

## Supplementary Methods

### **Overview**

We compiled a global pest-control database to model impacts of landscape composition on pest-control services (Fig. S4). First, we cleaned and transformed pest-control response data and land-use maps to help standardize predictor (landscape) and response (pest control) variables across diverse studies. Then, we used a model averaging procedure to assess the extent to which landscape composition alone could predict spatial variation in pest and enemy abundances, predator activity, plant damage, and crop yields. Finally, to assess predictive power, we applied landscape models to independent field observations, exploring different strategies for matching models to field observations. Below, we discuss these steps in greater detail.

### **Data Processing**

We used a multi-faceted strategy to standardize data within and across studies. Abundance data were processed as follows. First, because authors reported presences (but not absences) in their survey data, we assumed that if at least one individual of any species was censused at a given location, on a given date, and using a given sampling method, then any other species not listed on that location-date-method combination were absent. Second, because some sampling methods are ineffective for particular taxa (*e.g.*, sticky traps for epigeal predators), we only included data from sampling methods that contributed at least 5% of the total observations (across sampling methods). Third, because sampling effort sometimes differed among locations, we divided the total number of individuals in each functional group (pest, predator, etc.) by the number and/or duration of surveys conducted. If a mean abundance across surveys was reported, then accounting for variable effort was not necessary. Finally, to allocate equal importance to observations taken in different years or with different sampling methods, we standardized effort-corrected data across sites within a given year and sampling method by subtracting the mean and dividing by the standard deviation. Prior to standardization,

we log, square-root, and fourth-root transformed the data to adhere to model assumptions (see below).

Predator and pest activity and yield data were processed similarly to abundance data, accounting for variable effort and standardizing data within years. However, unlike abundance data, which was always expressed as animal counts, different activity and yield sampling methods produced distinct data types; therefore, unique sampling methods were analyzed separately. Moreover, additional processing was required to analyze data resulting from enclosure experiments. Specifically, we used enclosure data to create a biocontrol index (1). First, when before-after-control-impact data were reported, we subtracted pest density or damage values obtained before the experiments began from final values recorded upon the experiment's conclusion. Second, when necessary, we averaged across all exclusion replicates present at the same site. Third, we computed the biocontrol index either by dividing values observed in the exclusion treatment from those in the control treatment (provided that pests were detected in both treatments) or subtracting values (when any data other than pest counts were reported).

### ***Land-use maps***

We used a hierarchical approach to obtain land-cover maps for each study (Appendix 1). Because many data contributors had already obtained or created high-resolution maps of their study regions, we asked authors to submit land-cover maps if available. When contributors could not provide us with maps, we used either regional maps or, as a last resort, a 30 m global land cover product (Jun *et al.* 2014; <http://www.globallandcover.com/>). Regional maps included: Cropland Data Layer (United States; <https://nassgeodata.gmu.edu/CropScape/>), Land Use 2010 (Canada; <http://open.canada.ca/data/en/dataset/9e1efe92-e5a3-4f70-b313-68fb1283eadf>), CORINE land cover (Europe; <http://www.eea.europa.eu/publications/COR0-landcover>), Catchment Scale Land Use Map (Australia; <https://data.gov.au/dataset/catchment-scale-land-use-of-australia-update-march-2015>), and Land Cover Database (New Zealand;

<https://iris.scinfo.org.nz/>). When possible, land-cover maps were chosen so that they matched the dates that samples were collected. All maps were projected into WGS 1984, rasterized, and reclassified into the following categories: (1) forest and tree plantations, (2) grassland, (3) scrubland, (4) annual cropland, (5) perennial cropland, (6) urban areas, and (7) other. Some maps reported less finely-resolved land-cover categories, necessitating two aggregate categories: (8) all natural/semi-natural habitats and (9) all cropland. If both aggregate and finely-resolved categories were reported in the same map (e.g., forest, grassland, scrubland, and natural habitats), then we reclassified all finely-resolved categories into the aggregate category (e.g., forest, grassland, and scrubland into natural habitat).

In some instances, authors provided land-cover maps that did not extend to 2 km around their study sites. In this case, we overlaid their local land-cover map with a regional map (when possible) or the global product. Doing so sometimes resulted in a mixture of aggregate and finely-resolved land-cover categories. If all areas <700 m from the study locations were finely resolved, then we assumed that the same land cover proportions extended beyond to 2 km and disaggregated the broader classes. For example, if a local map indicated that annual and perennial agriculture occupied 10% and 30% of the area within 700 m of study sites, then we assumed that any areas beyond 700 m that were delineated as “agriculture” were composed of 25% perennial and 75% annual agriculture. If, on the other hand, any aggregate land-cover category was present within 700 m of a study site, then we reclassified all finely-resolved areas across the entire map into that aggregate land-cover category.

### ***Landscape composition***

We used a distance-weighting procedure to quantify landscape composition. First, we calculated the area (m<sup>2</sup>) of each land cover class in 20 concentric rings around each study site, with outer radii at 100 m intervals between 100 m and 2 km. Next, we used a Gaussian decay function to assign weights to each ring, where rings closer to the focal site were weighted more than those further away (3):

$$W = \exp(-O^2/(2*d^2))$$

equation 1

where  $W$  is the weight,  $O$  is out the outer edge distance of the ring, and  $d$  is a decay rate that determines how rapidly weightings decline with distance. We used three decay rates (250, 750, 1250) to later assess landscape composition at multiple spatial scales. We then used the weightings to calculate a weighted sum for the total area of each land cover class. Finally, we divided that number by the weighted sum of all land covers to ultimately obtain a proportional representation of each land-cover class around each study site.

### References

1. Chaplin-Kramer R, Kremen C (2012) Pest control experiments show benefits of complexity at landscape and local scales. *Ecol Appl* 22:1936–1948.
2. Jun C, Ban Y, Li S (2014) Open access to Earth land-cover map (correspondance). *Nature* 514:434.
3. Karp DS, et al. (2016) Farming practices for food safety threaten pest-control services to fresh produce. *J Appl Ecol* 53:1402–1412.

### Supplementary Tables and Figures

**Table S1:** Correlations between landscape model predictions and observed values (corresponding to Fig. 3).

	<b>N</b>	<b>N sig. models</b>	<b>r</b>	<b>R<sup>2</sup></b>	<b>T</b>	<b>95% C.I.</b>	<b>P</b>
Dominant pests	76	42	0.42	0.18	19.30	(0.37, 0.46)	<0.001
All pests	27	14	0.41	0.17	8.45	(0.31, 0.51)	<0.001
All enemies	78	41	0.36	0.13	16.00	(0.32, 0.41)	<0.001
Sentinel experiments	68	42	0.45	0.20	21.00	(0.40, 0.49)	<0.001
Cage experiments	23	9	0.39	0.15	9.84	(0.31, 0.47)	<0.001
Pest damage	34	17	0.38	0.14	10.60	(0.31, 0.46)	<0.001
Crop yield	53	25	0.43	0.18	13.70	(0.36, 0.49)	<0.001

*N* = number of tested datasets

*N sig.* = number of datasets where predictions and observed data were significantly correlated

*r* = mean Pearson correlation coefficient comparing predictions and observed data

*R<sup>2</sup>* = mean *R<sup>2</sup>* across all tested datasets

*t* = *t*-statistic assessing whether the mean Pearson correlation coefficient across datasets is different from 0

95% C.I. = 95% confidence interval around the mean Pearson correlation coefficient

*P* = *p*-value associated with the *t*-statistic

**Table S2:** Correlations between landscape model predictions and testing data (corresponding to Fig. 4).

	All models							Shared crop species						
	N	N Sig. Models (+)	N Sig. Models (-)	r	T	C.I.	P	N	N Sig. Models (+)	N Sig. Models (-)	r	T	C.I.	P
Dominant pests	75	9	8	0.01	0.22	(-0.06, 0.07)	0.83	61	9	3	0.11	3.25	(0.04, 0.18)	<b>&lt;0.01</b>
All pests	27	2	3	0.04	0.75	(-0.07, 0.16)	0.46	14	3	0	0.18	2.12	(0, 0.37)	<b>0.05</b>
All enemies	77	8	9	-0.02	-0.63	(-0.08, 0.04)	0.53	32	5	0	0.07	1.96	(0, 0.15)	<b>0.05</b>
Sentinel experiments	66	4	4	-0.01	-0.18	(-0.07, 0.06)	0.86	62	5	4	0.07	2.04	(0, 0.14)	<b>0.05</b>
Cage experiments	23	2	0	0.03	0.59	(-0.08, 0.15)	0.56	9	2	0	0.21	2.36	(0.01, 0.42)	<b>0.05</b>
Pest damage	34	3	3	-0.02	-0.52	(-0.12, 0.07)	0.61	25	3	3	0.00	0.06	(-0.12, 0.13)	0.95
Crop yield	47	2	1	-0.01	-0.33	(-0.09, 0.07)	0.75	33	1	2	0.02	0.32	(-0.08, 0.11)	0.75

*N* = number of tested datasets

*N sig. +* = number of datasets where predictions and observed data were significantly, positively correlated

*N sig. -* = number of datasets where predictions and observed data were significantly, negatively correlated

*r* = mean Pearson's correlation coefficient across all tested datasets

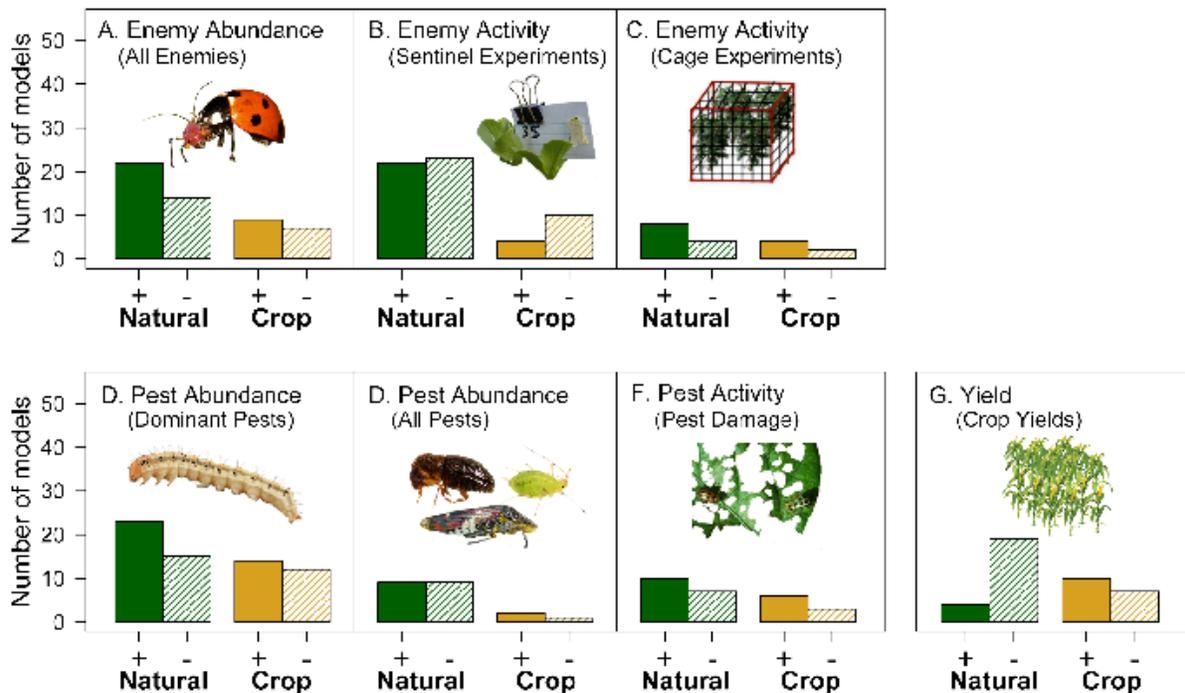
*t* = *t*-statistic assessing whether the mean correlation across datasets is different from 0

95% C.I. = 95% confidence interval around the mean Pearson correlation coefficient

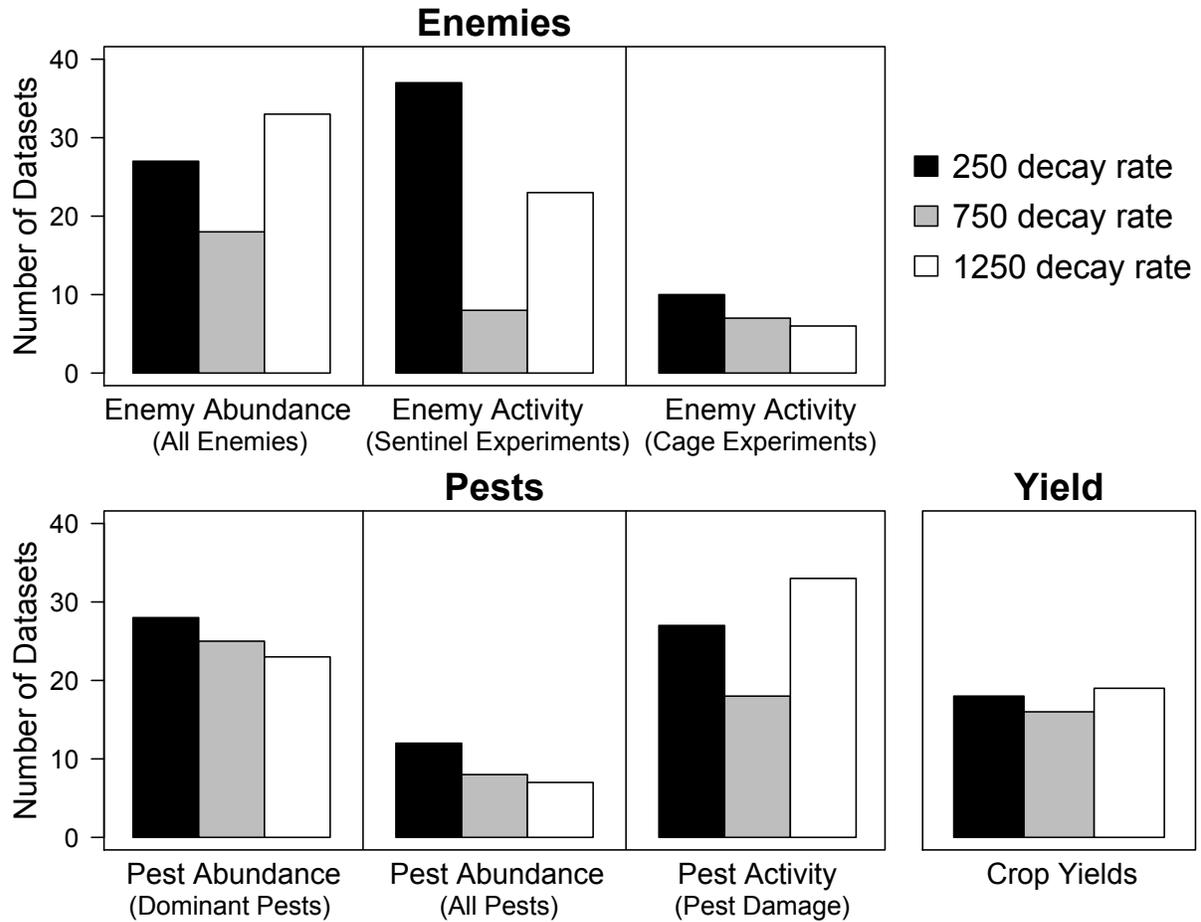
*P* = *p*-value associated with the *t*-statistic

**Table S3:** Sensitivity analysis of procedures that selectively applied models to data. In each cell, we indicated whether the procedure improved (+) or reduced (-) correlations between model predictions and testing data. Numbers in parentheses are  $\chi^2$  statistics and associated *P* values from likelihood-ratio tests (see Methods). Bold indicates significance ( $P < 0.05$ ).

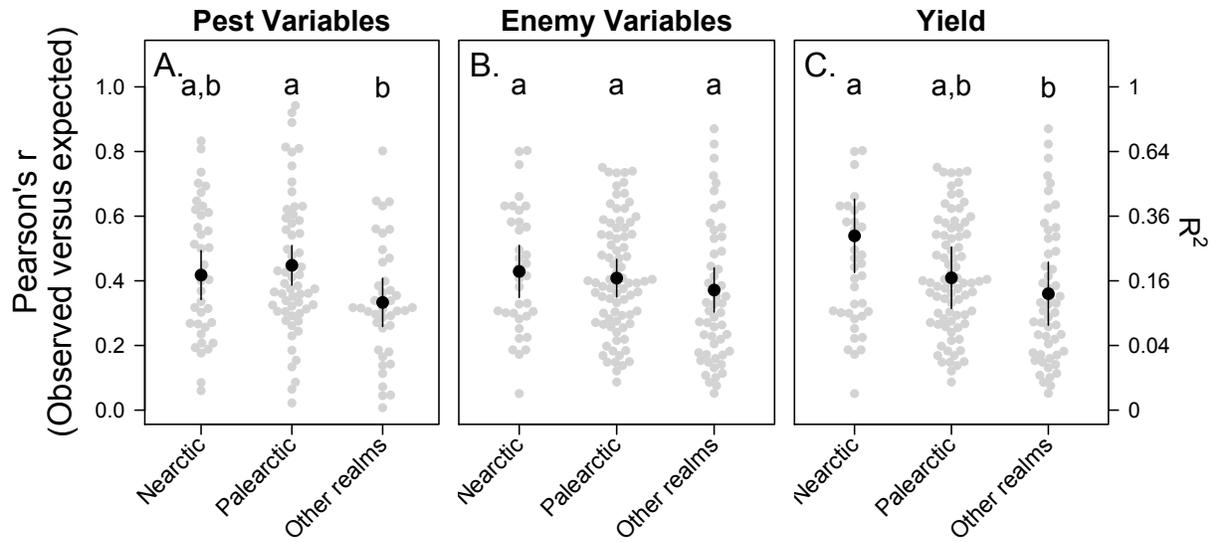
Models and field observations...	Dominant pests	All pests	All enemies	Sentinel experiments	Cage experiments	Pest damage	Crop yield
Are in the same biogeographic realm	- (1.3, 0.26)	- (3.1, 0.08)	- (2.8, 0.1)	- <b>(38.1, &lt;0.01)</b>	- <b>(3.9, 0.05)</b>	+ (3.2, 0.08)	- <b>(5.4, 0.02)</b>
Are in the same biome	+ (0.5, 0.46)	- (0, 0.89)	+ (0.5, 0.48)	- <b>(6.1, 0.01)</b>	+ <b>(37, &lt;0.01)</b>	+ (1.9, 0.16)	- <b>(9.6, &lt;0.01)</b>
Share the same crop species	+ <b>(55.6, &lt;0.01)</b>	+ <b>(10.6, &lt;0.01)</b>	+ (1.5, 0.22)	+ <b>(34.1, &lt;0.01)</b>	+ <b>(10.7, &lt;0.01)</b>	+ <b>(38.5, &lt;0.01)</b>	- (0.9, 0.34)
Are <500km apart	- <b>(35.5, &lt;0.01)</b>	+ <b>(25.1, &lt;0.01)</b>	- <b>(11.7, &lt;0.01)</b>	- <b>(88.2, &lt;0.01)</b>	- <b>(108.8, &lt;0.01)</b>	+ (2.6, 0.1)	+ <b>(37.2, &lt;0.01)</b>
Share the same land-use classes (or ranges of land use classes)	+ (3.2, 0.2)	+ <b>(117.3, &lt;0.01)</b>	+ <b>(46.5, &lt;0.01)</b>	+ <b>(55.4, &lt;0.01)</b>	+ (1.2, 0.55)	+ (2.2, 0.34)	+ <b>(138.4, &lt;0.01)</b>



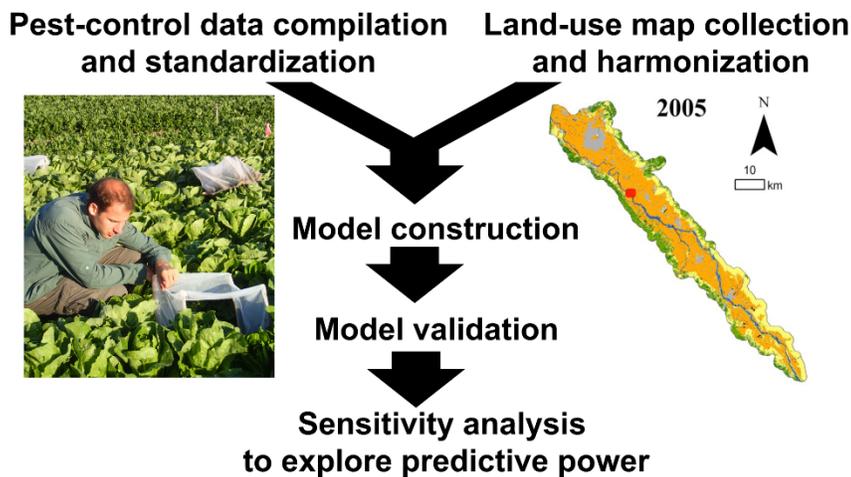
**Fig. S1: Landscape effects on most important pest-control variable in each model.** After (1) selecting the most predictive model for each pest-control response, (2) isolating the most important land-use predictor in each model, and (3) reclassifying those predictors as natural (forest, grassland, and scrubland; green bars) versus crop (annual and perennial; orange bars), we tallied the number of pest-control responses for which models had either positive (solid) or negative (diagonal hashed) estimates of the effect of each landscape predictor. Panels represent the seven pest-control variables: including abundance (A) and activity (B, C) of natural enemies; abundance (D, E) and activity (F) of pests, and crop yields (G).  $\chi^2$  tests indicated that most pest-control responses variables showed heterogeneous patterns of association with the extent of surrounding natural habitat and cropland— with roughly equivalent numbers of pest-control responses having models with positive and negative effects (all  $P > 0.05$ ). Crop yields, however, tended to be negatively associated with natural land covers.



**Figure S2: The most predictive spatial scales associated with each dataset.** Landscape composition was calculated using three Gaussian decay rates that gave increasing weight to areas further from sampling sites: 250 (black bars), 750 (gray bars), and 1250 (white bars). For each dataset, the most predictive scale was defined as the scale for which model predictions best correlated with observed data. Bars indicate the number of datasets that exhibited highest correlations for each spatial scale. Pest abundance responses, for example, tended to be more predicted by landscape variables that gave higher weights to areas closer to the sampling sites.



**Figure S3: Variation in explanatory power of landscape models across biogeographic realms.** Generalized Linear Mixed Models were used to assess the effect of the biogeographic realm of the dataset (Nearctic, Palearctic, or other realms) on the correlation between landscape model predictions and observed data. Separate analyses were conducted on pest variables (Panel A; abundance and crop damage), enemy variables (Panel B; abundance and activity), and crop yields (Panel C). Gray circles represent both Pearson correlations between model predictions and observed data and  $R^2$  values (square of Pearson's  $r$ ). Black circles are the mean correlation across all datasets in a given biogeographic realm between observed and predicted values. Black lines are 95% confidence intervals. Lowercase letters denote significance under likelihood ratio tests. Panel A shows that, for pest variables, explanatory power of landscape models was highest in Nearctic and Palearctic realms. Though no differences were observed in enemy variables (Panel B), yield models better fit observations in the Nearctic compared to other realms (Panel C).



**Fig. S4: Methods diagram.** Flowchart indicating the sequence of research activities, from data compilation to model testing.

## Dataset Descriptions

**Dataset S1: Study attributes.** Table detailing the pest-control responses analyzed. For each response (row), we include information on the study names (column a), the country of the study (column b), the target crop (column c), the broad response category (abundance, activity, or yield; column d), the specific type of pest-control response (abundance of all enemies, all pests, or dominant pests, cage experiments measuring changes in crop damage, crop yields, or infestation, sentinel pest experiments, crop damage, or crop yields; column e), the target species or measure type (column f), the number of sites analyzed (column g), the source of the land-use data (column h), and the citation corresponding to the target study (column i).

**Dataset S2: Biocontrol database.** We include the biological control database, consisting of 5 worksheets. Below, we detail worksheet:

Metadata worksheet: The metadata worksheet provides a description of each study in the database, as well relevant reference material. Columns include:

1. Study\_ID: The unique identifier for each included study.
2. Study\_Year: The years in which the study was conducted.
3. Country: The country in which the study was conducted.
4. Region: The region where the study was conducted. Authors were asked to describe a fine resolution descriptor of the region in which the study took place.
5. Land\_Use\_Change: Study authors reported whether or not their study area has undergone a significant amount of land-use change in recent years.
6. Covariates: Study authors reported whether there were any other factors that varied across their study sites that were important predictors of pest-control responses (*e.g.*, local diversity, soil moisture, organic status, *etc.*).
7. Sampling\_Design: Study authors were asked to describe how animal sampling was performed in their study.
8. Enclosure\_Treatments: Study authors were asked to state if their study involved enclosures, and, if so, to describe the treatments that were included and the number of replicates.
9. Function\_Methods: Study authors were asked to describe how enemy activity, pest activity, and crop yield data were collected.
10. Land.use.Source: The source of the land-use map that was used to calculate landscape composition around the study sites (see Karp *et al.* 2018 for more details).
11. Citations: References to any publications that have resulted from study as of May 2018.

Sitedata worksheet: The sitedata worksheet provides a description of each study site and key covariates recorded at those sites.

1. Study\_ID: The unique identifier for each included study.
2. Site: A unique identifier for the study site (*i.e.*, one of the places where data was collected).
3. Farm: A unique identifier for the different farms where studies took places. Multiple sites could be located on the same farm.
4. Study\_Year: The year (or years) in which the site was sampled.
5. Crop\_Species: The crop species that were present at the study sites.
6. Annual\_Perennial: Whether the site hosted annual, perennial agriculture, or unknown.
7. Organic: Whether the site was certified organic (yes), conventional (no), or unknown.
8. Local\_Diversity: Whether the site was locally diverse (yes), not diverse (no), or unknown. Examples of local diversity include flowering strips, weedy margins, hedgerows, smaller field sizes, more diverse plantings, *etc.*

9. Insecticide\_Plot: This column indicates whether the study site was treated with insecticides (yes), not treated (no), or unknown. Insecticides could be applied through sprays, seed coating, planting transgenic crops, *etc.*
10. Insecticide\_Farm: This column indicates whether the farm was treated with insecticides (yes), not treated (no), or unknown. Insecticides could be applied through sprays, seed coating, planting transgenic crops, *etc.*
11. Confidence\_Insecticide\_Farm: This column details the percent confidence the authors had in their assessment that insecticides were or were not present on the farm, using a scale from 0% to 100%. Authors who wrote 'unknown' did not score their confidence.
12. Tilling: Whether the site was tilled (yes), not tilled (no), or unknown during the year of the study.
13. Site\_Covariate1: This space was provided if a different site-level covariate was found to be important in an author's study system. Authors included information in this column at their discretion.
14. Site\_Covariate2: This space was provided if a second unique site-level covariate was found to be important in an author's study system. Authors included information in this column at their discretion.

Landusedata worksheet: The landusedata worksheet reports the landscape composition around each study site. Nine different land use classes (detailed below) were examined, and we reported the Gaussian-decay-weighted estimates of landscape composition around each site.

1. Study\_ID: The unique identifier for each included study.
2. Site: A unique identifier for the study site (*i.e.*, one of the places where data was collected).
3. X: The x coordinate of the study site, in decimal degrees (WGS 1984, unprojected). Some coordinates were masked to protect grower anonymity.
4. Y: The y coordinate of the study site, in decimal degrees (WGS 1984, unprojected). Some coordinates were masked to protect grower anonymity.
5. LC1Gau250: The fraction of forest around the study site, using 250 for the decay rate. When the land-use map did not resolve differences between forests, grassland, and shrubland, 'natural habitat' was used as the category and all sites in the study received a 0 in this category.
6. LC2Gau250: The fraction of grassland around the study site, using 250 for the decay rate. When the land-use map did not resolve differences between forests, grassland, and shrubland, 'natural habitat' was used as the category and all sites in the study received a 0 in this category.
7. LC3Gau250: The fraction of shrubland around the study site, using 250 for the decay rate. When the land-use map did not resolve differences between forests, grassland, and shrubland, 'natural habitat' was used as the category and all sites in the study received a 0 in this category.
8. LC4Gau250: The fraction of annual agriculture around the study site, using 250 for the decay rate. When the land-use map did not resolve differences between annual and perennial agriculture, 'agriculture' was used as the category and all sites in the study received a 0 in this category.
9. LC5Gau250: The fraction of perennial agriculture around the study site, using 250 for the decay rate. When the land-use map did not resolve differences between annual and perennial agriculture, 'agriculture' was used as the category and all sites in the study received a 0 in this category.
10. LC6Gau250: The fraction of other land uses around the study site, using 250 for the decay rate.
11. LC7Gau250: The fraction of urban areas around the study site, using 250 for the decay rate.

12. LC8Gau250: The fraction of 'natural habitats' around the study site, using 250 for the decay rate. This was used when the land use map did not sufficiently resolve forests grasslands, and/or shrublands. Otherwise, it is listed as 0.
13. LC9Gau250: The fraction of 'agriculture' around the study site, using 250 for the decay rate. This was used when the land use map did not sufficiently resolve annual and perennial agriculture. Otherwise, it is listed as 0.
14. LC1Gau750: The fraction of forest around the study site, using 750 for the decay rate. When the land-use map did not resolve differences between forests, grassland, and shrubland, 'natural habitat' was used as the category and all sites in the study received a 0 in this category.
15. LC2Gau750: The fraction of grassland around the study site, using 750 for the decay rate. When the land-use map did not resolve differences between forests, grassland, and shrubland, 'natural habitat' was used as the category and all sites in the study received a 0 in this category.
16. LC3Gau750: The fraction of shrubland around the study site, using 750 for the decay rate. When the land-use map did not resolve differences between forests, grassland, and shrubland, 'natural habitat' was used as the category and all sites in the study received a 0 in this category.
17. LC4Gau750: The fraction of annual agriculture around the study site, using 750 for the decay rate. When the land-use map did not resolve differences between annual and perennial agriculture, 'agriculture' was used as the category and all sites in the study received a 0 in this category.
18. LC5Gau750: The fraction of perennial agriculture around the study site, using 750 for the decay rate. When the land-use map did not resolve differences between annual and perennial agriculture, 'agriculture' was used as the category and all sites in the study received a 0 in this category.
19. LC6Gau750: The fraction of other land uses around the study site, using 750 for the decay rate.
20. LC7Gau750: The fraction of urban areas around the study site, using 750 for the decay rate.
21. LC8Gau750: The fraction of 'natural habitats' around the study site, using 750 for the decay rate. This was used when the land use map did not sufficiently resolve forests grasslands, and/or shrublands. Otherwise, it is listed as 0.
22. LC9Gau750: The fraction of 'agriculture' around the study site, using 750 for the decay rate. This was used when the land use map did not sufficiently resolve annual and perennial agriculture. Otherwise, it is listed as 0.
23. LC1Gau1250: The fraction of forest around the study site, using 1250 for the decay rate. When the land-use map did not resolve differences between forests, grassland, and shrubland, 'natural habitat' was used as the category and all sites in the study received a 0 in this category.
24. LC2Gau1250: The fraction of grassland around the study site, using 1250 for the decay rate. When the land-use map did not resolve differences between forests, grassland, and shrubland, 'natural habitat' was used as the category and all sites in the study received a 0 in this category.
25. LC3Gau1250: The fraction of shrubland around the study site, using 1250 for the decay rate. When the land-use map did not resolve differences between forests, grassland, and shrubland, 'natural habitat' was used as the category and all sites in the study received a 0 in this category.
26. LC4Gau1250: The fraction of annual agriculture around the study site, using 1250 for the decay rate. When the land-use map did not resolve differences between annual and

perennial agriculture, 'agriculture' was used as the category and all sites in the study received a 0 in this category.

27. LC5Gau1250: The fraction of perennial agriculture around the study site, using 1250 for the decay rate. When the land-use map did not resolve differences between annual and perennial agriculture, 'agriculture' was used as the category and all sites in the study received a 0 in this category.
28. LC6Gau1250: The fraction of other land uses around the study site, using 1250 for the decay rate.
29. LC7Gau1250: The fraction of urban areas around the study site, using 1250 for the decay rate.
30. LC8Gau1250: The fraction of 'natural habitats' around the study site, using 1250 for the decay rate. This was used when the land use map did not sufficiently resolve forests grasslands, and/or shrublands. Otherwise, it is listed as 0.
31. LC9Gau1250: The fraction of 'agriculture' around the study site, using 1250 for the decay rate. This was used when the land use map did not sufficiently resolve annual and perennial agriculture. Otherwise, it is listed as 0.

Abundancedata worksheet: The abundancedata worksheet details the abundances of all pests and/or natural enemies recorded at the study sites.

1. Study\_ID: The unique identifier for each included study.
2. Site: A unique identifier for the study site (*i.e.*, one of the places where data was collected).
3. Study\_Year: The year (or years) in which the site was sampled.
4. Sampling\_Date: A unique identifier that differs for each site when it was visited on a different day within the same year.
5. Species: The scientific name of the species that was surveyed.
6. Family: The family of the species that was surveyed.
7. Order: The order of the species that was surveyed.
8. Functional\_Group: The functional group of the species that was surveyed. Possibilities include: dominant pest (economically damaging), secondary pest (not strongly damaging but still herbivorous), dominant enemy (a predator or parasitoid that is known to control a dominant pest), parasitoid, or predator.
9. Abundance: The recorded abundance of the species. This value differs across studies, with some reporting the number of individual recorded and others reporting average abundances/counts across multiple surveys.
10. Number\_Censuses: The number of sub-samples that were summarized in the abundance column (*e.g.*, three pan traps averaged per plot would be recorded as 3).
11. Sampling\_Method: The method used to sample organisms (*e.g.*, pan traps, pitfall traps, mist nets, sticky cards, *etc.*)
12. Abundance\_Duration: The number of days that the sampling lasted (*e.g.*, how many days the sticky trap was left in the field).
13. Notes: Any notes that the study's author felt important to include.

Activitydata worksheet: The activitydata worksheet details the activity of pests (*e.g.*, crop damage) and enemies (*e.g.*, percent pests parasitized) that was recorded at the study sites.

1. Study\_ID: The unique identifier for each included study.
2. Site: A unique identifier for the study site (*i.e.*, one of the places where data was collected).
3. Study\_Year: The year (or years) in which the site was sampled.
4. Sampling\_Date: A unique identifier that differs for each site when it was visited on a different day within the same year.
5. Function\_Type: The broad category of data being collected. Can be one of the categories:

- a. Cage experiment (change in infestation): pest abundance recorded within an enclosure experiment
- b. Cage experiment (change in crop damage): crop damage recorded within an enclosure experiment
- c. Cage experiment (change in crop yield): crop yield recorded within an enclosure experiment
- d. Sentinel experiments (enemy activity): the percent predation or parasitism observed after placing sentinel pests in the field or, for parasitism, the fraction of parasitized pests observed naturally in the field.
- e. Pest damage: crop damage incurred by pest feeding.
6. Pest: The name of the pest species which is being studied (*i.e.*, the pest that is being consumed or parasitized or the pest that is exacting damage on the crop). If the pest is not differentiated, then 'all' is written.
7. Enclosure\_Treatment: If an enclosure is present, this column indicates whether the data reported are from the 'open' treatment (allowing predators to be present) or the 'closed' treatment (excluding predators).
8. Initial\_Density: If the study involved enclosures, this column indicates the level of function data before the enclosures were erected (*e.g.*, the starting abundances of the pests).
9. Function\_Data: The value of the measured function in the enclosure treatment and/or at the site.
10. Unit: The unit of measurement for the function data (*e.g.*, percentage of pests consumed).
11. Number\_Censuses: The number of sub-samples that were summarized in activity column (*e.g.*, three cage traps averaged per site would be recorded as 3).
12. Activity\_Duration: The number of days that the sampling lasted (*e.g.*, how many days the sentinel pests was left in the field).
13. Notes: Any notes that the study's author felt important to include.

Yielddata worksheet: The yielddata worksheet details the crop yields that were recorded at the study sites.

1. Study\_ID: The unique identifier for each included study.
2. Site: A unique identifier for the study site (*i.e.*, one of the places where data was collected).
3. Study\_Year: The year (or years) in which the site was sampled.
4. Sampling\_Date: A unique identifier that differs for each site when it was visited on a different day within the same year.
5. Function\_Data: The reported value of crop yield at a given site.
6. Unit: The unit of measurement for the yield data (*e.g.*, kg/ha).
7. Measure\_Type: A variable indicating whether the yield was recorded as the total yield of the plant (*e.g.*, total biomass) or within-plant-yield.
8. Sample\_Size: The number of plants or sampled area that went in to calculating the yield estimate.
9. Marketable\_or\_Total: A variable indicated whether the estimate of yield reported corresponded to the total yield of the crop or just the fraction that was marketable (*e.g.*, due to quality concerns).
10. Notes: Any notes that the study's author felt important to include.
11. CropType: The crop species for which the yield estimate was calculated.
12. WeeksSincePlanting: The number of weeks since planting when the yield estimate obtained in the field.