Electronic supplementary material

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In this supplementary material we present results of analyses where we use slightly different definitions of dominant crop pollinators. First, species are classified as being dominant crop pollinators if they comprised of at least 5% of all crop pollinators in our study (figures S1-4). Second, we show results of analyses where we have used the definition as used by Kleijn et al. (2015, *Nature communications* 6-7414), and as in the main manuscript, but where we excluded hoverflies and honeybees (figures S5-8). Third, we classified dominant crop pollinators as per Kleijn et al. (2015, *Nature communications* 6-7414) but included wild bees, hoverflies and honeybees (figures S9-12). We furthermore show that honeybee abundances were not significantly related to landscape complexity (figure S13).

<u>Dominant crop pollinators defined as all species comprising at least 5% of all individuals on crop flowers in this study</u>

The total crop pollinator species pool size was significantly positively related with the local species pool size in the semi-natural habitat transects ($F_{1,16}$ = 12.90, p = 0.002), but this relation was stronger for the opportunistic crop pollinators than for the dominant crop pollinators (significant interaction effect local species pool × functional group: $\chi^2(1)$ = 9.41, p = 0.002; figure S1A). With an increasing local species pool in the landscape, the abundance of pollinators in crop fields increased ($\chi^2(1)$ = 7.22, p = 0.007; figure S1B) similarly for both dominant and opportunistic crop pollinators (i.e. no significant interaction effect local species pool × functional group: $\chi^2(1)$ = 0.21, p = 0.64; figure S1B). Dominant crop pollinators were generally more abundant in crop fields than opportunistic crop pollinators ($\chi^2(1)$ = 32.43, p < 0.001; figure S1B).

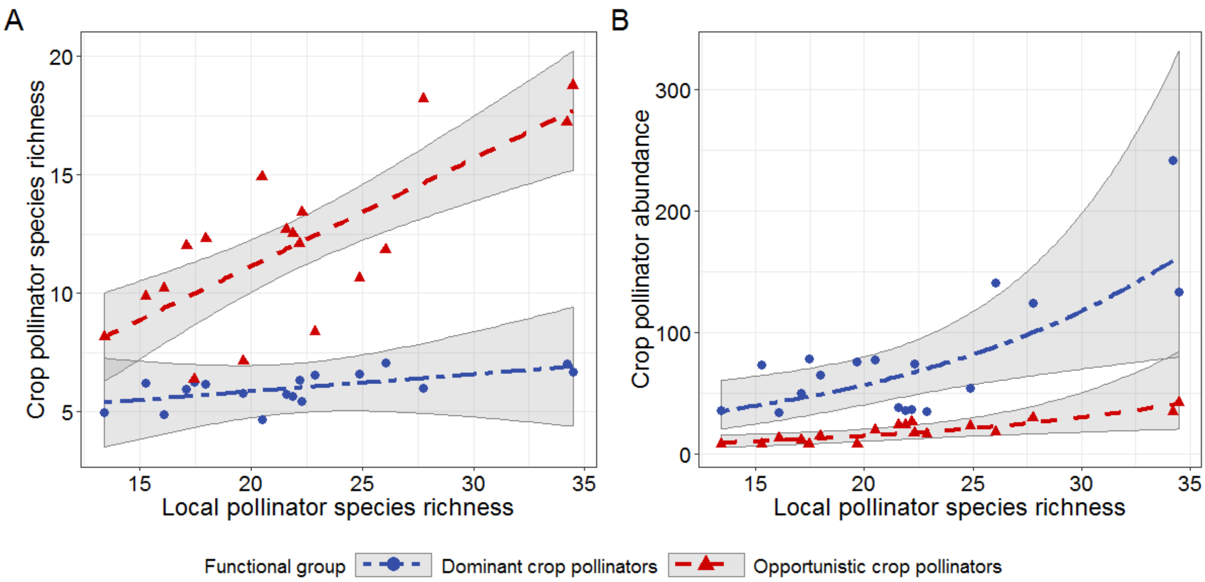

Figure S1. Relationships between the local pollinator species richness and the pollinator species richness (A) and abundance (B) in crops. Here, we defined dominant crop pollinators as all species comprising at least5% of all visits to crop flowers in our study. Local pollinator species richness is based on transects in semi-natural habitat (both before and during crop flowering), while crop abundances and richness are based on transects in crop fields. Separate regressions are indicated for dominant crop species (blue circles) and opportunistic crop species (red triangles) and 95% confidence intervals are indicated with grey. Results are back-transformed partial residuals.

The total size of the local species pool did not significantly increase with increasing landscape complexity ($F_{2,15}$ = 2.17, p = 0.11). The three-way interaction between functional group, period of sampling and landscape complexity was significant (three-way interaction: χ^2 (2) = 6.94, p = 0.03; figure S2A). There were no strong effects of landscape complexity before crop flowering, whereas during crop flowering, non-crop pollinators responded positive to semi-natural habitat cover ($F_{2,15}$ = 2.98, p = 0.045). Total pollinator species richness in the crop fields increased significantly with landscape complexity ($F_{1,16}$ = 8.93, p = 0.008). The species richness of dominant ($F_{1,16}$ = 31.57, p < 0.001) and opportunistic crop pollinators ($F_{1,16}$ = 6.10, p = 0.03) increased similarly with increasing landscape complexity (i.e. no significant interaction functional group x landscape complexity (χ^2 (1) = 3.37, p = 0.07; figure S2B).

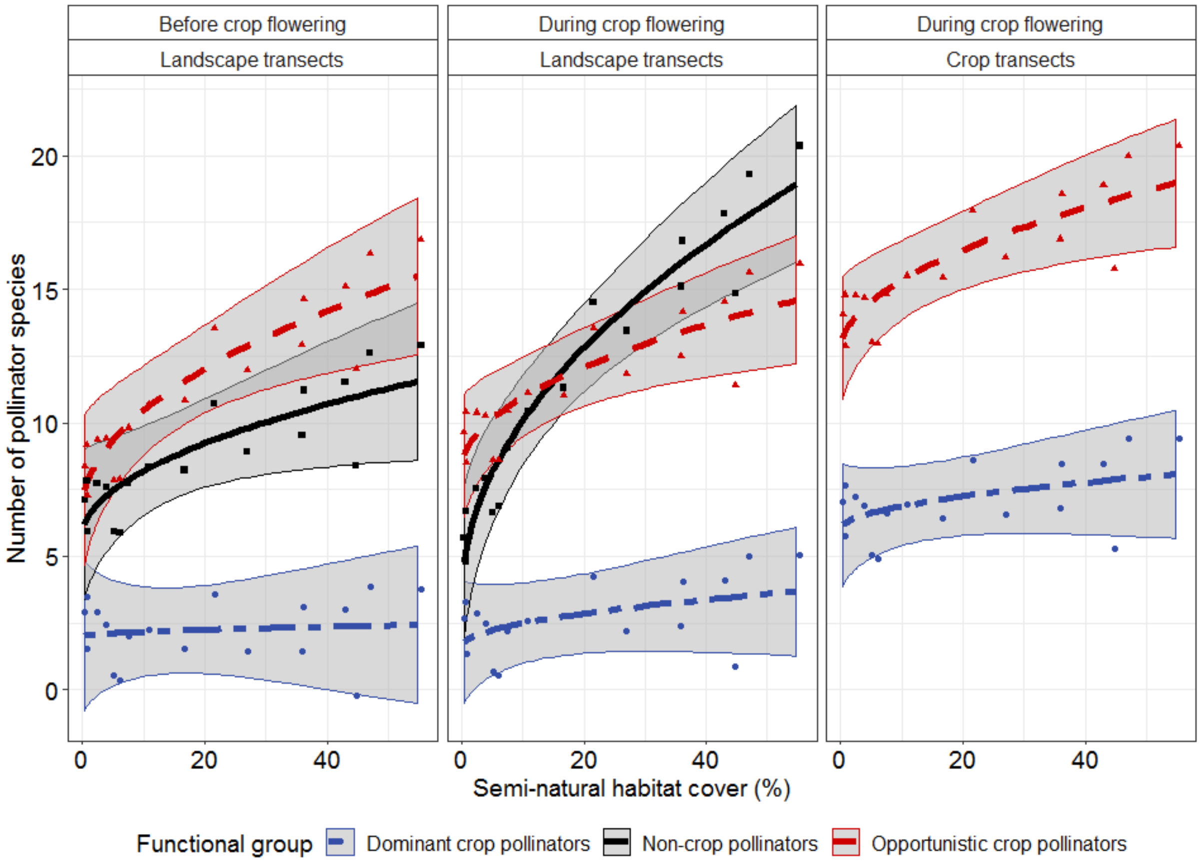

Figure S2. Relation between cover of semi-natural habitat (%) and pollinator species richness. Here, we defined dominant crop pollinators as all species comprising at least5% of all visits to crop flowers in our study. Separate panels are given for semi-natural habitat transects before, and during crop flowering, and crop transects during crop flowering. Back-transformed regressions and predicted species richness are indicated for dominant crop pollinator species (blue circles), opportunistic crop pollinator species (red triangles), and non-crop pollinator species in the landscape (black squares). 95% confidence intervals are indicated with grey.

In the semi-natural habitats surrounding leek fields, the total average abundance of pollinators was not related to semi-natural habitat cover ($F_{2,15} = 0.77$, $p = 0.88$), nor was one of the functional groups, both before and during leek flowering ($p > 0.38$, figure S3A-F). Abundances in the crop were generally related to semi-natural habitat cover ($F_{1,16} = 5.35$, $p = 0.03$), but this was stronger for the dominant crop pollinator abundance ($F_{1,16} = 8.50$, $\beta = 0.10$, $p = 0.01$; figure S3G), as the abundance of opportunistic crop pollinators was only marginally related to semi-natural habitat cover ($F_{1,16} = 4.27$, $\beta = 0.06$, $p = 0.06$; figure S3H).

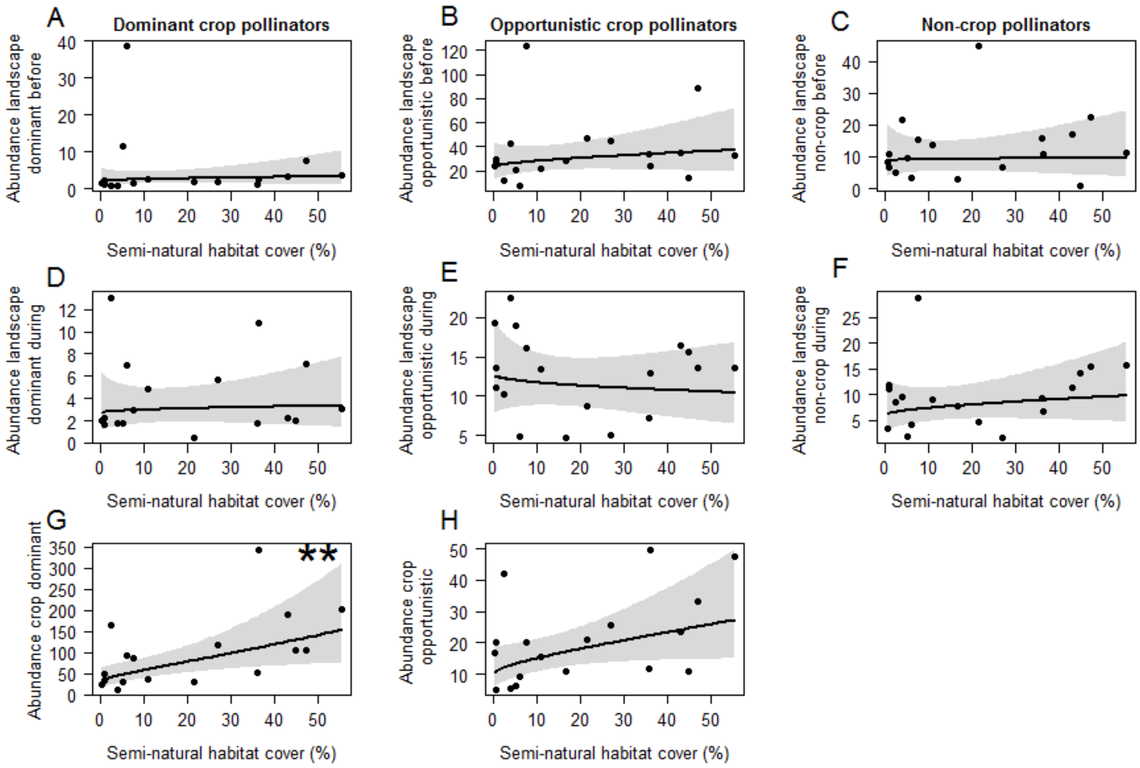

Figure S3. Relation of pollinator abundances with semi-natural habitat cover (%). Here, we defined dominant crop pollinators as all species comprising at least5% of all visits to crop flowers in our study. Abundances were separated in (A-C) semi-natural habitat transects before crop flowering, (D-F) semi-natural habitat transects during crop flowering and (G & H) crop transects. Panel A, D and G reflect dominant crop pollinator abundances, B, E and H opportunistic crop pollinator abundances and C & F non-crop pollinator abundances. Results are back-transformed partial residuals corrected for flower cover. Panel A-F show no significant relation, while G is significant ($p<0.01$, indicated with **) and panel H marginally significant ($p = 0.06$). 95% confidence intervals are indicated with grey.

Crop flowering did not alter the abundances of dominant crop pollinators in the landscape or abundances of non-crop pollinators in the landscape. However, the opportunistic crop pollinators showed a strong decline in abundances in the landscape when the nearby crop was flowering (figure S4A). Abundances of dominant crop pollinators were much higher in the crop than in the semi-natural habitat in the surrounding landscape. Abundances of opportunistic crop pollinators in the crop were comparable to those in the landscape (figure S4B).

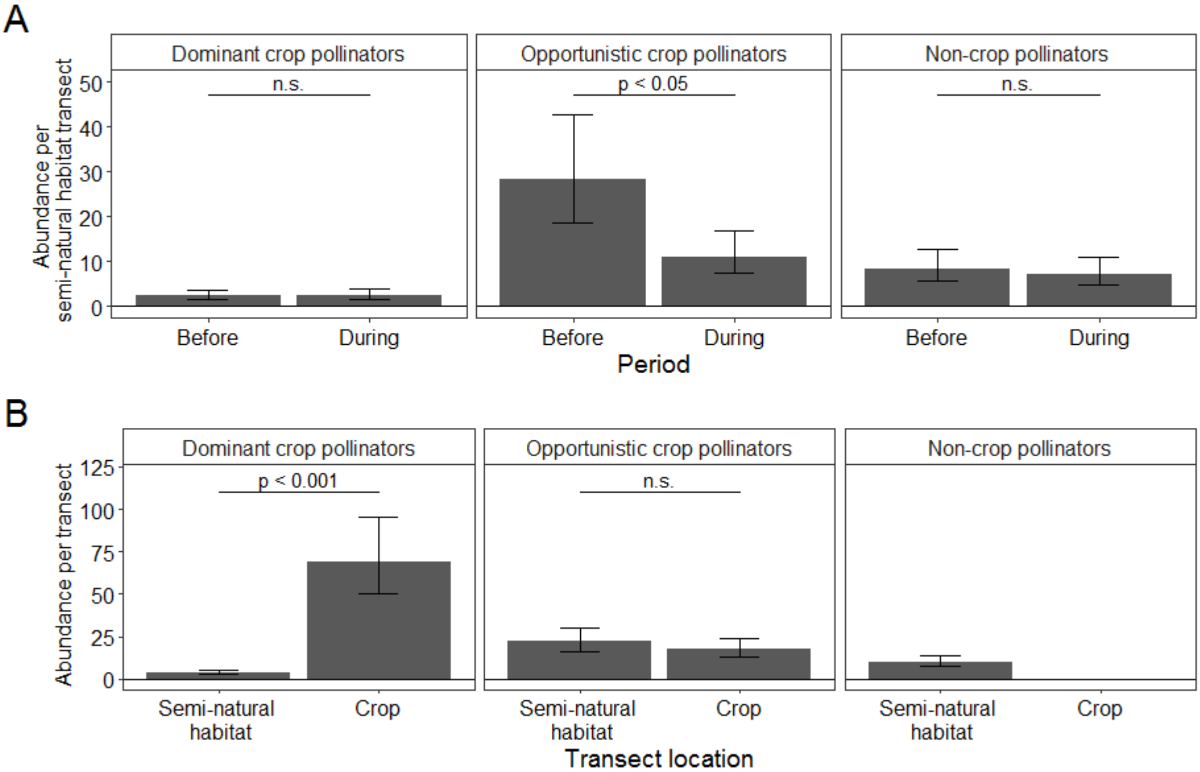

Figure S4. (A) Back-transformed mean abundances of dominant, opportunistic and non-crop pollinators in the landscape, before and during crop flowering. (B) Back-transformed mean abundances of dominant and opportunistic in the landscape (before and during crop flowering together) and in the crop, and mean abundances of non-crop pollinators in the semi-natural habitat for comparison. Here, we defined dominant crop pollinators as all species comprising at least5% of all visits to crop flowers in our study. Error-bars are 95% confidence interval. Pairwise significance values are indicated on top (n.s. = not significant).

Definition of dominance as in main article – excluding hoverflies and honeybees

The total crop pollinator species pool size was significantly positively related with the local species pool size in the semi-natural habitat transects ($F_{1,16}$ = 20.56, p < 0.001), but this relation was stronger for the opportunistic crop pollinators than for the dominant crop pollinators (significant interaction effect local species pool × functional group: χ^2 (1) = 4.10, p = 0.04; figure S5A). With an increasing local species pool in the landscape, the total abundance of pollinators in crop fields increased (χ^2 (1) = 5.24, p = 0.05; figure S5B). Furthermore, dominant and opportunistic crop pollinators increased similarly with increasing local species pool size (i.e. no significant interaction effect local species pool × functional group: χ^2 (1) = 2.20, p = 0.14; figure S5B). Dominant crop pollinators were generally more abundant in crop fields than opportunistic crop pollinators (χ^2 (1) = 9.97, p = 0.002; figure S5B).

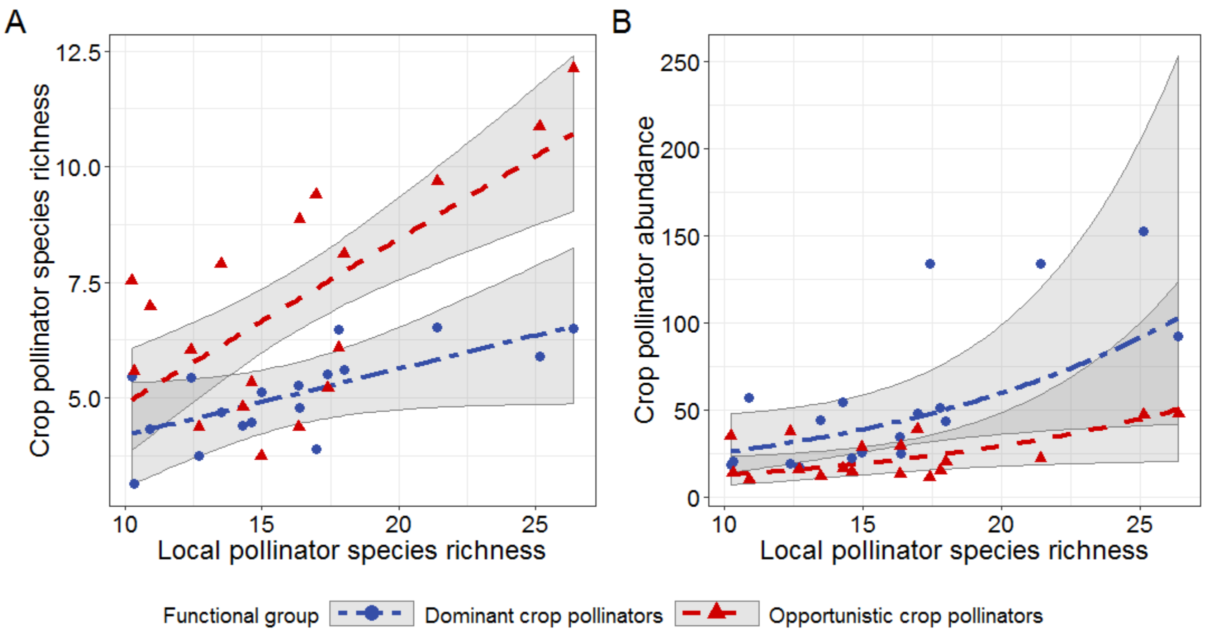

Figure S5. Relationships between the local pollinator species richness and the pollinator species richness (A) and abundance (B) in crops, excluding hoverflies and honeybees. Classification of dominant crop pollinators follows Kleijn et al. (2015, Nature communications 6-7414). Local pollinator species richness is based on transects in semi-natural habitat (both before and during crop flowering), while crop abundances and richness are based on transects in crop fields. Separate regressions are indicated for dominant crop species (blue circles) and opportunistic crop species (red triangles) and 95% confidence intervals are indicated with grey. Results are back-transformed partial residuals.

The total size of the local species pool did not significantly increase with increasing landscape complexity ($F_{2,15}$ = 2.19, p = 0.08). There was no support for a three-way interaction between functional group, period of sampling and landscape complexity (three-way interaction: χ^2 (2) = 0.73, p = 0.70; figure S6A), but both the two-way interactions between functional group and period (χ^2 (2) = 6.99, p = 0.03), as well as between functional group and landscape complexity (χ^2 (2) = 9.71, p = 0.008) were significant. There were no strong effects of landscape complexity before crop flowering, whereas during crop flowering, non-crop pollinators responded marginally positive to semi-natural habitat cover ($F_{2,15}$ = 2.46, p = 0.07). Total pollinator species richness in the crop fields increased significantly with landscape complexity ($F_{1,16}$ = 8.93, p = 0.008). The species richness of dominant ($F_{1,16}$ = 4.41, p = 0.05) and opportunistic crop pollinators ($F_{1,16}$ = 5.65, p = 0.03) increased similarly with increasing landscape complexity (i.e. no significant interaction functional group x landscape complexity (χ^2 (1) = 2.59, p = 0.10; figure S6B).

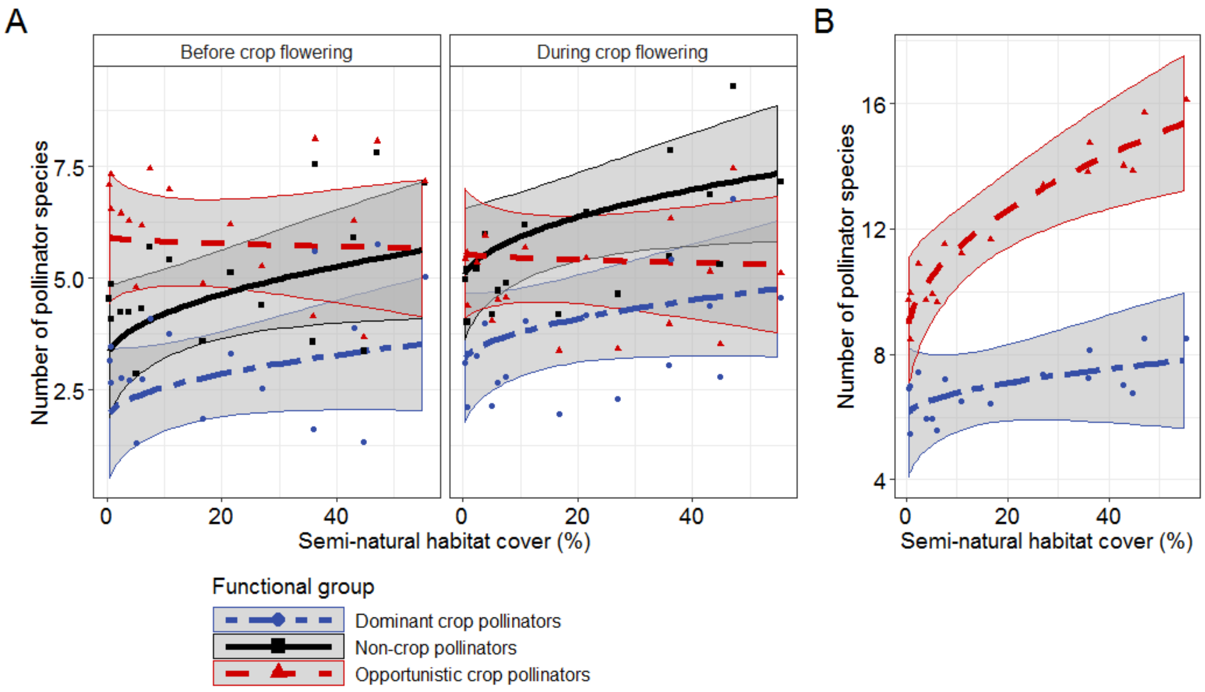

Figure S6. Relation between cover of semi-natural habitat (%) and pollinator species richness, excluding hoverflies and honeybees. Classification of dominant crop pollinators follows Kleijn et al. (2015, Nature communications 6-7414). Separate panels are given for (A) semi-natural habitat transects before and during crop flowering and (B) crop transects during crop flowering. Back-transformed regressions and predicted species richness are indicated for dominant crop pollinator species (blue circles), opportunistic crop pollinator species (red triangles), and non-crop pollinator species in the landscape (black squares). 95% confidence intervals are indicated with grey.

In the semi-natural habitats surrounding leek fields, the total average abundance of pollinators, excluding hoverflies and honeybees, was not related to semi-natural habitat cover ($F_{2,15} = 0.89$, $p = 0.84$), nor was one of the functional groups, both before and during leek flowering ($p > 0.43$, figure S7A-F). Abundances in the crop were generally related to semi-natural habitat cover ($F_{1,16} = 6.37$, $p = 0.02$), but this was largely caused by the dominant crop pollinator abundance ($F_{1,16} = 11.40$, $\beta = 0.12$, $p = 0.004$; figure S7G), as the abundance of opportunistic crop pollinators was not related to semi-natural habitat cover ($F_{1,16} = 0.77$, $\beta = 0.03$, $p = 0.50$; figure S7H).

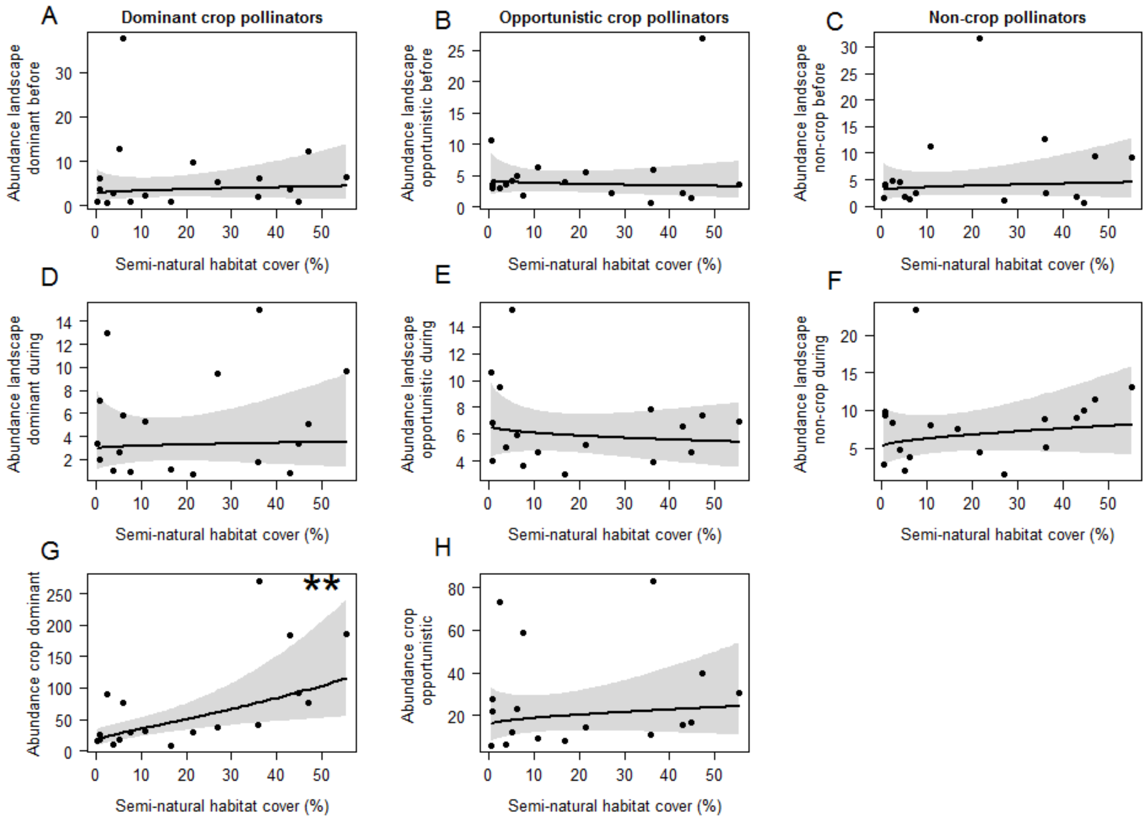

Figure S7. Relation of pollinator abundances, excluding hoverflies and honeybees, with semi-natural habitat cover (%). Classification of dominant crop pollinators follows Kleijn et al. (2015, Nature communications 6-7414). Abundances were separated in (A-C) semi-natural habitat transects before crop flowering, (D-F) semi-natural habitat transects during crop flowering and (G & H) crop transects. Panel A, D and G reflect dominant crop pollinator abundances, B, E and H opportunistic crop pollinator abundances and C & F non-crop pollinator abundances. Results are back-transformed partial residuals corrected for flower cover. Panel A-F & H show no significant relation, while G is significant (p<0.01, indicated with **). 95% confidence intervals are indicated with grey.

Crop flowering did not alter the abundances of dominant, opportunistic or non-crop pollinators in the landscape (figure S8A). Abundances of dominant and opportunistic crop pollinators were much higher in the crop than in the semi-natural habitat in the surrounding landscape (figure S8B).

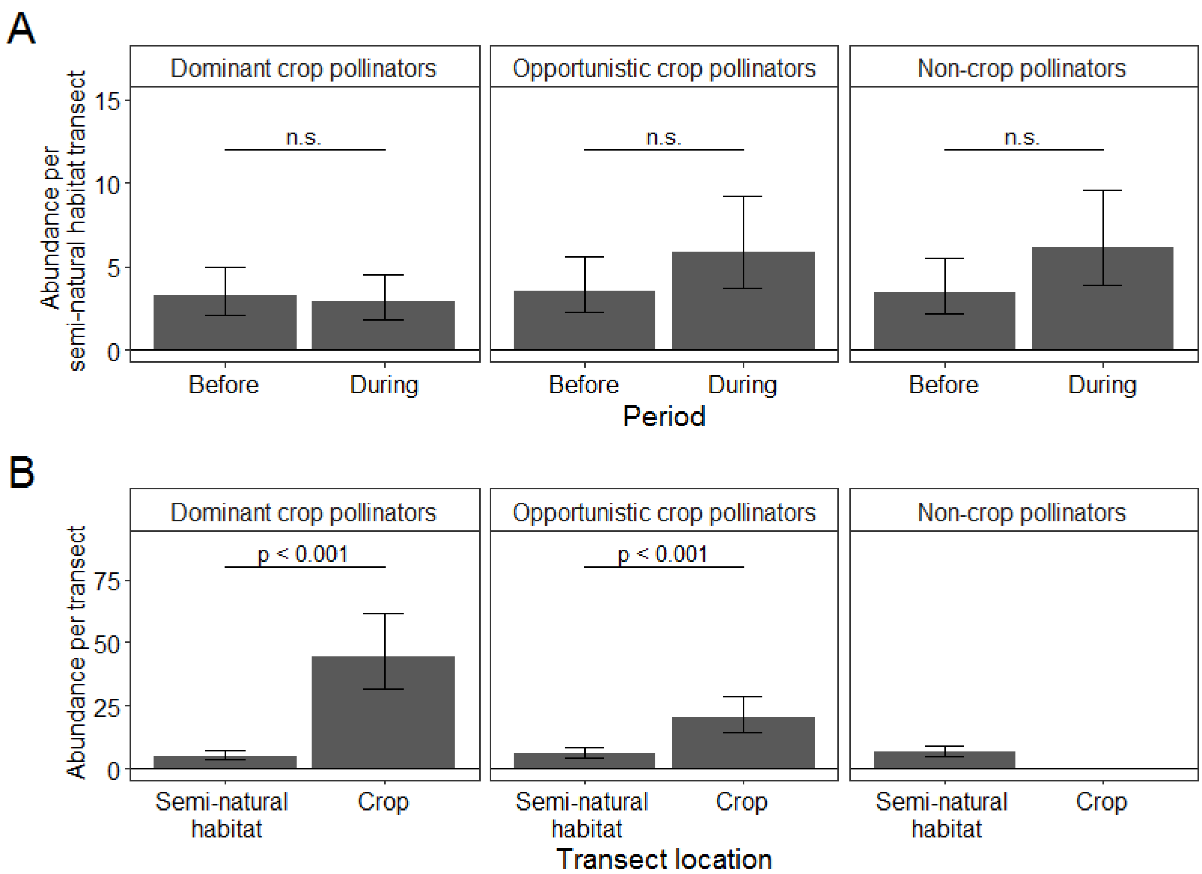

Figure S8. (A) Back-transformed mean abundances of dominant, opportunistic and non-crop pollinators in the landscape, before and during crop flowering, excluding hoverflies and honeybees. (B) Back-transformed mean abundances of dominant and opportunistic in the landscape (before and during crop flowering together) and in the crop, excluding hoverflies and honeybees. Classification of dominant crop pollinators follows Kleijn et al. (2015, Nature communications 6-7414). Mean abundances of non-crop pollinators in the semi-natural habitat are shown for comparison. Error-bars are 95% confidence interval. Pairwise significance values are indicated on top (n.s. = not significant).

Definition of dominance as in main article – including hoverflies and honeybees

Honeybee (*Apis mellifera*) hives are placed in the leek fields during crop flowering and are ubiquitous in the study area. Because we were interested in the patterns of wild pollinators, we have excluded honeybees from all analyses in the main article. Here we present results of analyses that include honeybees to show that the results are qualitatively the same. We furthermore show that honeybee abundances were not significantly related to landscape complexity (figure S13).

The total crop pollinator species pool size was significantly positively related with the local species pool size in the semi-natural habitat transects ($F_{1,16}$ = 15.06, p = 0.001), but this relation was stronger for the opportunistic crop pollinators than for the dominant crop pollinators (significant interaction effect local species pool × functional group: χ^2 (1) = 4.87, p = 0.03; figure S9A). With an increasing local species pool in the landscape, the total abundance of pollinators in crop fields increased only marginally (χ^2 (1) = 5.24, p = 0.09; figure S9B). But when accounting for the functional groups, an increasing local species pool size increased pollinator abundance (χ^2 (1) = 3.97, p = 0.046) similarly for both dominant and opportunistic crop pollinators (i.e. no significant interaction effect local species pool × functional group: χ^2 (1) = 0.04, p = 0.85; figure S9B). Dominant crop pollinators were generally more abundant in crop fields than opportunistic crop pollinators (χ^2 (1) = 22.09, p < 0.001; figure S9B).

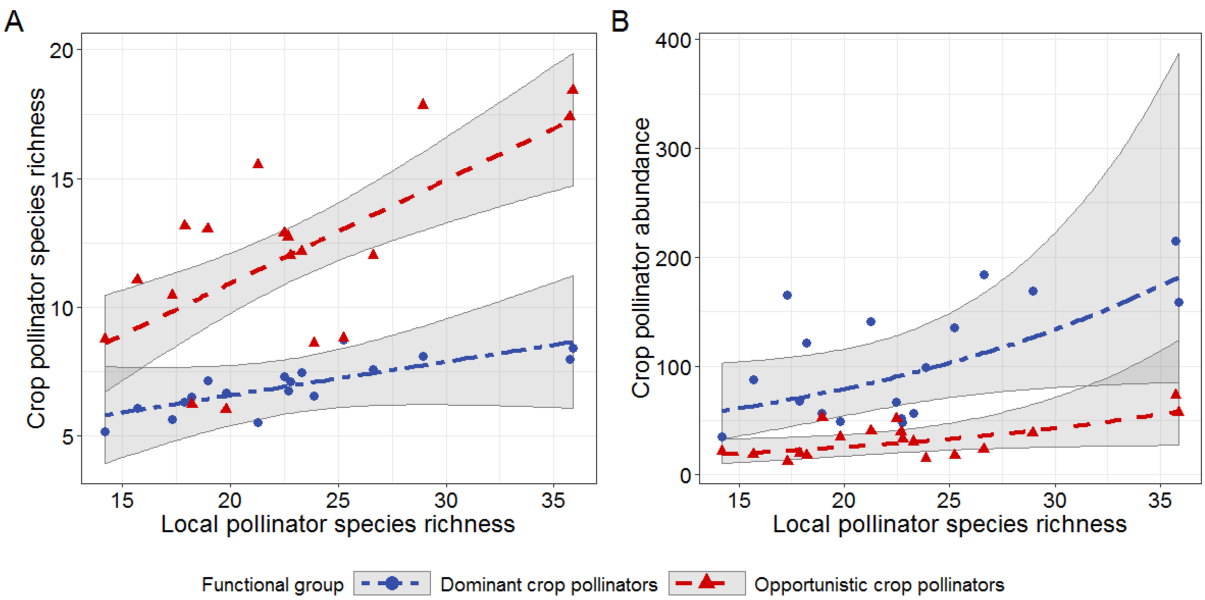

Figure S9. Relationships between the local pollinator species richness and the pollinator species richness (A) and abundance (B) in crops, including honeybees. Classification of dominant crop pollinators follows Kleijn et al. (2015, Nature communications 6-7414). Local pollinator species richness is based on transects in semi-natural habitat (both before and during crop flowering), while crop abundances and richness are based on transects in crop fields. Separate regressions are indicated for dominant crop species (blue circles) and opportunistic crop species (red triangles) and 95% confidence intervals are indicated with grey. Results are back-transformed partial residuals.

The total size of the local species pool did only marginally increase with increasing landscape complexity ($F_{2,15}$ = 2.84, p = 0.06). The three-way interaction between functional group, period of sampling and landscape complexity was only marginally significant (three-way interaction: χ^2 (2) = 4.93, p = 0.08; figure S10A). The two-way interaction between functional group and period (χ^2 (2) = 9.94, p = 0.007), as well as between functional group and landscape complexity (χ^2 (2) = 6.23, p = 0.044) were significant. There were no strong effects of landscape complexity before crop flowering, whereas during crop flowering, non-crop pollinators were positively related to semi-natural habitat cover ($F_{2,15}$ = 3.48, p = 0.03). Total pollinator species richness in the crop fields increased significantly with landscape complexity ($F_{1,16}$ = 8.93, p = 0.008), and this was stronger for the opportunistic crop pollinators than the dominant crop pollinators (i.e. significant interaction functional group x landscape complexity (χ^2 (1) = 4.87, p = 0.03; figure S10B).

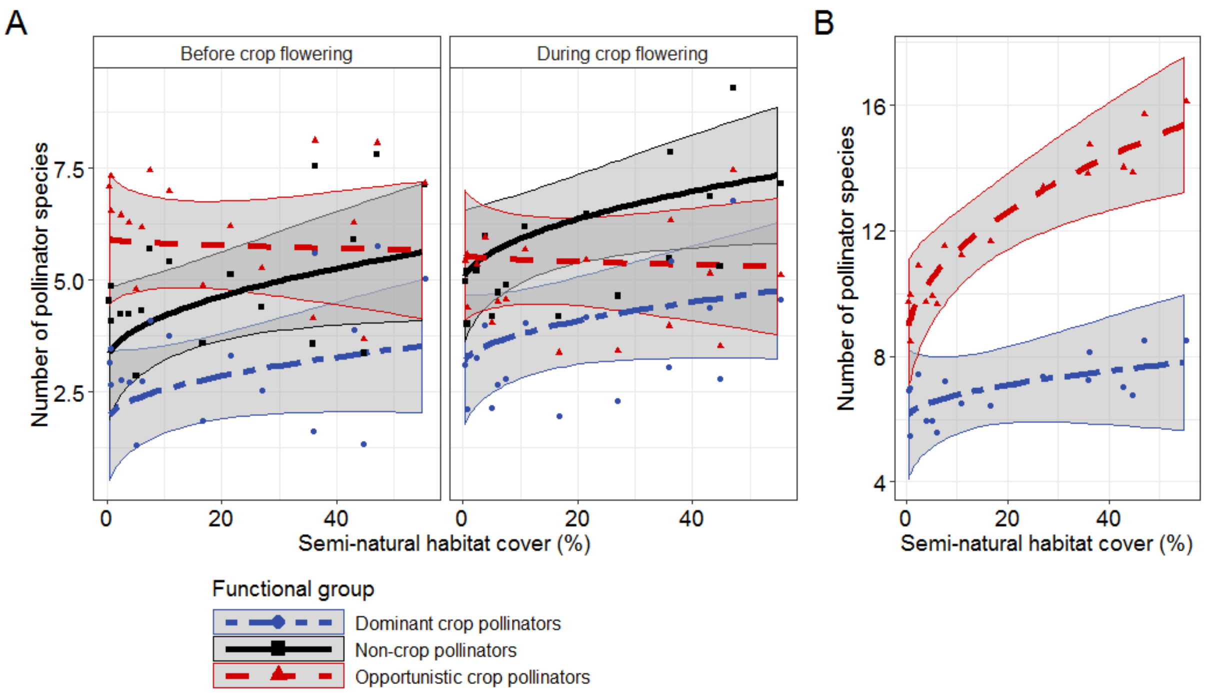

Figure S10. Relation between cover of semi-natural habitat (%) and pollinator species richness, including honeybees. Classification of dominant crop pollinators follows Kleijn et al. (2015, Nature communications 6-7414). Separate panels are given for (A) semi-natural habitat transects before and during crop flowering and (B) crop transects during crop flowering. Back-transformed regressions and predicted species richness are indicated for dominant crop pollinator species (blue circles), opportunistic crop pollinator species (red triangles), and non-crop pollinator species in the landscape (black squares). 95% confidence intervals are indicated with grey.

In the semi-natural habitats surrounding leek fields, the total average abundance of pollinators was not related to semi-natural habitat cover ($F_{2,15}$ = 3.78, p = 0.47), nor was one of the functional groups, both before and during leek flowering (p > 0.35, figure S11A-F). Abundances in the crop were marginally related to semi-natural habitat cover ($F_{1,16}$ = 3.86, p = 0.07), but this was mainly due to the dominant crop pollinator abundance ($F_{1,16}$ = 4.74, β = 0.08, p = 0.045; figure S3G), as the abundance of opportunistic crop pollinators was not related to semi-natural habitat cover ($F_{1,16}$ = 0.77, β = 0.03, p = 0.39; figure S11H).

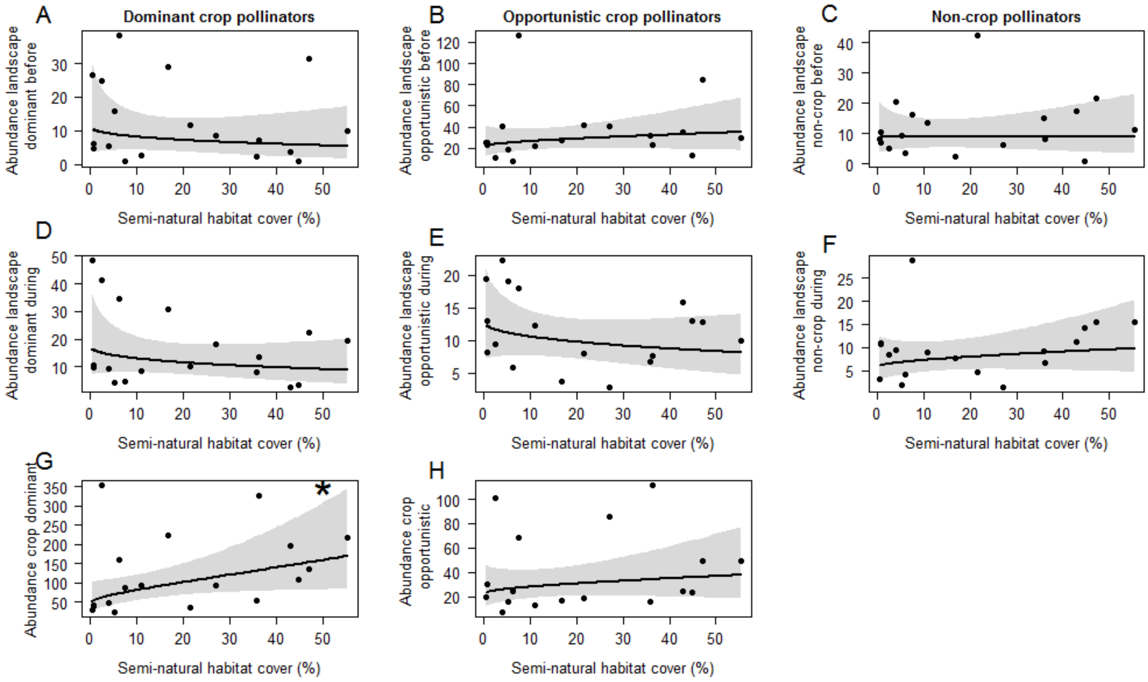

Figure S11. Relation of pollinator abundances, including honeybees, with semi-natural habitat cover (%).Abundances were separated in (A-C) semi-natural habitat transects before crop flowering, (D-F) semi-natural habitat transects during crop flowering and (G & H) crop transects. Panel A, D and G reflect dominant crop pollinator abundances, B, E and H opportunistic crop pollinator abundances and C & F non-crop pollinator abundances. Classification of dominant crop pollinators follows Kleijn et al. (2015, Nature communications 6-7414). Results are back-transformed partial residuals corrected for flower cover. Panel A-F & H show no significant relation, while G is significant (p<0.05, indicated with *). 95% confidence intervals are indicated with grey.

Crop flowering did not alter the abundances of dominant crop pollinators in the landscape or abundances of non-crop pollinators in the landscape. However, the opportunistic crop pollinators showed a strong decline in abundances in the landscape when the nearby crop was flowering (figure S4A). Abundances of dominant crop pollinators were much higher in the crop than in the semi-natural habitat in the surrounding landscape. Abundances of opportunistic crop pollinators in the crop were comparable to those in the landscape (figure S4B).

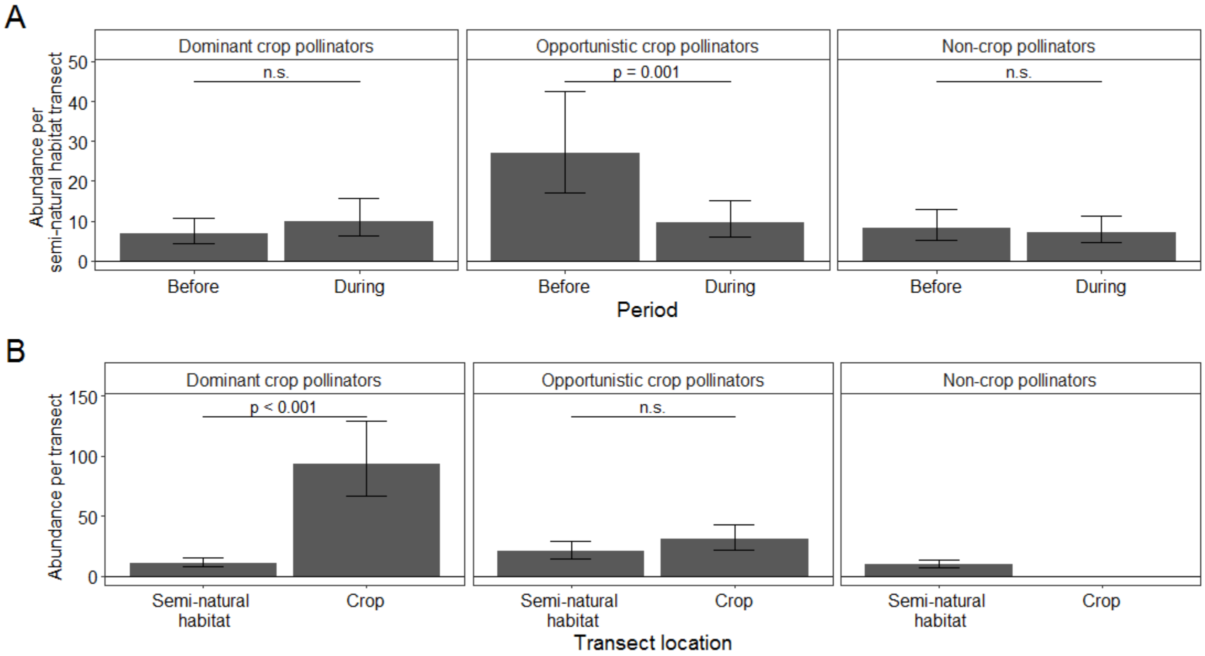

Figure S12. (A) Back-transformed mean abundances of dominant, opportunistic and non-crop pollinators in the landscape, before and during crop flowering, including honeybees. (B) Back-transformed mean abundances of dominant and opportunistic in the landscape (before and during crop flowering together) and in the crop, and mean abundances of non-crop pollinators in the semi-natural habitat for comparison. Classification of dominant crop pollinators follows Kleijn et al. (2015, Nature communications 6-7414). Error-bars are 95% confidence interval. Pairwise significance values are indicated on top (n.s. = not significant).

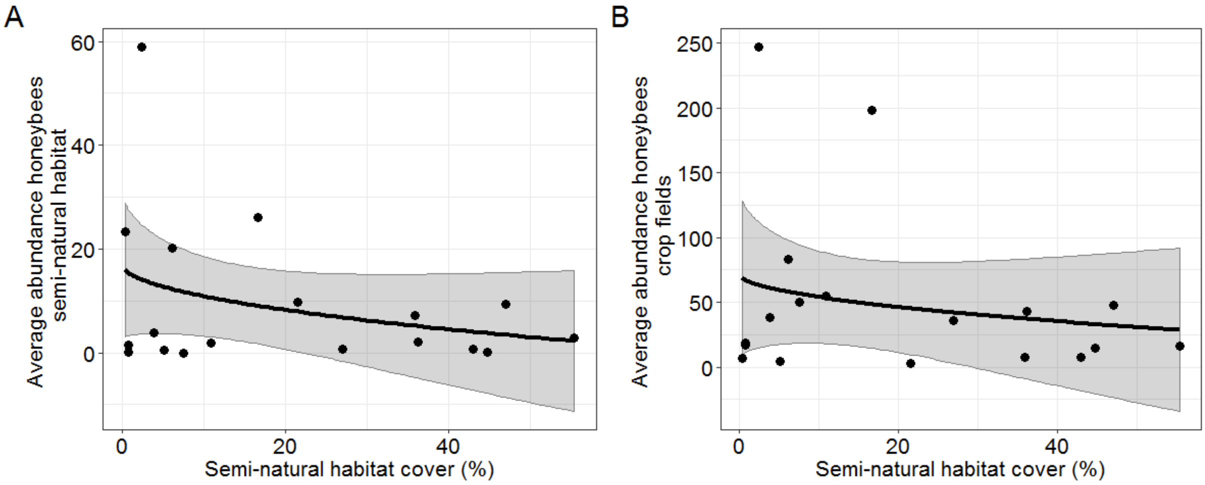

Figure S13. (A) Back-transformed mean abundances of honeybees in the landscape (simple linear regression: $F_{1,16}$ = 1.75, p = 0.20), and (B) in the crop fields (simple linear regression: $F_{1,16}$ = 0.70, p = 0.41) along the measured gradient of semi-natural habitat cover (%). 95% confidence intervals are indicated with grey.