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5s2: The environmental and economic consequences of adoptig circularity at different spatial scales

TOWARDS CIRCULAR FOOD SYSTEMS: ANALYSING BIOMASS- AND NUTRIENT FLOWS IN THE AGRI-FOODSYSTEM

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The concepts of circular agriculture are well established in scientific literature. However, interactions between food demand, local and regional production, land-use and environmental impacts as a function of the degree of circularity and intensity of land use remain poorly understood. Optimizing existing flows of biomass and nutrients of the agricultural and food systems within a particular geographical context is a first step towards improved circularity.

To this end, a framework was developed to quantify the flows of biomass, nitrogen (N) and phosphorus (P) of an entire agro-food-waste system. The framework was subsequently used to analyze flows in a case-study area including the three northern provinces of the Netherlands (NN). Current flows within and across the borders of NN were quantified for the subsystems: agriculture, food- and feed processing, consumption and waste-processing. As biomass and nutrient flows of agricultural activities are strongly related to local biophysical conditions, farm level data on livestock numbers and facilities were combined with field level data on cropping history, and data on soil type and groundwater. Accounting for site specific biophysical conditions allows more accurate assessment of the environmental impacts of various agricultural activities.

Preliminary results show that although most co-products from biomass processing are used for feed or energy production, nutrients flowing to waste(water) processing facilities are mostly lost. For P, these constitute the largest losses in the system, whereas for N on-farm losses were largest, especially those related to manure handling.

The flows within the region are far greater than the cross-border flows, due to the presence of large food- feed and waste processing facilities in the region. However, borders are diffuse: there is a much larger gross than net biomass transport across the

border for a range of products. There is a net accumulation of nutrients in the region, as the agricultural system relies heavily on imported feed and fertilizers. Even within the region, specialized farms tend to be clustered in specific areas, resulting in large flows of biomass and products between subregions.

The framework and analysis provide important insights for redesign or further optimization of the current agricultural and food system. It facilitates improving the spatial distribution of agricultural activities within the region and balancing of cross-border flows. Furthermore it serves as a benchmark for initiatives to improve circularity in the wider food system.

Keywords: Nutrients, Biomass, Agro-food-waste system, Circularity, Land use