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## Life cycle inventory of soybean production systems in Minas Gerais and Paraná states, in Brazil

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### Abstract

Soybean (*Glycine max* L.) is among the major grains produced globally as it is an efficient source of proteins and lipids, mainly used as animal feed, food, oil and biofuel. Brazil is the current global leader in production, with soybean grown in all its biomes. Soybean system is facing multiple sustainability crisis as its intensive production is driving environmental crises such as deforestation, biodiversity loss, soil degradation, water scarcity and pollution, and thus climate change. Alternative systems such as organic or the claimed ‘sustainable’ production are emerging. There is, therefore, a need for a comprehensive understanding of environmental impacts of different soybean production systems. While many Life Cycle Inventory (LCI) studies of soybean AFVCs have emphasised on intensive production systems, often with carbon footprint as the main impact category, there is still a research need to cover alternative production systems, with more relevant impact categories. The aim of this research is to provide a detailed LCI of soybean production systems in Paraná and Minas Gerais states in the Atlantic Forest biome. Data has been collected through surveys, interviews, and observations, and will be complemented with scientific literature data and the Ecoinvent 3.9 database. The inventory from cradle to farm gate has revealed four soybean production systems: conventional, organic, transgenic, and ‘sustainable’. The direct planting, weed control, biofertilisers and bioinputs production on farms were found to be among the factors hindering sustainable and organic soybean intensification. Intercropped soybean with coffee seemed to use smaller machinery but more fuel as huge machines seem to save fuel but at a high ecological cost of soil compaction and biodiversity loss. The inventory analysis is ongoing and will be followed by impact assessment using brightway2. By the end of this and subsequent research objectives, we will have provided evidence on where environmental loads and savings take place in different production systems of soybean, consumed, and wasted. With the broad range of impacts quantified, this work will raise awareness and show environmental trade-offs on the level of soybean footprints in Brazil, for improvement of sustainability research and decisions in soybean food system.

**Keywords:** Agroecology, Brazil, footprint, soybean production systems, sustainability