

Dynamic integrated valuation of trade-offs between crop provision and pollination services

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The expansion and intensification of agricultural production as well as the growth of cities and infrastructures, particularly in developed countries, endanger ecosystems and their capacity to supply services (e.g. soil fertility, water availability, pollination). By relying on existing modelling frameworks to assess ecosystem services, it is possible to evaluate the trade-offs and synergies between the necessary supply of biomass (for different purposes), and the preservation of the ecological processes that support it. Such information seems primordial to design more efficient and sustainable land use strategies.

A spatialized land use-based integrated model is developed and illustrated here to assess the pollination intermediate service with regard to its contribution to crop provision, considered as a final service. Through a modification and adaptation of the InVEST crop pollination model to the Luxembourgish context (taken as a case study), our model enables to spatialize the impact of land use changes on the production of pollination-dependent cultures. The InVEST model is improved according to its implementation within an existing integrated dynamic framework (i.e. MIMES; Boumans et al. 2015, *Ecosystem Services* 12:30-41), allowing to assess over time the trade-offs between the crop provision and pollination services underlying different agricultural land use scenarios for Luxembourg. Moreover, the contribution of managed honey bees is considered in parallel to wild pollinators, providing a broader outlook on the crop pollination process. Modelling results show overall a significant variability in the impact on crop yields of land use changes depending on their location. Aggregated at the municipality scale, these results *a priori* seem useful in a land management decision context. The definition and modelling of clear cause-effect chains and the management and coupling of multi-scalar data and models are key aspects of our approach.

Keywords: pollination service, integrated modelling, land use changes, trade-offs, agricultural scenarios.