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Testing the potential benefits of small fields for biocontrol needs a landscape perspective

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Rosenheim et al. (1) present an interesting study testing the effect of focal field size on pest suppression across multiple cropping systems. The main conclusion of their study is "The idea that larger field sizes consistently disrupt natural pest control services is without foundation in either the theoretical or empirical record." We argue that this general conclusion should be considered with more caution. First, Rosenheim et al. focused on the local effect of field size comparing pest density in small vs. large fields irrespective of the configuration of the surrounding landscape. However, most of the empirical research providing evidence for a positive effect of reducing field size on pest suppression or natural-enemy enhancement has tested the effect of landscape configuration (e.g., gradients in field size or edge density in the surrounding), usually adopting specific designs to control for differences in landscape composition (2–5). Decreasing field size at the landscape scale is expected to have more pervasive effects than the size of the focal field alone. Fine-grained landscapes usually have a higher density of margins and higher microhabitat diversity, resulting in improved landscape complementation and in the facilitation of spill-over of organisms between crop and noncrop patches (6). This scale dependence was not fully acknowledged in the study, generating confusion between the reported lack of a local effect and the potential—but not investigated—effect of reducing mean field size at larger spatial scales.

Second, the data used (1) come from unplanned field observations by farm staff, consultants, and pest control advisors who quantified pest pressures without any sampling design. As pest suppression is often context dependent, many potential biotic and abiotic drivers of success or failure exist (7, 8). Without a robust design, observational landscape studies usually suffer from nonindependence of composition and configuration metrics and reduced ranges in landscape gradients (2). Although the authors tried to statistically control for some potential predictors besides focal field size, the lack of landscape configuration metrics makes it difficult to test field size at multiple spatial scales. Moreover, effects of field size at both the local (9) and landscape scales (3) were often detected in interaction with other landscape metrics, something that was not fully explored in the study by Rosenheim et al.

We agree with Rosenheim et al. that there is a great variability in how pest control relates to local and landscape management (4, 10) and that it is too simplistic to assume that reducing local field size would automatically result in improved pest suppression. Nevertheless, robust evaluations of the effect of crop field size need a landscape perspective with well-designed gradients in local and landscape predictors that allow testing both main effects and interactions (Fig. 1). So far, published empirical evidence suggests that landscape-level reductions in field size are a still underestimated way to enhance biodiversity (2), pollination (3), and pest control alike (9), without compromising crop yields (5). We hope that this discussion will stimulate more hypothesis-driven research on this very important—but still underinvestigated— research area.

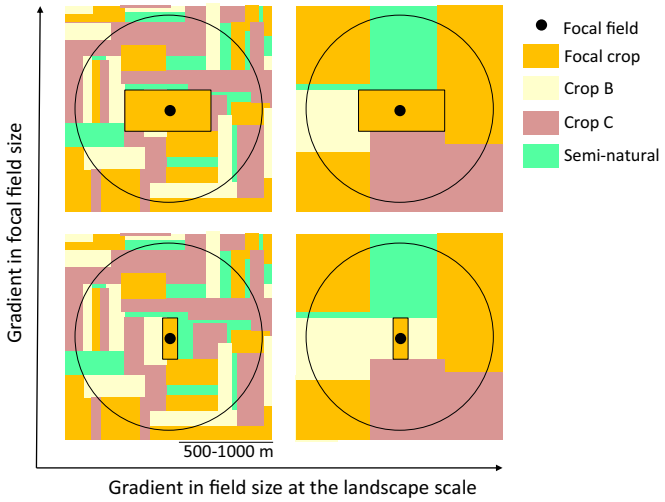

Fig. 1. Example of sampling design to test the effect of field size at both the local and landscape scales. This design requires one to sample multiple landscapes with different configurations controlling for other landscape variables such as cover of seminatural habitats or crop diversity. This design will allow to effectively test both main effects and interactions between local and landscape predictors. We expect that the gradient at the landscape scale is more important for biocontrol than the gradient in focal field size.

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