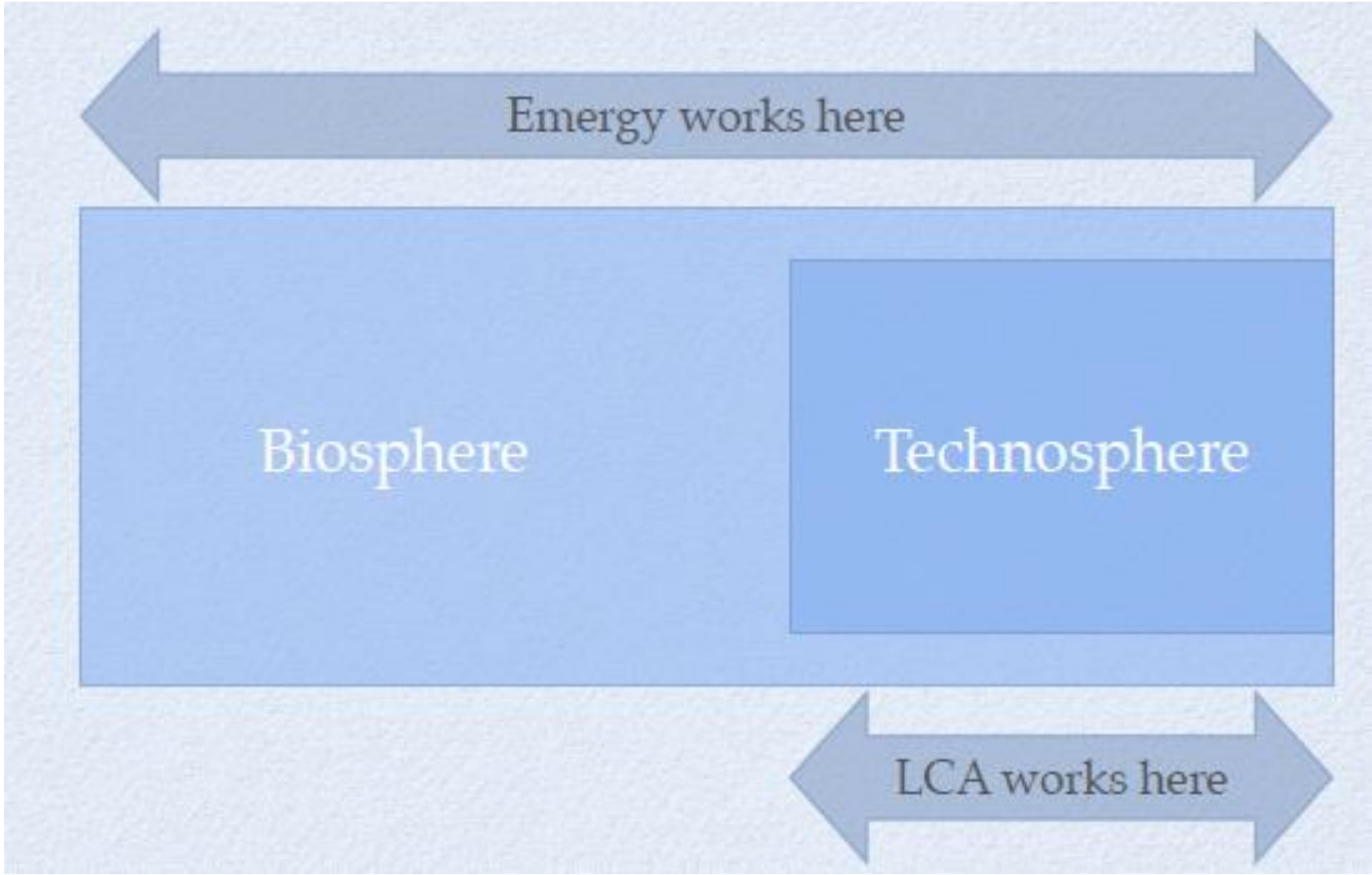
No allocation

# THE EVALUATION OF BY-PRODUCTS IN EMERGY (ALLOCATION)

By-products are credited with the same Emergy needed to support the system



# DIFFERENCES BETWEEN LCA AND EMERGY (1)

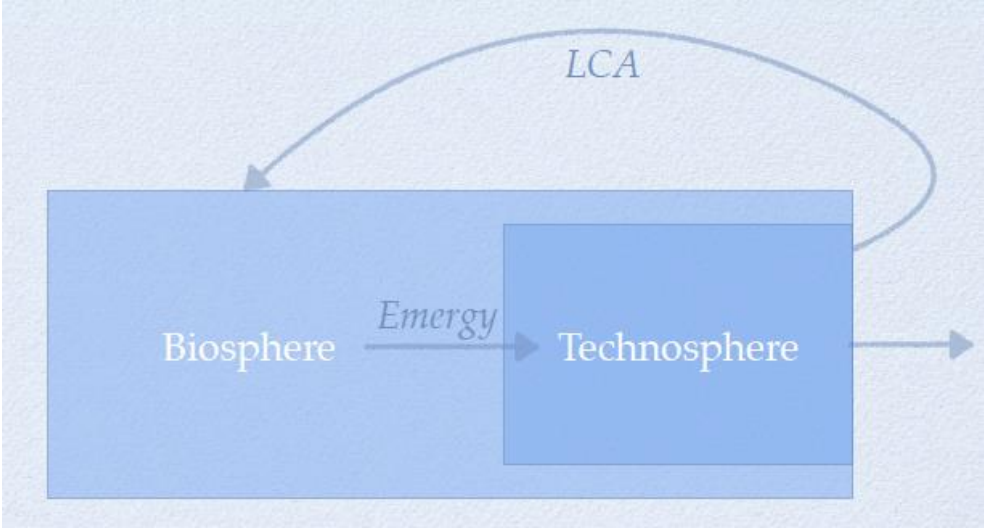


# DIFFERENCES BETWEEN LCA AND EMERGY (2)

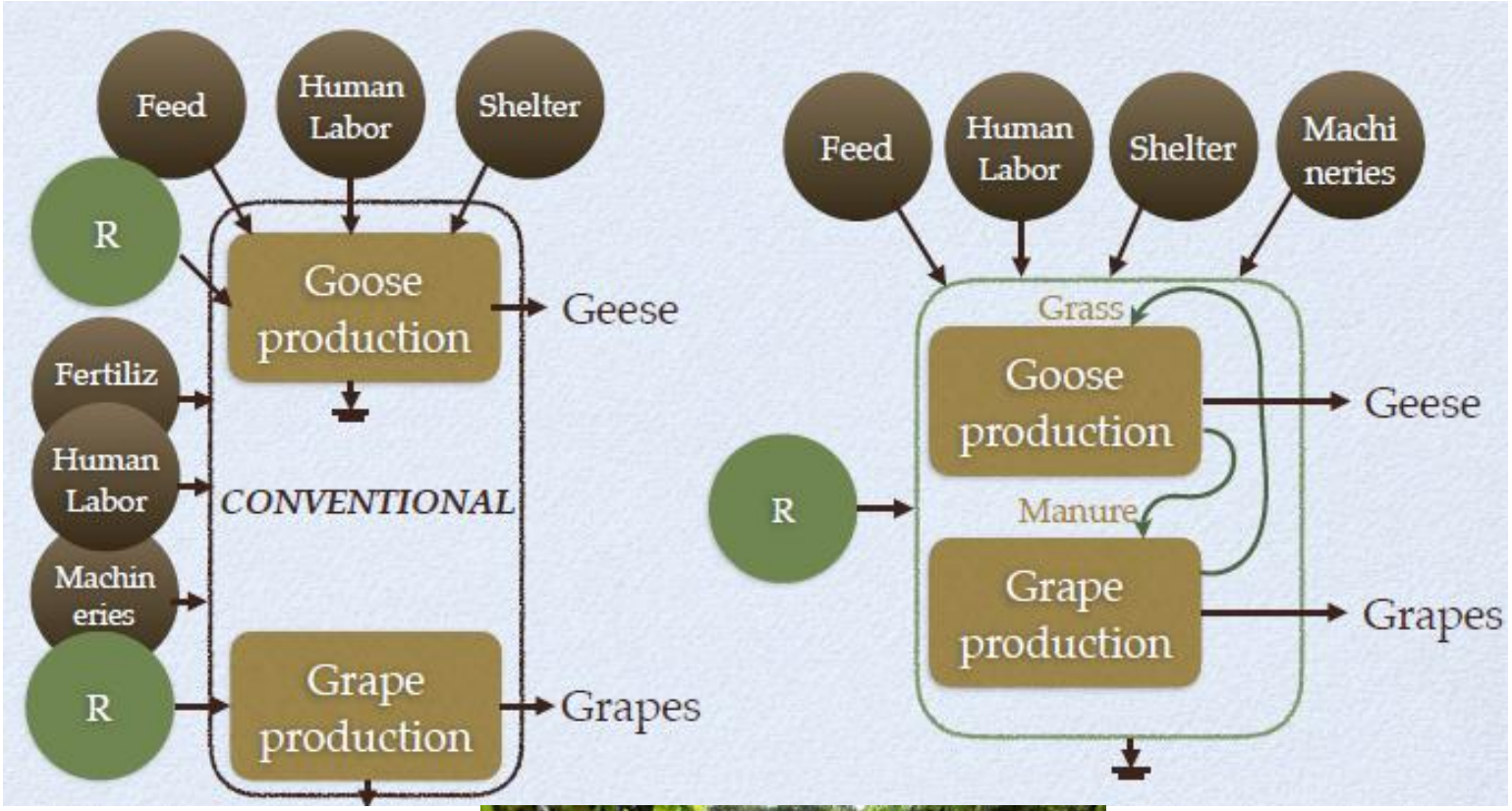
Although Emergy and LCA assessments are seen as alternatives, they can actually be considered complementary

Both assessments have limitations and strengths, but if used together the limitations of both can be reduced

When the production system leads to obtains more goods, both assessments should be used with caution

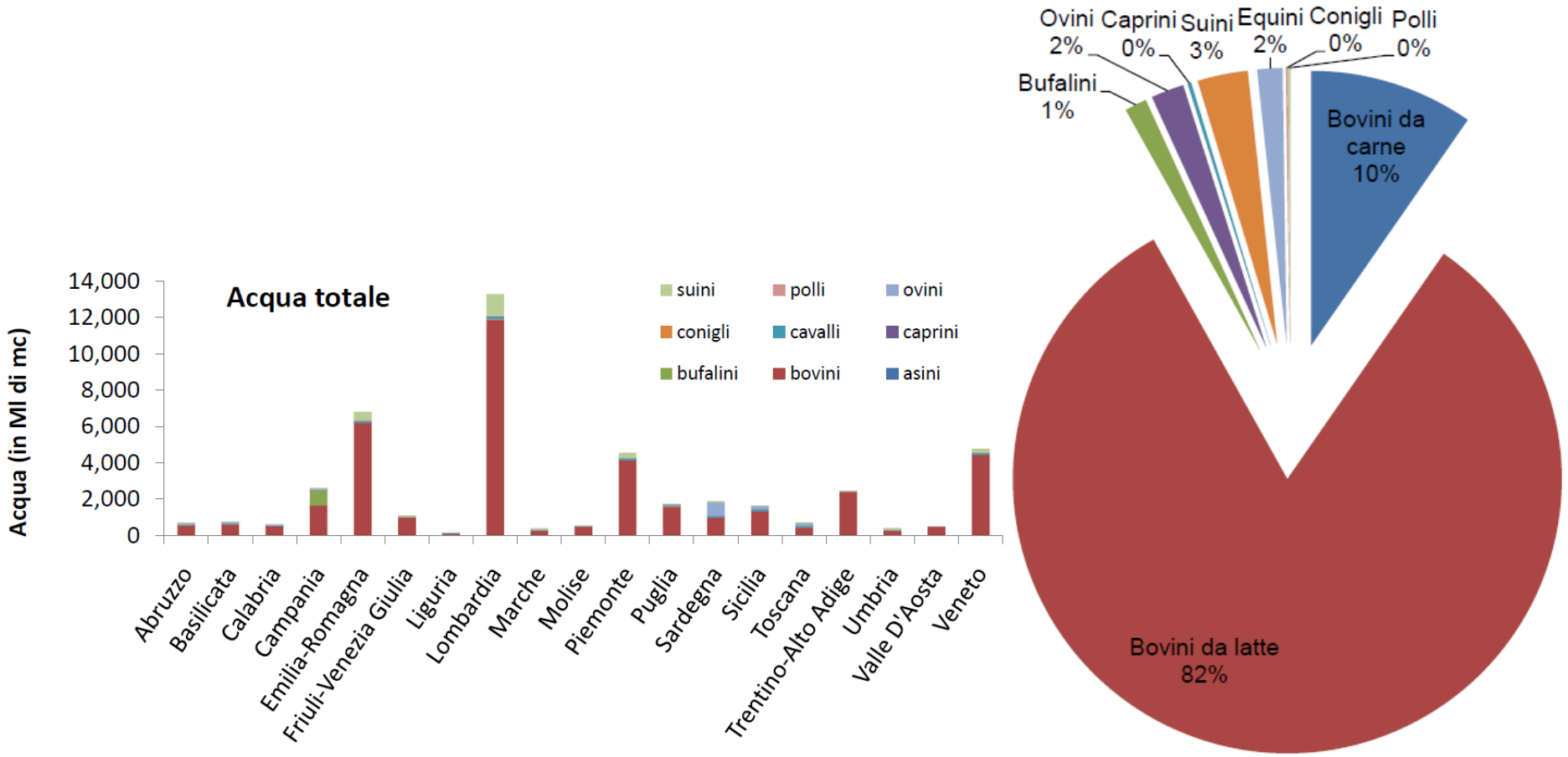


# EXAMPLE OF THE EVALUATION OF GEESE BREEDING IN THE VINEYARD WITH EMERGY




# INTRODUCTION TO THE WATER FOOTPRINT

Actual consumption of water for watering, washing and various services, food in the different Italian regions, by species

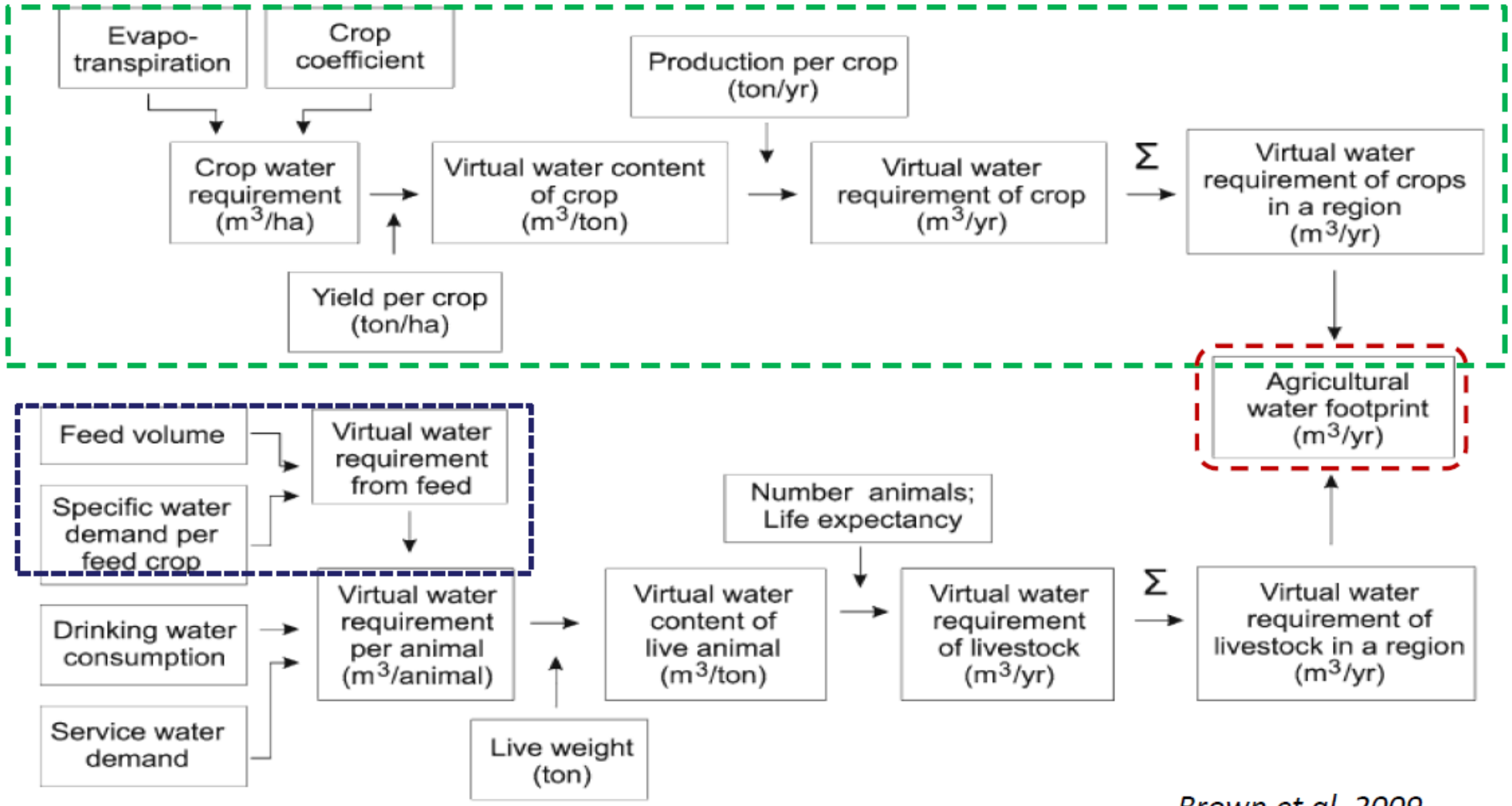


# WATER FOOTPRINT ASSESSMENT (WFA)

Water Footprint (WFP) splits the use of water from the production cycle for the production of a good into:

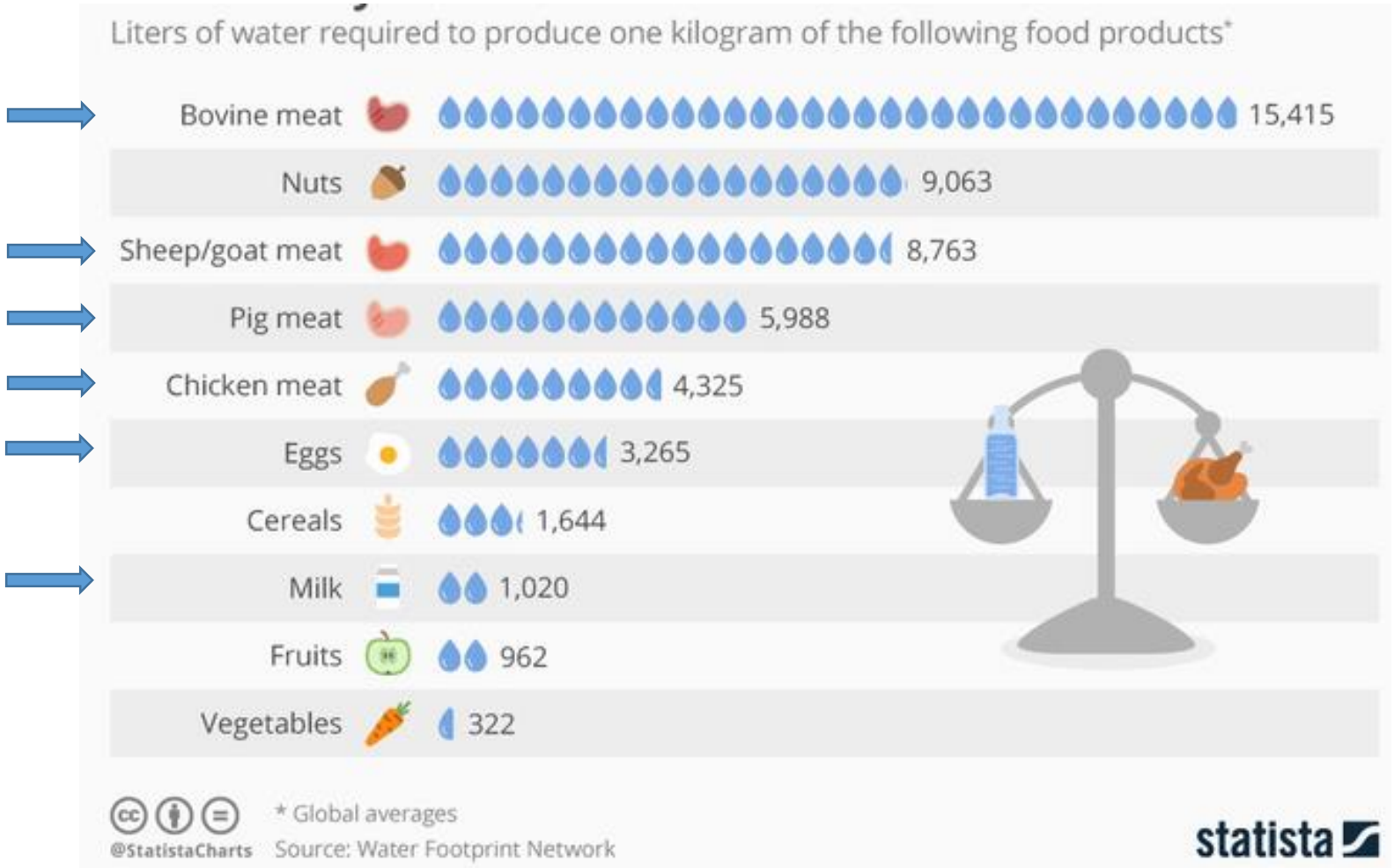

| | | |
|---|---|---|
| Includes evapotranspired water from crops | Includes drinking water and livestock services | Includes wastewater and otherwise polluted water |

# WFP CALCULATION MODEL




*Brown et al. 2009*

# WATER FOOTPRINT OF FOOD PRODUCTS



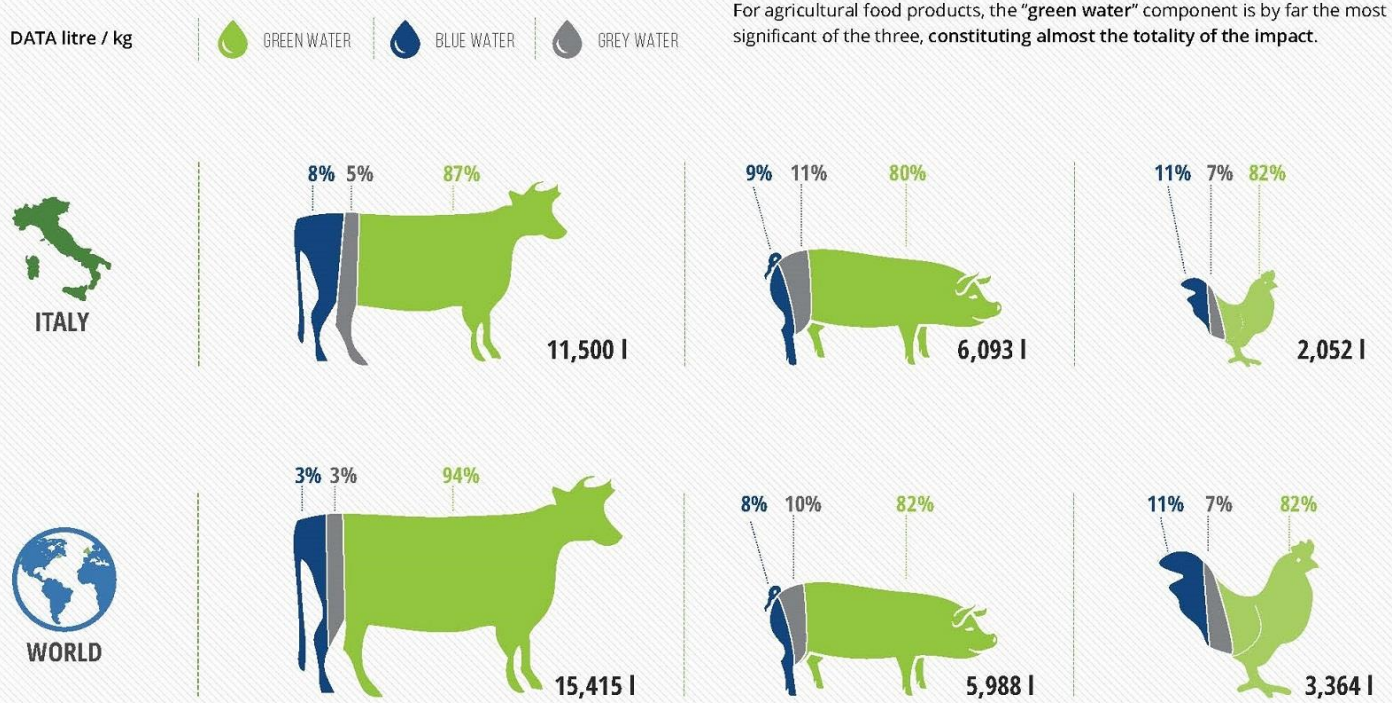
# MEAT WATER FOOTPRINT

## MEAT'S WATER FOOTPRINT

IN ITALY AND THE WORLD

The **water footprint** is the sum of three contributions that are partly real and partly virtual: evapotranspirational water used by plants to live (**green water**), water effectively used by production processes or to irrigate the fields (**blue water**) and the water potentially needed to dilute and purify waste water (**grey water**).

For agricultural food products, the "**green water**" component is by far the most significant of the three, **constituting almost the totality of the impact**.




*Source: Mekonnen, M. M., Hoekstra, A.Y. The Green, Blue and Grey Water Footprint of Farm Animals and Animal Products. Value of Water Research Report Series no.48, UNESCO-IHE, Delft, the Netherlands, 2010*

# THE DIFFERENT NUTRITIONAL VALUE OF FOODS

| | beef | vs | soy |
|---|---|---|---|
| |  | |  |
| Water Footprint (Water Footprint Network, 2021) | 15.500 l/kg | | 1.800 l/kg |
| | Ratio 9 a 1 | | |
| | Daily requirement coverage of essential amino acids adult male man of 80 kg | | |
| |  | |  |
| Assunzione giornaliera | 130 g | | 2.500 g |
| Weighed Water Footprint | 2.015 l/dose | | 34.560 l/dose |
| | Ratio 1 a 17 | | |

# FAO RECENT RECOMMENDATIONS


https://www.fao.org/3/cb8054en/cb8054en.pdf

| 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 |
| **Milk whole** | Dairy | 0.21 | 0.52 | 1.68 | 0.34 | 6.32 | 0.28 |
| **Milk skimmed** | Dairy | 0.20 | 0.49 | 2.03 | 0.56 | 5.32 | 0.44 |
| **Cheese Gouda 48+ average** | Dairy | 1.31 | 0.26 | 2.16 | 0.36 | 5.74 | 0.04 |
| **Shrimps Dutch peeled boiled** | Fish | 1.54 | 0.15 | 6.39 | 1.64 | 7.78 | 1.22 |
| **Herring salted** | Fish | 0.28 | 0.21 | 0.84 | 0.16 | 1.59 | 0.32 |
| **Kale curly boiled** | Vegetables | 0.16 | 0.08 | 1.14 | 0.35 | 4.00 | 0.19 |
| **Mushrooms boiled** | Vegetables | 0.52 | 0.26 | 5.21 | 2.48 | 13.71 | 49.60 |

Foods may be consumed for a variety of reasons, for their nutritional value, for enjoyment, and/or as a means of taking part in – or contributing to – socio-cultural functions

The nutritional LCA (nLCA) as either the main function or one of the main functions of a food must be considered

# CARBON FOOTPRINT

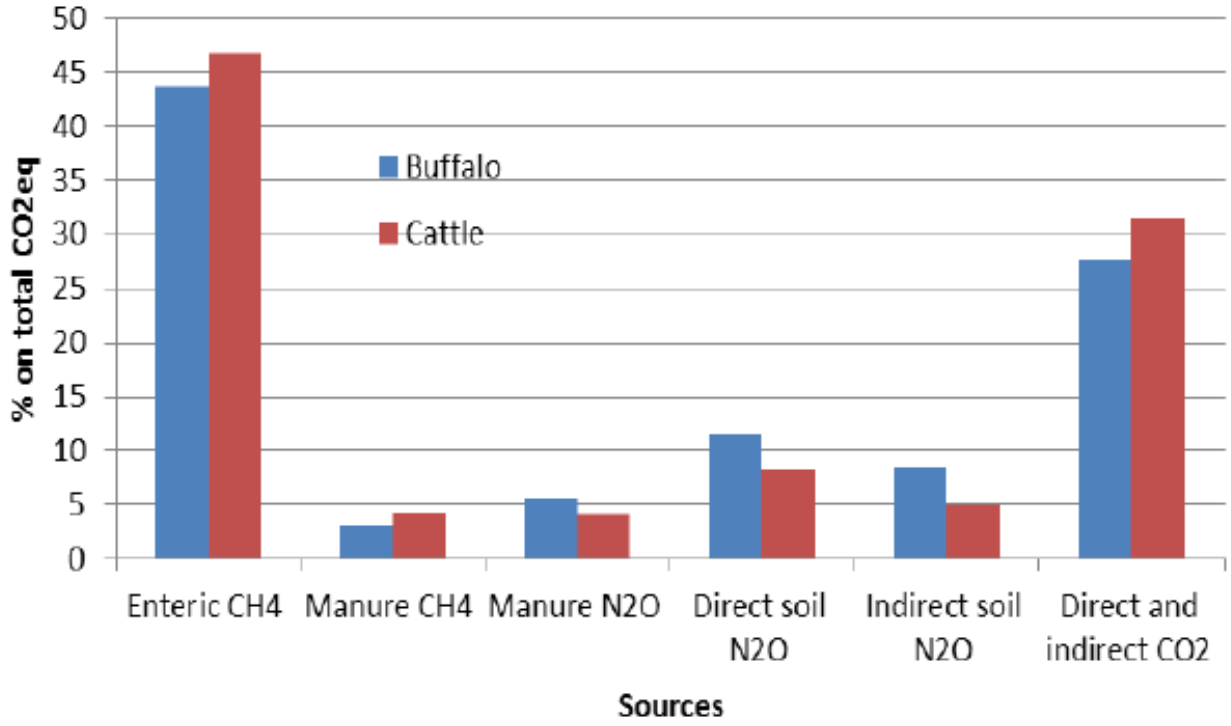
Reference standard UNI EN ISO 14067:2018 (UNI EN 14040 LCA)

Allows to highlight and quantify the different sources of gas emission

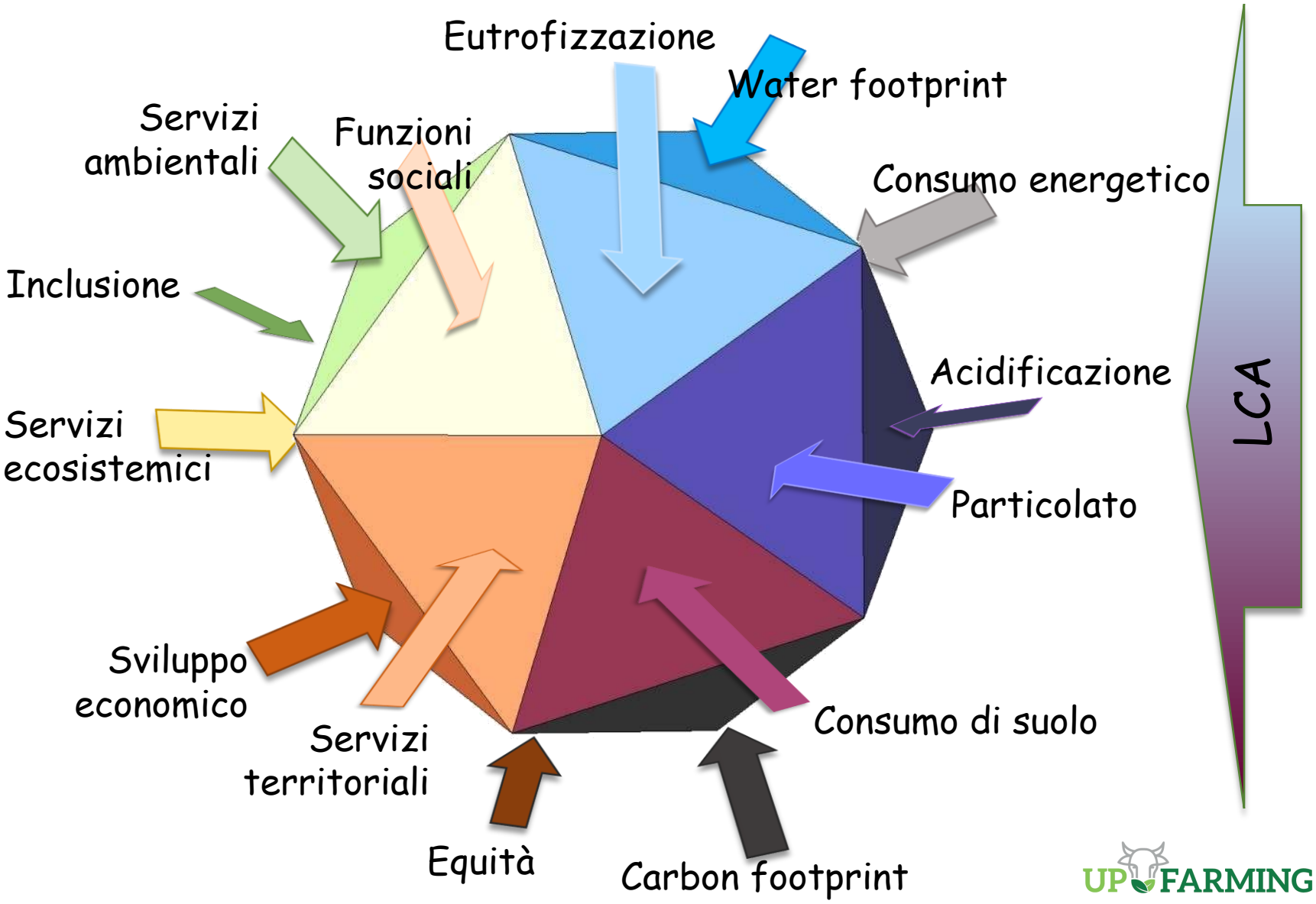
Again, used to make comparisons

CF of 1 kg dairy and buffalo Fat-Protein Corrected Milk (FPCM)

FPCM (kg) = raw milk (kg) x (0.337 + 0.116 x % fat + 0.060 x % protein) (Heuer, 2004)



# IMPOSSIBLE TO MEASURE WITH A SINGLE SYSTEM



# SUSTAINABILITY

In order to be expressed and quantified and communicate , it must be measured

## Arriva l'etichetta ambientale: misurerà l'impatto degli alimenti sull'ecosistema

Quanto inquino se compro un chilo di frutta? Paola Riscazzi, coordinatrice della società SPRIM, ha messo a punto un nuovo strumento utile per saperlo. Disponibile entro l'anno

## Impatto ambientale in Etichetta: In USA i Consumatori disposti a pagare di più

Pubblicato da indexfood_redazione | In Publiredazionali | Il 5 novembre 2014 | Segui @indexfood1

Gli americani sarebbero disponibili a pagare di più per alimenti a basso impatto ambientale, ma le etichette non mettono in luce con chiarezza i benefici delle pratiche ecosostenibili adottate per produrli



Considering the limitations of the methods discussed, the risk is to give misleading information and further confusing the consumer in his choices

E.g., an extensively rearing systems have higher environmental impact indices than an intensively one, but develop other environmental and not environmental functions

# INTENSIVE VS EXTENSIVE FARMS

With the same genetic and productive characteristics

- ✓ Lower dietary requirements
- ✓ Lower food consumption
- ✓ Food control
- ✓ Better transformation efficiency
- ✓ Better manure management
- ✓ Better manure nutrients utilization

Lower nutrient excretion
Less nutrient loss
Lower gas production

- ✓ Higher dietary requirements
- ✓ Higher food consumption
- ✓ Less controllable diet
- ✓ Lower transformation efficiency
- ✓ Manure management impossible
- ✓ Worst nutrient agronomic utilization

Higher nutrient excretion
Higher nutrient loss
Higher gas production

# INTENSIVE VS EXTENSIVE FARMS

With the same genetic and productive characteristics

- ✓ Production functions

Products supplied to the community at low cost

- ✓ Production functions
- ✓ Ecosystem functions
- ✓ Environmental functions
- ✓ Territorial functions
- ✓ Socio-economic functions
- ✓ Landscape functions

Services and products provided to community

# NEXT LESSONS

To know the activities that can be developed on farms to increase sustainability

Knowing how to propose solutions to specific problems

Helping the farmers to communicate their farms sustainability