RESEARCH PROJECT

EcoGAP

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Contributions of ecosystem services delivered by agro-ecological practices to narrow gaps in yield and resource use efficiency

Contact our coordinator

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Summary

This project targets increased agroecological transition of cropping systems, to enhance internal ecological processes, and make them less input dependent, more autonomous, and more resilient in the face of pests, diseases and climatic variation. We will do this by assessing the contributions of ecosystems services delivered by agroecological practices (AEPs), focusing on enhanced crop nutrition, weed management, and integrated crop management to reduce fertiliser and pesticide use. We thus propose three pathways to be embedded in a living lab (LL) approach (Fig. 1, WP2): i) The central scientific pathway is the concept of 'ecological yield gap', defined as the degree of divergence between attainable and actual yield and resource use efficiency attributable to unrealised ecosystem service provision (van Ittersum et al., 2025). This concept explicitly targets the agronomic role of ecosystem services in interaction with the other inputs, while accounting for different farming contexts (climate, soil and socio-economics) (Fig. 1, WP1); ii) We apply the concept to data from a comprehensive set of available cropping system experiments along a north to south gradient across Sweden, the Netherlands, and France to evaluate services provided along a continuum of increasing AEP adoption (Fig. 1, WP3). These experiments include organic inputs and integrated crop management practices (diversification, cultivar and cropping strategy, soil, water and nutrient management), to improve crop nutrition, weed, pest and disease management; iii) We also apply the ecological yield gap concept to comprehensive data of a spectrum of practices from farm networks (Fig. 1, WP4). Farms operate at different levels of transition towards sustainable systems, implementing principles from the continuum of agroecological principles to various degrees.

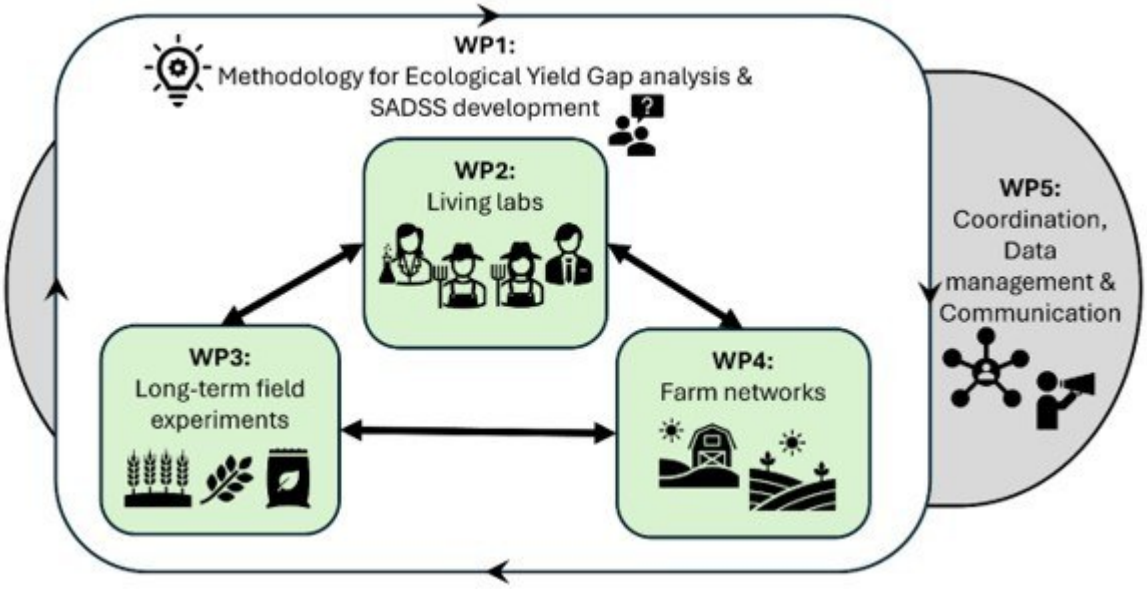

Fig. 1 Schematic representation of the EcoGAP project structure, bringing together (1) a novel concept of ecological yield gaps to assess a range of agroecological practices, and summarised in a Decision Support System (SADSS); (2) Living labs to employ the novel concept and SADSS, using co-creation and re-design processes enriched with data and analysis from (3) experiments, and (4) farm networks. All data will be used to assess agroecological practices that sustain crop productivity at lower input levels.

Insights from data analysis will be used in existing LLs in the three countries with networks of farmers, researchers, advisers and other stakeholders from the agri-food chain. The LLs will be supported by a Strategic Agroecological Decision Support System (SADSS) that will allow benchmarking of a farm's cropping system performance in terms of ecological yield gap and sustainability (including potential tradeoffs between production, environmental and socio-economic indicators). The LLs are intended to increase insights in practised agroecological measures, and to test and improve these measures through co-creation and collective re-design. This process aims to reduce chemical fertiliser and pesticide use, while maintaining yields and economic performance across a wide range of farming contexts. The project particularly targets farmers that have adopted relatively few agroecological principles, on the assumption that their progress in agroecological transition will contribute relatively large reductions of external inputs and environmental impact.

Publications

van Ittersum, M. K., Silva, J. V., Bommarco, R., Hijbeek, R., Lundin, O., Nandillon, R., Bergkvist, G., Menegat, A., Öborn, I., Söderholm-Emas, A., Stoddard, F. L., Vico, G., Vonk, W. J., Watson, C. A., & MacLaren, C. (2025). Narrowing the ecological yield gap to sustain crop yields with less inputs. Global Food Security, 45. https://doi.org/10.1016/j.gfs.2025.100857

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