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SESSION T1-8 Sustainability of Agri-Food Products

Life Cycle Analysis improvement in the ethanol chain: using geoprocessing to estimate the variation of soil carbon stocks

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Atvos

Goal: Land Use Change (LUC) has great relevance for Brazilian overall CO₂ emissions. Considering its relationship to agricultural production, especially for biofuels and biomaterials production, it becomes paramount to understand and replicate improvements on the methodologies to measure LUC in the ethanol chain. The objective of this work is to reduce uncertainties and to ensure traceability in the calculation of the variation of carbon stock in the soil and Biomass, during the ethanol production process in Brazil aiming at a complete LCA of the product. In this sense, Braskem, the world's largest producer of biopolymers, Atvos the largest supplier of ethanol, Embrapa (Brazilian Agricultural Research Company) and Quantis (Swiss sustainability consultancy) joined together to experiment a method of estimating LUC emissions, which will feedback the process to help to develop a LUC accounting guidance.

Methodology: The methodology used prior to the study utilized as a database the factors of the IPCC and the data of previous use of the soil informed by Atvos team. In the present work, the methodology applied for the estimation of LUC associated with the ethanol production obtained more accuracy and traceability mainly due to be based on satellite imagery data. The soil maps data were analyzed and combined with carbon stock data from Brazilian literature, in a GIS environment. From this, the type of soils and the occupation of the farms were obtained by gathering images from 20 years prior to the study's base year. Together with this framework, it was possible to synthesize the estimates needed to account for changes in carbon stocks (SOC, AGB and BGB). The area used for the study represents more than 170 thousands hectares of sugarcane production, which correlates to the actual image processing sample of 22 thousand hectares from real Atvos production units supplying sugarcane for ethanol mills that supply chemical grade ethanol for Braskem industrial units.

Results: The results indicated that in the past 20 years, most sugarcane expansions happened on agricultural land or pasture land leading to net carbon capture of 2.3 tonne C ha⁻¹ in the base case. Annualized over 20 years and applying a conversion from C to CO₂ based on the molecular weight leads to carbon capture of 0.4 t CO₂ ha⁻¹. Using the average sugarcane yield of 58.2 tonne sugarcane ha⁻¹, the CO₂ carbon capture due to LUC is 7.1 g per kg sugarcane. In the case of Atvos, there is a high probability of a significant increase in the carbon stock of the sugarcane plantations over time, given the change in the practice of harvest without burning and expansion over previously anthropized areas, mainly occupied by grazing in sandy soils pasture. The study may support decision-making of future agricultural expansions of Atvos aiming at maintain or increase the carbon stock in the soil and consequently reducing the carbon footprint materialized in the LCA.