

## Pest and Natural Enemy Abundance: Biological Pest Control Ecosystem Services in Organic Strawberry Fields

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### Abstract

Plant diversity at local and landscape scales may be important factors affecting the abundance of both pests and natural enemies in agricultural fields. These factors are especially relevant to organic agriculture because these fields depend on natural enemies to provide biological pest control ecosystem services. Increased knowledge regarding the effects of local and landscape diversity on pests and natural enemies may enable growers to increase the level of biological pest control in their fields by altering local farm diversity or—when given the choice—locating fields in certain landscapes over others.

Using an array of sampling methods including a gasoline-powered arthropod vacuum, pitfall traps, and pan traps, we surveyed abundances of pests and natural enemies in 27 organic strawberry ranches across gradients of local and landscape diversity. We also performed a sentinel experiment to estimate levels of predation provided by natural enemies across the local and landscape diversity gradients. Sentinel cards are created by affixing a known number of pest individuals onto a waterproof card which is then placed in the field for a certain amount of time. After the card is collected from the field, the individuals remaining on the card are counted and the proportion of pest individuals that are missing or damaged represents an estimated predation rate. We deployed beet armyworm (*Spodoptera exigua*) egg sentinels and western tarnished plant bug (*Lygus hesperus*) nymph sentinels to estimate levels of predation provided by natural enemies in the strawberry ranches.

Our results indicate that the western tarnished plant bug, an important strawberry pest, and some of its predators are more abundant in simplified landscapes and farms than more complex ones, while Coccinellids, known to be important generalist predators in agroecological systems, are more abundant in farms surrounded by complex landscapes. Results from the sentinel experiments indicate that on both local and landscape scales, more predation occurs at sites with higher plant diversity. These results suggest that growers may be able to increase the level of biological pest control by increasing plant diversity on their farms and locating farms in relatively diverse landscapes.

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