

# CONSEQUENTIAL MODELLING

## - IN LIFE CYCLE INVENTORY ANALYSIS

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LATEST UPDATED MARCH 2022

# Overview of videos

- 1) Attributional and consequential responsibility
- 2) ISO 14040/44: A standard for consequential LCA
- 3) How to fully reflect both physical and monetary causalities in LCA
- 4) Temporal issues in LCA
- ➔ 5) Learning from non-intuitive results
- 6) *The comparability algorithm*: Defining the functional unit
- 7) *The linking algorithm*: Composing a consumption mix
- 8) Identifying determining products
- 9) *The co-product algorithm*
- 10) Errors in background databases

# 29 years of explaining consequential LCA

If you want the whole history; see <https://lca-net.com/blog/memory-lane/>

It has turned out to be more difficult than expected

What could be the reasons?

- The intuitive parallel to product declarations
- Does not immediately seem to indicate any comparison
- Small decisions does not intuitively appear to have any consequences
- Absolute impacts are easier to grasp than relative impacts
- Counterintuitive results
- Uncertainty is larger when considering the future
- Attributional LCA has a much stronger application history

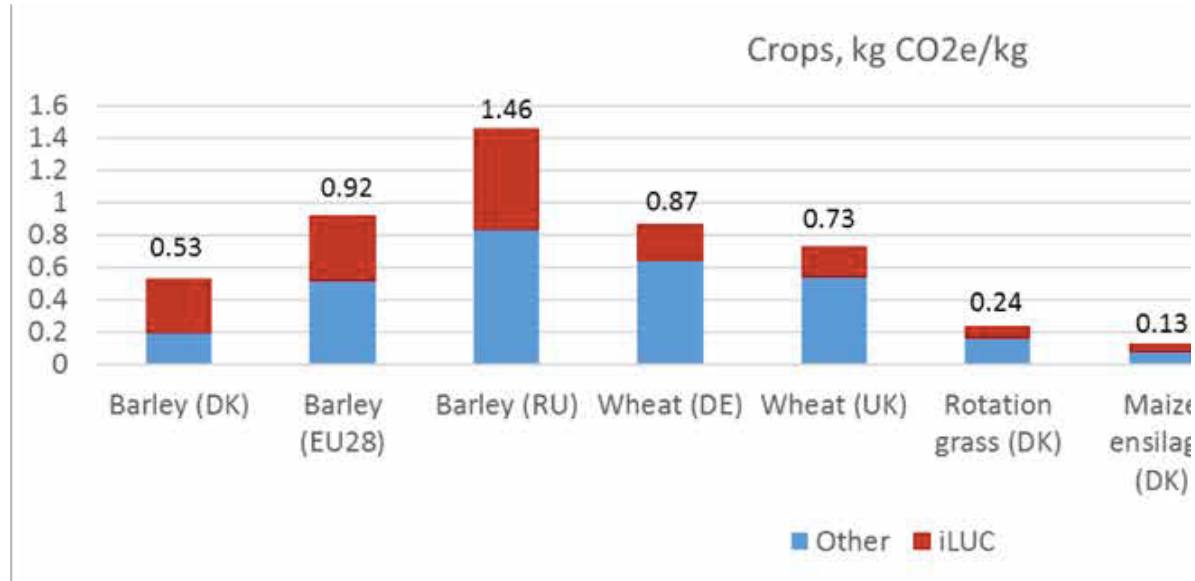
Conclusion: Main reason is that CLCA requires intellectual effort, i.e., it runs counter to immediate intuition

# Counter-intuitive results

- That is what we learn from...

- More global warming with bio-based substitutes than fossil-based?
- Certified forestry damages biodiversity?
- No effect of substituting palm oil by soy oil?
- No effect of substituting leather and plastic?
- No effect of choosing recycled paper?
- No effect of substituting manure and artificial fertiliser?
- No effect of boycotting wood from specific tropical species?
- No effect of sending corrugated board for recycling?

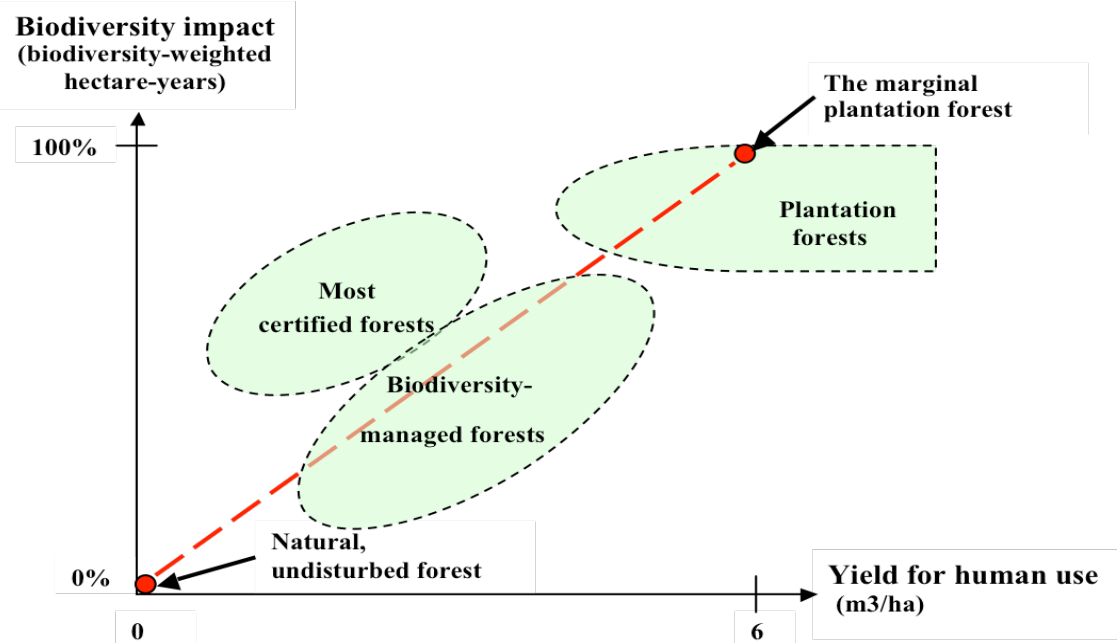
## Counter-intuitive?: More global warming with bio-based than fossil-based?



Intuitively right when we understand that farming is not CO<sub>2</sub>-neutral and that iLUC can make up half of the GHG emission from biological raw materials...

## Counter-intuitive?:

## Certified forestry damages biodiversity?

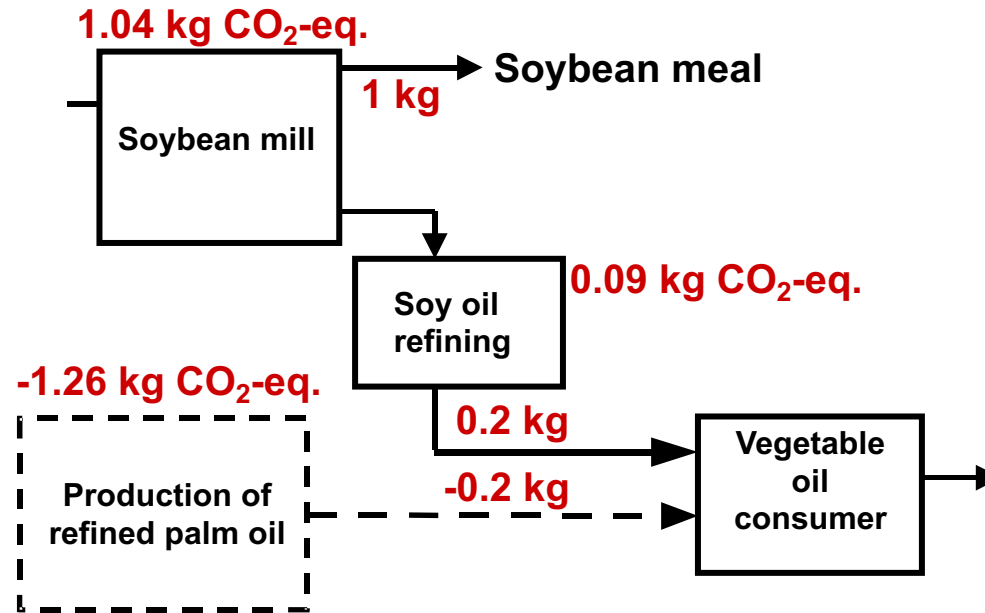


**Figure 1:** The place of different forest management systems (green dashed ovals) relative to the iso-biodiversity line (— — —), its determining extremes (●).

Weidema B P (2013). *Reducing impacts of forestry – the fallacy of low-intensity management*. Presentation for 6th International Conference on Life Cycle Management, Gothenburg 2013.08.25-28. <https://lcanet.com/p/229>

**Intuitively right** when we understand that certification does not manage for highest biodiversity *per produced volume*

## Counter-intuitive?: Increasing protein in feed is good for global warming?

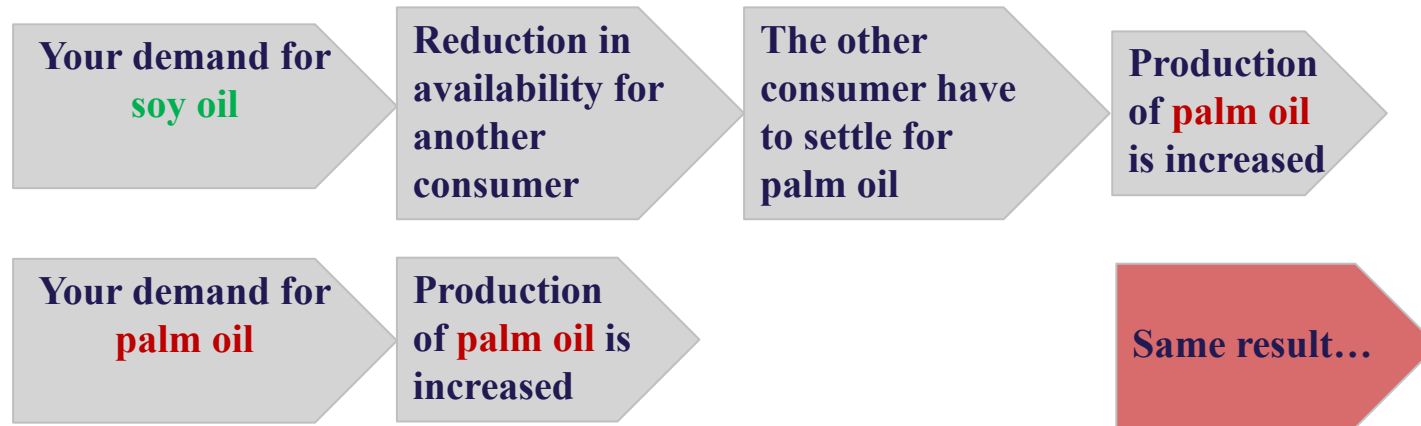


Intuitively right when we understand that the soy oil by-product displaces palm oil which has much larger emissions of greenhouse gases than soy production

## Counter-intuitive?:

### No effect of substituting palm oil by soy oil?

- The amount of soy oil is constrained by the demand for soy protein



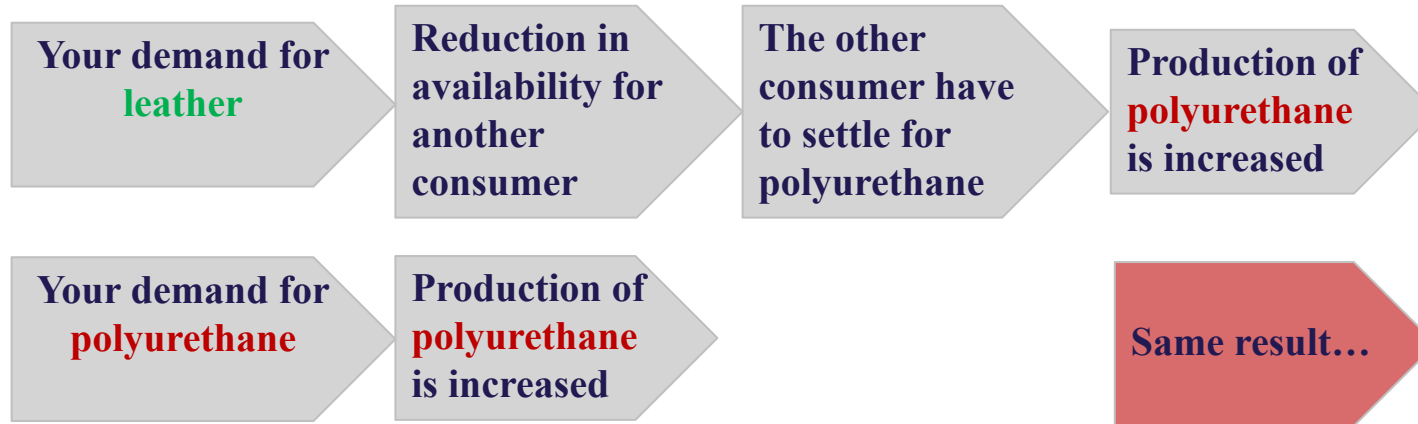
Intuitively right when we understand that purchasing from a constrained market just prevents others from buying, thus increasing demand for the marginal supply



## Counter-intuitive?:

### No effect of substituting leather and plastic?

- The amount of hides for leather is constrained by the demand for meat

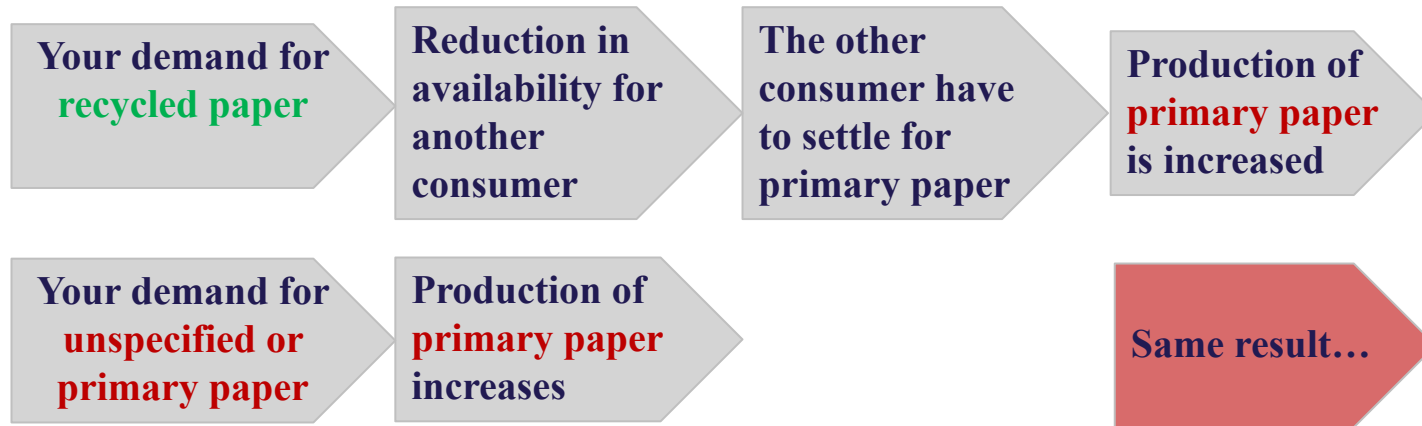


**Intuitively right** when we understand that purchasing from a constrained market just prevents others from buying, thus increasing demand for the marginal supply

## Counter-intuitive?:

### No effect of choosing recycled paper?

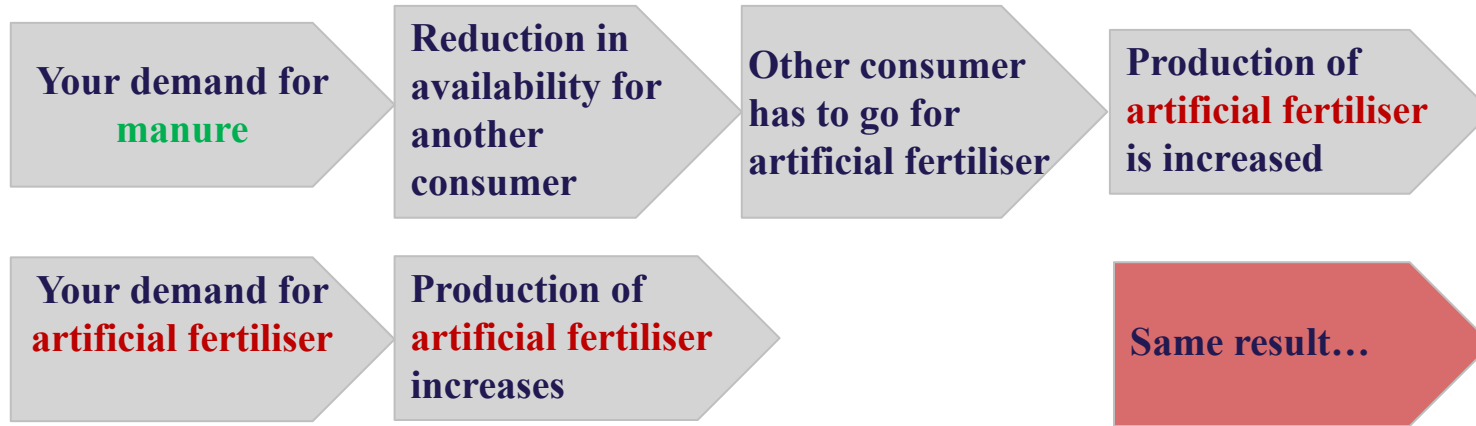
- Approx. 80% of paper is sorted and recycled
- Increased demand no longer increases collection rate



**Intuitively right** when we understand that purchasing from a constrained market just prevents others from buying, thus increasing demand for the primary supply

## Counter-intuitive?: No effect of substituting manure and artificial fertiliser?

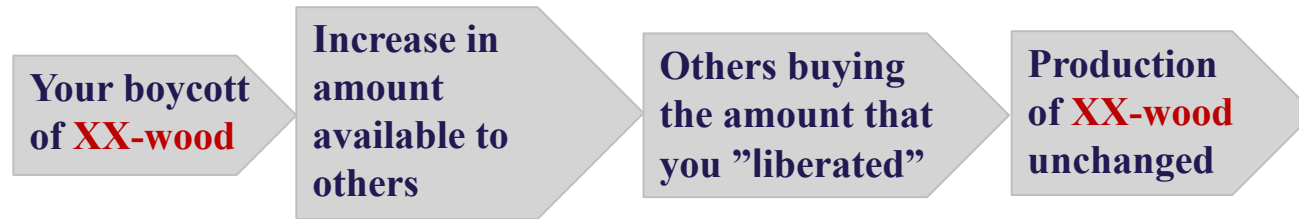
- The amount of manure is constrained by the demand for meat



**Intuitively right** when we understand that purchasing from a constrained market just prevents others from buying, thus increasing demand for the marginal supply

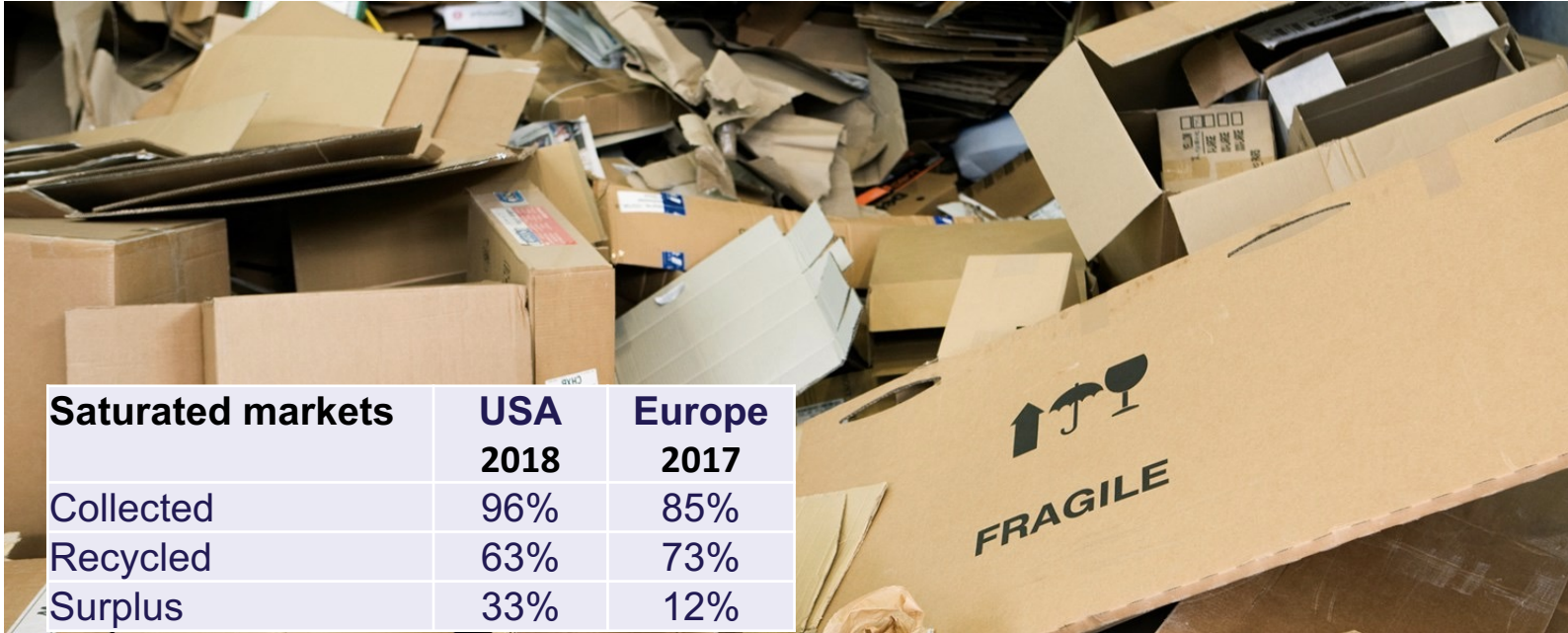
## Counter-intuitive?: No effect of boycott of wood from specific tropical species?

- If the market for a specific wood species is constrained, the production is not influenced by demand



**Intuitively right** when we understand that boycott of a constrained market just enables others to buy

## Counter-intuitive?: No effect of sending corrugated board for recycling?



Saturated markets	USA 2018	Europe 2017
Collected	96%	85%
Recycled	63%	73%
Surplus	33%	12%

**Intuitively right** when we understand that additional supply to a saturated market just increases the amount that must be diverted to alternative (waste) treatment

THANKS FOR YOUR ATTENTION