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Assessing the role of livestock within circular food systems

Clark Halpern^{1,2}, Loekie Schreefel¹, Hannah van Zanten^{1,2}

1 Farming Systems Ecology group, Wageningen University & Research, Wageningen, the Netherlands

2 Department of Global Development, College of Agriculture and Life Sciences, Cornell University, New York, USA

E-mail contact address: clark.halpern@wur.nl

1. INTRODUCTION

The competition for land in agriculture to produce food directly edible for humans or produce feed for livestock consumption is expected to increase as pressures on available land and rates of animal-source protein rise globally. One proposed solution to reduce this competition, known as the feed-food competition, is the use of circularity in the livestock sector. Livestock are able to utilize non-human edible products as feed, such as grass biomass, crop residues, co-products from food processing, and food waste. This process allows for livestock to upcycle resources that would otherwise be unused in the food system. However, in the need to transform our food systems to a more sustainable state, it is vital to understand how to best assess circularity in livestock systems (de Boer and Van Ittersum, 2018; van Hal, 2020; van Zanten et al., 2018).

2. METHODS

We first identify which types of indicators might be used for the purpose of assessing circularity in livestock systems: target-based indicators, practice-based indicators, result-based indicators, and outcome-based indicators (Schreefel et al., 2024). We compare how the current methods used to assess livestock could be applied to circularity through examples from the scientific literature.

3. RESULTS AND DISCUSSION

We situate the role of each assessment type in the context of assessing livestock and make recommendations for when to use which type of assessment. We found that nutrient use efficiency is best situated to practice- and result-based indicators (Gerber et al., 2014). If practice- and result-based indicators are measured without outcome indicators, then there is a risk of unintended rebound effects. In contrast, attributional and consequential life cycle assessments are best suited to outcome-based indicators. Consequential life cycle assessments can best show how changing the degree of circularity, for instance, by increasing or decreasing the level of non-human edible products, would impact environmental flows in and outside the product's production cycle (Figure 1). Holistic food systems models can demonstrate outcome-based indicators to the most detailed level, as the ability to track multiple production cycles at once solves issues with allocation present in LCA studies (van Zanten et al., 2019).

4. CONCLUSIONS

We demonstrate in our work that circularity in livestock systems can be measured with different indicators that each play an important role in monitoring the role that circular livestock play in our food systems. Policymakers and scientists should embrace the complexity of analyzing and designing circular livestock systems by choosing the correct methodological approach.

5. ACKNOWLEDGEMENTS

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Example: wheat middlings

Aim: consequences of increasing the use of wheat middlings in diets of dairy cattle

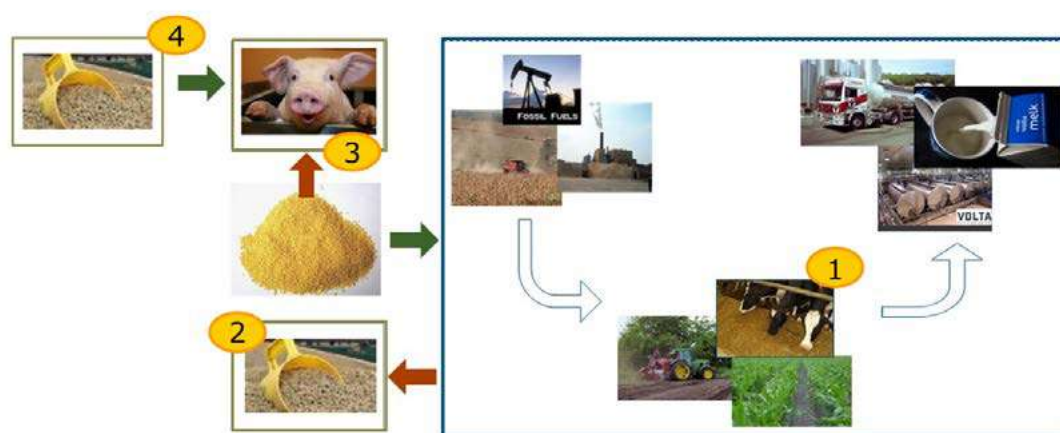


Figure 1 – An example of system expansion in the processing of wheat middlings to demonstrate how livestock fed on food processing by-products can change the environmental impact of the whole food system (Van Zanten et al., 2019).