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Title: Energy balance of a traditional and a modified land-use system in the Eastern Amazon Basin, Brazil, as a case study

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Content of Abstract:

The comparative case study traces anthropogenous energy input into land-use systems in tropical Brazil, and output in terms of agricultural production with related CO_2 emission into the atmosphere in the instances of growing passion fruit (*Passiflora edulis* Sims var. *flavicarpa* Degener) and cassava (*Manihot esculenta* Crantz). Introducing system sustainability in terms of nutrient preservation as a factor of balance, the traditional manual slash-and-burn system is compared to a mechanized, chop-and-mulch system employing a tractor propelled mobile chopping unit. Assessment of anthropogenous energy fluxes is achieved by calculating all related on-farm production steps, including human manpower, machine utilization and inputs like fertilizer or plant protection means. Chemical inputs, as well as machines and tools utilized are being calculated including indirect energies consumed during their production on a primary energy level. Figures for energy consumption during production of relevant means are adapted from state-of-the-art energy balances in terms of final energy, assuming comparable production conditions in Brazil. These values are then being recalculated to primary energy units, employing specific transformation factors for Brazilian conditions. Efficiency factors for primary to final energy transformation, valid for the relevant sectors of cast iron and steel production, chemical industry and other industry, are being calculated from the national energy balance of Brazil. CO_2 emission factors by fuel are adapted from literature and applied to the named sectors, due to lack of data, inconsistent or contradictory quantification in literature they partly had to be estimated. CO_2 emission from means production is being assessed at primary energy level, assuming emission to be linearly related to primary energy consumption. Nutrient loss by slash-and-burn practices is quantified according to SHIFT findings in the study area, it is being translated to energetic terms by calculating compensatory fertilization. CO_2 emission from above- and below-ground biomass in the land-use systems compared is being estimated from literature and findings of SHIFT research in the study area. Field study was carried out to quantify time demand and tools utilization during the steps of work necessary for the respective productive cycles, as they are commonly being performed in the study area. System scenarios for comparative calculation had to be set up based on non-chronological, thus virtual time sequences to be enabled to include the complete respective production period, which by far extended the period available for observation. As is the nature of energy balances, the outcomes of the case study can only claim to be estimating the true energy and CO_2 turnover.

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