Reaching the Right Conclusion the Wrong Way – reply to Searchinger

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Authors: Matthew Brander [1], Richard Tipper[1]

[1] Ecometrica

1. Introduction

Timothy Searchinger suggests that biofuel production must generate 'additional carbon' in order to reduce emissions, and that when biofuels use existing cropland they use crops which would have grown anyway, and the direct carbon uptake is therefore not additional (Searchinger 2010). Such biofuels will only achieve a carbon benefit if they increase carbon uptake indirectly, e.g. through raising market prices and incentivising farmers to grow more crops elsewhere. A further point is that whether biofuels indirectly increase net carbon uptake is uncertain, for all the same reasons that quantifying indirect land use change (ILUC) is uncertain (e.g. uncertainty about yield increases, and uncertainty about the area and types of new land which are brought into agricultural production). This conclusion works against the argument that the benefits of biofuels are direct and relatively certain, but ILUC is uncertain and so should be left out of the reporting requirements for biofuel support mechanisms such as the Renewable Energy Directive or the US biofuel mandates.

This paper suggests that an important part of Searchinger's argument is flawed, but that one of Searchinger's conclusions, that the net benefits of biofuels are uncertain, is still correct. However, this is not a new conclusion, and stems from the fact that quantifying ILUC is uncertain, which we already knew.

2. Direct GHG benefits from biofuels

Searchinger writes 'What happens when biofuels use existing crops, which means they do not directly change land use? By definition, that means the crops would be grown anyway. The short answer: because the diversion of existing crops to biofuels does not absorb any additional carbon from the atmosphere, there is no additional carbon. In that situation, the automatic assumption of an offset by plant growth is incorrect and there are no *direct* reductions in greenhouse gases.' (Searchinger 2010, pp 2).

The flaw lies in the inference that there are 'no *direct* reductions in greenhouse gases'. To see this consider the following simplified example: a hectare of existing cropland is used to grow a biofuel feedstock crop instead of a food crop. When the land *was* used for food production the crop absorbed CO_2 from the atmosphere, and that CO_2 was released back to the atmosphere through human respiration and crop residue decomposition. In this scenario society uses fossil fuel to meet energy needs, resulting in the release of CO_2 to the atmosphere.

When the hectare of land is used for biofuel production the crop absorbs CO_2 from the atmosphere, and that CO_2 is released back to the atmosphere through the combustion of the biofuel. But the biofuel helps to meet society's energy demand, and less fossil fuel is combusted. Figures 1 and 2 show the simplified physical flows of CO_2 in each of these scenarios, and net direct emissions.

Figure 1. Cropland is used for food production.

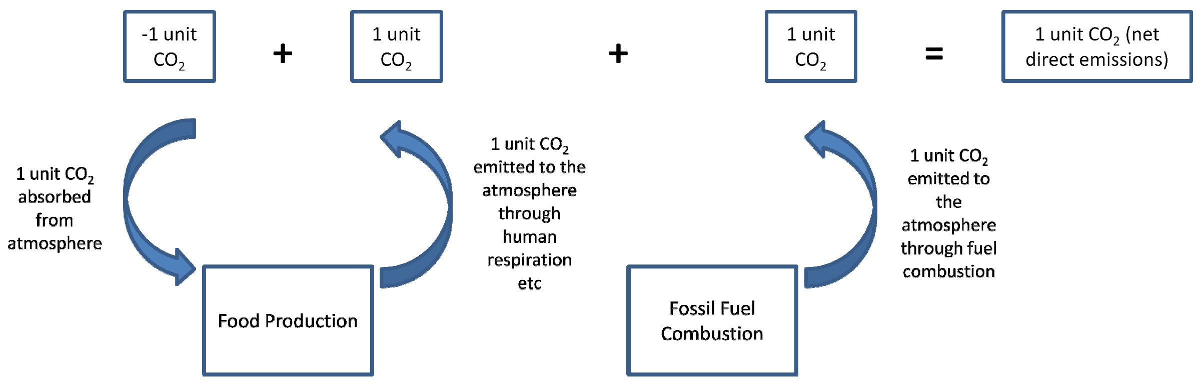
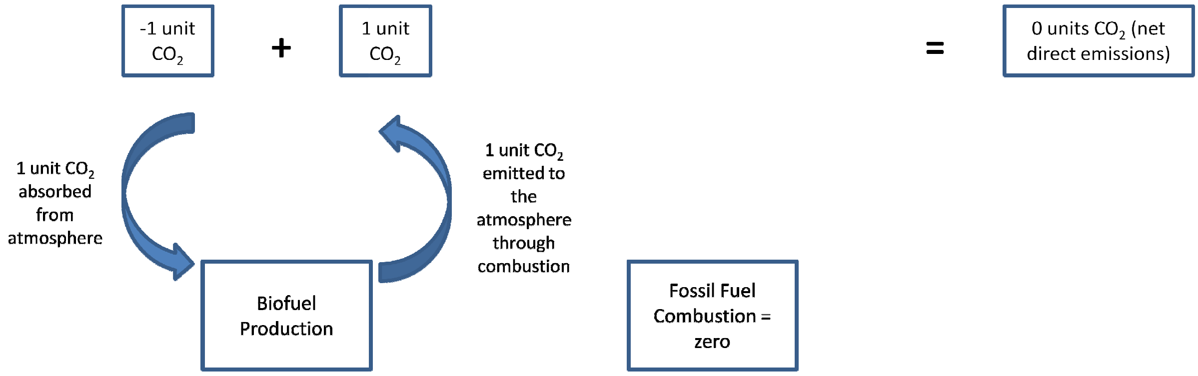


Figure 2. Cropland is used for biofuel production.



Net direct CO_2 emissions in the first scenario are 1 unit of CO_2, whereas in the biofuel scenario the net direct emissions are 0 units CO_2; a net reduction between the scenarios of 1 unit of CO_2. The reduction in CO_2 emissions illustrated in the example above does not require additional carbon capture elsewhere (and we do not require a complex and uncertain agro-economic model to see that there is a direct reduction)[1]. The direct reduction occurs because we have replaced one short-cycle flow of carbon (food cultivation, consumption, and respiration) with another (biofuel feedstock cultivation and combustion), but in the latter case there is also the displacement of fossil fuel combustion. It is important to note that the reduced consumption of food *directly* produced on the hectare of land does not entail that *total* human food consumption and respiration is necessarily reduced, though this *could* occur if food production is not increased elsewhere.

The question is then: will the food crop be replaced elsewhere, and if so will the additional production be through yield increases or the conversion of pasture and forest to agricultural use? But these are the familiar questions about quantifying indirect land use change, and not a new problem. The mistake in Searchinger's paper is to miss the fact that there is a *direct* reduction in

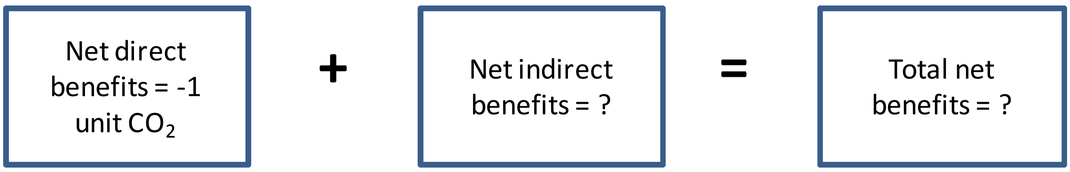
[1] The distinction between "direct" and "indirect" emissions is not actually necessary for conducting a consequential LCA – there are just "impacts" or GHG consequences which should be quantified and summed to show the total change in emissions resulting from the production, and other lifecycle stages, of the product. The underlying intention of Searchinger's paper is to show that there are no *certain* benefits from biofuels, and the nomenclature of "direct" or "indirect" is not of first importance. However the example discussed in this paper shows that some "benefits" are certain, i.e. we don't need a model to see that there is a reduction in emissions within the scope of the example.

emissions, and then to suggest that the only greenhouse gas reductions from biofuels grown on existing cropland must be indirect, with concomitant uncertainty[2].

3. Where Searchinger is right

One of the broad conclusions from Searchinger's paper is that the benefits of biofuels grown on existing cropland are uncertain. Although it is not correct to say that the benefits of biofuels are uncertain because they are all *indirect*, it is correct that the total net benefits of biofuels are uncertain because the net *indirect* benefits (or dis-benefits), such as emissions from ILUC, are uncertain. This is illustrated in Figure 3 below.

Figure 3. Uncertainty of the total net benefits of biofuels.



We can't know what total net benefits are if we don't know all of the values which determine total net benefits. Again, the conclusion that the total net benefit of biofuels is uncertain is not new information, but it does remain a highly important point which policy makers need to respond to.

As an aside, it is interesting to note that most, if not all, climate change mitigation policies have indirect effects which are also difficult to quantify. For example, energy efficiency projects reduce household expenditure on energy, which allows expenditure on other goods and services, with resulting emissions. Another example is the EU ETS reducing European demand for coal, which lowers coal prices and increases coal consumption elsewhere.

[2] Because there can be direct benefits from biofuels grown on existing cropland the "lessons" for LCA outlined in Searchinger's paper do not hold true, i.e. consequential LCAs which ignore ILUC are incomplete rather than completely incorrect, and the standard LCA assumption that biofuel tail-pipe emissions are net zero is also safe.

4. Conclusion

Searchinger's argument that the only possible greenhouse gas benefits from biofuels grown on existing cropland are indirect benefits is not correct. However, the broad conclusion that the total net benefits of biofuels are uncertain is correct, and this should be reflected in the policies used to support biofuels. Measures that could mitigate the risk of large ILUC impacts include investing in agricultural productivity to increase yields and protecting high carbon stock land.

References

Searchinger, T. (2010). "Biofuels and the need for additional carbon", *Environmental Research Letters* **5**: 1 – 10.