Slide Deck LCA training July 3 – 5 @WUR

LCA training for CIAT and WUR employees

Roel Helmes, July 2019

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Hour 1: Introduction to LCA

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1. General Introduction
2. Quick Examples of LCA
3. Exercise 1 / Discussion

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Movie

- Movie:https://www.youtube.com/watch?v=r0ucT1KRiO4
- What is most relevant?

Exercise 1 / Discussion

- Who are you?
  - Name, hometown, where you were born, family, ...
  - Work experience
- Which (various) things would you like to achieve within your contribution to the project "Resource-smart urban value chains and food systems"?
- What would you want to achieve with this LCA training?
- Think of three questions for this training

The LCA basics

- Focused on a product or a service
- Chain perspective: production, consumption, EOL
    - Also suppliers to production, transport, etc.
    - Smart focus on the largest impact, also use sec. data
- Fixed framework:
    1. Determine goal and scope
    2. Determine emissions and extractions of all steps in chain
    3. Translate those to environmental impacts: climate, land, water, nutrients, etc. (&compare)
    4. Interpretation

Learning Objectives (Roel)

- Understand all concepts of LCA
- Read and understand LCA studies and papers for interpretation and meta-analysis
- Talk with LCA experts on your research needs
- Work on excel-based LCAs in cooperation

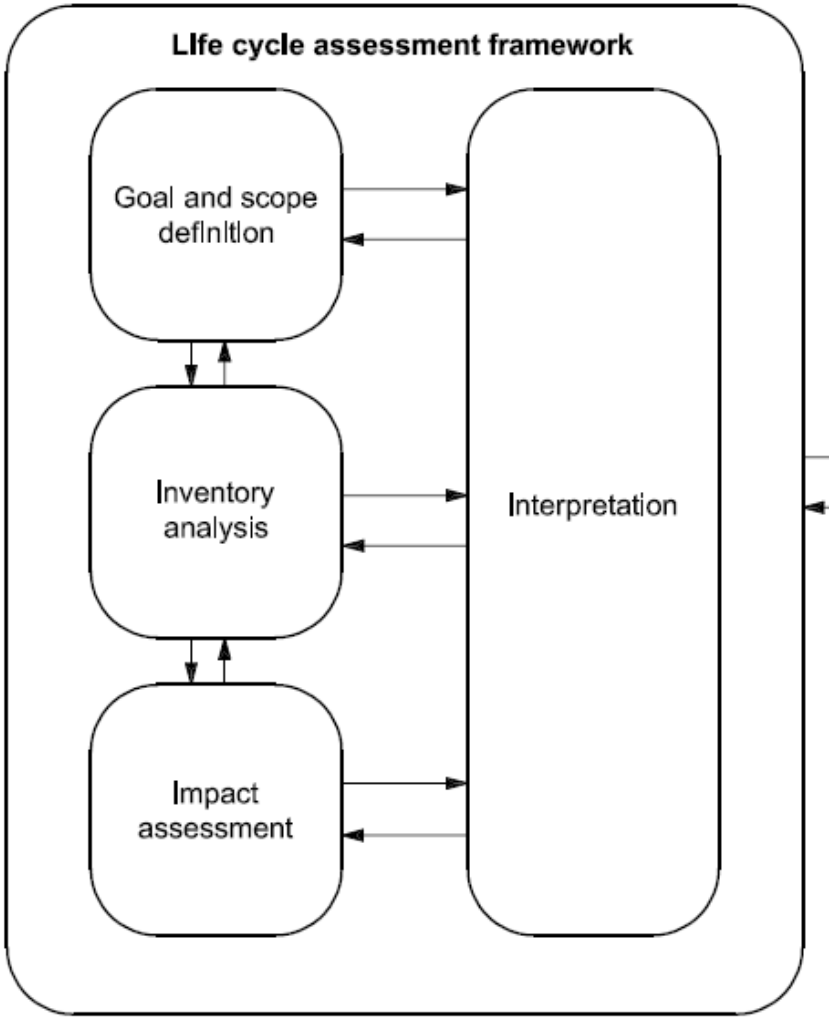
Not:

- Do an LCA in SimaPro
- Know your way through all methodological options

The example of milk: the chain perspective

Framework

1. Goal and scope definition
2. Life Cycle Inventory (LCI)
3. Life Cycle Impact Assessment
4. Interpretation



1. Goal and Scope Definition

1. Definition of the objectives of the assessment
2. Background & Audience
3. Definition of the system boundary
4. Definition of the functional unit
5. Assumptions and limitations
6. Data quality

2. Life Cycle Inventory Modelling

1. Collection of data necessary for the assessment
2. Data processing
3. Multifunctionality

3. Life Cycle Impact Assessment

1. Classification of release into impacts
2. Impacts calculation
3. Also: Normalisation
4. Also: Weighting

4. Interpretation

- Contribution analysis
- Sensitivity analysis
- Quality checks, a.o. an evaluation of completeness and consistency
- Identification of the significant issues
- Define limitations, and recommendations

- Many reasons to adjust Steps 1 – 3(!)
- ***Conclusion***

Quick examples of LCAs

Cocoa from Papua New Guinea 2018

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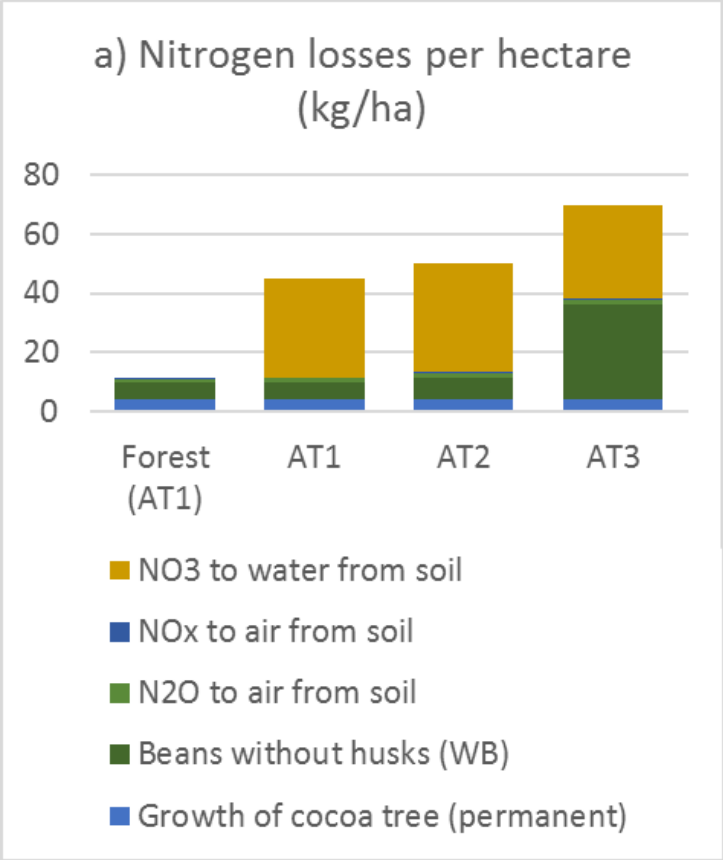
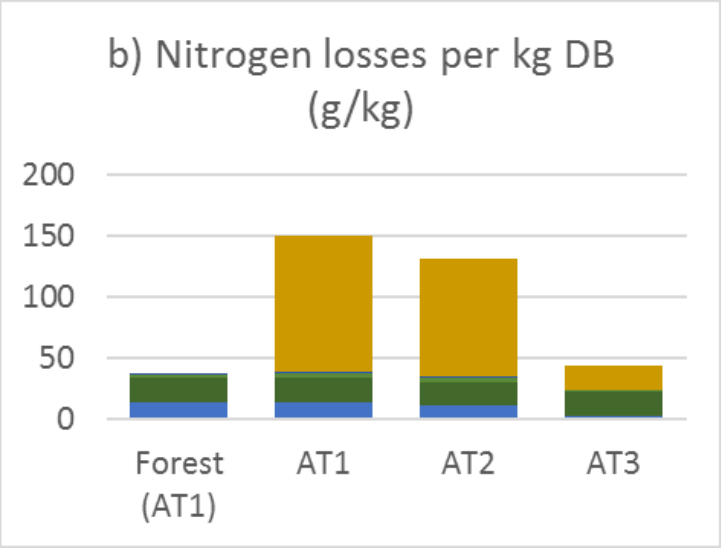
Basic Nutrient Balance with WPR





Brazilian Beef 2017

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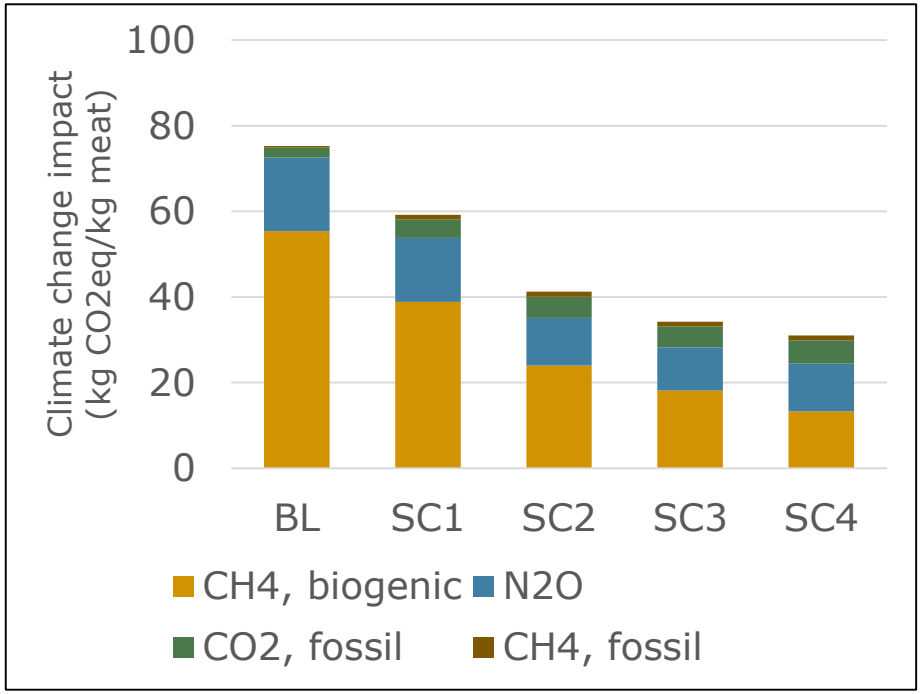
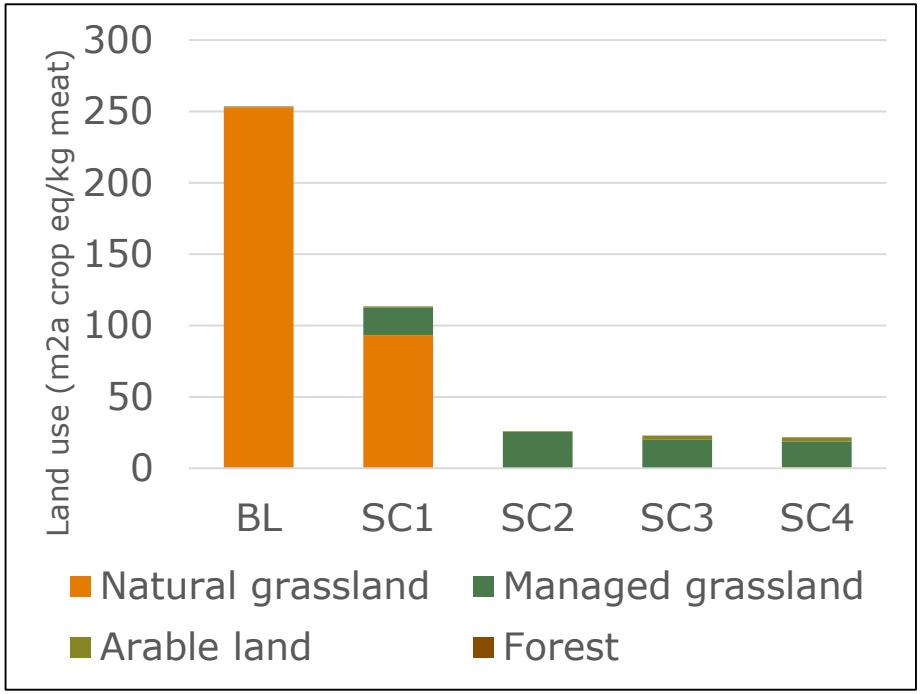
Developing realistic scenarios with WLR

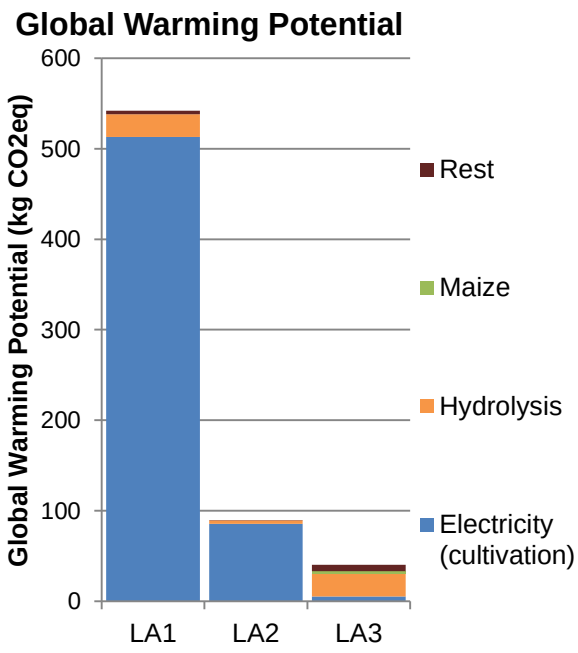
SC1: improved pastures during the finishing stage
SC2: feedlot system during finishing stage
SC3: improved pastures + reduced age of first calving + improved fertility
SC4: like SC3, finishing stage in feedlots, with concentrated feeds (incl. by-products)

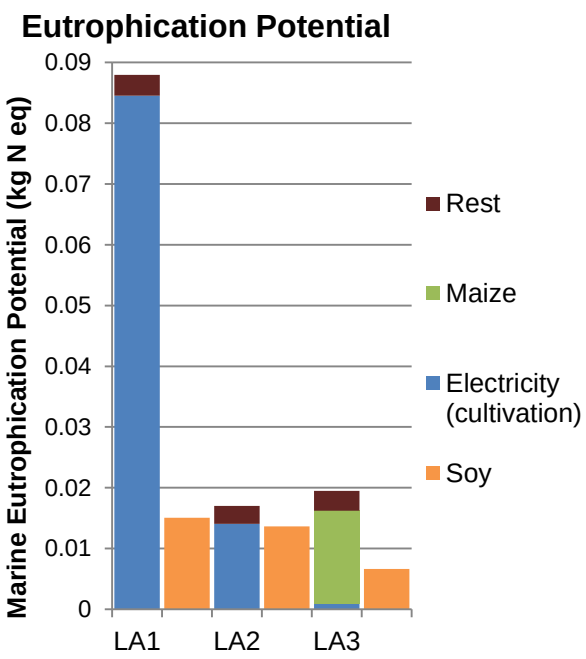




Plastic from Seaweed 2015

Including fermentation in a chain model with WFBR





Hour 2: Goal and Scope & Impact Characterization

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1. Goal & Scope Definition
2. Exercise 2
3. Exercise 3
4. Life Cycle Impact Assessment

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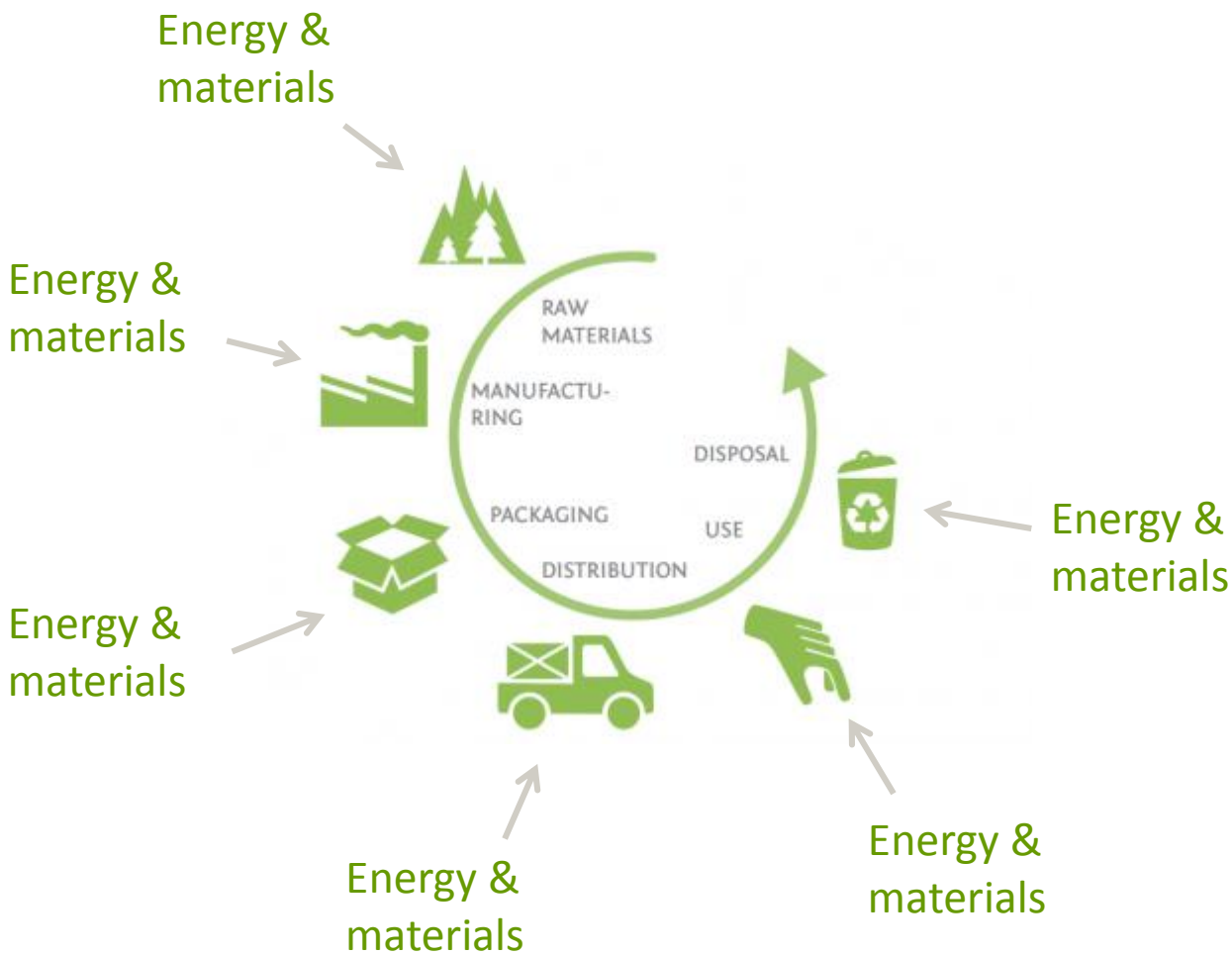
Phase 1. Goal and Scope Definition

1. Definition of the objectives of the assessment
2. Background & Audience
3. Definition of the system boundary
4. Definition of the functional unit
5. Assumptions and limitations
6. Data quality

Upstream processes



Downstream processes

Emissions and extractions of all processes!

Air: CO_2, N_2O, CH_4, NOx, particles
Water: NO_3^-, PO_4^{3-}, organics, metals
Land use: occupation, transformation
Resource: water, fossil fuels, minerals

Air: CO_2, CH_4
Water: BOD, COD
Land use: occupation
Resource: water

Air: CO_2, N_2O, CH_4
Water: BOD, COD

Air: CO_2

Air: CO_2

Air: CO_2, NOx, particles

Exercise 2: Draw on flip over

- Choose an agricultural product (a processed one)
- Draw circle; name steps
- Connect upstream and downstream
- Connect extractions and emissions

- What do you want to achieve? What do you want to know from about this whole system?

Determine goal of LCA

1. Hotspot analysis (which chain step/ which impact)
2. Product benchmarking & monitoring
3. Improvement opportunity assessment
4. Product design (materials/ingredients)
5. Scenario/policy analysis (DSS)

Choose functional Unit

- What?
- How well?
- How long?
- How much?
    - Mass / volume?
    - Nutritional value?
    - Economic value?

- Define the function (examples of milk & paint)
- Functional unit & Reference flow

Choose system boundaries

- See flipover exercise
- Cradle to gate or cradle to grave
- Exclude home-work transport
- Exclude very small inputs
- Exclude capital goods

How to deal with multifunctionality

Milk

Beef

Leather

Tallow

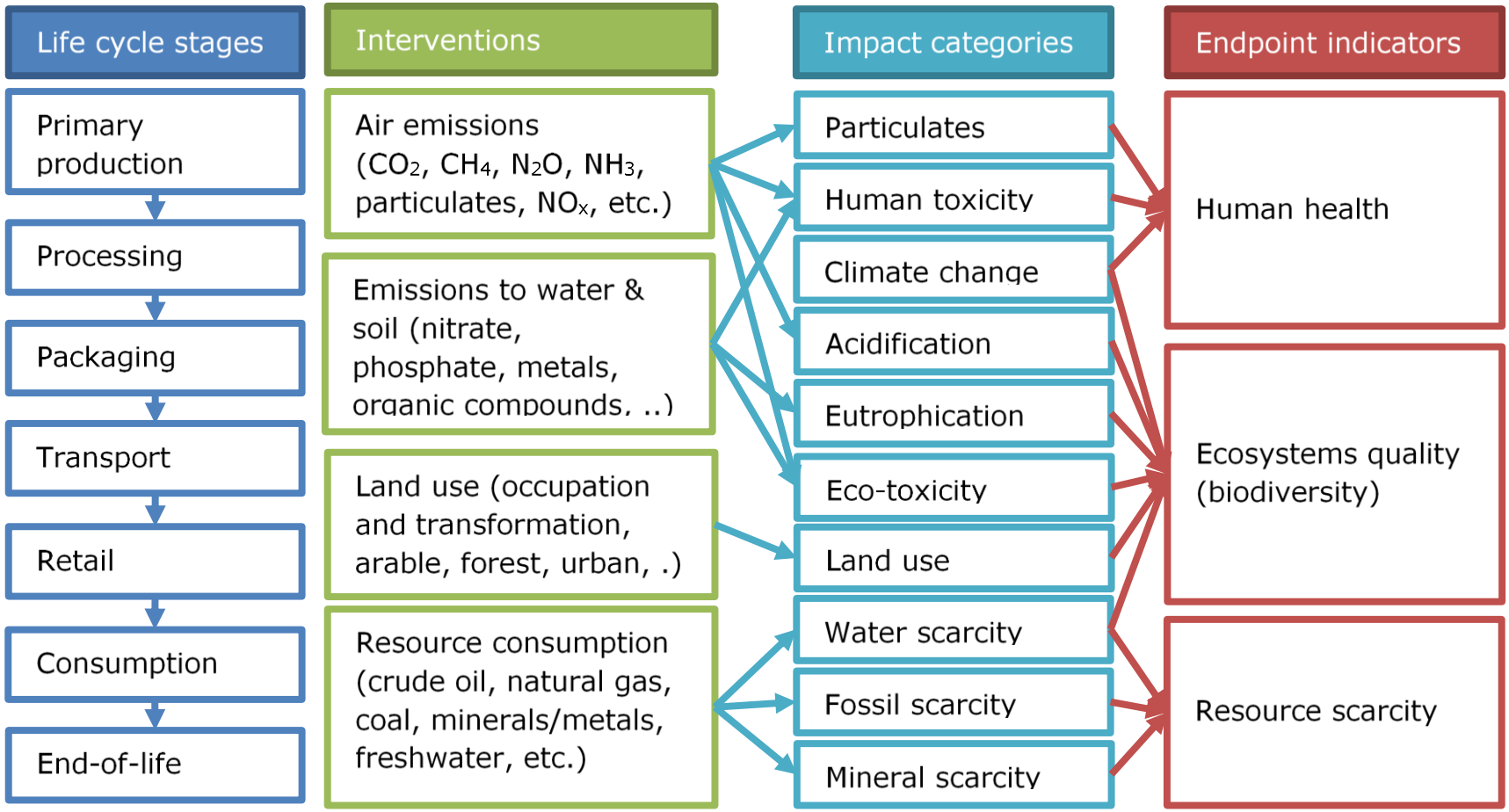
Cow

Phase 3. Life Cycle Impact Assessment

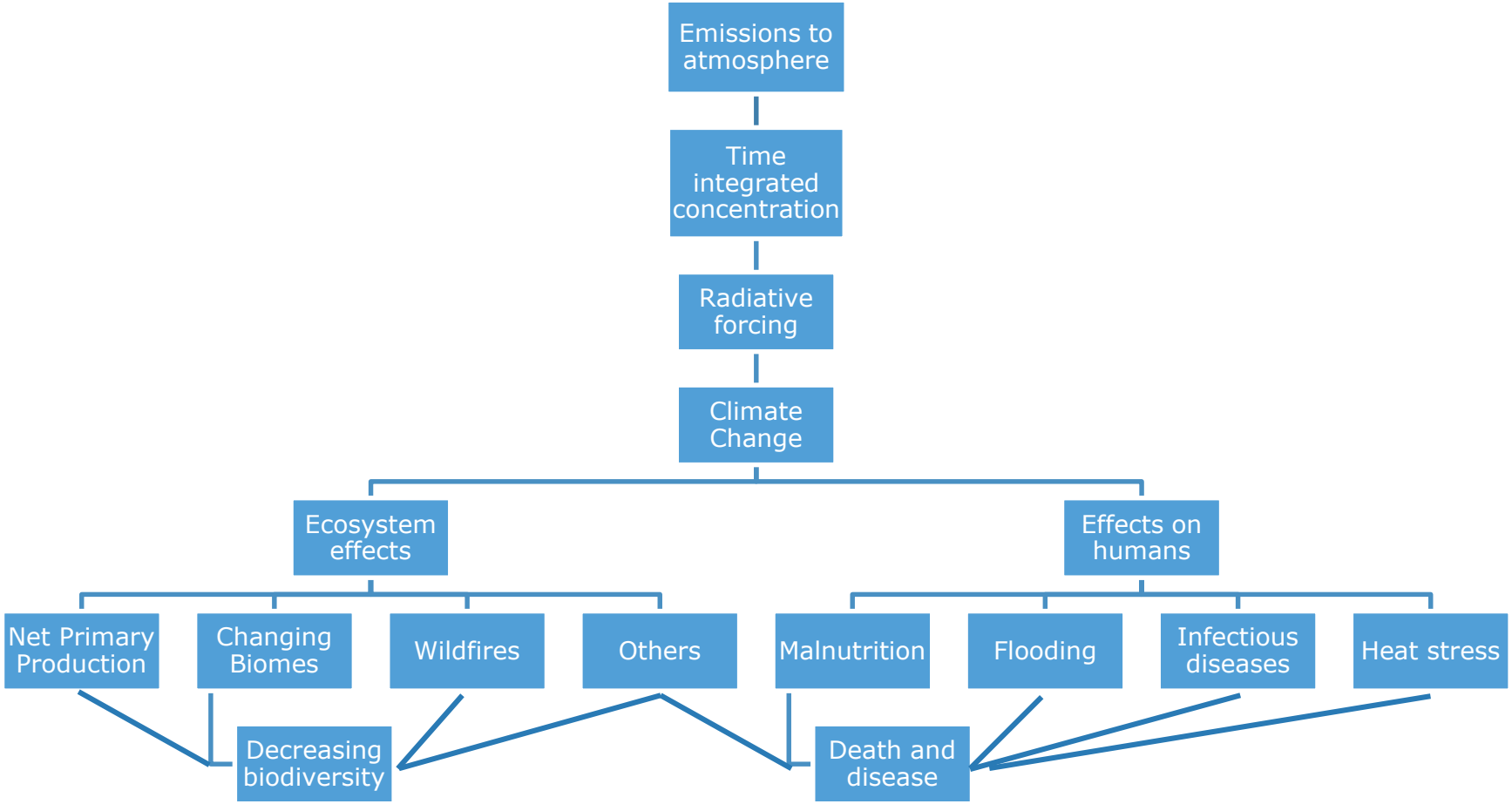
1. Classification of emissions and extractions into impacts
2. Impacts characterisation
3. Also: Normalisation
4. Also: Weighting

Choose environmental impacts

Midpoint and Endpoint methods

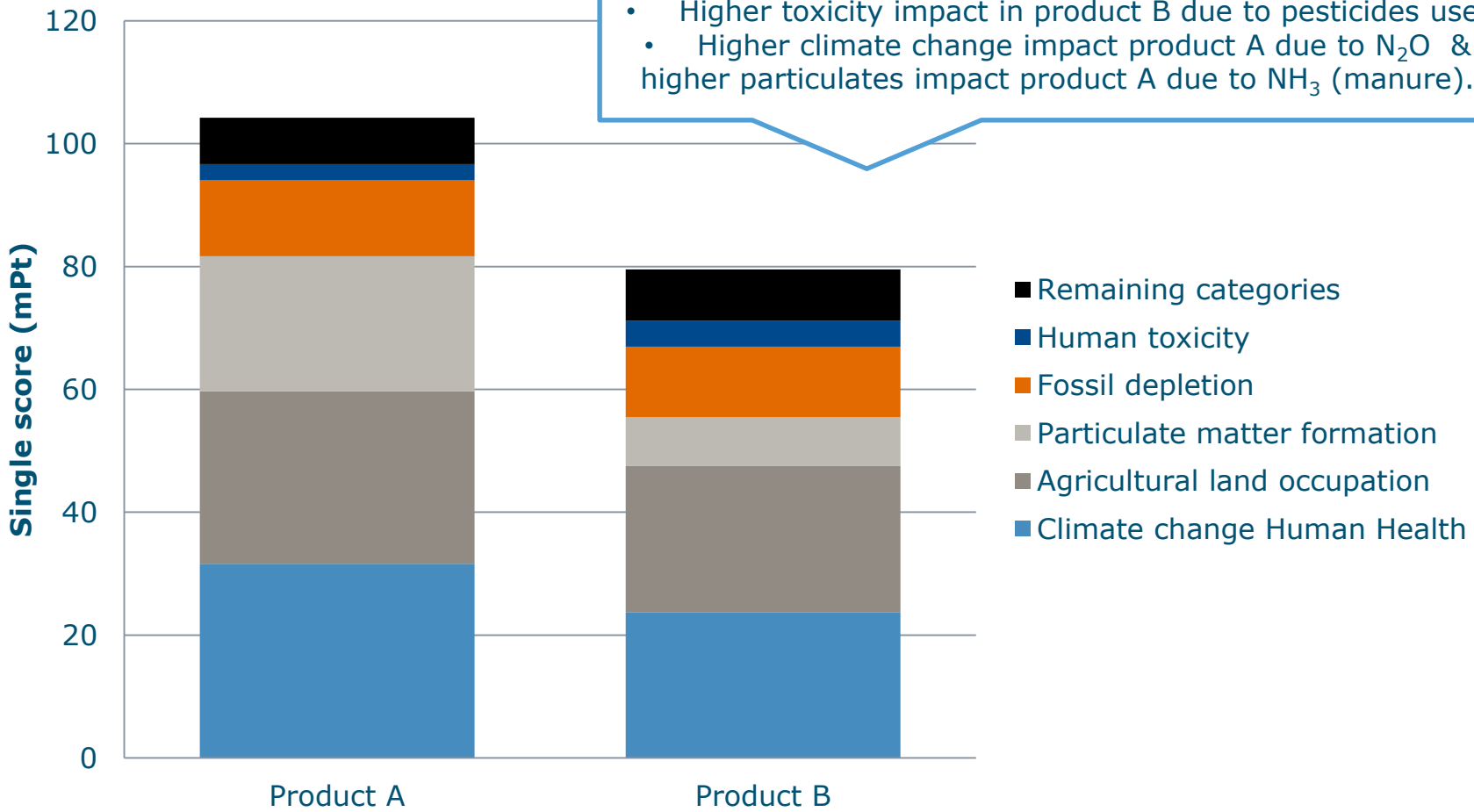


Cause effect chain: Ex. Climate Change



The result of Normalization & Weighting

- Slightly higher yield in system of product B
- Higher toxicity impact in product B due to pesticides use.
- Higher climate change impact product A due to N_2O & higher particulates impact product A due to NH_3 (manure).



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Normalization & Weighting

- Normalization
  - Divide by the score of a person*yr to relate to reference impact (which person, which year)
- Weighting
  - Human Health (DALY) <> Nutrition (Jolliet et al.)
  - Ecosystem Quality (species.yr)
  - Resource Depletion (US$ or MJ)

Choices, choices, choices

- Which environmental impacts
- How to weigh impacts:
  - Relate to scenarios, improvements, trade-offs
  - Listen to funder & stakeholders
  - From Midpoint to Endpoint Indicators:
    - Expert judgment
    - Societal Priorities (e.g. Panels)
    - Distance-to-target
    - Overshoot: Planetary Boundaries

Hour 3: Demo & Discussion

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1. SimaPro Demo 1: Intro
2. Exercise 4
3. Exercise 5

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Exercise 3: Goal definition

- Write down and group the things you would like to achieve within your contribution to the project "Resource-smart urban value chains and food systems"?
- Which parts could LCA solve? What is the goal of your LCA work?

Ex. 4: Life cycle thinking: Yes or No? (1)

- A study assessing the amount of feed in a diary farm
- A study assessing the impact of mixed systems considering the full supply chain upstream the agricultural phase
- A study assessing the ingredients and energy consumption for producing a Margherita type pizza

Ex 4: Life cycle thinking: Yes or No? (1)

- A study assessing the amount of waste produced by a supermarket on the basis of the number of customers
- A study assessing the impact of wheat production, considering agricultural input production
- A study assessing the potential impact of bioenergy power plant considering different pathways of conversion and biomass feedstocks

Exercise 5

- Use the LCA goal of exercise 3
- Determine scope choices:
  - Functional unit
  - System boundaries
  - Environmental impacts

SimaPro Demo 1: Intro & LCIA

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Grapes
Show 1 process
Show 1 characterization
Show 1 comparison

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