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1s3 The contribution of biodiversity to productivity in circular agriculture

Global typology of agricultural systems

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Circular agriculture is a novel concept that is being explored with the aim of reducing external inputs and waste in agriculture. External inputs, such as pesticides, could be substituted in circular agriculture by ecosystem services, such as natural pest control. The provision of ecosystem services depends on the management practices carried out in the agricultural land, as well as the biodiversity on and around the agricultural land.

Previous research has focused on how individual management practices affect different aspects related to circularity, such as the provision of ecosystem services, yields, preventing losses of nutrients, pesticides and soil processes (e.g. (Li et al., 2020; Tschumi, Albrecht, Jacot, & Entling, 2015)). However, in a farming system, it is not individual management practices but the combination of management practices and biodiversity that affects these aspects related to circularity. For example, planting flower strips could increase pollination services, but the use of pesticides could counteract the benefits provided by the flowers.

Therefore, there is a need to evaluate individual management practices together, as part of farming systems. Moreover, farming systems tend to be coherent in the combination of management practices and diversity, so that systems with low diversity and low provision of ecosystem services usually rely on higher amounts of external inputs to keep a high productivity, and vice versa. When farming systems are not coherently managed, the productivity is affected.

A systematic evaluation of opportunities for circular agriculture requires an overview of the gap that different farming systems have to achieve circularity. To understand the strengths and weaknesses of farming systems regarding circularity, a global typology of farming systems is needed. The aim of this research is to develop this typology. This typology should be based on categories regarding intensity of management and diversity (both crop diversity and non-crop plants). The broad agricultural systems that form the base of this typology are: cropping systems, grasslands and agroforestry. Each of these three systems is subdivided into categories from less to more intensive and from less to more diverse, obtaining a global array of farming systems that represents all existing systems in an organised manner.

This global typology of farming systems based on management intensity and biodiversity will help to assess how current farming systems stand regarding circularity, and whether biodiversity in and around agricultural fields can act as a substitute for inputs, and thus contribute to circular food production.

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Tschumi, M., Albrecht, M., Jacot, K., & Entling, M. H. (2015). High effectiveness of tailored flower strips in reducing pests and crop plant damage. Proceedings of the royal society B: biological sciences, 282(1814). doi:10.1098/rspb.2015.1369

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