Hour 7: LCA Phase 4: Interpretation

LCA training for CIAT and WUR employees

Roel Helmes, July 2019

1. Theory & Discussions

WAGENINGEN
UNIVERSITY & RESEARCH

100years
1918 — 2018

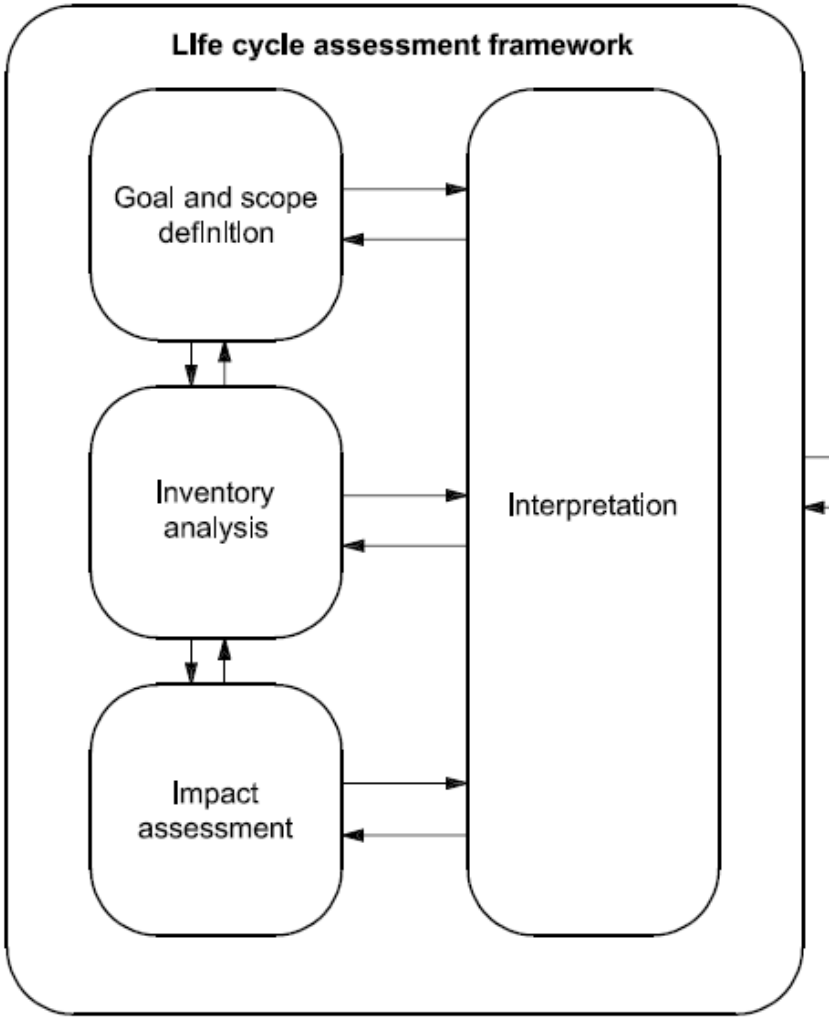
Questions today?

Question to you

- What do you normally do to finish your research, once you have results from your work?

Framework

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



Interpretation: Which steps?

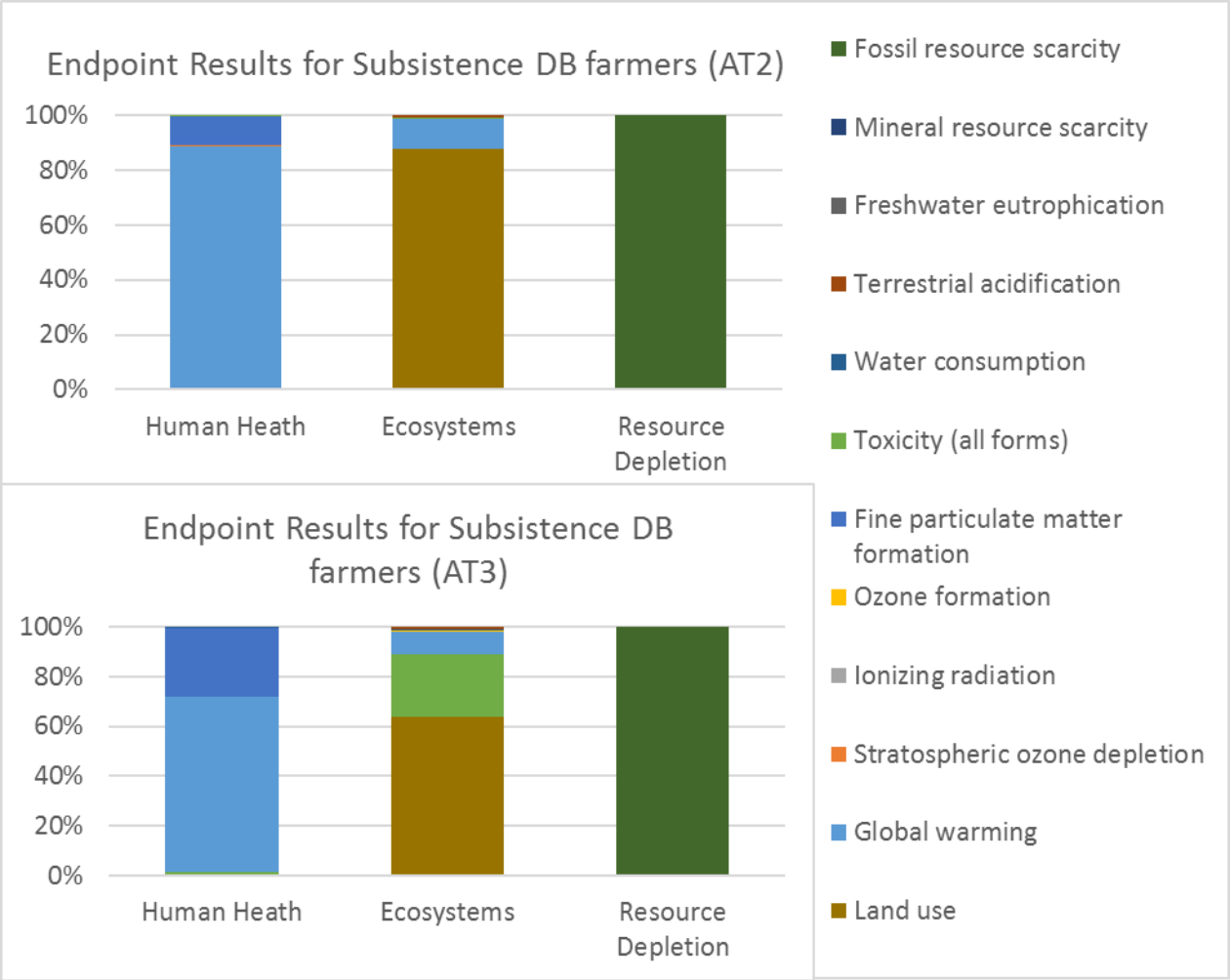
- Contribution analysis = Hotspot Analysis
- Sensitivity analysis
- Quality checks, a.o. an evaluation of completeness and consistency
- Identification of the significant issues
- Define limitations, and recommendations

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

Hotspot Analysis

- Structured approaches: PEFCR development
- Alternatively: Interesting approaches ☺
    - Flexibility
    - Iteration
- Regardless of application: improve data & modelling

Using Endpoint Indicators



Variability & uncertainty

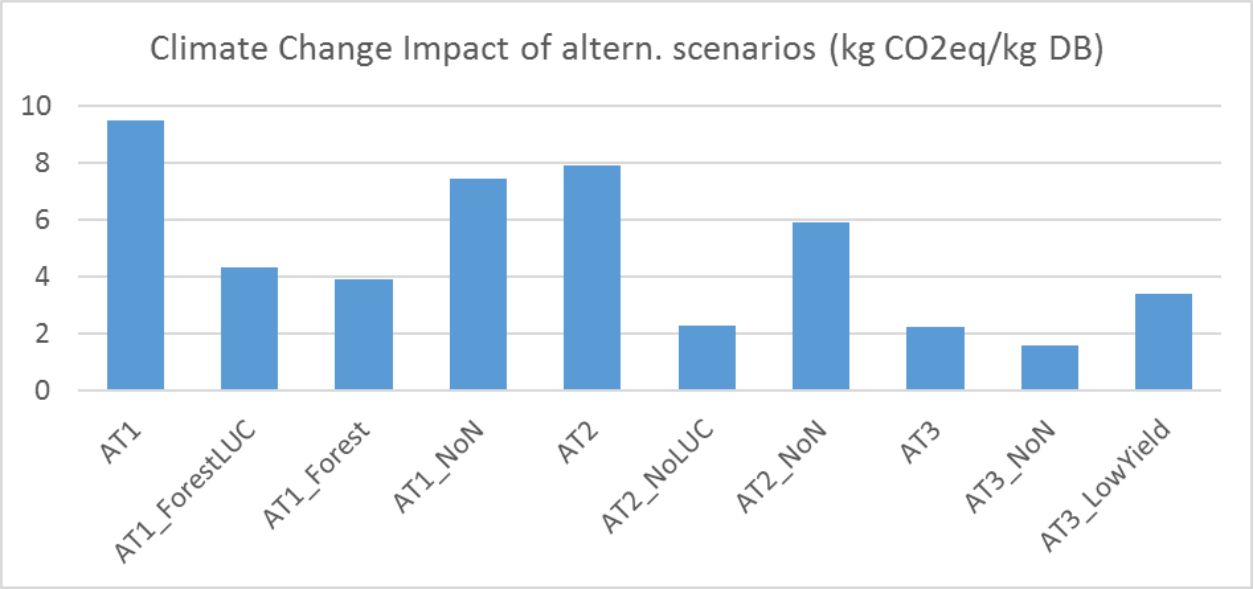
Variation = Uncertainty + Variability

- Sources of variation
  - Method choices (in LCI and LCIA)
  - Assumptions (in emission modelling & background data choice)
  - Data

Approaches to analyse

- Scenario studies
- Sensitivity studies
- Monte Carlo Analysis

Scenarios: Climate Change



- Forest cultivation: Less carbon loss, less nitrogen loss
- No deforestation: No effect of carbon loss
- Excluding nitrogen losses: less climate change
- Less optimistic yield: strong increase

Sensitivity

		AT2		AT3	
		-20	+20	-20	+20
Climate Cl	WByield	24%	-16%	22%	-15%
	LUC_area	-15%	15%	-12%	12%
	N2O	-4%	5%	-6%	5%
	allTDs	0%	0%	0%	0%
Land use	WByield	25%	-16%	23%	-16%
	LUC_area	0%	0%	0%	0%
	N2O	0%	0%	0%	0%
	allTDs	0%	0%	0%	0%
Fossil resc	WByield	2%	-1%	1%	-1%
	LUC_area	0%	0%	0%	0%
	N2O	0%	0%	0%	0%
	allTDs	-3%	3%	-4%	4%

Data quality assessment

1. Reliability
2. Completeness
3. Temporal representativeness
4. Geographical correlation
5. Technological representativeness
6. ... Different typologies...

- Scoring approach
- Structures discussion
- (Source of uncertainty information for Monte Carlo)

Monte Carlo Analysis

- Define distributions for “all” model parameters
- Select values at random for parameters and run model
- Repeat
- Store each result and study the distribution of the results

- Draw on flipover

- Discuss He et al. 2018, methods section

Hour 8: Food Consumption patterns

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1. Discussions

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Discussion on basics

- General approaches
- Specific methods
- Why so little impacts?
- Data sources for LCA info

- Discuss He, Temme, Notarnicola,
- Consider also Kernebeek, production based: https://link.springer.com/article/10.1007/s11367-015-0923-6

Other studies

- Australia
- Ireland
- …
- PEFCR Retail?

Discussion

- What are next steps for this project, for everyone's contributions?
    - Flip over > Discussion with notes; continued on Th

Hour 9: Special topics & Questions

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1. Special Topics
2. Closing discussion & questions
3. Optional topics
    1. Multifunctionality
    2. Land Use

Special Challenges for Agri-LCA

1. How to allocate deforestation to land use activities
2. How to assess agricultural emissions profiles
3. How to make regionalized water scarcity assessments
4. How to choose the functional unit of food and beverages
5. How to deal with multi-functional processes in agro-industry

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Contents lists available at ScienceDirect

Journal of Cleaner Production

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

Five propositions to harmonize environmental footprints of food and beverages

T.C. Ponsioen [a, *], H.M.G. van der Werf [b]

[a] Wageningen Economic Research, Wageningen University & Research, PO Box 29703, 2502 LS, The Hague, The Netherlands
[b] UMR SAS, INRA, Agrocampus Ouest, 35000, Rennes, France

Special Challenges for Agri-LCA

1. The variability of food production
2. Distinction between technosphere and ecosphere
3. The most appropriate functional unit
4. Multifunctionality of biological systems
5. Consumer behaviour

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

The role of life cycle assessment in supporting sustainable agri-food systems: A review of the challenges

Bruno Notarnicola [a], Serenella Sala [b, *], Assumpció Anton [c], Sarah J. McLaren [d], Erwan Saouter [b], Ulf Sonesson [e]

[a] Ionian Department of Law, Economics and Environment, University of Bari Aldo Moro, Via Duomo, 259, 74123 Taranto, Italy
[b] European Commission, Joint Research Centre, Institute for Environment and Sustainability, Via Enrico Fermi 2749, T.P. 290, 21027 Ispra, VA, Italy
[c] IRTA, Institute for Food and Agricultural Research and Technology (IRTA), Carretera de Cabrils, km 2, Cabrils, Barcelona 08348, Spain
[d] IAE, Massey University, Private Bag 11222, Palmerston North 4442, New Zealand
[e] SP Technical Research Institute of Sweden, Food and Bioscience, Box 5401, SE-402 29 Göteborg, Sweden

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ABSTRACT

Life cycle thinking is increasingly seen as a key concept for ensuring a transition towards more sustainable production and consumption patterns. As food production systems and consumption patterns are among the leading drivers of impacts on the environment, it is important to assess and improve food-

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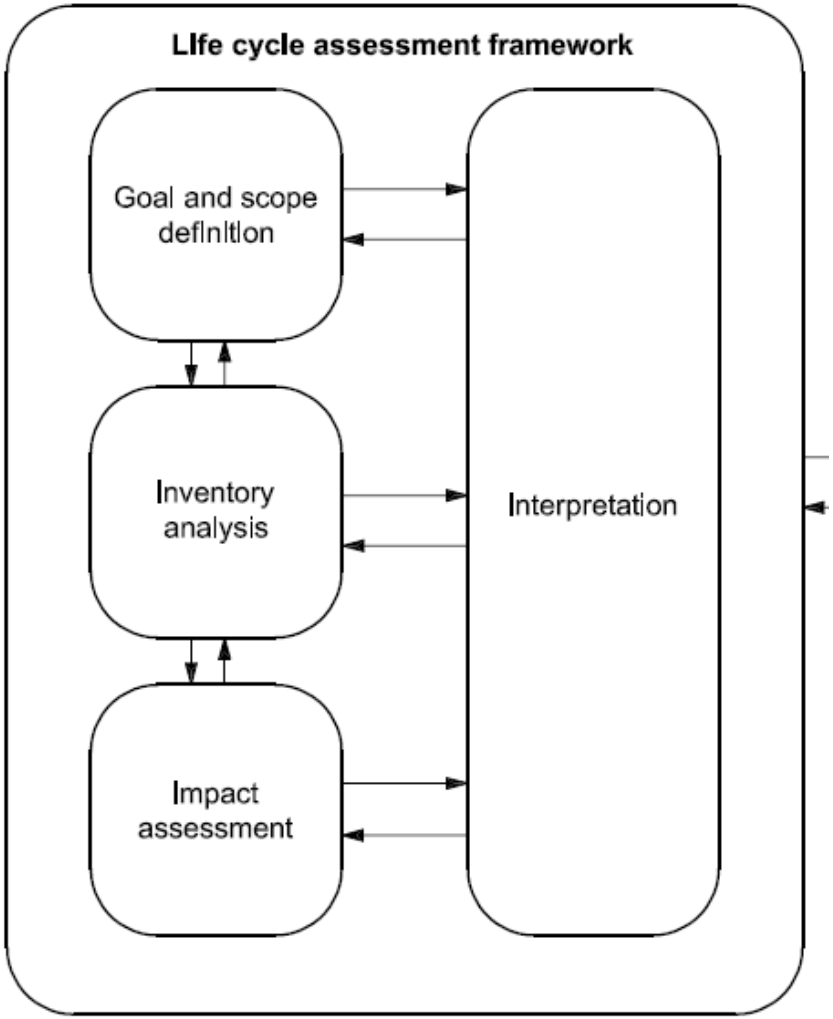

Finishing the training

- What is the question about LCA you'd like to ask now?
- What was your biggest surprise about LCA?
- What will you do different in the coming 6 months?
- Which big question would you like to solve in 6 months?

Feedback

- What would you tell your colleagues about the training?
- What would you like to improve in the training?

Optional discussion exercise: pro's & con's

Pros	Cons
Multiple impact categories	Uncertainties
Best tool available	Data requirements
Complete life cycle	Subjective choices
Choices are made explicit	Technical choices

Optional items (not discussed)

- Reflecting on LCA
- Functional Unit (Ponsioen and Notarnicola)
- Multifunctionality (slides below)
- Land Use (slides below)
- Nutritional questions (Ponsioen)
- Cultural & Behavioural questions (Notarnicola)

Reflecting on LCA

What is your goal with LCA?

How much time, skills and data?

Who wants this LCA?

Which disciplines do I borrow?

Multifunctionality

- Coproduction of marketable products
- Recyclable materials or waste?
- Depends on the goal of your LCA (discuss palm oil)

- ISO

1) Avoid allocation by splitting processes
2) Avoid allocation by system expansion
3) Physical causality
4) Economic allocation

How to deal with multifunctionality

Milk

Beef

Leather

Tallow

Cow

- System expansion
- Substitution
- Allocation

Multifunctionality (draw on flipover)

- System expansion: FU = Protein & Leather; so when compare ImCow=ImBeef + ImLeather with ImAlt = ImPeas + ImSynthleather

- Substitution: FU = Protein, so ImBeef = ImCow – ImSynthleather

- Allocation: ImBeef = AFBeef * ImCow, with AFBeef = CBeef / CTotal
  - C:
    - Energy invested by animal
    - Mass
    - Revenue (Economic)

Multifunctionality: even more complex

Milk

Beef

Leather

Tallow

Labor

Saving

Land Use Change - Intro

- Tropical deforestation is about 10 Mha / yr and accounts for 10% global carbon GHG emissions and drives biodiversity loss
- Causes are complex: Infrastructure & urbanisation, agricultural expansion (95% observed), wood extraction; everything relates to everything
- The drivers are more and more global and commercial; with a change (and variability) in driving product: beef, soy, palm oil.
- Different types of land use cause different GHG emissions

Land Use Change - Methods

- Initial emission & over time emissions
- How to distribute these over
  - Time (what is the time horizon?)
  - Different crops
- Different principles: what drives LUC?
  - Global land demand
  - National / Regional cropping changes
  - Cropping changes ON deforested area
  - Every individual involved (farmer, forester)