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Making two parallel land-use sector debates meet: Carbon leakage and indirect land-use change

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ABSTRACT

Several land-based policy options are discussed within the current quest for feasible climate change mitigation options, among them the creation and conservation of forest carbon sinks through mechanisms such as Reducing Emissions from Deforestation and Forest Degradation also called REDD+ and the substitution of fossil fuels through biofuels, as legislated in the EU Renewable Energy Directive. While those two policy processes face several methodological challenges, there is one issue that both processes encounter: the displacement of land use and the related emissions, which is referred to as carbon leakage in the context of emissions accounting, and indirect land-use change also called ILUC within the bioenergy realm. The debates surrounding carbon leakage and indirect land-use change issues run in parallel but are rather isolated from each other, without much interaction. This paper analyzes the similarities and differences as well as common challenges within these parallel debates by the use of peer-reviewed articles and reports, with a focus on approaches to address and methods to quantify emissions at national and international scale. The aim is to assess the potential to use synergies and learn from the two debates to optimize climate benefits. The results show that the similarities are many, while the differences between carbon leakage and ILUC are found in the actual commodity at stake and to some degree in the policy forum in which the debate is taken. The geographical scale, actors and parties involved also play a role. Both processes operate under the same theoretical assumption and face the same problem of lacking methods to quantify the emissions caused by international displacement. The approach to international displacement is one of the main differences; while US and EU biofuel policymakers acknowledge uncertainties in ILUC accounting but strive to reduce them, the United Nations Framework Convention on Climate Change excludes accounting for international carbon leakage. Potential explanations behind these differences lie in the liability issue and the underlying accounting principles of producer responsibility for carbon leakage and consumer responsibility for ILUC. This is also reflected on the level of lobby activities, where ILUC has reached greater public and policy interest than carbon leakage. Finally, a possible way forward for international leakage accounting in future climate treaties could be the adoption of accounting methods taking a consumer perspective, to be used alongside the existing set-up, which could improve climate integrity of land-based policies.

Introduction

The effectiveness of climate change mitigation action in the land-use sector, for example through the Clean Development Mechanism (CDM) or Reducing Emissions from Deforestation and Forest Degradation (REDD+), is constantly discussed in climate policy forums such as the United Nations Framework Convention on Climate Change (UNFCCC). The effectiveness of reducing greenhouse-gas (GHG) emissions has also been discussed vividly in the context of bioenergy and biofuel policies in the United States (US) and European Union (EU). Alongside these discussions at policy level, aspects of effectiveness debated within academia have included actual climate effectiveness (e.g., Henders and Ostwald, 2012), sustainable development (e.g., Sonwa et al., 2012) or cost efficiency (e.g., Hedenus and Azar, 2009), as well as the concept of 3E+ in REDD+; effective and efficient emission reduction with equitable impacts of co-benefits (see Angelsen et al., 2009, 2012).

There are many methodological challenges to effectiveness when implementing a climate policy focusing on land use. If these

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hurdles are not properly addressed, the climate effectiveness of the policy, in terms of avoiding GHG emissions or increasing sinks, might be undermined or even reversed. Examples of such methodological challenges from the REDD+ debate are the creation of baselines or reference levels against which an intervention should measure its performance, or ensuring additionality, which implies demonstrating that the effect of the intervention would not have happened in its absence. Such hurdles within the biofuel debate include ensuring that the substituting biomass has a lower emission factor than the fossil fuel it is supposed to replace. Another such issue threatening the effectiveness of climate policy is that of land-use displacement as a response to interventions that aim to reduce GHG emissions, which is in focus in this paper.

Here we focus on two parallel debates within the field of climate change mitigation and land use: the issue of carbon leakage within forest conservation efforts such as REDD+ and the issue of indirect land-use change (ILUC) within the bioenergy production sector. We only relate to the concept of carbon, carbon stocks and carbon emissions while disregarding other impacts such as biodiversity, water and soil. The concepts of carbon leakage and ILUC both work under the conceptual understanding of land-use displacement and face the same challenges in quantifying indirect, non-measurable effects. We will primarily base our analysis on *how* carbon leakage and ILUC can be assessed, in other words which approaches exist to address and what methods are available to quantify these unintended impacts. This issue is of policy relevance, or as presented by Nassar et al. (2011, p. 225) "Policy makers find themselves in a chicken and egg situation: they know that [indirect] LUC [land-use change] emissions have the potential to undermine [policies aiming at] GHG savings, but they are hesitant in setting a value for LUC emissions because there are still several uncertainties associated with the methodologies available".

Through text analysis information is sought from peer-reviewed literature and related reports, starting from the work on assessing carbon leakage methods by Henders and Ostwald (2012), and the ILUC dilemma described by Gawel and Ludwig (2011). The aim is then to compare approaches and quantification methods for carbon leakage and ILUC, identify overlaps in methods, application and applicability, and analyze the similarities and differences as well as common challenges within these parallel debates to see if there is room for synergies in the quest to optimize climate benefits.

The concept of carbon leakage

Carbon leakage can be defined as displacement of carbon or GHG emissions from one place to another due to emission reduction interventions. Displacement and emission can happen domestically or internationally, where the latter is of interest here due to the focus on the global scale implications of REDD+ and biofuels. Displacement is caused by a direct or indirect shift of activities that create those emissions from within an emissions accounting system to outside of that system (Henders and Ostwald, 2012). The IPCC defines carbon leakage as the unanticipated increase or decrease (the latter is called positive or benign leakage and is generally unaccounted for) in GHG benefits outside of the project's accounting boundary as a result of the project activities (IPCC, 2000). This definition is mainly applicable for local scale emission reduction project activities; however leakage can also occur on international scales, when emission-related policies are adopted in one place and emissions shift to a place where this policy is not effective (Murray, 2008). Carbon leakage is therefore most likely to happen when the scale of the intervention is smaller than the scale of the overall problem (Wunder, 2008), which would mean that in a global climate agreement there would be no leakage because displaced emissions would be accounted for wherever they occur.

Carbon leakage has the potential to undermine the effectiveness of climate change mitigation under the UNFCCC and even though the phenomenon can occur in all sectors, there has been strong focus on land use and forest interventions such as afforestation and reforestation (A/R) or REDD+. Carbon leakage was one of the main methodological concerns why avoided deforestation was excluded from the CDM in 2001 (Skutsch et al., 2007; Sohngen et al., 2008). Responding to the discussions about carbon leakage in the land-use sector within the Kyoto Protocol negotiations, the scientific literature has addressed the issue on conceptual and methodological levels.

Conceptionally, the debate within the scientific arena has framed key definitions concerning carbon leakage (e.g., Sathaye and Andrasko, 2007). Two basic types of carbon leakage can be distinguished; primary and secondary leakage (Table 1). Primary or direct leakage is caused by displacement of activities or agents from one area to another. This is usually referred to as activity shifting and happens when a forest conservation activity reduces land availability for activities such as shifting cultivation or fuel wood collection that move to another forest area to continue. Secondary leakage happens when forest conservation in one place indirectly creates incentives to deforest elsewhere (Auckland et al., 2003). This can happen when there is a reduction in supply of a commercial product (e.g., timber), which leads to a shift in market equilibrium. Hence this type of leakage is sometimes referred to as the market effect (Schwarze et al., 2002). The difference to primary leakage is that the forest conservation activity causes incentives for others to start deforest, rather than moving the initial deforestation agent. The distinction between the two leakage types can however be less evident in the cases of large land-based commercial interventions (e.g., palm oil companies) that are involved in many geographical areas. In these cases conservation actions affecting the company in one place can cause market effects, but it might be the same agent that causes displacement. Observe in Table 1 that within ILUC no difference is made between primary and secondary effects, and both are referred to as indirect land-use change. The terms described in Table 1 refer to land-use changes in a climate-policy context, they are not or only partly applicable for land-use change processes in general.

Carbon leakage can take place on all geographical scales depending on the drivers of deforestation. It can be a local process mainly when smallholders or local communities are affected in subsistence activities such as small-scale agriculture and firewood collection. These small-scale processes are clearly a responsibility within the country where they occur. Carbon leakage can also be an international phenomenon when global players or production of market commodities are affected. At this scale it is harder to account for the displaced emissions if they take place in another country than the intervention itself (Skutsch et al., 2007).

Modeling exercises of carbon leakage from forest conservation yield large ranges, which indicate the potential magnitude of the problem as well as uncertainties in assumptions and quantification (see Henders and Ostwald, 2012). When it comes to market effects from forest conservation, improved forest management and afforestation, studies modeling international leakage show that 42–95% (Gan and McCarl, 2007) or 47–52% (Sun and Sohngen, 2009) of the possible emission reductions could be offset by leakage. National scale assessments also based on equilibrium models yield market effects of 5–42% for Bolivia (Sohngen and Brown, 2004) and 18–42% for the US (Murray et al., 2004). In an assessment of direct leakage, Lasco et al. (2007) found regional-scale leakage from forest conservation, afforestation and agroforestry activities in a watershed in the Philippines to be in the range of 19–41%.