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LETTER

Mismatched outcomes for biodiversity and ecosystem services: testing the responses of crop pollinators and wild bee biodiversity to habitat enhancement

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Abstract

Supporting ecosystem services and conserving biodiversity may be compatible goals, but there is concern that service-focused interventions mostly benefit a few common species. We use a spatially replicated, multiyear experiment in four agricultural settings to test if enhancing habitat adjacent to crops increases wild bee diversity and abundance on and off crops. We found that enhanced field edges harbored more taxonomically and functionally abundant, diverse, and compositionally different bee communities compared to control edges. Enhancements did not increase the abundance or diversity of bees visiting crops, indicating that the supply of pollination services was unchanged following enhancement. We find that actions to promote crop pollination improve multiple dimensions of biodiversity, underscoring their conservation value, but these benefits may not be spilling over to crops. More work is needed to identify the conditions that promote effective co-management of biodiversity and ecosystem services.

Keywords

Apoidea, bees, biodiversity, conservation, ecosystem services, functional traits, restoration.

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INTRODUCTION

Conserving biodiversity and supporting ecosystem services – the ecosystem functions (EF) that sustain human well-being – have been cast as compatible goals based on the implicit assumption that they covary (MEA 2005). However, evidence that biodiversity and ecosystem services (ES) are linked is mixed and the ecological dynamics behind this link remain unclear (Cardinale *et al*. 2012; Ricketts *et al*. 2016). Although governments and international institutions increasingly integrate ES into conservation planning and decision-making (Bateman *et al*. 2013; Posner *et al*. 2016), ES may be an unsuitable surrogate for biodiversity conservation (Schröter *et al*. 2014).

Concern over biodiversity and ES co-management stems from

resource use and can be more productive [i.e. niche complementarity; (Loreau *et al*. 2001; Cardinale *et al*. 2011)], yet a small number of functionally dominant species within a community can sustain ecosystem functioning [i.e. mass ratio; (Grime 1998; Lohbeck *et al*. 2016)]. Variation in the identities and abundances of species among assemblages may be critical to maintain functioning across environmental conditions that accumulate at large spatial scales (Mori *et al*. 2018; Thompson *et al*. 2018), however if a few functionally dominant species sustain local service delivery, then interventions designed to support service providers may benefit only a subset of total species.

Crop pollination research has highlighted the potential for these decoupled relationships between ES and biodiversity. Pollination is an important ES for agriculture worldwide