

SENSE



CHALLENGE

Specialization, intensification and spatial separation of crop, livestock and forestry production systems have contributed to climate change and biodiversity loss. Integrated crop-livestock-forestry systems offer multiple opportunities to reduce the environmental impact of agricultural production systems. Circular systems have been proposed to increase resource use efficiency, particularly of scarce nutrients, in a more sustainable way than conventional systems. Therefore, bringing in circularity contributes to minimizing the environmental footprint of agriculture. A clear picture of potential synergies and trade-offs is required before prioritizing solutions.

APPROACH

SENSE will develop a matrix of indicators for effective quantification of the status of circularity within various integrated system case studies in four European countries (Germany, Italy, the Netherlands, and UK) and three South American countries (Argentina, Brazil and Uruguay). Contrasting scenarios of carbon, nutrients, water, and biomass flows will be simulated in the case studies through the application of process-based models such as manure-DNDC. This analysis will return the predictions trajectories at farm level to redesign systems towards more complete local circularity within crop-livestock-forestry integrated systems. SENSE will compare the circularity scenarios according to their potential for mitigating greenhouse gases (GHG) emissions. Further, the resilience of farm systems under climate change will be compared for the scenarios using a probabilistic risk analysis approach.

At farm level, SENSE will evaluate their side effects on other societal goals based on multidimensional sustainability assessment tools. SENSE will demonstrate a novel solution for improved land management systems, building knowledge through the linkage between sensors and High-Performance Computing (HPC) based data analysis, supported by modelling and visualization to meet farmers information needs to attain net-zero GHG emissions. SENSE will test a novel digital Monitoring, Reporting and Verification (MVR) system developed by James Hutton Institute and its application in quantifying and mitigating GHG emissions. SENSE will compare and discuss our cases, including with the participating farmers, at different levels of detail, through both circularity and ecological functioning indicators to discover general lessons for enhancing circularity at the farm level.

SENSE will contribute to the European Farm to Fork Strategy and to crosscutting actions of the European Circular Economy Action Plan. Circularity is considered a prerequisite for climate neutrality but bears potentially negative outcomes for other grand societal challenges. And will provide guidance for informed circularity decisions at farm level that consider the trade-offs with other sustainability goals. Translated into policy briefs, this information will help to design an enabling environment that effectively supports farmers to enhance circularity in their farming systems. The use of information from individual farms and the participation of farmers at several levels and different points during the implementation of the activities is key for the outcome of the project.

FIRST RESULTS

- Field research conducted in Brazil: To understand the degree of integration between crop, livestock, and forestry systems, field research on three case studies in Brazil was conducted.
- Circularity matrix developed to perform the circularity baseline assessment: To support robust decision-making for integrated production systems, a circularity matrix has been developed that includes a list of circularity indicators to quantify the current circularity performance of the case studies in SENSE.
- Sensor networks deployed for data-driven assessment: As part of the SENSE project, several sensors have been deployed in selected case studies to collect real-time data.
- Holistic sustainability assessment: A multidimensional assessment is currently being conducted utilizing the SMART tool (Sustainability Assessments in the Food and Agriculture Sector). This holistic sustainability analysis aims to assess the sustainability of management practices in farming systems.

Consortium

Coordinator

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Partners

- UNITED KINGDOM: Centre for Ecology and Hydrology - University of Bristol
- THE NETHERLANDS: Stichting Wageningen Research
- GERMANY: University of Hohenheim - Demeter e.V.
- ITALY: Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria
- BRAZIL: Brazilian Agricultural Research Corporation
- ARGENTINA: National Institute of Agropecuarian Technology
- URUGUAY: Instituto Nacional de Investigación Agropecuaría

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