LIFE-CYCLE ANALYSIS

Carbon footprint of Brazilian soy

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The contribution of global agricultural trade to climate change remains poorly quantified. Even policy efforts aimed at directing production to the most greenhouse gas (GHG)-efficient regions (where emissions per unit product are low and energy sources are clean, for example) often ignore GHG emissions embedded in agricultural inputs or generated along the supply chain — including the transport to the point of consumption. Comprehensive and product-specific carbon footprints are therefore paramount for successful climate change mitigation.

Neus Escobar, from the University of Bonn, and colleagues have now combined life-cycle analysis and physical trade flow analysis to offer a detailed account of the GHG emissions embedded in the production and trade of Brazilian soy exports over 2010–2015. Calculations were based on ~90,000 individual trade flows of beans, oil and protein cake identified from the municipality of origin through international markets. Land-use change, farming conditions, transport mode and other GHG sources were considered.

At the sub-national level, from a producer perspective, the authors found that the footprint of municipalities in the agricultural frontier in the Cerrado and Amazon biomes was up to 2.5 times higher than that of other regions, largely due to land-use change. Mato Grosso state, the largest soy producer in Brazil, showed a smaller footprint but ranked among the main GHG contributors in absolute terms. From an importer perspective, the European Union showed the largest carbon footprint per unit of imported soy (0.77 $tCO_2e\ t^{-1}$), followed by China (0.67 $tCO_2e\ t^{-1}$). More than half of the European Union's carbon footprint stemmed from land-use change since most soy it imported over the period of analysis came from northern Brazil (where deforestation is higher). Overall, Brazilian soy-related emissions stem from land-use change (74.81 Mt), domestic transport (57.89 Mt) and industrial processing (46.03 Mt).

By examining specific sourcing regions, importing countries and stages of the supply chain, this study reveals the most critical emission sources and sheds light on the attributability of impacts — two key elements for effective mitigation efforts. Furthermore, the approach proposed could be replicated for other commodities. Environmental footprints other than carbon, and the interactions between soy and other products via combined trade and shared infrastructure, are relevant too; yet, this study is an important stepping stone to achieve a more sustainable agricultural trade.

Juliana Gil

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