Synergies in Integrated Systems

Improving Resource Use Efficiency While Mitigating GHG Emissions
Through Well Informed Decisions about Circularity

Short information paper, per 22-07-2024

How sustainable and climate-neutral is circular farming?

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This short information paper is about circular farming, climate protection, and sustainability.

***Take-home messages**. Four circularity strategies offer insightful perspectives on the circular economy at the farm level. We have used these in an analytical framework to scan agricultural activities for circular development opportunities. Scanning such opportunities supports the planning and implementation of circular measures that ultimately benefit not only the farm but also society as a whole. For farms where the SMART-Farm tool (a sustainability analysis) has been applied, an initial assessment of its circularity can be derived from the same set of questions used there.*

Project partners:

Funding:
We are grateful for the financial support through the partners of the Joint Call of the Cofund ERA-Nets SusCrop (Grant N° 771134), FACCE ERA-GAS (Grant N° 696356), ICT-AGRI-FOOD (Grant N° 862665) and SusAn (Grant N° 696231).

Why our study?

The circular economy (EC 2020) is considered as a development model to reduce resource consumption in the agricultural sector and minimize its negative contribution to climate change. In addition, the interests of society, which wants more resource protection, are to be strengthened. This requires a rethink away from the linear system of individual, short-term and cost-orientated consumption of goods towards their integrated use in a long-term system context.

Circular farming was presented in a strategy paper as a model for Dutch agriculture (LNV 2018). In addition, the German Federal Government's Council for Sustainable Development calls for a strengthening of the circular economy in the agricultural sector (RNE 2021). However, what does "Circularity" mean for agriculture and how to implement it? It is also not always clear to what extent circular economy practices lead to a strengthening of sustainability – there can also be trade-offs that reduce sustainability. Therefore, we have to combine the concept of the circular economy with that of sustainability and climate protection, to utilize synergies and learn from them in practice. In our project "SENSE" we gave a first try to merge both concepts.

What did we do?

We developed a conceptual framework for circular farming that takes into account climate change mitigation and the sustainability of agricultural production systems. We also scrutinized a sustainability analysis tool – the SMART-Farm tool (Schader et al. 2016) – to determine the extent to which it can be used to capture and evaluate circular economy strategies at farm level. We piloted our approach together with selected agroforestry farmers in Germany and the Netherlands.

What did we find and how can you further use it?

Circular agriculture is often described as closing cycles by reusing material flows (biomass, nutrients, water) at the highest possible energy level. However, this closing or 'cascading down' is only one of four main strategies. The other three are: the narrowing of cycles through optimization, the slowing down of consumption and regenerative practices. In the table 1, we describe exemplarily how one can use the strategies on farm level. Our example uses one of several indicators for circularity, namely feed self-sufficiency. We show options on how feed self-sufficiency could be enhanced on the farm. The different strategies make us think into different directions.

Table 1: The circularity strategies help to rethink farm activities

Circularity strategies	**Feed self-sufficiency (an example for a circularity indicator) and measures to arrive at it**
Slowing: carry on for longer	Seek longevity of the farm's means of production. Perennial forage that lasts for long. Clean and functional storage. Responsible selection of suppliers who provide tools and machinery that last for long.
Narrowing: need less	Do more with less. Fodder crops that fit to the location and need little external inputs per unit of output. Perennial crops as feed source. Sourcing as few external inputs as possible, from suppliers who themselves take care to minimize their use of fossil fuels, aiming at as little environmental impact as possible, in an ethical and socially responsible manner.
Closing: maintain and deploy	Use and reuse wisely, limit leakage. Use of own crops and/or industrial by-products for feeding. Careful preparation and use of own manures and compost for feed production. Water harvesting and reuse of (dairy) wastewater for fertigation. Handling feeds carefully to avoid losses.
Regenerating: self-reinforcing	Make the farm a vital living system. Perennial fodder crops as part of the animals' diet. Species-rich permanent grassland. Different perennials and annuals that enhance the health of animals, and local biodiversity. Species and varieties, respectively breeds, fitting to the location.

We categorized the four strategies according to the time horizon, operational independence and climate adaptation strategies, and highlighted the processes and procedures to be considered (O' Keeffe et al. under review). Then, we linked the developed analytical framework with the indicators that are collected in the sustainability analysis using the SMART-Farm method. In figure 1, we show a prototype of what this could look like – it is work in progress. The analytical framework helps to determine whether and in what way agricultural practices are circular. It helps to identify the contribution of such practices to sustainable development and climate change mitigation strategies.

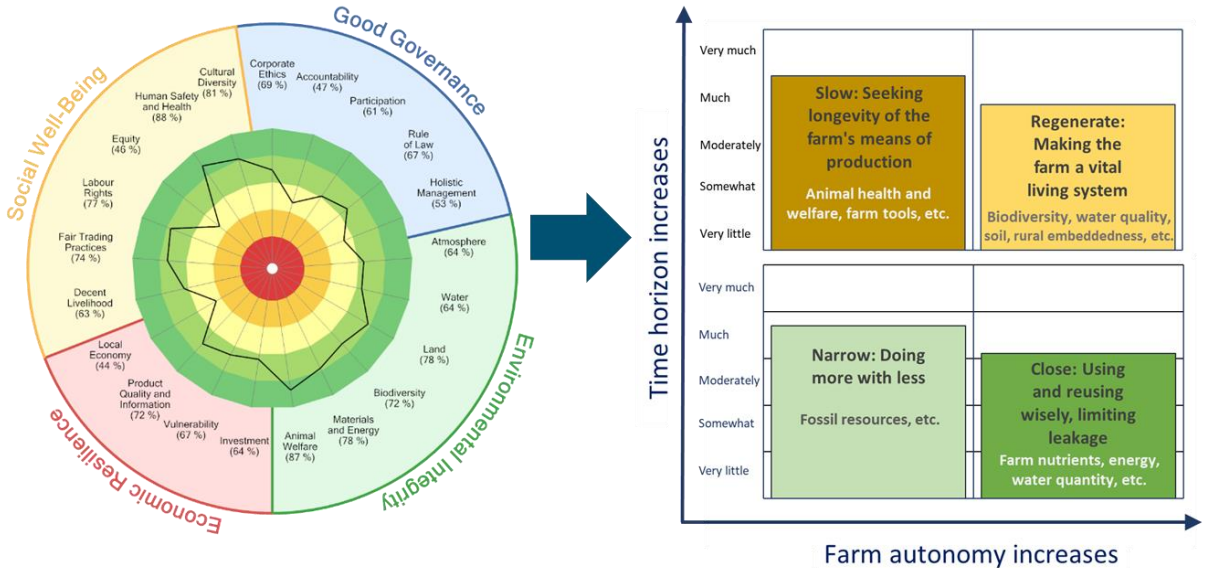

Figure 1: The results of the SMART-Farm tool (left) are remapped to reflect the use of circularity strategies (right), with a few points to explain the strategies. Work in progress.

The analytical framework can further be used to scan farm processes for development opportunities with regard to the four strategies. This can support more holistic planning, organization and implementation of circular activities that benefit the sustainability of the farm and thus society. For farms where the SMART-Farm tool has been applied, a first circularity assessment can be derived from the same set of questions. We see great potential for mixed farming systems, particularly organic farms and agroforestry to lead the way in terms of circularity.

Literature

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LNV (Dutch Ministry of Agriculture, Nature and Food Quality) (2018) Agriculture, nature and food: valuable and connected. The Netherlands as a leader in circular agriculture. https://www.government.nl/binaries/government/documenten/policy-notes/2018/11/19/vision-ministry-of-agriculture-nature-and-food-quality---english/Vision+Ministry+of+Agriculture+Nature+and+Food+Quality_English.pdf

RNE (German Council for Sustainable Development) (2021) Circular economy: Leveraging a sustainable transformation. https://www.nachhaltigkeitsrat.de/wp-content/uploads/2022/02/20211005_RNE-Statement_Circular-Economy-1.pdf

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This short information paper has been prepared based on:

O 'Keeffe S, Stein S, Curran MP, Baumgart L, Zikeli S, Siegmund-Schultze M (2024) Wie nachhaltig und klimaneutral ist Kreislauflandwirtschaft? Paper in 17. Wissenschaftstagung Ökologischer Landbau, Gießen/Germany, 5-8 March 2024. Pages 417-418 in: https://orgprints.org/id/eprint/53471/1/WiTa24_Tagungsband_final.pdf

Short description of the SENSE project

Acronym	SENSE
Title	Synergies in integrated systems: Improving resource use efficiency while mitigating GHG emissions through well-informed decisions about circularity
Call	2021 Joint Call ERA-NET Cofund ICT-AGRI-FOOD, FACCE ERA-GAS, SusCrop and SusAn: Circularity in mixed crops and livestock farming systems with emphasis on climate change mitigation and adaptation
Durationr	1 March 2022 until 28 February 2025
Website	https://sense-eranet.hutton.ac.uk/
Coordinator	The James Hutton Institute (JHI)
Partners	Centre for Ecology and Hydrology (CEH) University of Bristol (UOB) Stichting Wageningen Research (WUR) University of Hohenheim (UHOH) Demeter e.V. (Demeter) Consiglio per la ricerca in agricoltura e l'analisi dell'economia agrarian (CREA-AA) Brazilian Agricultural Research Corporation (Embrapa) National Institute of Agropecuarian Technology (INTA) Instituto Nacional de Investigación Agropecuaria (INIA)
Work package	WP4: Multidimensional assessment and optimization with farmers
Dutch website	https://www.wur.nl/nl/onderzoek-resultaten/kennisonline-onderzoeksprojecten-lvvn/soorten-onderzoek/kennisonline/sense-project-synergien-in-geintegreerde-systemen.htm
German website	https://oeko.uni-hohenheim.de/en/research_project_sense