

# MI BICYCLE

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Mitigation and adaptation through better Biomass CYcling in Crop Livestock systems of north and western Europe



## CHALLENGE

Farms and farming systems in North and Western Europe are generally highly specialised, with little integration between crop and livestock production within farms and between farms within a region. Yet, improved integration, be it at farm or landscape level, offers substantial potential for enhanced circularity of utilization of biomass, especially for co-products (e.g. residues, manure, waste). The main objective of this research project is to co-design locally improved, innovative circular crop and livestock systems in North and Western Europe. To reach this objective, MI BICYCLE assesses alternative utility options of biomass and co-products in integrated crop-livestock systems at field, farm and landscape levels.

## APPROACH

Alternatives will be assessed in terms of nutrient cycling, greenhouse gas emissions, carbon sequestration and agricultural productivity. It is hypothesized that co-product utilisation options can be identified that are beneficial in terms of climate change mitigation and lead to more resilient and adapted systems. We will apply our systems approach and participatory and quantitative methods in four European case study regions situated in the Netherlands, Denmark, Scotland and France. All four case regions are characterised by highly specialized crop and livestock farming systems, with innovation and transition pathways towards integration of crop and livestock production being initiated. We expect these pathways to benefit from a systematic, science-based and participatory assessment of current and alternative utilisation options of co-products across crop and livestock activities and farms, in a landscape context.

The project takes a systems perspective, distinguishing activity (field and livestock units), on- and inter-farm integration and landscape levels. Using focus group discussions, current and alternative co-product utilisation options will be gathered for each of the case studies. These will be quantitatively assessed in terms of nutrient cycling, greenhouse gas emissions, carbon sequestration and productivity. Using literature and participatory inputs we will add semi-quantitative assessments of social and economic performance of utilisation options. The environmental, economic and social indicators will be brought together in a management guide for on- and inter-farm integration. Finally, a serious game will be developed to explore opportunities for enhanced circularity of crop-livestock integration and co-product utilisation at landscape level. The serious game will be adapted for use in BSc and MSc level courses in the four countries to enhance learning on circularity of future generations of scientists and stakeholders.

## FIRST RESULTS

WP1: For every case study region, a poster has been created to map the current situation and provide a conceptual overview of the main agricultural characteristics in each region.

WP2: Using a modelling approach, future co-product management scenarios (biogas production, crop residue grazing, composting) will be evaluated on environmental and productivity performance. A list of potential indicators was compiled and a start has been made with the methodology to quantify each indicator.

WP3: A start has been made with reviewing literature, and is soon to be finished. Many different co-product types exist and their usage varies from region to region. The variety of current practices will be captured in this work package's deliverables.

WP4: A working document has been finished in which current available tools and methods to analyse circularity at landscape levels were reviewed. These insights are now used in the development of a serious game. The game is under development, frequently using test sessions with the project partners. A finished version can be expected in the last year of the project and will be applied in a teaching environment to bring across the ins and outs of circularity at landscape scale.

### Consortium

#### Coordinator

- Martin van Ittersum - Wageningen University, The Netherlands

#### Partners

- DENMARK: Aarhus University, AU
- UNITED KINGDOM: Scotland's Rural College, SRUC
- FRANCE: French National Research Institute for Agriculture, Food and Environment, INRAE - Ariege Chamber of Agriculture

### Duration

01/03/2022 - 28/02/2025

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