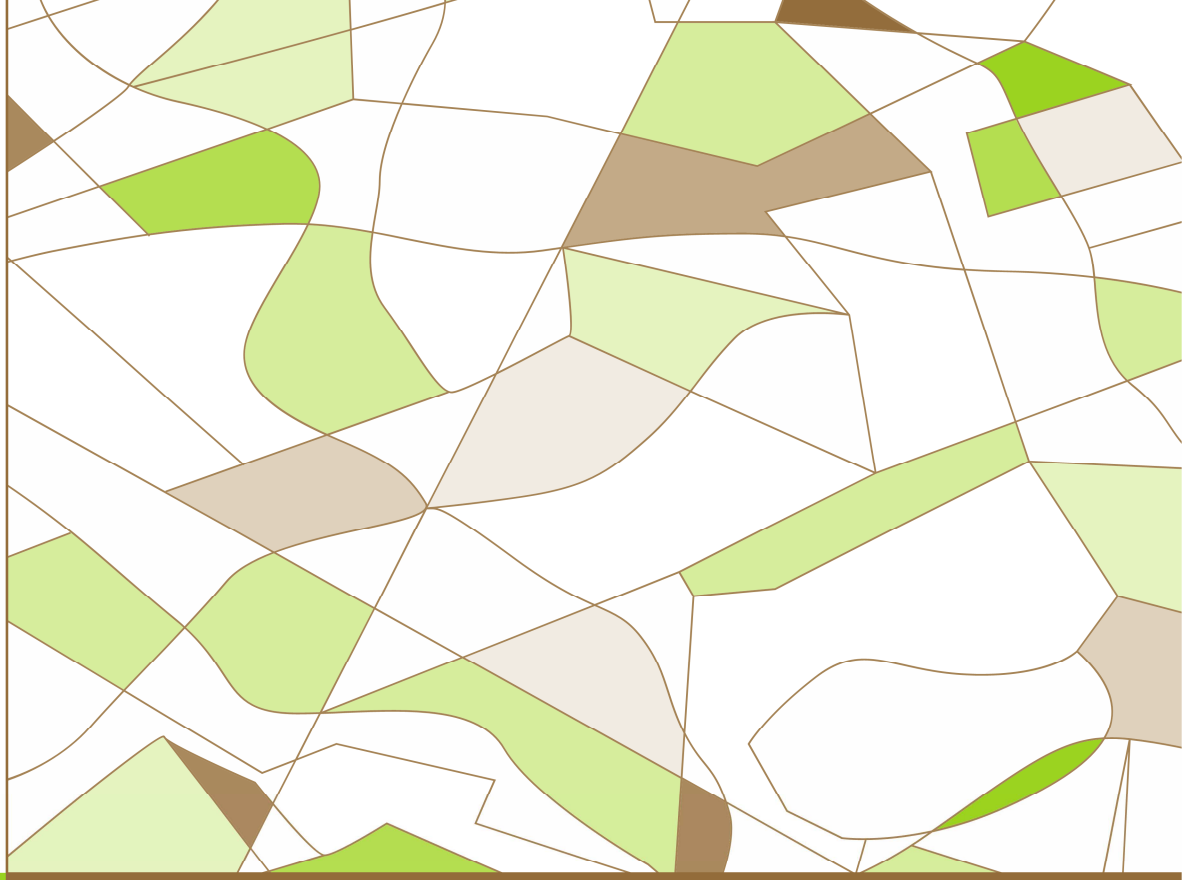
EXECUTIVE SUMMARY



INDIRECT LAND USE CHANGE (ILUC) WITHIN LIFE CYCLE ASSESSMENT (LCA) - SCIENTIFIC ROBUSTNESS AND CONSISTENCY WITH INTERNATIONAL STANDARDS

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Executive Summary

The 'food versus fuel' debate and the discussion about the environmental performance of biofuels in general has led to the development of the concept of indirect land use change (iLUC) and the proposal to include iLUC factors into environmental assessments of biofuels.

While the science behind iLUC is still in its infancy, life cycle assessment (LCA) has matured over a few decades and is nowadays accepted internationally by all stakeholders as "…best framework for assessing the potential environmental impacts of products currently available (EU 2003)". The international standards ISO 14040/44 represent the constitution of LCA.

The core question of this study is, if and how iLUC can be included in the LCA or carbon footprints (CF) of biofuels in a scientifically robust and consistent way. While the currently published mainstream trend seems to demand the integration of iLUC factors into LCA and CF assessments and thereafter in regulations, this study seeks proof whether this is supported by the sober, critical and neutral perspective of science.

The study reveals that there is hardly any fact-based support for a scientifically robust and consistent inclusion of iLUC factors into LCA and CF. This statement is based on the following results:

I. Indirect land use change cannot be observed or measured.

II. The iLUC quantification is based on theoretical models that mainly rely on hypothetical assumptions and market predictions.

III. The economic LUC models cannot differentiate between direct (dLUC) and indirect land use change. There is no iLUC without dLUC. If every product on earth accounted for its dLUC, there is no iLUC – unless double-counted.

IV. They suffer from a number of deficiencies and do not address the allocation of greenhousegas-emissions from a particular agricultural field between the displaced and the displacing crop ('inter-crop-allocation'). However, this is necessary to avoid doublecounting respectively free-rider incentives.

V. There are basically no primary data available for iLUC calculations; there is hardly any resolution with regard to individual crops or regions. The data quality underlying iLUC factors is significantly lower than any other data used for LCA and CF.

VI. There is full agreement in the scientific community that iLUC factors are highly uncertain. The level of cruelty for characterizing the uncertainties goes from "significant" (Laborde et al. 2011) to "enormous" (Edwards et al. 2010).

VII. iLUC values found in the existing literature vary in enormous ranges:

   a. for bioethanol from negative values (e.g. -116 gCO_{2e}/MJ (Dunkelberg 2013) or -85 gCO_{2e}/MJ (Lywood et al. 2009)) up to 350 gCO_{2e}/MJ (Plevin et al. 2010).

   b. for biodiesel from 1 gCO_{2e}/MJ according to Tipper et al. (2009) up to 1434 gCO_{2e}/MJ as the upper value of Lapola et al. (2010).

   These ranges mean that just the iLUC factors can be either some 200% below or some 1700% above the fossil fuels value. The uncertainty range for iLUC factors is even larger than the substantial differences between the LCA data of all types of food from lentils via tomatoes, cheese and even chicken to beef and lamb.

VIII. The uncertainties are dominated by systematic rather than statistical errors. As a consequence, there is currently no way to determine which of the iLUC factors published is more right than any other. It is not only about the size of the numbers, it is even unclear whether the iLUC effect of certain biofuels is positive or negative.

IX. There is a trend of an erosion of iLUC factors over time. For US corn ethanol, the initial LUC effect was given as 104 gCO_{2e}/MJ. Improvements in the model used resulted in large reductions - first to 32 gCO_{2e}/MJ (which is the value used in California's Low Carbon Fuel Standard) and more recently to 15 gCO_{2e}/MJ. If California's Low Carbon Fuel Standard used the most recent iLUC factor, most corn ethanol production would be able to meet the required emission reduction percentage of 10% compared with fossil fuels by 2020 while this is not the case with the current factor of 32 gCO_{2e}/MJ (Wicke et al. 2012).

X. The lack of scientific robustness and consistency of iLUC models and their data make the provision of any single numbers for iLUC factors rather sham than substance – just data, but no information.

   a. The current information content, reliability and integrity of exact iLUC factors are not on the quality level of robust scientific findings.

   b. Any single figure published to date is more representative for the approach or model used than the crop or biofuel assessed.

   c. The quality of iLUC factors is way below the quality of the material and energy flow data that are typically used for process-based attributional LCA. It makes no sense to add these data into one number.

XI. The lacking scientific robustness and consistency of iLUC is properly reflected in the existing international standards for LCA and CF.

   a. None of the generic LCA or CF standards and guidelines studied[1] requires the mandatory inclusion of iLUC factors into the assessment.

   b. Even the intention to include iLUC factors in the future is limited to only a few documents and tightly constrained by the condition that this requires a scientifically robust and internationally agreed method.

   c. Even if this condition might be met at some point in the future, the standards still require to report iLUC separately from the core LCA or CF result due to the different quality of the data (ISO 14067 2012, GHG 2011).

   d. Some standards provide clear indications for either the limited use of iLUC factors (for consequential LCA only) or the comprehensive use of iLUC factors (for all products) or even indirect effects in general (beyond indirect effects for land use).

XII. iLUC factors are a hasty reaction in method development and an arbitrary choice for decision-making.

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[1] ISO standards on life cycle assessment (ISO 14040, ISO 14044), EC Product Environmental Footprint Guide, ILCD Handbook, French Labelling Scheme, ISO draft standard on carbon footprinting (ISO DIS 14067), GHG Protocol Product Standard, PAS 2050, Japanese CF Specification, Korean CF Labelling Guideline

a. The isolated application of iLUC for biofuels is scientifically not consistent. If it is a robust and meaningful concept, it has to be applied to all products, not only one - “iLUC for all or iLUC for none” (Laborde 2011).

b. For a fair comparison of biofuels with fossil fuels, the same rules have to apply. If iLUC is considered for biofuels as indirect effect, the indirect effects of fossil fuels have to be considered as well. For example, the indirect military GHG emissions from Middle Eastern petroleum are well within the range of iLUC-factor estimates for ethanol and raise the GHG intensity of gasoline according to Liska & Perrin (2009) by roughly two-fold.

c. A scientifically robust assessment of indirect effects cannot be limited to the arbitrarily chosen issue of land use change. Full scientific consistency requires “including all indirect effects or none”. Any arbitrary selection of indirect effects is a value choice, not justified by science.

These facts should be acknowledged for any consideration of iLUC factors in LCA and CF for decision-making. Decision-makers in both private and public organizations need to appreciate the benefits of LCA. However, for a robust, sustainable and credible use of LCA the over-interpretation of LCA results without proper consideration of its gaps and limitations has to be avoided. ISO 14040/44 clearly indicates that an LCA is not a complete assessment of all environmental issues of the product system under study. LCA does not fail, if it cannot capture indirect effects like iLUC - provided this limitation is documented properly. LCA does fail and damages its credibility, integrity and reliability, if it pretends to be able to do so by adding speculative, low quality iLUC factors to otherwise robust LCA results. Due to the different nature of iLUC and the material and energy flows typically assessed in LCA, it is wise to address iLUC separately from LCA – at least for quite some time.

For the topic of indirect land use change, more focus and resources should be directed towards proactive mitigation of such effects rather than reactive iLUC factors. For LCA, there are much more robust policy applications to expand the fact-based domain in environmental policy making. They should be tackled first – for the sake of both environmental policy and LCA.

The complete study is available at:

www.ovid-verband.de

www.biokraftstoffverband.de