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BOOK OF ABSTRACTS

Topic 1: Ecosystem responses to landuse change

Using agroecosystem models to design newly diversified cropping systems in combination with new field arrangements in spatially heterogeneous landscapes

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Over the past decades, intensive agriculture in Germany has been highly productive, characterized for large fields, high mechanization, high resources input use and simplified crop rotations. However, it has resulted in a series of environmental problems that compromise the delivery of ecosystem services (ESS) and biodiversity levels from the agroecosystem. Crop diversification in combination with new field arrangements (i.e. smaller field units) considering soil heterogeneities stand as an option to improve resource use efficiency (RUE), ecosystem services (ESS) and biodiversity. Moreover, agroecosystem models are a tool to understand and design diversified cropping systems as they provide the flexibility to virtually explore spatial and temporal arrangements of a diverse set of crops. The main goal of the current study was to review to what extent agroecosystem models have been used for crop diversification design at field and landscape scale by considering soil heterogeneities, and to understand the model requirements in terms of their capability on simulating the dynamics of diversified field but also in the quantification of the delivery of ESS. Results showed that a number of agroecosystem models are available for simulating spatio-temporal crop diversification at the field scale. For spatial crop diversification, simplified modelling approaches consider the important crop interactions for light, water, and nutrients, particularly for cereal-legume and cereal-cereal combination. However, they can be limited when using them for design purposes due to the restricted crop combinations. As for temporal crop diversification, agroecosystem most models include the major cereal, legume, and tuber crops. However, limited crop parameterization for marginal crops and soil carbon and N multi-year dynamics are a shortcoming. At the landscape scale, static decision making frameworks are a common approach to crop diversification. Crop configuration and composition arrangements define the spatial landscape patterns. Within-field soil heterogeneities are rarely considered in the field or landscape design. Many models at field and landscape scale account for the provision food, feed, fiber and the regulation of water quality (N retention) and to a lesser extent, soil erosion and pesticide fate, but they often lack biodiversity dynamics. We conclude that adapting agroecosystem model to design crop diversification in heterogeneous landscapes will involve model improvements but also field experimentation to quantify the effects of spatio-temporal crop diversification on ESS and biodiversity.