# Estimating pollination potential in orchards: looking for a simple field method

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## Abstract

Pollination is a critical ecosystem service due to its essential role in sustaining food production, and the recent observed decline of pollinating insects worldwide. However estimating the pollination service is complicated by the existence of multiple definitions and associated estimation methods. Here, based on a systematic bibliographic review we focused on methods for estimating the potential pollination allowed by the presence of pollinators. We tested a protocol including direct estimation of pollinator abundance and richness, and indirect proxies based on landscape context and orchard feeding and nesting resources. We aimed to identify the subset of variables accounting for potential pollination from insect presence, from which a simplified and standardized method could be designed for environmental impact studies. The method comprised 3 steps: a land cover analysis, field observations of plot-scale resources and insect focal observations. We worked in orchards of the Grenoble region during two consecutive years, sampling 8 orchards in 2017 and 31 in 2018. Mixed linear models with orchard identity as random effect showed that pollinator abundance was significantly impacted by landscape composition within a 2-km radius. For 2017, it decreased with increasing built-up land. For 2018, it increased with increasing grassland area. For both years, floral resources of orchard ground layer, and specifically richness in flower shapes, favoured pollinator abundance. Conversely orchard edge features had only weak marginal impacts on pollinator abundance or richness. For 2017, a combined model with built-up area and an indicator of orchard management intensity explained 42% of variation in pollinator abundance and 50% of variation in pollinator richness. For 2018, a combined model with grassland area and flower shape richness explained only 23% of variation in pollinator abundance. Consequently, a protocol simplification excluding direct observations of pollinators does not seem yet possible. Further work could explore potential influences of orchard management practices.

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