Supporting Figures S1-S7.

Supporting Information to Martin, E. A. et al. The interplay of landscape composition and configuration: new pathways to manage functional biodiversity and agro-ecosystem services across Europe.

Contents

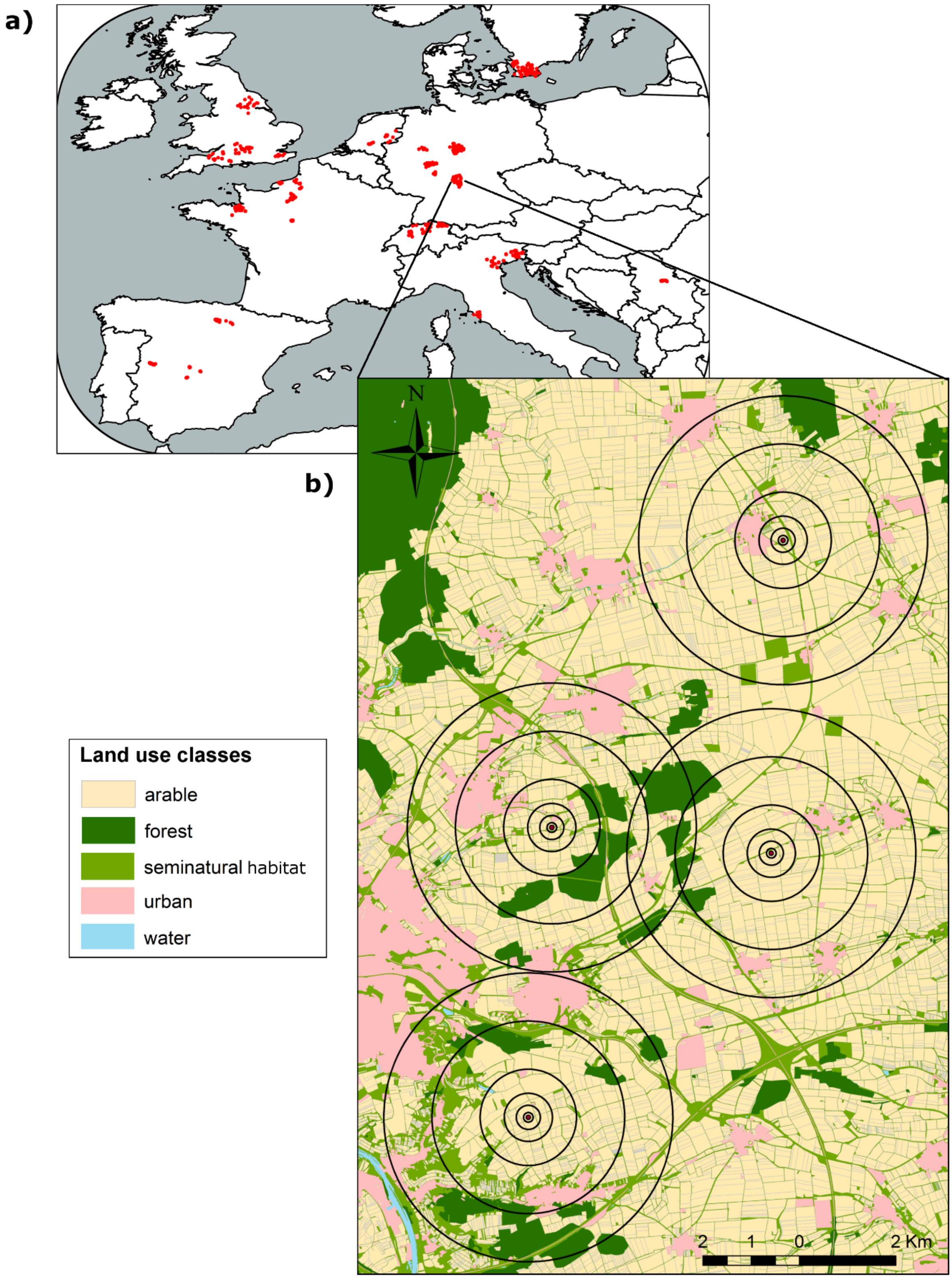

Figure S1. a) Map of study landscapes across Europe. Only landscapes included in analyses are represented (i.e., excluding organic and Hungarian sites; see Methods and Appendix S1). A total of 1,515 landscapes (see definition in Appendix S1) were analysed from 9 countries and 27 regions of Europe. b) Example land use map from one included study (Schnei01;

Table S1). Dots in the centre of circles represent a subset of sampled sites for this study (oilseed rape fields) where pests, parasitism, crop damage and yields were measured on 5 plants in two transects located 1 m and 20 m from the field edge, respectively. Concentric circles represent the extent of sectors surrounding sampled sites within which landscape variables were measured (i.e. our definition of a landscape). Sectors were defined at successive radii of 0.1, 0.25, 0.5, 1, 2, and 3 km around sites. Land use maps were classified for all studies into the five land use classes arable (managed grasslands in rotation, annual and perennial crops), forest, seminatural habitat (hedges, grassy ditches, unmanaged grasslands, shrubs, fallows), urban and water (see also Appendix S1). The minimum mapping unit of land use maps was ca. 4*4 m and all maps included borders between individual fields.

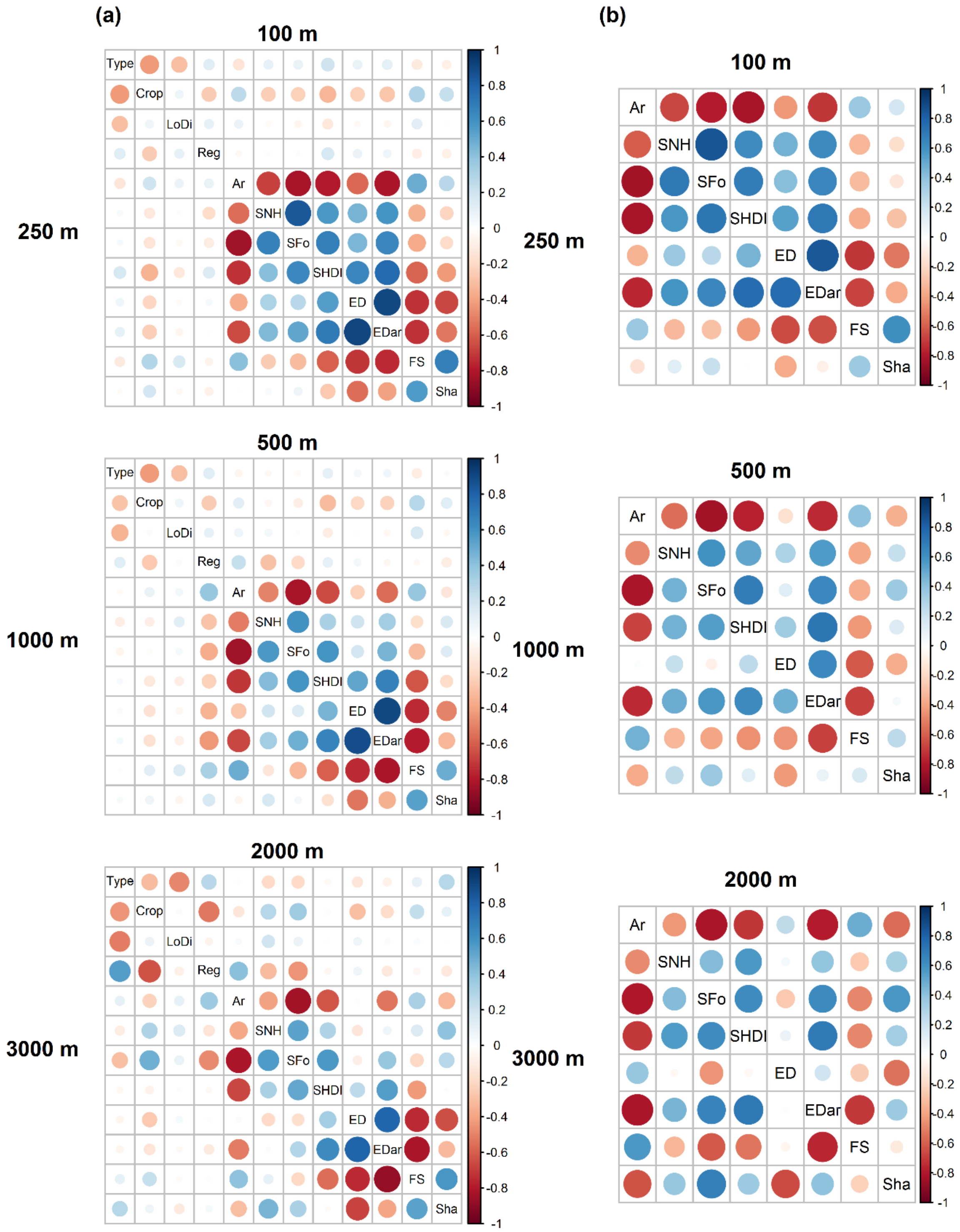

Figure S2. Spearman correlations between environmental variables shown (a) across studies, (b) as the mean of within-study correlations (site-level covariates not shown). Site-level covariates are site type (Type = annual crop field, perennial/orchard, managed grassland or margin), crop species (Crop), local diversity (LoDi = low, intermediate or high, representing the local plant diversity of sampled sites), and geographic region (Reg = central, western, northern, eastern or southern Europe).

Several related variables can be used to characterize the composition and configuration of landscapes. Here, we represent the variables used in main analyses (in bold below) and further related variables for additional reference. Variables relating to landscape composition are % arable land (**Ar**), % seminatural habitat (**SNH**), % seminatural habitat and forest combined (SFo), and Shannon's index of habitat diversity (SHDI) calculated based on five land use classes. Variables relating to landscape configuration are edge density (**ED**), edge density per ha of arable land (EDar), mean field size (FS), and the mean Shape index (Sha; a perimeter-area ratio accounting for variation in patch size, McGarigal *et al.* 2002).

Panels show correlations calculated at six increasing spatial scales around sites (100-3000m radii). Dots above diagonals correspond to 100, 500 and 2000 m radii, respectively; dots below diagonals correspond to 250, 1000 and 3000 m radii, respectively. All studies are included in radii up to 500 m, and further radii include subsets of all studies according to maximum radius definition (Table S1). The radius of dots is proportional to the correlation they represent.

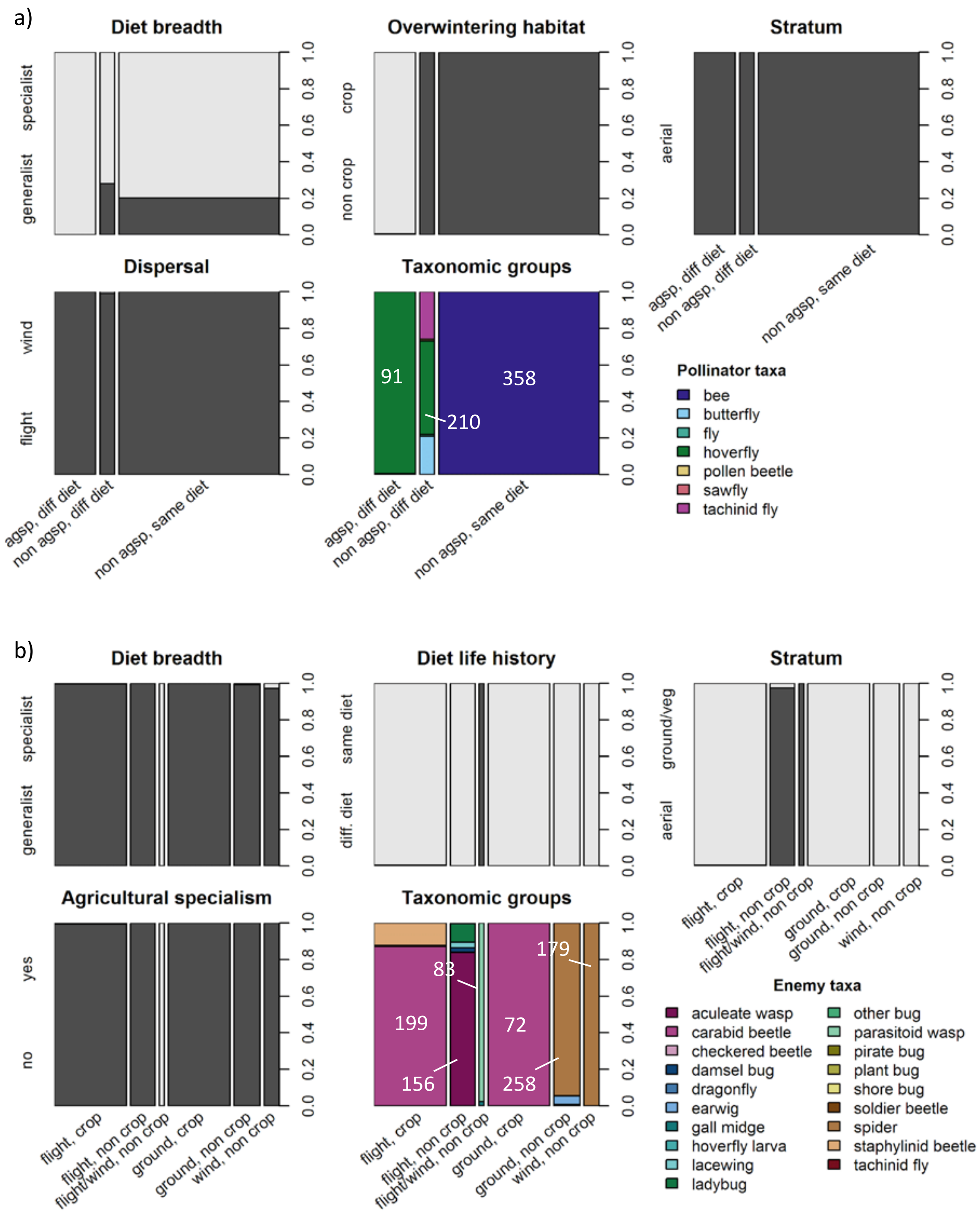

Figure S3. Abundance distribution of a) pollinator, b) natural enemy trait syndromes between functional trait levels and taxonomic groups. Trait syndromes on the x-axes are defined by the levels of clustering traits (Pollinators: 'diet life history' and 'agricultural specialism'; Enemies: 'dispersal' and 'overwintering habitat'; see Appendix S1 for trait description). Bars show the proportional abundance of organisms at each level of the trait (or in each taxonomic group), with dark grey indicating the lowest level of the trait (e.g. generalists for Diet breadth). Bar width is proportional to the abundance of organisms in each cluster. Numbers in white indicate the number of species or morphospecies per cluster. ‘Agsp’: agricultural specialists, defined as species associated with crop hosts or pest prey at any stage of their life cycle; ‘diff. diet’: organisms with a different diet between larval and adult stage; ‘ground/veg’: organisms occupying the ground or vegetation stratum.

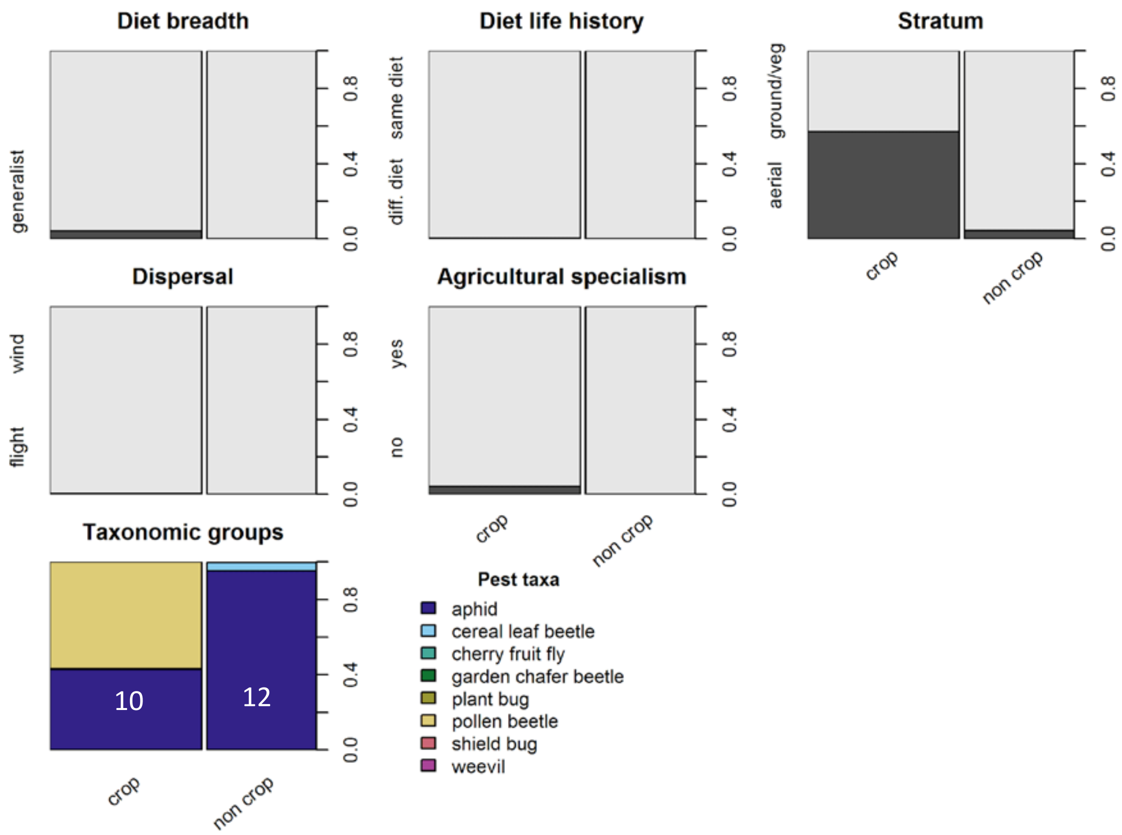

Figure S4. Abundance distribution of pest trait syndromes between functional trait levels and taxonomic groups. Trait syndromes on the x-axes are defined by the levels of the pest clustering trait ‘overwintering habitat’. Bars show the proportional abundance of organisms at each level of the trait (or in each taxonomic group), with dark grey indicating the lowest level of the trait (e.g. generalists). Bar width is proportional to the abundance of organisms in each cluster. Numbers in white indicate the number of species or morphospecies per cluster. ‘Diff. diet’: organisms with a different diet between larval and adult stage, ‘ground/veg’: organisms occupying the ground or vegetation stratum.

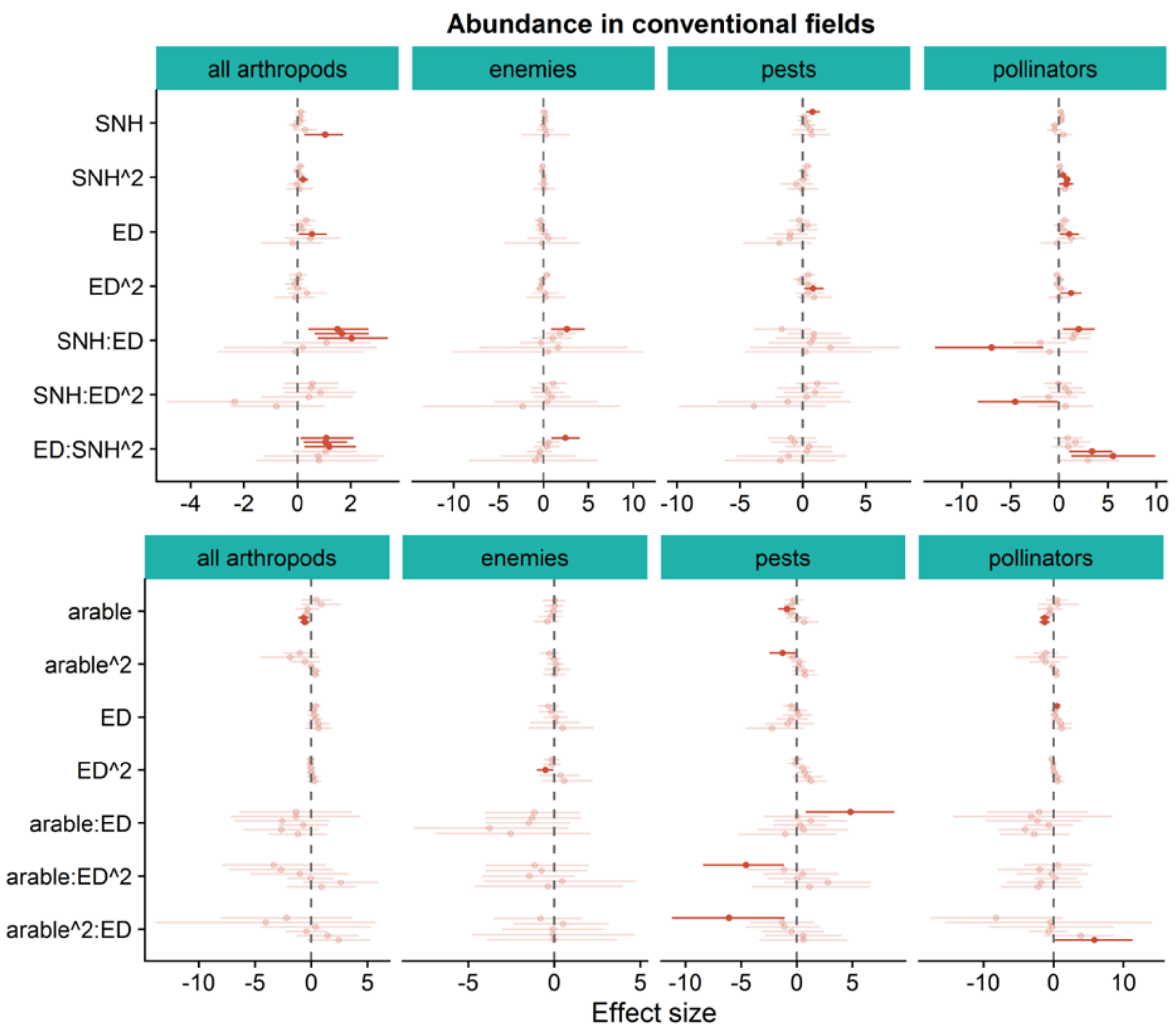

Figure S5. Results of models explaining the abundance of all arthropods and subsets of enemies, pollinators and pests as a function of landscape composition (% SNH, top panel; % arable land, bottom panel) and configuration variables (ED, edge density of crop/crop and crop/non-crop boundaries) in conventional fields. Effect sizes are estimates and bootstrapped 95% CI of full model terms, calculated at six successive spatial scales (0.1, 0.25, 0.5, 1, 2 and 3 km radii around sites) shown from top to bottom for each term. Radii at which CI do not overlap with zero are highlighted. Separate models were run with either % SNH or % arable as composition variable. Intercept estimates are not shown. Only effects for which CI do not overlap with zero at more than one radius are considered for interpretation. To account for variance inflation, estimates for enemies at 0.1 km radius are not shown (models with % arable land; see Appendix S1).

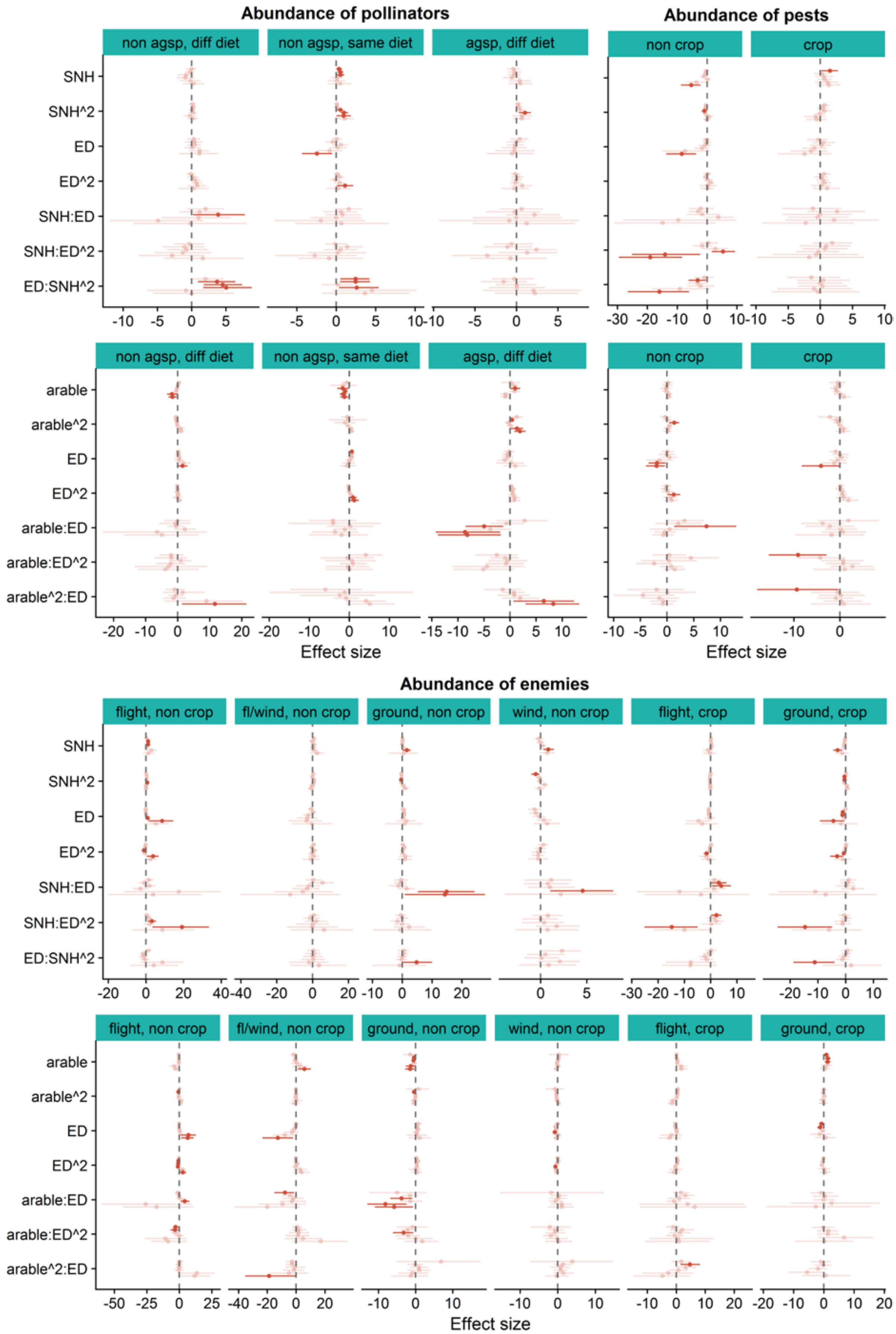
Abundance of pollinators
non agsp, diff diet
non agsp, same diet
agsp, diff diet
Abundance of pests
non crop
crop
SNH
SNH^2
ED
ED^2
SNH:ED
SNH:ED^2
ED:SNH^2
arable
arable^2
arable:ED
arable:ED^2
arable^2:ED
Effect size
Abundance of enemies
flight, non crop
fl/wind, non crop
ground, non crop
wind, non crop
flight, crop
ground, crop

Figure S6. Results of models explaining the abundance of functional trait syndromes of enemies, pollinators and pests as a function of landscape composition (% SNH, top panels; % arable land, bottom panels) and configuration variables (ED: edge density of crop/crop and crop/non-crop boundaries) in conventional fields. Trait syndromes were determined for each functional group by cluster regression of categorical traits. Effect sizes are estimates and bootstrapped 95% CI of full model terms, calculated at six successive spatial scales (0.1, 0.25, 0.5, 1, 2 and 3 km radii around sites) shown from top to bottom for each term. Radii at which CI do not overlap with zero are highlighted. Separate models were run with either % SNH or % arable as composition variable. Intercept estimates are not shown. Only effects for which CI do not overlap with zero at more than one radius are considered for interpretation. To account for variance inflation, estimates for 'gd, crop' enemies at 0.1 km radius (models with % arable land) and for 'wind, non crop' enemies at 3 km radius (models with % SNH) are not shown (see Appendix S1).

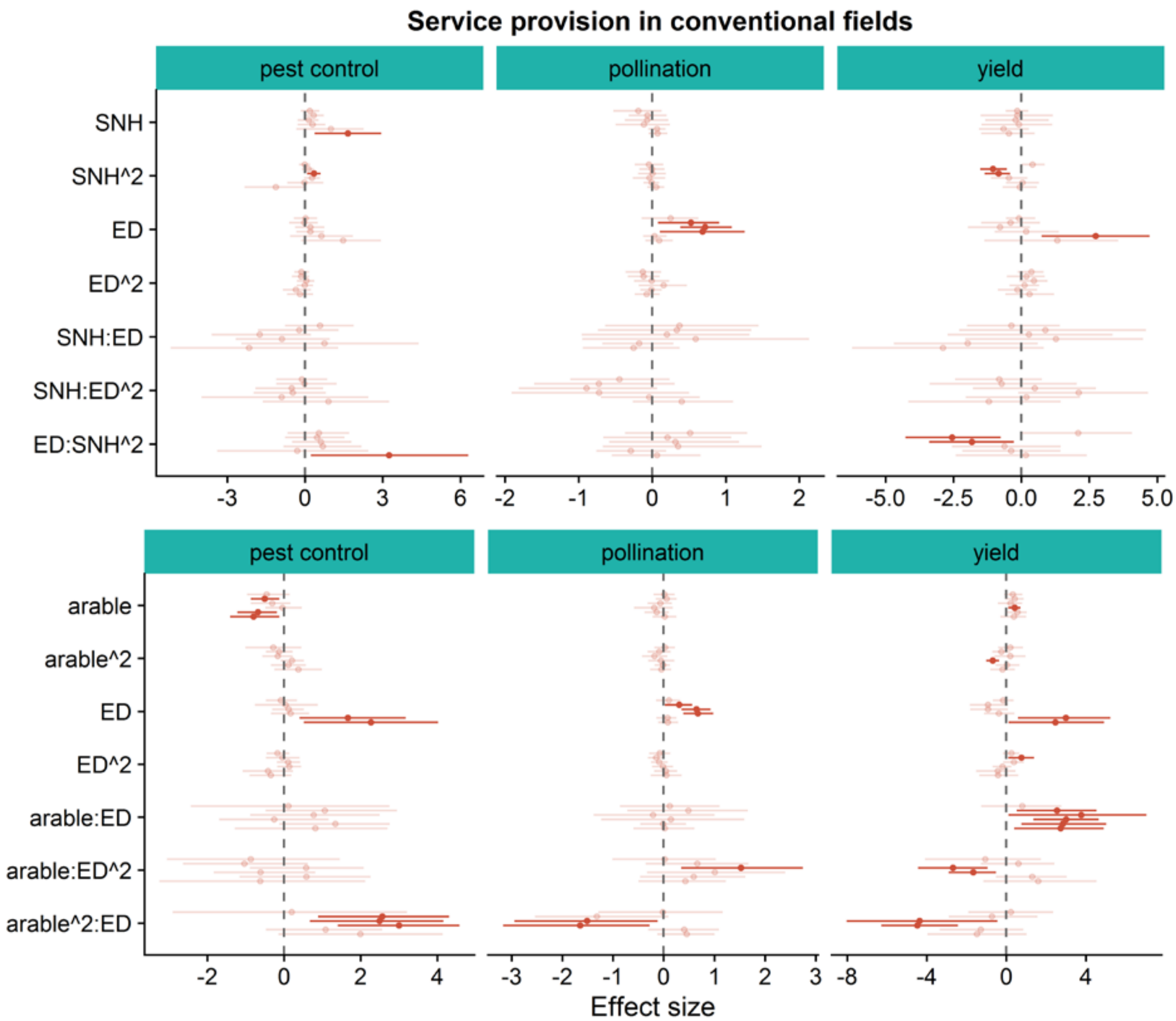

Figure S7. Results of models explaining the provision of pest control, pollination and yields as a function of landscape composition (% SNH, top panel; % arable land, bottom panel) and configuration variables (ED: edge density of crop/crop and crop/non-crop boundaries). Effect sizes are estimates and bootstrapped 95% CI of full model terms. Effects were calculated at six spatial scales (0.1, 0.25, 0.5, 1, 2 and 3 km radii around sites) shown from top to bottom for each model term. Scales at which CI do not overlap with zero are highlighted. Separate models were run with either % SNH or % arable as composition variable. Intercept estimates are not shown. Only effects for which CI do not overlap with zero at more than one radius are considered for interpretation in the main text.