Assessement methods of animal food system' sustainability and climate impact

Anders H. Herlin, Jean-Louis Peyraud, Harald Sverdrup

Assessment methods of animal food systems' sustainability and climate impact

Anders H. Herlin[1], Jean-Louis Peyraud, Harald U. Sverdrup

[1] Swedish University of Agricultural Sciences, Alnarp, Sweden, e-mail: anders.herlin@slu.se

In assessing the sustainability of agricultural systems several approaches have been used depending on the purpose of indices and the complexity of the aimed indicators. Life Cycle Assessment (LCA) is the most common method. Greenhouse gas (GHG) emissions of livestock have been widely investigated using LCA by summarizing Carbon dioxide, Methane and Nitrous oxide into a global "carbon footprint" (CF).

All sources of emissions in LCA are identified from e.g. fossil fuels and biological processes in soils and animals metabolism are accounted for in the CF within certain boundaries of the production. However, there are flaws in the use of LCA for assessing CF in biological systems found in agriculture and livestock that have to be considered. A major concern is that LCA is a static approach that cannot provide predictions on a long-term basis. Different scenarios can be compared but it is not possible to evaluate or predict the impacts of factors of importance for land-based production systems such as soil carbon, fertility, and water holding capacity. This is because LCA treats all carbon emissions equally, whereas loss of soil carbon should be a matter of great concern in the long term. There are also difficulties and uncertainties in the LCA calculations of the biological systems because LCA uses steady state and linear approaches whereas it is well established that in agricultural systems, and in livestock systems, most of the mechanisms are based on dynamic relationships with a lot of integrated feedback loops.

Another major flaw is that foods are treated equally using the same functional unit (e.g. CF per kg grains, milk or bone free beef) without correcting for water or nutrient content. When comparing protein-rich food sources this is somewhat adjusted for, at best, by using human edible protein as the functional unit. To capture the composite value of a food, the use of an index which reflects the nutrient demand of humans have been proposed.

There is an urgent need to develop integrated systemic methods and indicators to assess sustainability and climate impact of agricultural systems. Creating a conceptual map of the production system will provide a basis for developing a systemic and dynamic approach. This will allow a multi-criteria assessment of sustainability. Such approach will be able to consider geographical contexts of production and to predict the short and long-term effects of various actions and scenarios.

Keywords: sustainability, life cycle analysis, methods, food systems modelling