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LETTER

Rebuttal to 'Indirect land use change (iLUC) within life cycle assessment (LCA) – scientific robustness and consistency with international standards'

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Assessing the effects of land use change (LUC) at the product level, as it is done in life cycle assessment (LCA) and carbon footprinting (CF), has been and still is subject to debate, especially when the focus is on so-called indirect land use change (iLUC). It is in this context that Prof. Matthias Finkbeiner recently published a report titled 'Indirect land use change (iLUC) within life cycle assessment (LCA) – scientific robustness and consistency with international standards', where he addressed whether iLUC 'can be included in the LCA or CF calculations of biofuels in a scientifically robust and consistent way' (Finkbeiner, 2013a; p. 7). Finkbeiner's conclusion to this core question is a 'no'. The arguments for this conclusion are concisely summarized in seven bullet points in a 1-page document shared with the European Parliament (Finkbeiner, 2013b), where we find statements such as '…there is no fact-based support for a scientifically robust and consistent inclusion of iLUC factors into LCA and carbon footprints (CF) assessments'.

After careful reading of the above documents, the signing authors find that most of its specific arguments and key conclusions are misinformed, and thus we do not find the main conclusion of the study to be supported by the evidence and arguments put forth. Unfortunately, there is not enough room in this article to present a detailed rebuttal to Prof. Finkbeiner, and for this reason we focus only on a few arguments. For the interested readers, a point-by-point rebuttal is available in Muñoz *et al.* (2014).

Some of the arguments used by Prof. Finkbeiner include that iLUC (Finkbeiner, 2013a,b):

- Cannot be observed or measured,
- Is based on theoretical models relying on hypothetical assumptions,
- It uses low-quality data,
- Is currently excluded by international LCA and CF standards,
- It is highly uncertain.

What cannot be observed or measured is the 'indirectness' of the LUC, whereas LUC itself is a well-established fact. Linking the LUC to its indirect drivers is what LCA and CF models do. Also, an LCA or CF result—with or without iLUC—is always based on a theoretical model. Product life cycles are artificial constructs and cannot be measured as a whole in the real world. In spite of this limitation, LCA and CF are widely used and accepted tools to assess the impacts of products and services, including biofuels. As for the utilization of low-quality data, this can only be an argument for improving the data quality, and not an argument to justify exclusion of iLUC from LCA altogether.

A review of several national and international LCA and CF standards leads Prof. Finkbeiner to state that the lack of scientific robustness of iLUC is reflected in these standards. It is worth noting that the most important LCA standards, i.e., ISO 14040 and ISO 14044 (ISO, 2006a,b) were published before the iLUC debate had started. As for the remaining standards, we find that they do not reject iLUC as an invalid concept that should be ignored. On the contrary, many of them accept it as a cause for concern, although they conclude that currently there is no scientific agreement on how to assess it. They actually leave the door open for inclusion once methods are more mature. After all, it is obvious that iLUC modeling is in its infancy, as one of the first studies attempting to model it was published just 6 years ago (Searchinger *et al.*, 2008). In fact, we can draw an analogy with the early days of LCA during the late 1980s and early 1990s, which led to the ISO standardization process. The efforts of countless scientists and the support of many institutions during the following years have resulted in LCA being considered nowadays the best approach for a comprehensive environmental assessment of products and services. Would it have

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been a good idea to reject LCA back then, on grounds of lack of maturity? Obviously not.

While the arguably high uncertainty is a scientific issue, robustness of a finding depends on the decision context. We disagree that uncertainty should be an argument for systematically excluding iLUC from LCA and CF. In fact, inclusion of iLUC makes LCA and CF studies of bio-based products more accurate, not less. In other words, we argue that studies of bio-based products should better be 'approximately right than precisely wrong'.

Prof. Finkbeiner also argues that 'credibility, robustness, integrity and reliability of LCA and CF would be damaged if policy makers decide to introduce speculative and inconclusive iLUC factors into environmental impact assessment' (Finkbeiner, 2013b). We hold exactly the opposite to be true, that is, that damage to LCA and CF comes not from addressing challenging issues, even if they are not methodologically mature, but by deliberately omitting them, especially when these issues are within the traditional scope of LCA and CF (greenhouse-gas emissions from human activities) and when they appear to be of crucial importance for decision making in a particular context, like bio-based materials and fuels. It is our opinion that we as LCA and CF scientists would fail if we voluntarily apply an observational bias to the questions we are asked to answer.

In summary, we have failed to find convincing evidence in Prof. Finkbeiner's study to support his conclusions. Excluding, ignoring or describing uncertain elements qualitatively may make the quantitative LCA or CF results look less uncertain, but it does not reduce the true uncertainty of the results. We assert that a robust decision must be one that can withstand the inclusion of uncertain knowledge.

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