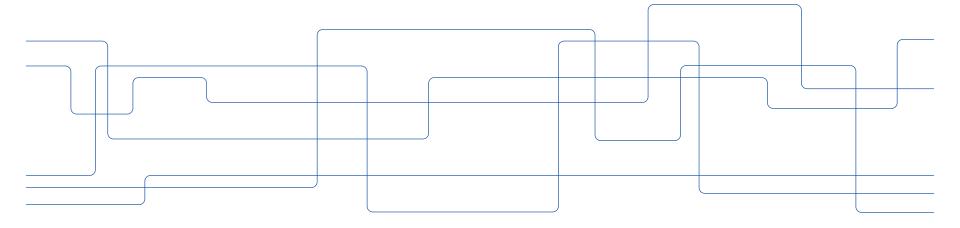


How sensitive is the estimated carbon footprint of biofuels to the LCA modelling approach?

Dr. Miguel Brandão





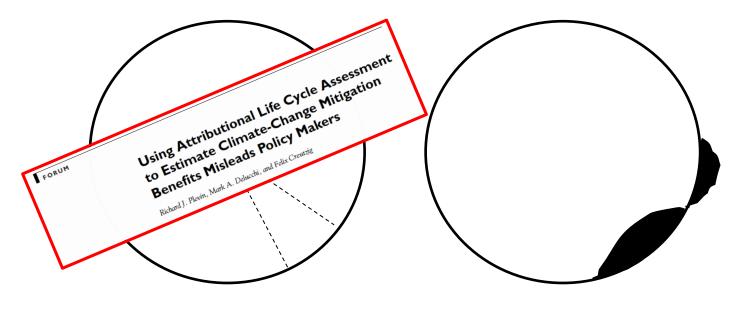
Attributional and consequential modelling

UNEP/SETAC (2011) Shonan LCA database guidance principles:

- Attributional approach: System modelling approach in which inputs and outputs are attributed to the functional unit of a product system by linking and/or partitioning the unit processes of the system according to a normative rule.
- Consequential approach: System modelling approach in which activities in a product system are linked so that activities are included in the product system to the extent that they are expected to change as a consequence of a change in demand for the functional unit.



Attributional and consequential modelling



Attributional

Consequential

Source: Weidema (2003)



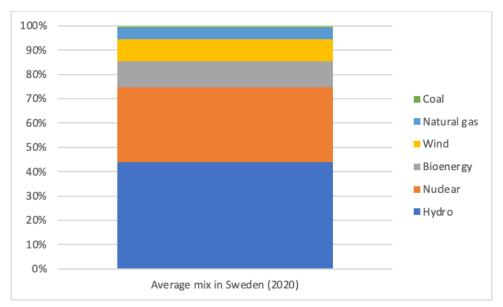
The main differences between attributional and consequential models

	Attributional	Consequential
Market modelling (supply mix)	Average	Marginal
Co-production	Rule-based allocation (e.g. according to economic value)	Substitution (ISO compliant as allocation is avoided)



The standard assumption in LCA

Fully elastic supply – Current suppliers are affected in proportion to their current market share

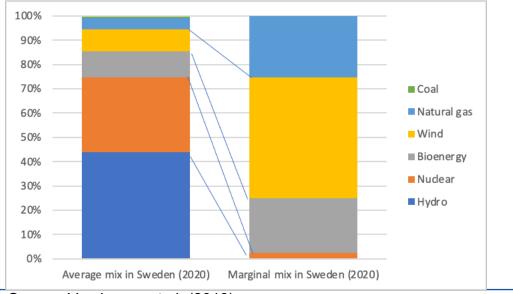


Source: Vandepaer et al. (2019)



Three situations that demand deviations from the standard assumption

- 1. Constrained suppliers: no changes in supplier production \rightarrow Shift to alternative suppliers
- 2. Constrained markets: no changes in total production \rightarrow Consumption changes (+1-1=0)
- 3. Co-product supply: no changes in consumption \rightarrow Substitution of marginal product (-1)

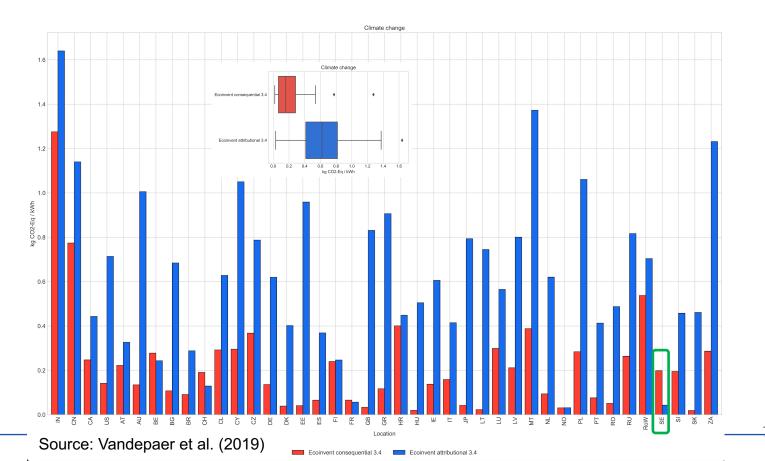


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Source: Vandepaer et al. (2019)



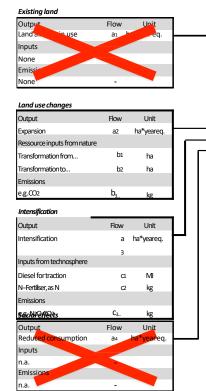
Does it make a difference? The case for electricity



2020-11-25



Does it make a difference? The case for iLUC



			L	Wheat LCA activity (1 ha yr)	rl	11-24
			L	Output	Flow	Unit
and market activity			d.	Wheat	7,296	kg
Dutput	Flow	Unit	II.	Inputs from technoesphere		
nd	Σ _(a1:a4)	ha*yeareq.		Land	1.15	ha*yeareq.
puts from technosphere				Diesel for traction	3,306	MJ
and already in use	aı	ha*yeareq.		N-Fertiliser, as N	198	kg
xpansion	a2	ha*yeareq.		P-Fertiliser, as P2O5	46	kg
ntensification	a3	ha*yeareq.		K-Fertiliser, as K2O	84	kg
educed consumption	a 4	ha*yeareq.		Emissions		
			1	CO2fossil (diesel combustion)	245	kg
			L	N2O	4.15	kg
			L	Resources		
			L	CO2biogenic fromair	11,370	kg
						8
			L			0
			L			
			L			
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			L	A 1 II		
	il	UC		Agriculture		
				0		

Source: Schmidt et al. (2015)



In summary

Attributional iLUC modelling includes the effects of:

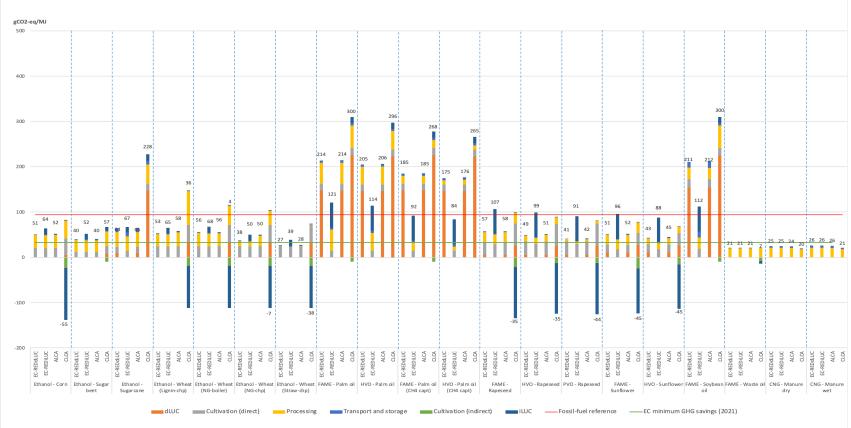
- Using existing land
- Expanding existing land
- Intensification of existing land

Consequential iLUC modelling includes the effects of:

- Using existing land (constrained supplier)
- Expanding existing land
- Intensification of existing land



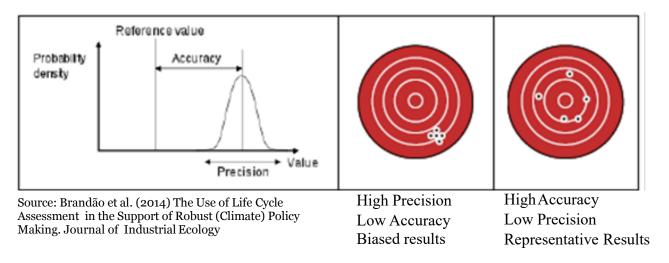
What is the difference in outcome? The case for biofuels



Source: Brandão, Azzi, Novaes, Cowie (submitted)



Precision vs. Accuracy



"It is much more important to be able to survey the set of possible systems approximately than to examine the wrong system exactly.

The scaling for my km.

It is better to be approximately right than precisely wrong."

Tribus and El-Sayed (1982)

Letter to the Editor					
The law of Life Cycle Assessment the Star Star Cycle Cycle Assessment in Star Star Star Cycle Cy	<text><section-header><text><text></text></text></section-header></text>				
	ALCA not be and to be store points, but CLCA note some store, meaning due ALCA mucha may be build and CLCA mucha impracts. Though CLCA may be say be build and CLCA mucha impracts. Though CLCA may be say be build and though concernity to contrast, sports studied by from adding and the same store and the same store and the same store of anotany is performed in a sport and the same store and data a scale sport of the same store of the same store in the same store and store and the same store of the same store and data as scale sport of the same store of the same store in the business or defaunt and store that the same store of the same store business are defaunt and store of the same store the same store in the business are defaunt and store that the same store the same store in the business are defaunt and store that the same store in the same stor				
On Missing Climate-Change Impacts	shing multiple accession to reflect alternative applies in CLCA				
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Single galaxies a soluble
Idear II, Hades I



Outlook: (C)LCA for decision support

- LCA's relevance for policy support growing
 - Several international developments and ongoing initiatives ightarrow better methods, databases, software
 - Lack of consensus \rightarrow increasing harmonisation needed in LCA practice for robustness and reproducibility

• LCA of biofuel systems

- Not necessarily better than the fossil fuels/materials/chemicals they replace
- (C)LCA helps us in identifying the best and worst systems
- May still play a role in climate change mitigation
- Message for policy makers: promote the good system, discourage the bad and ugly
- Methodological choices determine results \rightarrow delimitation of system boundary and indirect effects
- "All models are wrong, but some are useful" → non-shifting of burdens (Box and Draper, 1987)



THANK YOU!

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