

# Cross-correlation between impact categories in LCAs of forest biomass-based products

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## 1. Motivation

- LCA can be used to evaluate technologies under development for the production of forest biomass-based products
- There are however many such technologies, and the number of fossil-based products that can be replaced is also very large
- There is thus a need to screen multiple product-technology combinations to identify promising alternatives, and LCIA may be simplified by selecting a number of relevant impact categories based on statistical analyses<sup>1,2</sup>

## 2. Method

- The studies used in this cross-correlation analysis of LCA impact results were selected from a review of 101 papers by Røyne et al. (2016)<sup>3</sup> and two additional papers<sup>1,4</sup>. These studies used at least 2 midpoint impact categories, and used impact categories that were applied in more than 25 % of all studies.
- In total, results from 18 papers were analysed
- Results were normalized per study and per impact category:  

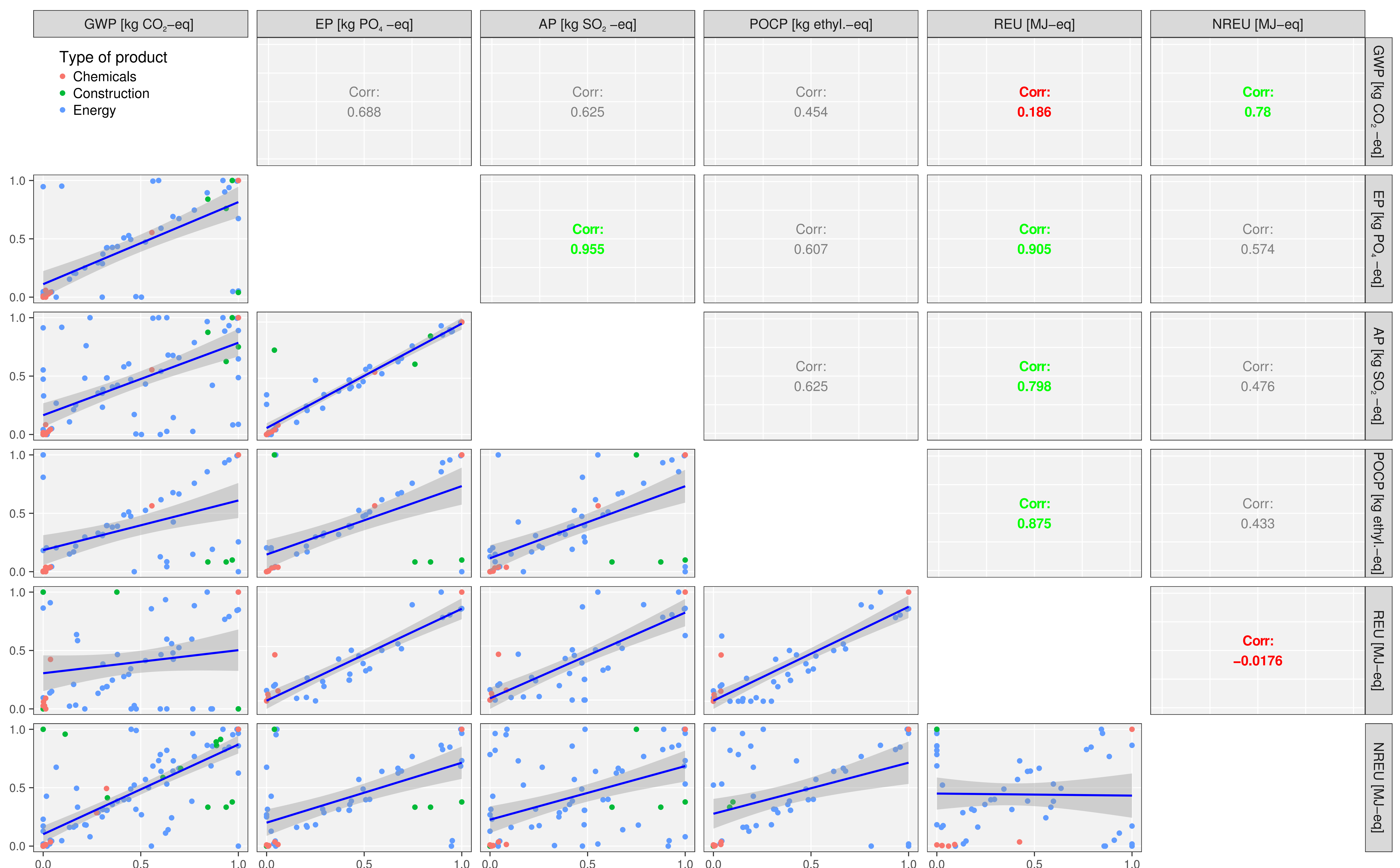
$$n_{i,j,k} = \frac{x_{i,j,k} - \min_k x_{i,j}}{\max_k x_{i,j} - \min_k x_{i,j}}$$
 with: i=study, j=impact category, k=scenario
- Correlation factors were calculated using the Pearson method

## 3. Results

- The most used impact categories in the selected studies were Global warming (GWP; 100%), non-renewable energy use (NREU; 94%), acidification (AP; 56%), renewable energy use (REU; 50%), eutrophication (EP; 39%) and photochemical ozone creation (POCP; 33%)
- Correlation results show that:
  - NREU strongly correlates with GWP
  - REU strongly correlates with EP, AP and POCP, and does not correlate with GWP and NREU
  - EP strongly correlates with AP
- Outliers can be explained by the use of a specific technology (e.g. CCS) or product (e.g. biological fertilizer) in a system

## 4. Conclusion

- Normalization of impact results per study enabled the comparison of LCAs with different functional units
- In many cases impacts are not correlated due to system specifics
- Energy use does not explain all impacts, as suggested before<sup>5</sup>
- Other product categories and feedstocks will be included to widen the scope of the analysis



## References

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- [2] Z. J. N. Steinmann et al. *Environ Sci Technol* 50.7 (2016), pp. 3913–3919.
- [3] F. Røyne et al. *J Clean Prod* 116 (2016), pp. 90–99.
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- [5] M. A. J. Huijbregts et al. *Environ Sci Technol* 44.6 (2010), pp. 2189–2196.



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