# The current status and future of iLUC in the scientific community

## From quantification to prevention

Biofuels are viewed as a sustainable energy source that can be used as a substitute for diminishing supplies of fossil fuels. Nevertheless, there has been much discussion about the scale and negative implications of indirect land use change (iLUC) through the promotion of biofuels. Wouldn't the cultivation of soya for biodiesel, for example, or maize for bio-ethanol, ultimately be to the detriment of the natural environment? Science is making advances in understanding and gaining new insights. Initially high iLUC estimates have been lowered as a consequence of improved data and methods. However, there is still considerable scope for further scientific improvements. Moreover, it appears to be possible to largely circumvent negative iLUC effects with the right modifications in arable and livestock farming.

### Motivation

In view of the topicality of the subject of iLUC in the debate regarding renewable energy, and the global confusion regarding the relevance of the subject, the authors of this letter hope to update the Dutch House of Representatives of the States General on the latest scientific insights relating to this topic. The motivation for this is the fact that sustainability was added to the agenda of the Standing Committee for Infrastructure and the Environment as well as that of the House of Representatives on 20 January.

As research institutes, the Copernicus Institute of Utrecht University and LEI, part of Wageningen UR, are internationally considered to be a primary source of scientific knowledge on this subject. These two institutes work closely with PBL, the Netherlands Environmental Assessment Agency

### Background

There is intense competition for land between agriculture, infrastructure and other forms of land use. Changes in land use are therefore not unique to bio-energy but relate to all activities that influence the use of land. The cultivation of energy crops requires land, as do crops for food, animal feed and fibres. In essence, the issue relates to the use of scarce resources (in this case: agricultural land), by definition the subject of economic sciences.

iLUC is just one aspect of the sustainability of renewable fuels, although it is a very important one. The initial problem is caused because an increase in the demand for biofuels implies that an increase in demand is expected for land currently used to produce agricultural products or other types of land. The concern in this respect is that extra agricultural land will be created at the expense of nature, leading to a loss of biodiversity and to a single release of greenhouse gases containing carbon as new land is brought into production. This non-recurrent emission – the scale of which will be largely dependent on whether it is grassland or woodland that is being cleared – will need to be offset against any future reductions in emissions from the use of biofuels instead of fossil fuels. The subject has been put firmly on the agenda by a

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number of scientific publications. One early reference was made by Searchinger et al. (Science, 2008). Since then, a wide range of positions have been taken on the matter. We can refer to various recommendations from the Corbey committee, the Social and Economic Council and the recent Dutch response to the iLUC consultation by the EU.

A great deal of scientific research has been carried out since the first studies took place on this subject. The scientific status is as yet not entirely clear, mirroring the situation in the social debate. There are large differences in assumptions and data used regarding:

- types of land use and changes in that land use, in particular the conversion of natural areas (woodland or marginal land) or grassland into arable fields;
- the contribution of intensification of production on existing agricultural land;
- tthe assessment of the utilisation of by-products;
- twhether or not technological progress in the bio-energy sector is assumed;
- tthe way in which the environmental impact of land-use changes are estimated and assigned.

A further complication is the lack of historical data concerning this developing sector or regarding the expected depletion of fossil fuels. Due to these ambiguities, the predictions of even the authoritative models vary enormously and the models themselves are currently undergoing major revisions. Advances in understanding are proceeding at a rapid pace.

## What do we know?

The social debate refers to a great extent back to the early study by Searchinger (2008). That study claims an 'iLUC-factor' of almost 1: every extra hectare of maize cultivated in the US for the production of ethanol would lead to one hectare of lost natural environment. Searchinger also assumes that these losses will include areas containing rainforests. However, this study assumes no intensification of existing land use. Energy crops often lead to the intensified use of existing agricultural land, or they are cultivated on previously depleted grasslands. This phenomenon has been seen in Brazil, for example. Since Searchinger (2008), improved studies have begun to incorporate the required complexity and better insights into the actual changes in land use in the largest biofuel-producing countries, and have found that the effects of changes in land use are smaller than originally estimated. Currently, cautious estimates of the iLUC-factor in the case of an unchanged policy vary between 0.15 and 0.30, but these estimates are expected to improve. Evaluations that take into account the effects of agriculture and sustainability policies suggest that only limited extra agricultural land would be needed, if any at all. This is actually dependent on the relationship between:

- the speed of the required improvements in productivity in agriculture;
- the speed of the development of bio-energy production;
- the enforcement of sustainability requirements.

However, raising the efficiency levels in the world of arable and livestock farming is not possible without major efforts in policy, capacity building or market development and access.

## Challenges for science and policy

The scientific community needs to focus on better forecasts and policy analyses by means of:

1 more current and more accurate data on land use (monitoring by satellite);
2 future scenarios that take into account the effect of technological progress and regulation (certification, REDD);
3 improved modelling of:
   - the increase in productivity that the bio-energy sector itself automatically brings about by contributing more added value, investments and infrastructure in agricultural areas – this has been observed in the past for grain production all over the world, and also for sugar cane in Brazil, for example;
   - differences in iLUC-risk between regions and situations;
   - the most important economic feedback mechanisms: prices, innovations and policy-driven productivity increases.

The policy itself could concentrate primarily on preventing iLUC. This could be achieved, for example, by means of measures that promote desirable effects:

- the use of residual flows and by-products;
- the enforcement of sustainability requirements;
- the use of marginal and depleted land for biomass production;
- the improvement of efficiency in conventional arable and livestock farming;
- or the improved efficiency of the chain of bio-energy production;

By monitoring progress relating to these aspects and land use in general, it may be possible to ascertain the extent of the iLUC-effects.

More information:

Andre Faaij
e-mail: A.P.C.Faaij@uu.nl
Copernicus Institute, Utrecht University

Hans van Meijl and Douwe-Frits Broens
e-mail: douwefrits.broens@wur.nl
LEI, part of Wageningen UR

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