This document provides electronic supplementary material for the article titled:

**Interactions of local habitat type, landscape composition and flower availability moderate wild bee communities**

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**Testing for a bias caused by the position of the plots within the respective radii**

We statistically tested, if the position of the plots within the radius had an effect on our model estimates. To do so, we calculated the distance between the centroid of the 500m radius and the centroids of the sample plots within each landscape and added these distances as an interaction (“landscape variables” \* ”habitat type” \* “distance to centroid”) to our models. All interactions (two-way [landscape variables\*distance] and three-way [landscape variables\*type\*distance]) were non-significant (all p-values ≥0.14) and had very low estimates (lower than 0.002). Hence, we found no evidence that the results of our regression analyses are biased by the position of the plots within the radii.

**Methodology of mid-point calculation**

Flower cover was recorded in 4 categories: <1%, 1-10%, 10-40% and >40%. For the two middle categories, we calculated mid-points by adding the upper and the lower limit (e.g. 1+10=11) and then dividing this number by two. The lowest category (<1%) was set to 0.5 (as 0+1=0.5). For the highest category (>40%) we halved the previous interval (30/2=15) and added this to the Value (40+30/2=55). Accordingly, the final factors that were subsequently averaged for our models were 0.5, 5.5, 25 and 55.

**Figures**



Fig. S1 Exemplary satellite pictures of 3 research areas. The black circle marks the 500m radius about the centroid. Flower plantings in orange, residual habitats in blue and near-natural grassland in green.

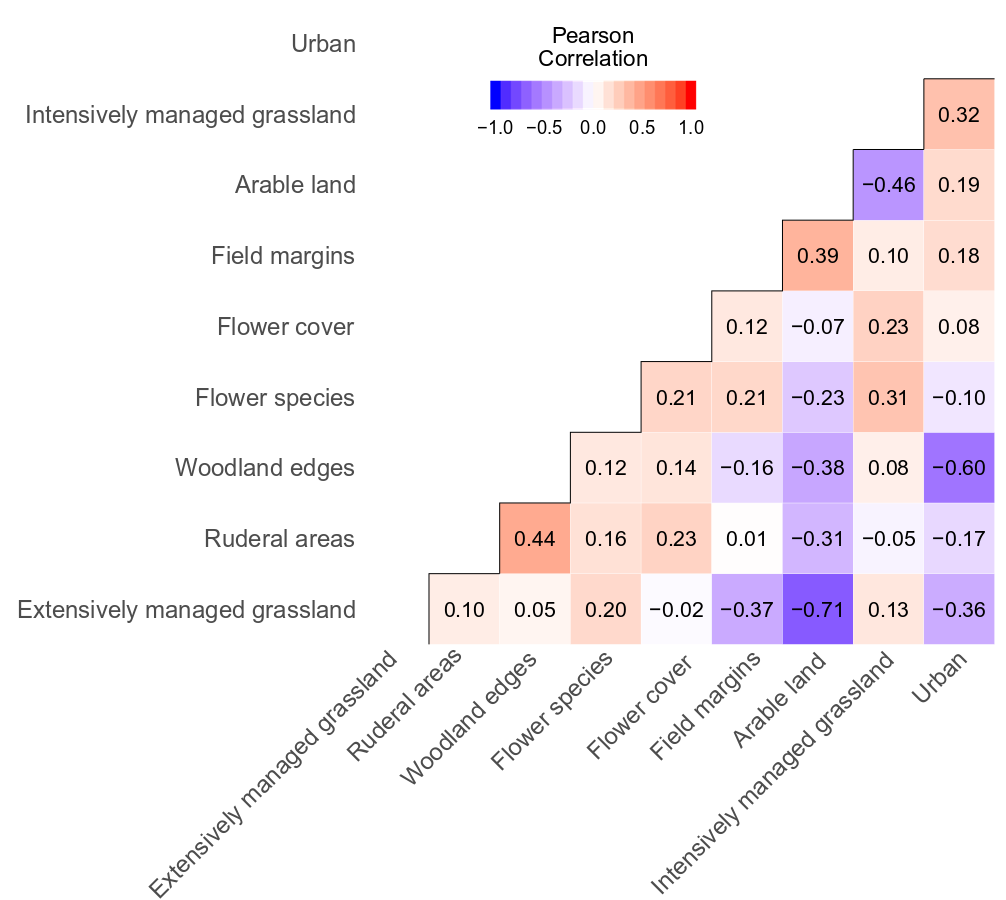


Fig. S2 Correlation between predictor variables. Red fields indicate a positive, purple fields a negative Pearson Correlation (P<0.05).

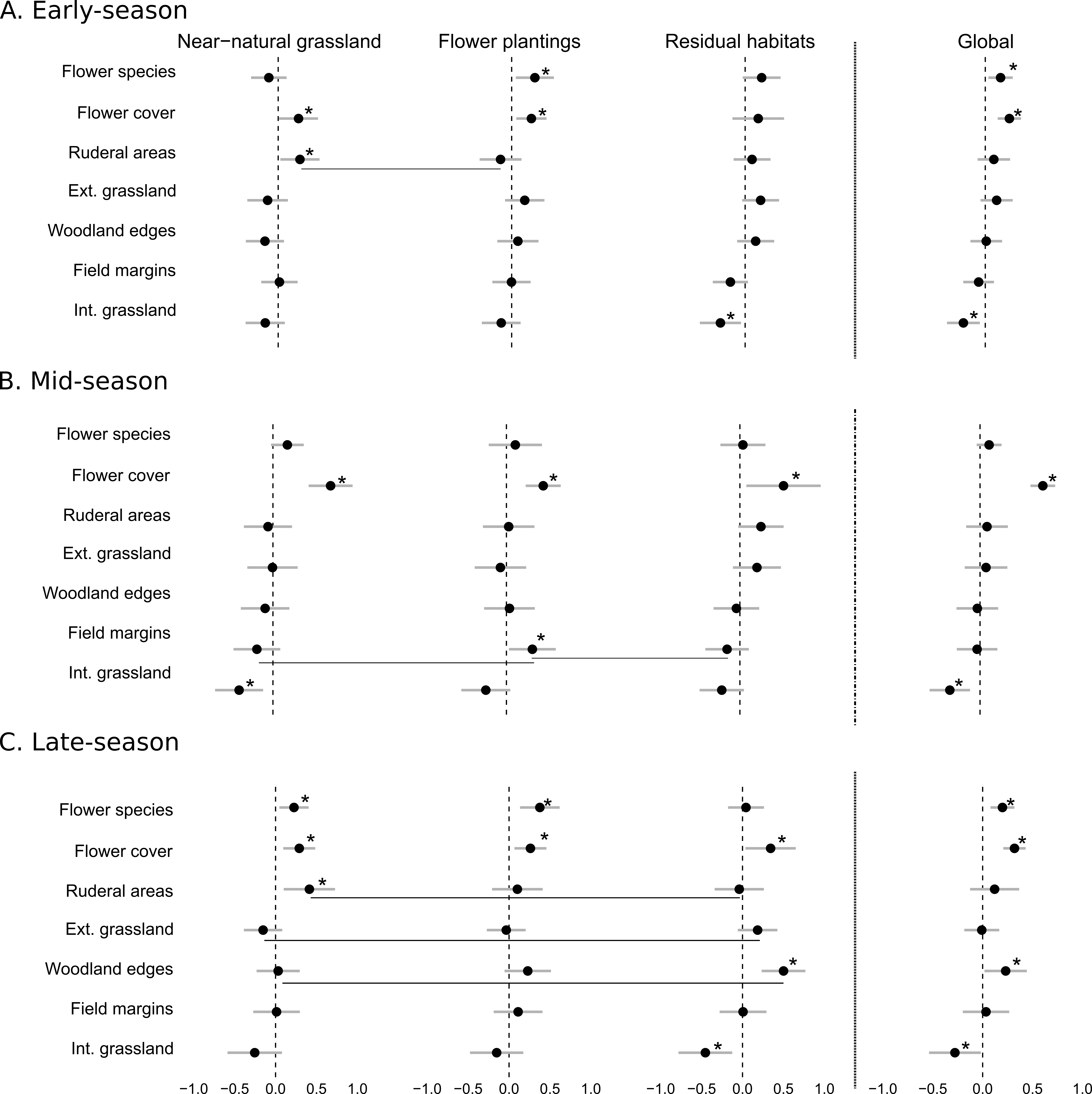


Fig S3. Effect of local and landscape parameters on bee abundance. Estimated slopes are predicted from the GLS regression models with a spatial dependency structure. Dots and bars show standardized effect sizes with 95% confidence intervals of the two local (flower species and cover) and five landscape parameters on wild bee abundance during the early (A), mid (B) and late (C) seasons. Global models show effect sizes for a model combining data of all three habitat types, without consideration of habitat type in the modelling structure. Effects where confidence intervals do not overlap zero are marked with an asterisk to indicate significance. Bars beneath a pair of effects indicate significantly different (p < 0.05) effect sizes between two habitat types in the models that include habitat as an interaction term. All models with regard to single habitat types have 150 degrees of freedoms; all global models have 172 degrees of freedoms.

**Tables**

Table S1 Plants registered during vegetation surveys on flower plantings. Columns represent individual research areas (indicated by the ID of each research area). Numbers indicate on how many of the three sampled plots the plant was found.

|  | bb\_go | bb\_te | bw\_dh | bw\_et | bw\_fs | | bw\_hh | bw\_ht | bw\_kg | bw\_og | bw\_rb | by\_di | by\_la | he\_gd | he\_ro | mv\_ge | mv\_wk | nw\_eb | nw\_rb | rp\_aw | rp\_rb |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Achillea millefolium* | 3 | 3 | - | 2 | | 1 | 3 | 1 | 1 | 3 | - | 3 | 3 | - | 2 | 3 | 3 | 3 | 3 | 3 | 2 |
| *Adonis aestivalis* | - | - | - | 1 | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Aethusa cynapium* | - | - | 2 | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Anchusa arvensis* | - | 2 | - | - | - | | - | - | - | - | - | - | - | 1 | - | 2 | 1 | - | - | - | - |
| *Anchusa officinalis* | 3 | - | - | - | - | | - | - | - | - | - | - | - | - | - | 3 | - | - | - | - | - |
| *Anethum graveolens* | 2 | 1 | 3 | - | 1 | | - | - | 3 | 1 | - | - | - | 2 | - | 3 | 2 | - | - | - | - |
| *Anthemis arvensis* | - | - | - | 3 | 2 | | 3 | 1 | 1 | - | - | - | - | - | 2 | - | - | - | - | - | - |
| *Anthemis tinctoria* | 3 | 3 | 3 | - | 3 | | 3 | 3 | 3 | 2 | 3 | 3 | 3 | - | 3 | 3 | - | 3 | 3 | 3 | 3 |
| *Anthriscus sylvestris* | 1 | - | - | - | - | | - | - | - | - | - | - | 1 | - | - | - | 1 | - | - | - | - |
| *Arabidopsis* | - | - | - | - | - | | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Arabidopsis thaliana* | 3 | 1 | - | - | - | | - | - | - | - | - | - | - | - | - | 2 | - | - | 3 | - | - |
| *Arenaria serpyllifolia* | - | - | - | - | - | | - | - | - | - | - | - | - | - | 2 | - | - | - | - | - | - |
| *Arnoseris minima* | - | - | - | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - |
| *Barbarea sp.* | - | - | - | - | - | | - | - | - | - | - | 1 | - | - | - | - | - | 1 | - | - | - |
| *Bellis perennis* | - | - | - | - | - | | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - |
| *Berteroa incana* | 3 | 3 | - | - | - | | - | - | - | - | - | - | - | 2 | 3 | 3 | 3 | - | - | - | - |
| *Borago officinalis* | - | 2 | 3 | 3 | 3 | | 3 | 2 | 3 | - | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 1 | 3 | - | 3 |
| *Brassica sp.* | - | - | - | - | - | | - | - | - | - | - | 3 | - | - | - | - | - | - | - | - | - |
| *Brassica napus* | - | - | - | - | - | | - | - | - | - | 2 | - | 3 | - | - | - | - | - | - | - | - |
| *Brassica nigra* | - | - | - | 3 | 2 | | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 1 | - | - | - | - | - | - | - |
| *Brassica oleracea* | 1 | 1 | - | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Calendula officinalis* | - | - | - | - | - | | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| *Calystegia sepium* | - | - | 3 | - | - | | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Camelina sativa* | 2 | 2 | - | 2 | 2 | | 3 | 3 | 2 | - | 3 | 2 | 3 | 2 | 1 | 2 | 3 | 3 | - | 3 | 3 |
| *Campanula rapunculus* | - | - | - | - | - | | - | - | - | - | 1 | - | - | - | - | - | - | - | - | 1 | - |
| *Capsella bursa-pastoris* | 1 | 2 | - | - | 1 | | 2 | 2 | 1 | 1 | 2 | 3 | 1 | 1 | 3 | - | - | - | 1 | 3 | 3 |
| *Carduus sp.* | - | - | - | - | - | | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - |
| *Carduus acanthoides* | - | - | - | 2 | - | | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | 1 |
| *Carduus nutans* | 1 | - | 1 | 1 | 2 | | - | 3 | - | - | 3 | - | - | - | - | 3 | - | 3 | 3 | - | - |
| *Centaurea cyanus* | 3 | 3 | 3 | 3 | 3 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| *Centaurea jacea* | - | 2 | 3 | 2 | - | | 2 | - | 2 | 3 | 1 | 3 | - | - | - | 3 | - | 2 | 3 | 2 | 1 |
| *Centaurea scabiosa* | - | 2 | 2 | 3 | - | | - | - | - | 1 | - | - | - | - | - | 1 | - | - | - | - | - |
| *Centaurea solstitialis* | - | - | - | 1 | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Centaurea stoebe* | 3 | 3 | - | - | - | | - | - | - | - | - | - | - | - | - | 3 | 2 | - | - | - | - |
| *Cerastium glomeratum* | - | - | - | 1 | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Cerastium semidecandrum* | - | - | - | - | - | | - | - | - | - | - | - | - | 1 | 2 | - | - | - | - | - | - |
| *Chenopodium album* | - | - | - | - | - | | - | - | - | - | - | - | - | - | - | - | 3 | - | - | - | - |
| *Chondrilla juncea* | 2 | - | - | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Cichorium intybus* | 3 | 3 | 1 | 1 | - | | - | - | - | 3 | - | - | 1 | 1 | - | 3 | - | 3 | 1 | - | - |
| *Cirsium arvense* | 1 | - | 3 | 3 | 3 | | - | 3 | - | 3 | 2 | - | - | - | 1 | 1 | - | 2 | 3 | - | - |
| *Cirsium vulgare* | - | - | 2 | 3 | 2 | | - | - | - | - | - | - | 1 | - | - | - | - | - | 2 | - | 1 |
| *Clinopodium vulgare* | - | - | - | - | - | | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| *Consolida regalis* | 2 | 3 | - | 3 | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Convolvulus arvensis* | 3 | - | - | 2 | - | | - | - | - | 2 | - | - | - | - | - | - | 1 | - | - | - | 1 |
| *Coriandrum sativum* | - | - | 3 | 3 | 3 | | 3 | 3 | 3 | 1 | 2 | - | 2 | - | 2 | 1 | 2 | 1 | 2 | - | 3 |
| *Crataegus monogyna* | - | - | - | - | - | | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - |
| *Crepis sp.* | - | - | - | - | - | | - | - | 3 | - | - | - | - | - | - | 2 | 1 | - | - | - | - |
| *Crepis biennis* | - | - | - | - | - | | - | - | - | 3 | - | - | 3 | - | - | - | - | - | - | - | - |
| *Crepis capillaris* | - | 1 | - | - | 1 | | - | - | 2 | - | - | - | - | - | - | 1 | - | - | - | 3 | - |
| *Crepis tectorum* | 1 | 2 | - | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Daucus carota* | 3 | 2 | 3 | 3 | 3 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 1 | 2 | 3 | 3 | 3 |
| *Delphinium elatum* | - | - | - | 3 | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Descurainia sophia* | 2 | 2 | - | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Dipsacus fullonum* | - | - | - | - | 1 | | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - |
| *Draba verna* | - | - | - | - | - | | - | - | - | - | - | - | - | - | 1 | 3 | - | - | - | - | - |
| *Echium vulgare* | 1 | - | 2 | - | 1 | | - | - | - | - | - | 1 | - | - | - | - | - | - | - | 2 | - |
| *Erigeron annuus* | - | - | - | - | - | | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - |
| *Erigeron canadensis* | - | - | - | - | - | | - | - | - | - | - | - | - | 1 | 1 | 3 | 1 | - | - | - | - |
| *Erodium cicutarium* | 2 | 3 | - | - | - | | - | - | - | - | - | - | - | - | - | - | 3 | - | - | - | - |
| *Erysimum cheiranthoides* | 3 | 2 | - | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Euphorbia sp.* | - | - | - | - | - | | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Euphorbia cyparissias* | - | - | - | 2 | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Euphorbia peplus* | - | - | 2 | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Fagopyrum esculentum* | 1 | - | - | - | - | | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - |
| *Falcaria vulgaris* | - | 2 | - | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Fallopia convolvulus* | - | - | - | - | - | | - | - | - | - | - | - | - | - | - | - | 3 | - | - | - | - |
| *Filago arvensis* | - | - | - | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - |
| *Foeniculum vulgare* | - | - | - | - | - | | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| *Fumana procumbens* | - | - | - | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| *Fumaria officinalis* | - | - | - | - | 1 | | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Geranium molle* | - | - | - | - | - | | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Glechoma hederacea* | - | - | - | - | - | | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - |
| *Helianthus annuus* | - | - | - | - | 1 | | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - |
| *Helichrysum arenarium* | - | - | - | - | - | | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - |
| *Hieracium umbellatum* | - | - | - | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | 3 | - |
| *Hypericum perforatum* | 1 | - | - | - | - | | - | - | - | - | - | - | - | - | - | - | 2 | - | - | - | - |
| *Hypochaeris radicata* | - | 1 | - | - | - | | - | - | 3 | - | - | - | - | 2 | - | 3 | 2 | - | - | 1 | 1 |
| *Jasione montana* | - | - | - | - | - | | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - |
| *Knautia arvensis* | 1 | - | - | 3 | - | | - | - | - | 2 | - | 2 | 3 | - | - | - | - | - | - | - | - |
| *Lactuca serriola* | - | - | 1 | - | 1 | | - | - | - | - | - | - | - | - | - | - | - | 2 | - | - | - |
| *Lamium album* | 1 | - | - | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Lamium amplexicaule* | - | - | - | - | - | | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - |
| *Lamium maculatum* | - | - | - | - | - | | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - |
| *Lamium purpureum* | - | 1 | - | - | 2 | | 3 | - | 2 | 1 | - | 3 | - | 1 | 3 | - | - | - | - | 2 | 3 |
| *Lapsana communis* | - | - | - | - | - | | - | 2 | - | - | 2 | - | - | - | - | - | - | - | - | - | - |
| *Lathyrus tuberosus* | - | - | - | - | 1 | | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Legousia speculum-veneris* | - | - | - | - | - | | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Legousiaulum-veneris* | - | - | - | 2 | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Leonurus cardiaca* | - | - | 1 | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Lepidium sativum* | - | - | - | - | 1 | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Leucanthemum* | - | 1 | - | - | - | | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - |
| *Leucanthemum ircutianum* | - | - | - | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - |
| *Leucanthemum vulgare* | - | - | 2 | - | 2 | | - | - | 1 | 3 | - | 2 | - | - | 2 | 1 | - | - | - | - | - |
| *Linaria vulgaris* | - | - | 2 | - | - | | - | - | - | - | - | - | - | - | - | - | 1 | - | - | 1 | 1 |
| *Linum usitatissimum* | - | - | - | - | - | | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| *Lotus corniculatus* | - | - | - | - | - | | - | - | 1 | 3 | - | - | 2 | - | - | 3 | 2 | - | 2 | - | - |
| *Lupinus polyphyllus* | - | - | - | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 | - |
| *Lycopus europaeus* | - | - | 1 | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Lythrum salicaria* | - | - | 3 | - | - | | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - |
| *Malva sp.* | 2 | 2 | - | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Malva alcea* | - | 1 | - | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Malva moschata* | - | - | 2 | - | 1 | | 1 | - | 2 | - | - | - | - | 2 | - | - | - | - | - | 1 | - |
| *Malva neglecta* | - | - | - | - | - | | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - |
| *Malva sylvestris* | - | - | 3 | - | - | | - | - | 1 | - | 1 | - | - | 3 | 1 | - | - | 2 | - | - | - |
| *Matricaria discoidea* | - | - | - | - | - | | 1 | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - |
| *Matricaria recutita* | 2 | 2 | - | - | - | | - | - | - | - | - | 3 | 3 | - | - | 3 | - | - | - | 3 | 3 |
| *Medicago falcata* | - | - | - | - | - | | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Medicago lupulina* | - | - | - | - | - | | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - |
| *Medicago sativa* | - | - | - | 2 | - | | 3 | 2 | 2 | 3 | 3 | - | 2 | 3 | - | 1 | 1 | 3 | - | - | 1 |
| *Medicago varia* | - | 1 | - | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Melilotus albus* | - | - | - | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - |
| *Melilotus officinalis* | - | - | 1 | - | - | | - | - | - | 2 | - | - | - | - | - | - | - | - | 2 | - | - |
| *Mentha arvensis* | - | - | 2 | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Myosotis sp.* | 3 | - | - | - | - | | - | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| *Myosotis arvensis* | - | - | - | 1 | - | | - | 1 | - | - | 2 | - | 1 | - | - | 2 | - | - | 1 | - | - |
| *Myosotis stricta* | - | - | - | - | - | | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - |
| *Origanum vulgare* | - | - | - | - | 1 | | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - |
| *Papaver argemone* | 2 | 2 | - | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Papaver rhoeas* | 3 | 3 | 2 | 3 | 3 | | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | - | 3 | 3 | 1 | 3 |
| *Pastinaca sativa* | - | - | - | - | 1 | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Persicaria lapathifolia* | - | - | - | - | 1 | | - | 1 | - | - | 1 | - | 1 | - | - | - | - | - | - | - | - |
| *Phacelia tanacetifolia* | - | - | - | 1 | 1 | | 2 | 2 | 2 | - | - | - | 1 | - | - | 1 | - | - | 2 | - | 3 |
| *Picris hieracioides* | - | - | 3 | - | 2 | | 2 | - | 1 | - | - | - | - | - | - | 2 | - | 3 | 2 | 2 | - |
| *Plantago lanceolata* | - | - | - | - | - | | - | - | - | - | - | - | 1 | - | - | - | 1 | - | - | - | - |
| *Polygonum aviculare* | - | - | - | - | - | | - | - | - | - | - | - | - | - | - | 2 | - | - | - | - | - |
| *Polygonum persicaria* | - | - | - | - | - | | - | - | - | - | - | - | - | - | - | - | 2 | - | - | - | - |
| *Potentilla anserina* | - | - | - | - | - | | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Prunus spinosa* | - | - | - | - | - | | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - |
| *Pulicaria dysenterica* | - | - | 1 | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Ranunculus acris* | - | - | - | - | - | | - | - | 1 | 3 | - | - | 3 | - | - | - | - | - | - | 2 | - |
| *Ranunculus repens* | - | - | - | - | - | | - | - | - | - | - | 3 | 1 | - | - | - | - | - | 1 | - | - |
| *Raphanus sp.* | - | - | - | - | - | | 3 | - | 3 | - | - | 3 | - | - | - | - | - | - | - | - | 3 |
| *Raphanus raphanistrum* | - | - | - | - | - | | - | - | - | - | - | - | - | - | - | - | - | 1 | 1 | - | - |
| *Raphanus sativus* | 3 | 2 | 1 | 3 | 3 | | - | 3 | - | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | - | 3 | - |
| *Reseda lutea* | - | - | 1 | - | - | | - | - | - | - | 2 | - | - | 1 | - | - | - | 3 | - | 1 | 2 |
| *Reseda luteola* | - | - | - | 1 | - | | 2 | - | - | - | 1 | - | - | - | - | 3 | - | - | - | - | - |
| *Rorippa sylvestris* | - | - | 2 | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Salvia pratensis* | - | - | - | - | - | | - | - | - | 2 | - | - | - | - | - | - | - | - | - | - | - |
| *Scorzoneroides autumnalis* | - | - | - | - | - | | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - |
| *Securigera varia* | - | - | - | - | 1 | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Senecio jacobaea* | - | - | - | - | 2 | | - | - | - | - | - | - | - | - | - | - | 1 | - | - | 1 | - |
| *Senecio vernalis* | - | 2 | - | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Senecio vulgaris* | - | - | - | - | - | | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - |
| *Sherardia arvensis* | - | - | - | - | - | | - | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Sinapis sp.* | - | - | - | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | 3 | 3 |
| *Sinapis alba* | - | - | - | 2 | 2 | | 3 | - | 3 | - | - | - | 1 | - | 2 | - | 3 | 2 | 3 | - | - |
| *Sinapis arvensis* | - | 1 | 2 | 3 | 3 | | 3 | - | 3 | 3 | 3 | - | - | 2 | - | - | - | - | - | - | - |
| *Sisymbrium altissimum* | - | - | - | - | - | | - | - | - | - | - | - | - | - | 2 | - | - | - | - | - | - |
| *Solidago canadensis* | - | - | 1 | - | 2 | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Sonchus sp.* | - | - | - | - | - | | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| *Sonchus arvensis* | - | - | 1 | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Sonchus oleraceus* | - | - | - | - | - | | - | - | - | - | 1 | - | - | 1 | - | - | - | - | - | - | - |
| *Spergula arvensis* | - | - | - | - | - | | - | - | - | - | - | - | - | - | - | - | 2 | - | - | - | - |
| *Spergularia rubra* | - | - | - | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - |
| *Stachys palustris* | - | - | 3 | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Stellaria media* | - | - | - | - | - | | 1 | - | - | 2 | - | - | 1 | 2 | - | 1 | - | 3 | - | 3 | - |
| *Symphytum officinale* | - | - | 2 | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Tanacetum vulgare* | 1 | 1 | 1 | - | 2 | | - | - | - | 1 | - | 2 | - | - | - | 3 | - | - | - | 3 | 1 |
| *Taraxacum* | - | - | 2 | 3 | 1 | | 1 | - | 1 | 3 | - | 1 | 3 | 2 | - | 2 | - | - | - | 3 | - |
| *Thlaspi arvense* | - | 1 | - | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Torilis japonica* | - | - | - | - | 2 | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Tragopogon pratensis* | - | - | - | - | - | | - | - | - | 2 | - | - | - | - | - | - | - | - | 1 | - | - |
| *Trifolium alexandrinum* | - | - | - | - | - | | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| *Trifolium arvense* | - | - | - | - | - | | 2 | - | 3 | - | - | - | - | - | 1 | - | - | - | - | - | 1 |
| *Trifolium incarnatum* | - | - | - | 3 | 2 | | 3 | 3 | 3 | - | 2 | 3 | 2 | 1 | 1 | 3 | 3 | 3 | 2 | - | 3 |
| *Trifolium pratense* | - | 1 | - | - | 2 | | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | - | 1 | - | - | - | 2 | 2 |
| *Trifolium repens* | - | - | - | - | - | | - | - | - | 3 | - | - | 1 | - | - | 2 | - | - | - | 2 | - |
| *Tripleurospermum* | - | - | - | - | - | | - | - | - | - | - | - | - | - | - | 3 | - | - | - | - | - |
| *Tripleurospermum* | - | - | - | - | - | | - | - | - | - | - | - | - | - | - | - | - | 3 | 3 | - | - |
| *Tripleurospermum maritimum* | - | - | - | 3 | - | | - | 2 | - | - | 1 | - | - | - | - | - | - | - | - | - | - |
| *Tripleurospermum perforatum* | 3 | 3 | 3 | 3 | 2 | | - | 3 | - | 3 | 3 | - | - | - | 1 | 1 | - | - | - | 3 | 3 |
| *Valeriana officinalis* | - | - | - | 1 | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Valerianella locusta* | - | - | - | 1 | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Verbascum densiflorum* | - | - | 2 | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Veronica sp.* | - | - | - | - | - | | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Veronica arvensis* | - | - | - | - | - | | - | - | - | 3 | - | - | - | - | - | - | - | - | - | - | - |
| *Veronica chamaedrys* | - | - | - | - | - | | - | 1 | - | - | - | 3 | 1 | 1 | - | - | - | - | - | 1 | - |
| *Veronica hederifolia* | - | - | - | - | - | | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - |
| *Veronica persica* | - | - | 1 | 3 | 3 | | 3 | - | 3 | 3 | 2 | - | - | 1 | 2 | - | - | - | 3 | - | 3 |
| *Vicia sp.* | 1 | 3 | - | - | - | | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Vicia cracca* | - | - | 1 | 3 | 1 | | 3 | - | 3 | - | - | - | - | - | - | - | 1 | - | - | 2 | 3 |
| *Vicia sativa* | - | - | 1 | - | 1 | | - | 1 | 1 | - | - | - | 2 | 1 | - | - | - | - | - | - | - |
| *Vicia sepium* | - | - | - | 3 | - | | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Vicia villosa* | - | - | 2 | - | - | | - | - | - | 1 | - | - | - | - | - | - | 3 | 3 | 3 | - | - |
| *Viola sp.* | - | - | - | - | - | | - | - | - | - | - | 3 | - | - | - | - | - | - | - | - | - |
| *Viola arvensis* | 2 | - | - | 1 | - | | - | 2 | 2 | - | - | 1 | - | - | - | 2 | - | - | - | 2 | 2 |
| *Viola tricolor* | - | - | - | - | - | | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - |

Table S2. Minimum, maximum and mean cover of the five landscape variables in the 20 sampled landscapes. Units are in 10.000 square metres.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Minimum | Maximum | Mean |
| Ruderal areas | 0.000 | 2.414 | 1.055 |
| Ext. grassland | 4.493 | 39.717 | 15.678 |
| Woodland edges | 0.321 | 1.942 | 1.182 |
| Field margins | 0.022 | 0.137 | 0.070 |
| Int. grassland | 0.000 | 22.757 | 6.014 |

Table S3. Estimate slopes predicted from the GLS regression models with spatial dependency structure. Effects where confidence intervals do not overlap zero are in bold.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Near-natural grassland (df = 150) | | Flower plantings (df = 150) | | Residual habitats (df = 150) | | Global models (df = 172) | |
| **Early season** | estimate | SE | estimate | SE | estimate | SE | estimate | SE |
| Flower species | 0.068 | 0.271 | **0.437** | 0.284 | 0.222 | 0.275 | **0.373** | 0.080 |
| Flower cover | 0.229 | 0.301 | **0.264** | 0.234 | 0.344 | 0.380 | **0.174** | 0.077 |
| Ruderal areas | **0.527** | 0.304 | -0.101 | 0.316 | 0.187 | 0.298 | **0.248** | 0.116 |
| Ext. grassland | -0.052 | 0.312 | **0.361** | 0.299 | **0.358** | 0.298 | **0.240** | 0.116 |
| Woodland edges | -0.287 | 0.294 | **0.405** | 0.298 | 0.075 | 0.305 | 0.002 | 0.113 |
| Field margins | 0.120 | 0.286 | 0.201 | 0.286 | -0.263 | 0.287 | -0.020 | 0.110 |
| Int. grassland | -0.093 | 0.303 | **-0.412** | 0.303 | **-0.366** | 0.325 | **-0.327** | 0.116 |
|  |  |  |  |  |  |  |  |  |
| **Mid-season** |  |  |  |  |  |  |  |  |
| Flower species | **0.312** | 0.208 | 0.311 | 0.344 | -0.096 | 0.288 | **0.222** | 0.066 |
| Flower cover | **0.548** | 0.295 | **0.411** | 0.218 | **0.764** | 0.490 | **0.487** | 0.064 |
| Ruderal areas | 0.144 | 0.274 | 0.208 | 0.302 | **0.293** | 0.258 | **0.197** | 0.087 |
| Ext. grassland | 0.195 | 0.277 | 0.101 | 0.288 | **0.328** | 0.275 | **0.184** | 0.087 |
| Woodland edges | 0.023 | 0.277 | 0.007 | 0.292 | 0.000 | 0.256 | 0.042 | 0.087 |
| Field margins | -0.057 | 0.267 | **0.425** | 0.274 | -0.177 | 0.251 | 0.056 | 0.085 |
| Int. grassland | **-0.360** | 0.271 | -0.271 | 0.279 | -0.167 | 0.248 | **-0.282** | 0.084 |
|  |  |  |  |  |  |  |  |  |
| **Late season** |  |  |  |  |  |  |  |  |
| Flower species | **0.334** | 0.221 | **0.770** | 0.299 | 0.201 | 0.272 | **0.401** | 0.077 |
| Flower cover | **0.336** | 0.242 | 0.196 | 0.242 | **0.629** | 0.379 | **0.393** | 0.072 |
| Ruderal areas | **0.518** | 0.419 | 0.264 | 0.415 | -0.027 | 0.405 | 0.189 | 0.172 |
| Ext. grassland | -0.168 | 0.313 | -0.141 | 0.317 | 0.315 | 0.322 | -0.011 | 0.124 |
| Woodland edges | 0.114 | 0.352 | **0.502** | 0.374 | **0.666** | 0.355 | **0.388** | 0.147 |
| Field margins | 0.102 | 0.368 | 0.193 | 0.384 | 0.040 | 0.369 | 0.062 | 0.155 |
| Int. grassland | -0.251 | 0.444 | -0.117 | 0.435 | **-0.465** | 0.439 | -0.275 | 0.183 |

Table S4. Results of the post-hoc tests for a pairwise comparison of the estimate values given in supplementary table 1. Bold p-values indicate a significantly different (p < 0.05) response to an independent variable when compared between a pair of habitat types.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *Early-season* | *Habitat comparison* | *estimate* | *SE* | *t* | *p.value* |
| *Flower species* | Residual habitats x Near-natural grassland | 0.154 | 0.193 | 0.797 | 0.705 |
|  | Residual habitats x Flower plantings | -0.215 | 0.198 | -1.083 | 0.526 |
|  | Near-natural grassland x Flower plantings | -0.369 | 0.197 | -1.876 | 0.149 |
| *Flower cover* | Residual habitats x Near-natural grassland | 0.116 | 0.237 | 0.488 | 0.877 |
|  | Residual habitats x Flower plantings | 0.080 | 0.217 | 0.367 | 0.928 |
|  | Near-natural grassland x Flower plantings | -0.036 | 0.188 | -0.190 | 0.980 |
| *Ruderal areas* | Residual habitats x Near-natural grassland | -0.339 | 0.173 | -1.957 | 0.127 |
|  | Residual habitats x Flower plantings | 0.288 | 0.175 | 1.645 | 0.230 |
|  | Near-natural grassland x Flower plantings | 0.628 | 0.180 | 3.480 | **0.002** |
| *Ext. grassland* | Residual habitats x Near-natural grassland | 0.410 | 0.172 | 2.380 | **0.048** |
|  | Residual habitats x Flower plantings | -0.003 | 0.163 | -0.020 | 1.000 |
|  | Near-natural grassland x Flower plantings | -0.413 | 0.173 | -2.382 | **0.048** |
| *Woodland edges* | Residual habitats x Near-natural grassland | 0.362 | 0.174 | 2.079 | 0.098 |
|  | Residual habitats x Flower plantings | -0.329 | 0.170 | -1.937 | 0.132 |
|  | Near-natural grassland x Flower plantings | -0.692 | 0.173 | -4.003 | **<0.001** |
| *Field margins* | Residual habitats x Near-natural grassland | -0.384 | 0.161 | -2.375 | 0.049 |
|  | Residual habitats x Flower plantings | -0.464 | 0.160 | -2.909 | **0.012** |
|  | Near-natural grassland x Flower plantings | -0.081 | 0.161 | -0.503 | 0.870 |
| *Int. grassland* | Residual habitats x Near-natural grassland | -0.273 | 0.191 | -1.428 | 0.329 |
|  | Residual habitats x Flower plantings | 0.046 | 0.184 | 0.253 | 0.965 |
|  | Near-natural grassland x Flower plantings | 0.319 | 0.179 | 1.784 | 0.178 |
|  |  |  |  |  |  |
| ***Mid-season*** | *Habitat comparison* | *estimate* | *SE* | *t* | *p.value* |
| *Flower species* | Residual habitats x Near-natural grassland | -0.407 | 0.176 | -2.317 | 0.056 |
|  | Residual habitats x Flower plantings | -0.407 | 0.228 | -1.784 | 0.178 |
|  | Near-natural grassland x Flower plantings | 0.001 | 0.204 | 0.004 | 1.000 |
| *Flower cover* | Residual habitats x Near-natural grassland | 0.216 | 0.292 | 0.740 | 0.740 |
|  | Residual habitats x Flower plantings | 0.353 | 0.267 | 1.319 | 0.387 |
|  | Near-natural grassland x Flower plantings | 0.137 | 0.188 | 0.730 | 0.746 |
| *Ruderal areas* | Residual habitats x Near-natural grassland | 0.149 | 0.177 | 0.843 | 0.677 |
|  | Residual habitats x Flower plantings | 0.085 | 0.184 | 0.460 | 0.890 |
|  | Near-natural grassland x Flower plantings | -0.064 | 0.193 | -0.333 | 0.941 |
| *Ext. grassland* | Residual habitats x Near-natural grassland | 0.133 | 0.185 | 0.717 | 0.754 |
|  | Residual habitats x Flower plantings | 0.227 | 0.184 | 1.239 | 0.432 |
|  | Near-natural grassland x Flower plantings | 0.094 | 0.187 | 0.505 | 0.869 |
| *Woodland edges* | Residual habitats x Near-natural grassland | -0.023 | 0.176 | -0.130 | 0.991 |
|  | Residual habitats x Flower plantings | -0.007 | 0.176 | -0.040 | 0.999 |
|  | Near-natural grassland x Flower plantings | 0.016 | 0.193 | 0.082 | 0.996 |
| *Field margins* | Residual habitats x Near-natural grassland | -0.120 | 0.172 | -0.699 | 0.764 |
|  | Residual habitats x Flower plantings | -0.602 | 0.172 | -3.507 | **0.002** |
|  | Near-natural grassland x Flower plantings | -0.482 | 0.178 | -2.707 | **0.021** |
| *Int. grassland* | Residual habitats x Near-natural grassland | 0.194 | 0.174 | 1.109 | 0.510 |
|  | Residual habitats x Flower plantings | 0.105 | 0.167 | 0.628 | 0.805 |
|  | Near-natural grassland x Flower plantings | -0.089 | 0.183 | -0.485 | 0.879 |
|  |  |  |  |  |  |
| ***Late-season*** | *Habitat comparison* | *estimate* | *SE* | *t* | *p.value* |
| *Flower species* | Residual habitats x Near-natural grassland | -0.133 | 0.166 | -0.805 | 0.700 |
|  | Residual habitats x Flower plantings | -0.569 | 0.197 | -2.887 | **0.012** |
|  | Near-natural grassland x Flower plantings | -0.436 | 0.175 | -2.486 | **0.037** |
| *Flower cover* | Residual habitats x Near-natural grassland | 0.293 | 0.222 | 1.321 | 0.386 |
|  | Residual habitats x Flower plantings | 0.433 | 0.219 | 1.980 | 0.121 |
|  | Near-natural grassland x Flower plantings | 0.140 | 0.172 | 0.817 | 0.693 |
| *Ruderal areas* | Residual habitats x Near-natural grassland | -0.545 | 0.169 | -3.217 | **0.005** |
|  | Residual habitats x Flower plantings | -0.291 | 0.170 | -1.716 | 0.203 |
|  | Near-natural grassland x Flower plantings | 0.254 | 0.174 | 1.455 | 0.316 |
| *Ext. grassland* | Residual habitats x Near-natural grassland | 0.484 | 0.168 | 2.879 | **0.013** |
|  | Residual habitats x Flower plantings | 0.456 | 0.168 | 2.708 | **0.021** |
|  | Near-natural grassland x Flower plantings | -0.028 | 0.164 | -0.168 | 0.985 |
| *Woodland edges* | Residual habitats x Near-natural grassland | 0.552 | 0.164 | 3.358 | **0.003** |
|  | Residual habitats x Flower plantings | 0.164 | 0.174 | 0.942 | 0.615 |
|  | Near-natural grassland x Flower plantings | -0.388 | 0.171 | -2.271 | 0.063 |
| *Field margins* | Residual habitats x Near-natural grassland | -0.061 | 0.163 | -0.377 | 0.925 |
|  | Residual habitats x Flower plantings | -0.152 | 0.169 | -0.900 | 0.641 |
|  | Near-natural grassland x Flower plantings | -0.091 | 0.170 | -0.534 | 0.855 |
| *Int. grassland* | Residual habitats x Near-natural grassland | -0.213 | 0.169 | -1.261 | 0.420 |
|  | Residual habitats x Flower plantings | -0.348 | 0.165 | -2.108 | 0.092 |
|  | Near-natural grassland x Flower plantings | -0.135 | 0.165 | -0.815 | 0.694 |

|  |  |  |  |
| --- | --- | --- | --- |
| **Residual habitats x Near natural grassland** | average contribution | sd | cumulative contribution |
| *Bombus lapidarius* | 0.073 | 0.093 | 0.095 |
| *Bombus pascuorum* | 0.047 | 0.046 | 0.156 |
| *Andrena flavipes* | 0.033 | 0.046 | 0.198 |
| *Bombus terrestris* | 0.032 | 0.037 | 0.240 |
| *Bombus sylvarum* | 0.028 | 0.032 | 0.276 |
| *Halictus subauratus* | 0.024 | 0.036 | 0.308 |
| *Lasioglossum malachurum* | 0.020 | 0.043 | 0.334 |
|  |  |  |  |
| **Residual habitats x Flower plantings** | average contribution | sd | cumulative contribution |
| *Bombus lapidarius* | 0.077 | 0.070 | 0.100 |
| *Andrena flavipes* | 0.061 | 0.058 | 0.179 |
| *Bombus pascuorum* | 0.038 | 0.044 | 0.228 |
| *Bombus terrestris* | 0.035 | 0.036 | 0.273 |
| *Lasioglossum malachurum* | 0.034 | 0.056 | 0.316 |
| *Halictus subauratus* | 0.026 | 0.033 | 0.350 |
| *Lasioglossum pauxillum* | 0.024 | 0.024 | 0.381 |
| *Lasioglossum politum* | 0.024 | 0.038 | 0.412 |
|  |  |  |  |
| **Near natural grassland x Flower plantings** | average contribution | sd | cumulative contribution |
| *Bombus lapidarius* | 0.089 | 0.084 | 0.120 |
| *Andrena flavipes* | 0.058 | 0.054 | 0.197 |
| *Bombus pascuorum* | 0.044 | 0.040 | 0.256 |
| *Bombus terrestris* | 0.038 | 0.042 | 0.307 |
| *Lasioglossum malachurum* | 0.027 | 0.048 | 0.344 |
| *Lasioglossum politum* | 0.025 | 0.038 | 0.377 |
| *Bombus sylvarum* | 0.024 | 0.030 | 0.409 |
| *Lasioglossum pauxillum* | 0.020 | 0.021 | 0.436 |

Table S4. Pairwise simper analysis showing the average and cumulative contribution of individual bee species to the overall compositional dissimilarity between near natural grassland, residual habitats and flower plantings. Only species that contributed more than 2% are given. All listed species occurred regularly on all three habitat categories and were generalist ground-nesting species (Scheuchl and Willner 2016).

References

Scheuchl E, Willner W (2016) Taschenlexikon der Wildbienen Mitteleuropas. Quelle & Meyer, Wiebelsheim