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Methodological and Ideological Options

European Timber Consumption: Developing a Method to Account for Timber Flows and the EU's Global Forest Footprint

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ABSTRACT

The growing demand for timber, in particular for renewable energy, increases pressures on global forests and requires a robust monitoring system to ensure sustainability. This article takes a first step toward more systemic monitoring by asking how the global use of forests by EU consumers can be accounted for. Specifically, this article builds on and develops the method of global land use accounting to account for the EU-27's consumption of primary timber between 2002 and 2011 in terms of both volume and forest area. It assesses international trade flows for around 100 commodities and converts them into a volume of primary raw timber based on conversion values. Results reveal that both imports and exports increased over the assessed time period, with primary EU-27 timber estimated to be around 1 m^3/cap in 2011. Gaps, uncertainty and a lack of harmonization regarding especially trade data and conversion values are key challenges to further improving the robustness of the method and reliability of results. Future research may focus on improving the method to address in particular recycled and recovered flows as well as the question of whether area or volume is the most appropriate metric for further development of a forest footprint indicator.

1. Introduction

The demand for timber is increasing both in the EU and globally. Meeting renewable energy targets in the EU would require more than a doubling of timber consumption for energetic purposes between 2010 and 2030 (Steierer, 2010b; UNECE et al., 2012). FAO (2009) forecasts an increase in global timber consumption by 44% between 2005 and 2030, in particular to meet the expected demand for paper in Asia (FAO, 2009).

These trends raise concerns regarding both where and how this increasing demand for timber shall be met. Net global deforestation occurred at a rate of 13 Mha/a between 2000 and 2010 (FAO, 2010). Deforestation and forest degradation are estimated to be responsible for around 12% to 15% of global warming pollution (van der Werf et al., 2009; UCS, 2009). At the same time, many forests in Europe have in general been returning, enabled by trade. According to Kastner et al. (2011), forest return in many Western European countries—which have been net importers of wood–would have been slower without trade, or would not have happened at all, e.g. for the Netherlands, Belgium, the UK, Ireland, Denmark and Italy (Kastner et al., 2011). Existing subsidy schemes for bioenergy in the EU are expected to increase dependency on wood imports (Schulze et al., 2012; UNECE et al., 2012), thus adding to the EU's global land demand.

Global land use trends, especially expectations for the expansion of cropland and pastures, are also increasing pressure on forests and raising the likelihood of land competition (UNEP, 2014). In the future, competition between agriculture and fast-growing tree plantations—especially used for energy and to produce wood fibres for paper and wood-based panels—is likely to intensify (FAO, 2009; Schulze et al., 2012).

While individual countries may practice sustainable management of their domestic forests, import of timber products may cause that country to use a disproportionally high amount of the global forest resource, with unintended consequences on the forest and on the local people in places where that timber is sourced (Boucher et al., 2011; Weinzettel et al., 2013). There are a lack of indicators linking the pressures of increased land use abroad and the underlying drivers of that land use change. This heightens the risk that renewable energy policies in the EU will unintentionally lead to perverse incentives, unless these dynamics are monitored and better understood.

This article takes a first step toward tackling one key aspect of a systemic monitoring system for sustainable forest use. Namely, it ad-

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dresses the question of how the global use of forests by EU consumers can be accounted for. It aims to make progress toward the development of a robust method to account for global timber flows that may lead to the development of a forest footprint indicator. In the bigger picture, this article intends to contribute to expanding and deepening a monitoring system for the global use of natural resources.

2. State of Research

The four footprints – materials, water, carbon and land – are increasingly discussed in both the European and international contexts (UNEP, 2014; EREP, 2014; Tukker et al., 2016). They relate closely to the European Commission's proposed "dashboard approach" for measuring resource use in the Roadmap to Resource Efficient Europe (EC, 2011). Footprints describe a consumption-oriented approach for monitoring environmental pressures, and are based on the premise that higher levels of consumption are related to higher levels of environmental degradation (O'Brien et al., 2015). While the concept of footprints originated by Wackernagel and Rees (1996) to describe "ecological footprints", which combine real and theoretical land use and are dominated by the effect of GHG emissions, the four footprints are increasingly used to indicate real environmental pressures. The degree of conceptual and methodological maturity differs widely in relation to the four categories. While carbon and material footprint accounting is relatively advanced (see e.g. the review by Giljum et al., 2013) and water footprints have gained increased attention in both the research and public policy arenas (e.g. Chapagain and Hoekstra, 2004; Mekonnen and Hoekstra, 2011; Lutter et al., 2016; Tukker et al., 2016), work on land footprints has increased only recently (see Bruckner et al., 2015; O'Brien et al., 2015; Schaffartzik et al., 2015; Hubacek and Feng, 2016).

Land footprints are defined as "the land used to produce the goods and services devoted to satisfy the domestic final demand of a country regardless of the country where this land was actually used" (Arto et al., 2012). They are regarded as a monitoring tool to compare the dependency of countries or world regions on foreign land, to highlight inequalities in the scale of land use between regions and to indicate pressures related to the driving forces in the production and consumption systems of countries or territories (O'Brien et al., 2015). Most of the land footprint research performed so far accounts for cropland (ibid), with this article being the first to focus exclusively on forests.[1]

In the context of cropland, there are two basic approaches for calculating land footprints based on (1) multi-regional input-output (MRIO) analysis (e.g. Weinzettel et al., 2013; Bruckner et al., 2014) and (2) economy-wide material flow accounting (ew-MFA) combined with life-cycle-based coefficients of imports and exports for land (e.g. Bringezu et al., 2012; O'Brien et al., 2015). Both methods appear to lead to a convergence of results for the accounting of cropland use, indicating growing accuracy of the methods. This articles builds on the latter approach to account for timber flows. The ew-MFA method was chosen in order to be consistent with past work toward developing an overarching Global Land Use Accounting method (see below), to enable a higher level of detail regarding product flows and to avoid distortions related to the price of products stemming from different world regions. Nevertheless, MRIO should be urgently pursued by further research in order to compensate shortcomings, such as sectoral coverage, and check the consistency of results.

The method of Global Land Use Accounting (GLUA) is based on ew-MFA and combines accounting of resource flows with the associated land use of a country or region to determine the global land use associated with the total consumption of goods. The aim is to provide a measure of the actual land use. GLUA has been applied to cropland ($GLUA_C$) by accounting for commodity imports and exports combined with information on yields for agricultural primary products (e.g. from FAOSTAT) and with land use coefficients for agricultural plant and animal products (Wuppertal Institute database) (Schütz et al., 2003; Bringezu et al., 2008; Bringezu et al., 2012; O'Brien et al., 2015). It can be used to compare the global land use of different countries and regions to indicate either an inequality between nations or a growing imbalance over time.

As regards forestry, forest area land use accounting was attempted in the context of the MOSUS project (2003–2006).[2] However, the method did not take all forestry products into consideration (in particular in advanced stages of processing) and trade flows and forest growth rates were distinguished for around 50 countries (mostly from countries included in the temporal-boreal forest resource assessment). The method elaborated by this article aims to reflect all countries as well as timber products.

Timber trade flows have been accounted for in the Wood Resource Balance (WRB) method (Mantau et al., 2010; Steierer, 2010a). The purpose of a WRB is to compare actual and potential supply with demand for a certain country or group of countries to indicate possible discrepancies (gaps) and to monitor the woody biomass balance for a given year. It is comprised of two basic columns depicting potential supply and demand. Potential supply contains all sources of woody biomass (e.g. including stemwood, residues from the forest, residues from the forest processing industry, and post-consumer wood) and demand depicts the uses of woody biomass by sector (ibid). Although the WRB has a different purpose than accounting for forest footprints and cannot be compared directly (due to the inclusion of secondary flows), the method can be leaned on for guidance in the accounting and conversion of trade flows.

3. Methods

Economy-wide material flows analysis was used to calculate the consumption of timber products. Fig. 1 graphically depicts this approach with the material flows relevant for this study. It shows how the EU economy uses timber from the EU forest and world forest. The spatial scope, in this case the EU, is represented by the dashed line. While the timber products entering and leaving the EU economy are accounted for, the EU economy itself is treated as a 'black box'. This means that re-use and recycling of timber within the EU economy are not accounted for, enabling the consumption explicitly linked to annual land use to be depicted. Total consumption equals removals plus imports minus exports. Two key flows were assessed:

- removals from EU-27 forests (reported in m^3); and
- traded timber volumes (reported in m^3, tonnes and Euros).

To determine the input flows from the domestic natural environment, official statistics on removals of wood from domestic forests (EU-27) were used. A number of different data sources are available, with somewhat different volume estimates depending on whether they report roundwood production (excluding bark and residues; FAOSTAT, EUROSTAT), removals (including bark; FAO, 2010) or fellings (including bark and logging losses; Forest Europe et al., 2011). In this case, to stay consistent with international data, FAOSTAT roundwood production data was used for the years 2002 to 2011 and adjusted for bark using a conversion of 1.12 (UNECE and FAO, 2010).

UN-Comtrade trade statistics were used as the primary source of trade data. Data for imports and exports to and from the EU-27 were

[1] Some studies have aggregated cropland, pastures and forests to compare consumption levels of world countries. However, this type of aggregation has come under scrutiny as differences in data (relating to accuracy and availability) are less transparent and results may have less useful implications for policy makers (O'Brien et al., 2015).

[2] Modeling opportunities and limits for restructuring Europe towards sustainability, www.mosus.net; Accessed 10 March 2010