Title page (not for review)

Land-use intensification reduces multi-taxa diversity patterns of Small Woodlots Outside Forests in a Mediterranean area

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Author contribution

E.B. designed the study and the methodology, collected and analyzed the data, and wrote the manuscript. E.B., E.L., M.C., C.A., and F.A. helped with the fieldwork and laboratory activities. E.B., E.L., M.C., P.P., E.S., D.C., and F.A. identified specimens.

E.S. contributed to drafting the manuscript. M.M., S.M., and G.B. designed the methodology, supporting statistical analyses and revising the article for important intellectual content. M.M. supervised the research project. All authors revised the manuscript and gave final approval for publication.

Conflict of Interest Statement

The authors declare that they have no conflict of interest. Any research in the paper not carried out by the authors is acknowledged in the manuscript and all forms of approval, whether they be of ethical or other nature, were obtained for this research.

Highlights

- Land-use intensity exacerbates landscape fragmentation, affecting biodiversity.
- Species composition was more sensitive than species richness to land-use change.
- Plants and invertebrates responded differently to land-use surrounding patches.
- The higher the land-use intensity was, the lower composition dissimilarities were.
- Small patches can be valuable for biodiversity conservation in human-altered areas.

Abstract

Land-use intensification exacerbates landscape fragmentation, increasing the negative effects on biodiversity. In this context, the biodiversity value of Trees Outside Forests (TOF; scattered trees, tree lines and small woodlots) is often overlooked by landscape planning and conservation programs, which typically focus on protecting larger and more intact areas. More empirical studies on taxa inhabiting TOF are needed to support and promote their conservation in human-altered lands.

However, we are not aware of any study focusing on multiple taxa living in small woodlots outside forests (SWOFs) in the Mediterranean basin. We investigated how diversity patterns of multiple taxa in SWOFs respond to a land-use intensification gradient, from natural areas to more disturbed ones (agricultural and urban areas), in a Mediterranean biodiversity hotspot.

We explored the influence of land-use types on species richness and composition of vascular plants and six ground-dwelling invertebrate groups (pseudoscorpions, spiders, darkling beetles, rove beetles, ground beetles, and ants). Species composition was more sensitive than species richness to land-use change, highlighting the need to consider a suitable measure for interpreting ecological processes. We observed a strong influence of land use embedding SWOFs on the mean composition and beta diversity of taxa: land-use intensification led to a general homogenization of diversity patterns, especially among agricultural and urban areas. In our study area, vascular plants responded more sensitively to land-use change than invertebrates. For most invertebrates: the higher the land-use intensity, the lower the species composition dissimilarity due to the dominance of good dispersers or disturbance-tolerant species. More vagile species and disturbance-tolerant species can move across open habitats and colonize new areas, reducing compositional differences and potentially boosting species pools. We demonstrated that SWOFs play a key role in supporting viable populations of invertebrates, also in human-altered lands, underlining the need to promote their conservation in this Mediterranean fragmented landscape to avoid homogenization from driving a generalized biodiversity loss.

Keywords

Land-use influence, Trees Outside Forests, multi-taxa diversity patterns, ground-dwelling invertebrates, Coleoptera, Hymenoptera, Pseudoscorpiones, Araneae, vascular plants

1. INTRODUCTION

Land-use intensification are among the most important direct drivers of ecosystem service changes from global to local scales. A large percentage of remnant forestland is projected to be converted to other uses by 2050 due to agriculture and urban sprawl (MEA, 2005). In the Mediterranean basin, we observed a constantly increasing rate of land consumption and different sprawling patterns at the local scale (Strollo et al., 2020). The observed trend of land-use intensification (Newbold et al., 2015) and habitat loss exacerbates landscape fragmentation, affecting biodiversity (Fischer and Lindenmayer, 2007).

Although large, intact and well-connected patches are vitally important for the maintenance of ecological processes (Lindenmayer, 2019), small isolated fragments and appropriate matrix management are considered valuable complements (Fischer and Lindenmayer, 2002). The high conservation value of small remnant patches in human-modified landscapes is demonstrated (Fischer and Lindenmayer, 2002; Le Roux et al., 2015; Lindenmayer, 2019; Tulloch et al., 2016). In this context, Trees Outside Forests are gaining increasing attention. They are scattered individual trees, linear arboreal elements and small woodlots outside forests (hereafter SWOFs), distributed along watercourses, canals, roads and highways or, in general, over all-natural and human-modified lands (de Foresta et al., 2013). They play a crucial role in climate mitigation, soil and water resources protection, agricultural crop protection and, thanks to their wide distribution, promote biodiversity conservation by representing ecological corridors and offering habitats for animal and plant species (Bellefontaine et al., 2001; Manning et al., 2006).

Despite this, small patches are excluded from most connectivity analyses and conservation initiatives (Cadavid-Florez et al., 2020). Considering that policymakers, land planners and conservation organizations generally focus their efforts on large, intact and well-connected areas by underestimating the importance of small fragments (Wintle et al., 2019), more empirical studies on taxa inhabiting these patches are urgently needed to support and promote their conservation (Lindenmayer, 2019). However, only a few studies consider diversity patterns of multiple taxonomic groups across different areas and landscape contexts with scattered trees (Le Roux et al., 2018; Prevedello et al., 2018). Surprisingly enough, we are not aware of any study focusing on multiple taxonomic groups in Mediterranean SWOFs along a land-use intensification gradient.

We conducted a study in a Mediterranean fragmented landscape located in Sardinia (Southern Italy): we investigated diversity patterns of vascular plants and six groups of ground-dwelling arthropods (pseudoscorpions, spiders, darkling, rove and ground beetles, ants) living in SWOFs located in different land-use types. We focused on vascular plants and arthropods as potential biological indicator taxa, considering that they constitute more than 80% of all currently described species (Stork, 2018), showing multiple responses to disturbance levels (Noriega et al., 2018). We specifically asked: what is the role of these small patches for biodiversity conservation of multiple taxonomic groups along the gradient of land-use intensification? Does the gradient of land-use intensification affect SWOF multi-taxa diversity?

Simultaneously examining the responses of multiple taxonomic groups to the same stressor-environmental gradient could contribute to understanding the effect of land use on SWOFs diversity patterns, with theoretical and applied implications for their management. In a perspective of an increasing need for nature-based solutions, quantitative tests based on multiple taxonomic groups would also provide evidence to explicitly consider SWOFs in future conservation programs (Lindenmayer, 2019; Wintle et al., 2019), particularly in Mediterranean areas, recognized as one of the main hotspots for biodiversity conservation (Médail, 2017).

2. MATERIALS AND METHODS

2.1. Study area

The study area, covering about 18,300 hectares, is located in the Metropolitan City of Cagliari (Southern Sardinia, Italy), a medium-sized functional urban area characterized by three levels of fragmentation degree (i.e., low, medium, high; Palumbo et al., 2020). The area is ascribable to the Mediterranean pluvioseasonal oceanic bioclimate, with a class of continentality (strong euoceanic), four thermotypic horizons (from lower thermomediterranean to upper mesomediterranean) and five ombrothermic horizons (from lower dry to lower humid), resulting in a combination of 11 isobioclimates (Canu et al., 2015) and high climate variability (Bazzato et al., 2021b). Due to the anthropic disturbance, a gradient of land-use intensification runs roughly in a north-east/south-west direction from natural and semi-natural areas (NAT) at higher altitudes to more disturbed ones at lower altitudes (agricultural areas, AGR; urban and artificial areas, URB) (Fig. 1; Table A.1 in Appendix). Considering the vegetation (Bacchetta et al., 2009), the NE sector is characterized by evergreen sclerophylls, dominated by *Quercus ilex* or *Quercus suber*, and different shrub species (*Erica arborea*, *Arbutus unedo*, *Phyllirea latifolia*, *Myrtus communis* and *Juniperus oxycedrus*). The high-shrub and pre-forest successions are distributed in the most thermo-xerophilous SW sector with wild olive and juniper shrublands (*Olea europaea* var. *sylvestris*, *Pistacia lentiscus*, *Juniperus turbinata* and *Euphorbia dendroides*). Halophilous and psammophilous communities dominate coastal areas, ponds and lagoons.

2.2. Sampling design

Using photo-interpretation of digital colour orthophotos (RAS, 2016), we identified and mapped all SWOFs ranging from 0.05 to 0.5 hectares. Hence, SWOFs were assigned to the corresponding land-use type (NAT, AGR, URB) according to the first hierarchical level of the land-use map (RAS, 2008). We excluded SWOFs smaller than 0.1 hectares (about 42%), as well as those embedded in a mixed land-use type (about 1.50%). A total of 201 SWOFs were retained (67 in URB, 70 in AGR, 64 in NAT): from this population, we carried out a proportional stratified random sampling to select a total of 30 SWOFs along the land-use intensification gradient (NAT, AGR, URB). Due to the difficulties to survey in private estates and similar areas located in the URB areas, 8 urban SWOFs were sampled, and the remaining SWOFs (up to 30) were equally assigned to the other two land-use types (11 sites in NAT and AGR; Table A.1 in Appendix).

For each SWOF, we used the centroid as the central middle point of a linear transect, which was radiated from the centroid to the farthest sides of SWOF boundaries. For each linear transect, we identified 5 plots equally spaced along the longest axes of the patch (P1-P5; Fig. 1; Table A.2 in Appendix).

2.3. Data collection

We recorded data of vascular plants and six groups of ground-dwelling invertebrates (pseudoscorpions, spiders, darkling beetles, rove beetles, ground beetles, ants).

Vascular plant occurrences and abundances were recorded from April to August 2018. We visually estimated vascular plant abundance as percentage cover within five replicate plots of 1 m^2 in each transect per SWOF. Then, they were summed across the five plots in each transect per SWOF.

Ground-dwelling invertebrates were collected from April 2018 to May 2019 to optimize the capture efficiency of seasonally active ground-dwelling groups using five replicate pitfall traps in each transect per SWOF, located in the centre of each plot (see Appendix for further details on pitfall trap design and trapping effort). The traps were emptied every 30-40 days; thus, nine trap-emptying made up a year sample for each sampled SWOF. Hence, we pooled abundance data along the year sample to optimize the catch and overcome occasional trap losses (Kotze et al., 2011). Since some traps were found overturned or tampered, we expressed invertebrate abundances as absolute abundance (aA, number of collected individuals) and annual activity density (aAD) to standardize pitfall catches for the trapping effort (i.e., the number of active traps, and the duration of the catching period; see Appendix and Saska et al., 2021).

The annual activity density of each species was calculated by dividing the number of collected individuals during the entire sampling period (tot indiv) with the total (yearly) trapping effort (TE) for each sampled SWOF:

Eq. (A.1) $$aAD = tot\ indiv / TE$$

with TE = Σ te and te = trap * (dd/15), where trap is the number of active traps and dd is the number of days during which traps were active in each sampling session (Brandmayr et al., 2005).

The latest expression, originally proposed by Brandmayr et al. (2005) dividing by 10 (for periods of 10 days), was modified to obtain the active number of individuals who fall into the traps during that period of the year within 15 days.

2.4. Statistical analyses

2.4.1. Species richness

To consider the bias due to different sampling efforts, sample-based rarefaction and extrapolation approach (Colwell et al., 2012) was applied based on incidence data, using the `*iNEXT*´ package (Hsieh et al., 2016). This approach extends methods for rarefaction and extrapolation (R/E) of species richness to higher-order Hill numbers: species richness (q = 0); Shannon diversity (q = 1), the exponential of Shannon entropy interpreted as the effective number of frequent species in the assemblage; Simpson diversity (q = 2), the inverse Simpson concentration interpreted as the effective number of highly frequent species in the assemblage (Chao et al., 2020). Rarefaction was used to compare the land-use types by correlating the three orders of taxonomic diversity with a certain number of samples (i.e., the minimum number of samples overall land-use types). We applied asymptotic estimators, via the functions `*ChaoRichness*´ for q = 0, `*ChaoShannon*´ for q = 1 and `*ChaoSimpson*´ for q = 2, to compare the potential number of sampled species in a scenario of maximized sampling intensity (Colwell et al., 2012). The 95% confidence intervals obtained by 200 replicate bootstrapping runs and associated with the estimates were also calculated. Whenever the 95% confidence intervals did not overlap, diversity measures differed significantly at $p < 0.05$ (Colwell et al., 2012).

We adopted a semi-parametric PERMANCOVA approach (Anderson, 2017) to investigate land use effect (LU, fixed factor with three levels: NAT, AGR and URB) on species richness of each taxonomic group, accounting for altitude (Z) and two-way interaction effects (ZxLU). We omitted the interaction term from the full models when the p-values were not significant. Hence, we calculated the pseudo variance components for each variation source, and post-hoc permutational pairwise comparison tests with PERMANOVA t statistic for the main effect of land use in the final reduced models (ZxLU; Anderson, 2017). All tests were performed using Euclidean distances of untransformed species richness values aggregated at SWOF level, 999 random permutations and the most conservative type III sum of squares for unbalanced designs in PRIMER v.6.1.12 software (Anderson et al., 2008).

2.4.2. Species composition

We evaluated the influence of land-use types on species composition using (1) non-metric multidimensional scaling (NMDS), (2) permutational multivariate analysis of covariance (PERMANCOVA), (3) beta- dispersion analysis, and (4) SIMilarity PERcentages Procedure (SIMPER). Analyses were carried out separately for each taxonomic group using Bray-Curtis distances on square-root transformed abundance data at SWOF level. For invertebrates, all analyses were conducted using both aA and aAD data and considering samples entirely defaunated (i.e., zero animal species) through the use of the zero-adjusted Bray-Curtis coefficients (Clarke et al., 2006).

We indirectly visualized differences in species composition among land-use types via NMDS plots, using the `*metaMDS*´ function of the `*vegan*´ package (Oksanen et al., 2019). PERMANCOVA was applied to test the null hypothesis of no differences in the position of centroids (i.e., the average community composition) (Anderson, 2017; Anderson and Walsh, 2013) among land-use types (LU, fixed factor with three levels; NAT, AGR and URB), including altitude (Z) and two-way interaction effects (ZxLU). We omitted the interaction term from the full models when the p-values were not significant (Anderson, 2017). Hence, we calculated the pseudo multivariate variance components and post-hoc permutational pairwise comparison tests with PERMANOVA t statistic for the main effect of land use in the final reduced models (Anderson, 2017).

Differences in beta dispersion (hereafter beta diversity) among land-use types were assessed with the `*betadispersion2*´ R function (Bacaro et al., 2013, 2012) using 9999 permutations. This method was used to test the null hypothesis of no differences in multivariate dispersion among groups (Anderson, 2006), avoiding mixing within-group dissimilarities with between-group dissimilarities (Bacaro et al., 2013). We evaluated differences between pairs of group mean dispersion by Tukey HSD (Honestly Significant Difference) tests (Anderson, 2006).

Finally, a SIMPER was carried out to identify the most important species of each taxonomic group typifying pairwise differences (Warton et al., 2012) among land-use types, setting a cut-off level of 90% for low contributions.

3. RESULTS

3.1. General results and species richness

We collected a total of 330 species of vascular plants and 269 species of ground-dwelling invertebrates grouped into six taxonomic groups: 390 individuals belonging to 13 species of pseudoscorpions; 2,821 spiders assigned to 106 species; 1,084 darkling beetles of 22 species; 7,215 rove beetles of 55 species; 2,777 ground beetles assigned to 38 species; 52,125 ants of 35 species.

The mean number of pseudoscorpions, spiders and ant species were higher in SWOFs embedded in AGR areas than in those located in URB and NAT areas, but their abundance (aA and aAD) reached the highest values in urban ones (Fig. A.1-A.3 in Appendix). The highest values of the mean species richness and abundance of darkling beetles were in AGR SWOFs, followed by URB and NAT SWOFs (Fig. A.1-A.3 in Appendix). Considering ground beetles, the mean richness and abundance (aA and aAD) were highest in disturbed areas, particularly in URB SWOF. Rove beetles and vascular plants reached the highest values in NAT SWOFs, both for richness and abundance (Fig. A.1-A.3 in Appendix).

Sample-based rarefaction and extrapolation curves with 95% confidence intervals for the three Hill numbers of order q based on the 30 samples showed similar patterns for almost all taxonomic groups (Fig. 2; Table A.3 in Appendix). The analysis revealed that the number of samples was sufficient for the representative sampling of the frequent and highly frequent species in the communities (curves of $q = 1$ and $q = 2$ approached an asymptote, Fig. 2). However, infrequent species might be underrepresented ($q = 0$, Fig. 2). For almost all invertebrate groups (except pseudoscorpions, rove beetles and vascular plants), the 95% confidence intervals from different land-use types overlap, implying that diversity estimates did not differ significantly. By contrast, the empirical and estimated asymptotic Simpson's diversity profiles along with 95% confidence intervals ($q = 2$ in Fig. 2) were disjoint for AGR and NAT samples, respectively, in pseudoscorpions and rove beetles, indicating a significant difference from the other land-use types. For vascular plants, the 95% confidence intervals for the URB samples in any rarefaction/extrapolation curve were disjoint, implying a significant difference from both AGR and NAT (Fig. 2).

PERMANCOVA showed the highest component of variation to the overall species richness model was the residual for almost all taxonomic groups, except vascular plants, for which effects of land use across altitudes contributed the most (Table A.4-A.5 in Appendix). Statistically significant two-way interaction (Z×LU, $p \leq 0.05$, Table A.4 in Appendix) appeared only for the richness of vascular plants, suggesting that the land-use effects significantly differed across altitudes. Although there was no evidence for a two-way interaction (Z×LU, $p \geq 0.05$) in any other taxa, the main effect of land use was significant only for spider richness (Table A.5 in Appendix). Post-hoc tests further supported general results, underlining that species richness of spiders differed between NAT and disturbed areas, while no significant differences were evident for any other taxonomic groups (Fig. 3; Table A.6 in Appendix).

3.2. Species composition

In NMDS, we observed the shift of group centroids among NAT and disturbed areas for almost all taxa (except rove beetles) and high overlaps of 95% confidences ellipses around centroids. These results suggested that differences in community composition were more related to the changing of the mean composition rather than the increase in within-group variance (Fig. A.4-A.5 in Appendix). This pattern was more evident in beetles than in other groups, using both aA and aAD data (Fig. A.4-A.5 in Appendix). However, the use of aAD for darkling beetles led to the minimization of within-group variance, maximizing the variance among NAT and disturbed areas (Fig. A.5 in Appendix). Results of NMDS were supported by PERMANCOVA and beta diversity analyses.

PERMANCOVA analyses showed that the land use had a significant effect on the community composition of almost all taxonomic groups, except rove and darkling beetles, even accounting for altitude and two-way interaction effects (Table A.7-A.10 in Appendix). Statistically significant two-way interaction (ZxLU, $p \leq 0.05$) appeared only for darkling beetles using aAD data (compare Table A.7 vs Table A.9 in Appendix).

Results of PERMANOVA t-test revealed that the mean community composition of spiders, ground beetles, ants and vascular plants was significantly different among NAT vs AGR areas (Fig. 3; Table A.11-A12 in Appendix). A significant contrast among NAT vs URB areas was identified for all taxonomic groups, except darkling and rove beetles (Fig. 3; Table A.11-A12 in Appendix). No significant differences in the mean community composition of all ground-dwelling invertebrates were detected among AGR vs URB areas; remarkably, only vascular plants differed across these two land-use types (Fig. 3; Table A.11-A12 in Appendix).

On average, beta diversity was slightly higher in NAT areas for spiders and rove beetles, AGR areas for pseudoscorpions and ground beetles, and URB areas for ants and vascular plants (Table A.13-A.14 in Appendix). Beta diversity average dissimilarities, from individual observation samples to their group centroid, proved to be significantly different for pseudoscorpions and spiders, but also darkling beetles using aAD data (Fig. 3; Table A.15-A.16 in Appendix). The Tukey HSD test showed significant differences in beta diversity among NAT vs AGR areas for both of these taxonomic groups, among NAT vs URB areas for spiders and darkling beetles, and among AGR vs URB areas for pseudoscorpions (Fig. 3; Fig. A.6-A.7 in Appendix).

According to SIMPER analysis, a limited number of invertebrate species contributed to the dissimilarity between disturbed areas (AGR vs URB; Table A.17 in Appendix).

4. DISCUSSION

Aside from studies on the role of scattered trees as keystone structures or biodiversity foci of landscapes (Fischer et al., 2010; Manning et al., 2006), we are not aware of any other study focusing on SWOF's diversity pattern using multiple taxonomic groups across different land-use types in a Mediterranean fragmented landscape. Assessing diversity patterns is fundamental to understanding the potential of animal and plant populations to persist in fragmented and disturbed habitats. In this study, we simultaneously examined responses of multiple taxonomic groups to the same stressor-environmental gradient to estimate the land-use intensification effects on SWOF multi-taxa diversity, considering multiple diversity measures. The specific response patterns of taxa to land-use is controversial: the effects of land-use intensity on diversity patterns are described as neutral, positive or negative according to the considered taxa (Gosling et al., 2016), the trophic level (Seibold et al., 2019), the urbanization intensity (McKinney, 2008), as well as the spatial scale (Piano et al., 2020). Most literature focused on the impact of extensive urbanization on species richness, especially for plants (McKinney, 2008). In our study, species richness and composition responded differently to land use surrounding SWOFs, revealing that species composition was more sensitive than species richness to land-use change.

To our knowledge, this is the first study comparing different measures of pseudoscorpion diversity among small patches in different land-use types, corroborating the beta diversity sensitivity to land-use change. This result could be promising to consider pseudoscorpions as good indicators to monitor land-use changes (but see Aguiar et al., 2006), likely thanks to their high habitat dependence and their adaptations to life in environments subject to temporal variations (Battirola et al., 2017; Liebke et al., 2021; Villarreal et al., 2019).

The contrasting pattern of richness and composition observed for the other taxonomic groups are in line with previous studies focused on beetles (scarabs, rove and ground beetles) (Yong et al., 2020) and plants (Aggemyr et al., 2018). The adoption of low-informative measures (e.g., total species richness and abundance) to evaluate the impacts of disturbance intensity may conduct to insufficient or even misleading descriptions of ecological community changes, underling the importance of the use of high-informative measures (e.g., species composition and beta diversity) both in meta-analyses and primary studies (Hekkala and Roberge, 2018).

The comparison of richness and compositional differences between land-use types allows the understanding of how the diversity of multiple taxonomic groups can be affected by the increase of human disturbance along the investigated gradient. According to studies demonstrating an increasing species richness with moderate urbanization (McKinney, 2008), we observed that agricultural and urban SWOFs sustained a relatively high richness of all ground-dwelling invertebrates (except rove beetles) compared to natural and semi-natural SWOFs. Conversely, rove beetles and vascular plants showed low levels of species richness in all disturbed areas. These results were also confirmed by the variation in the abundances along the disturbance gradient, and in all ground-dwelling invertebrates, the number of individuals in each land-use type reflected their activity density. The positive effect of disturbance on the richness and abundances of ground-dwelling invertebrates may be related to the increased fragmentation degree observed along the gradient from SWOFs embedded in natural areas to those located in agricultural and urban areas (Bazzato et al., 2021a): at landscape level, a reduction of mean patch size, patch size standard deviation and mean shape, as well as an increment of the number of patch, Shannon's Diversity and Evenness, but also edge habitat were previously observed in the same study area from natural areas to human-modified land-use types. Similar variations in invertebrate species richness and abundance related to the increase of spatial habitat heterogeneity were documented elsewhere (McKinney, 2008). According to the intermediate disturbance hypothesis (Moi et al., 2020) and specifically to the disturbance heterogeneity model (Porter et al., 2001), the disturbance may favour biodiversity by increasing resource heterogeneity. It is also known that spatial diversity of habitats enhances the beta diversity of taxonomic groups that can support viable populations in small areas, such as insects (Fattorini et al., 2020; McKinney, 2008).

Our results suggest that an increase in land-use intensification homogenizes species composition, reducing the difference in beta diversity (except in pseudoscorpions, spiders and darkling beetles) without reducing species richness, as shown for groups occupying different trophic levels (Gossner et al., 2016). The homogenization driven by land-use intensification observed in this study is consistent with previous studies focusing on species richness (McKinney, 2006), beta diversity patterns (Buhk et al., 2017) and functional traits (Bazzato et al., 2021c).

For most of the considered groups, the effects of land use on community composition were more evident when we compared agricultural and urban areas, supporting evidence for biotic homogenization among these land-use types in the study area. The mean composition of all ground-dwelling invertebrates did not differ across disturbed areas considering either their absolute abundance or their annual activity density, while only vascular plants changed their mean composition.

Vascular plants responded more sensitively to land-use change than invertebrates, corroborating the findings of other studies (McKinney, 2008). We observed a vertical structure simplification with decreased presence of native trees and shrubs (e.g., *Arbutus unedo, Erica arborea, Erica terminalis, Salix atrocinerea* subsp. *atrocinerea*) and an increased presence of cultivated or alien species (e.g., *Pinus halepensis* subs. *halepensis*, *Olea europaea*, *Eucalyptus camaldulensis* subsp. *camaldulensis*) as the land-use intensity increases due to management practices adopted during the years (Bazzato et al., 2021a), responsible for altering not only the vegetation structure but also the biodiversity in managed lands (Rouvinen and Kuuluvainen, 2005) compared to irregular, unmanaged and uneven-aged woodlands (Hansen et al., 1991; McComb et al., 1993).

Plant community composition and its vertical structure contribute to changes in higher trophic-level organisms by altering light penetration, microclimate, resources, and habitat spaces (Schuldt et al., 2019). This could be especially true for pseudoscorpions and spiders, known to be dependent on lower trophic groups and their fluctuations (Cardoso et al., 2011; Jiménez-Hernández et al., 2020).

Plant composition can drive beta-diversity patterns of pseudoscorpions, influencing species replacement (Jiménez-Hernández et al., 2020). Here, we observed that community changes along the disturbance gradient were more related to the difference in beta diversity patterns than changes in species richness, likely due to species replacement: two species were found to be almost exclusive of SWOFs in natural areas (*Hysterochelifer tuberculatus, Roncus caralitanus*), others showed a variable abundance in agricultural and urban areas (*Chthonius leoi*, *Hysterochelifer* cf. *spinosus*, *Pselaphochernes lacertosus*), being absent in natural ones. On the other hand, the beta-dissimilarity among disturbed areas was mainly due to species showing a high abundance (or exclusiveness) in agricultural habitats (*Geogarypus minor*, *Geogarypus italicus*, *Occidenchthonius berninii*) or urban ones (*C. leoi*, *P. lacertosus*).

Changes in land use can decrease spider species diversity and modify their composition, leading to differentiated spider assemblages (Pinto et al., 2021). Our study confirmed that spider assemblages responded more sensitively to land-use change from natural to disturbed areas than other invertebrates, showing differences in the richness, mean composition, and beta diversity. As plant communities' structure changes resulting from the increase in land-use intensity differed along the disturbance gradient, it may have favoured different spider species according to their habitat requirements. Most of the dissimilarities among natural and disturbed areas resulted from the dominance of species with broad environmental tolerance (e.g., *Lycosoides coarctata*, *Dysdera crocata*, *Marinarozelotes barbatus*, *Marinarozelotes lyonneti*, *Urozelotes rusticus*, *Zelotes callidus*, *Zelotes tenuis*, *Loxosceles rufescens*, *Zodarion elegans*, *Zodarion ruffoi*) (Caria et al., 2021; Pantini et al., 2013), in both agricultural and urban habitats.

Darkling beetles include species with different responses towards environmental gradients (Fattorini, 2014), and species that occur in the soil do not seem to follow a rural-urban gradient (Fattorini and Galassi, 2016). Our results showed that the beta-diversity of darkling beetles responded to land-use intensification from natural to disturbed areas, due to activity density differences: natural areas were dominated by high activity of habitat-specialist species, strictly range-localized in local forested areas (*Asida androgyna*; Leo, 2012); agricultural and urban areas showed no marked compositional differences, being dominated by species that can support a high activity density even in altered areas (*Stenosis sardoa sardoa*, *Tentyria grossa sardiniensis*; Ruffo and Stoch, 2006) or in a wide variety of environments (*Crypticus gibbulus*, *Pimelia goryi goryi*; Aliquò et al., 2006).

Urbanization can reduce favourable conditions for forest specialist species, contributing to their richness decline (Magura et al., 2013). Specialist species may perceive the surrounding matrix as a stronger barrier than generalists or opportunists, which can exploit a wide variety of resources from neighbouring green areas (Niemelä, 2001). As a result, species composition in human-altered areas becomes more and more similar, which may lead to a decrease in functional diversity (Melliger et al., 2018). Accordingly, we observed a reduction of compositional differences of rove beetles due to the dominance of macrohabitat generalists (*Atheta laticollis*, *Atheta oblita*, *Ocypus olens*, *Tachyporus nitidulus*, *Heterothops dissimilis*) (Lupi et al., 2006; Zanetti et al., 2016), both in natural and disturbed areas. Nevertheless, the microhabitats requirements of rove beetles demonstrate that SWOFs can provide suitable substrates (e.g., debris, litter, tree hole, tree base, mosses) (Lupi et al., 2006; Parmain et al., 2015) for the persistence of their populations, also in human-altered areas.

Taxa with active or high movement ability may have more chances of (re)colonizing surrounding areas, keeping viable populations and reducing the compositional differences than groups with lower or passive dispersal capacities, such as plants (Silva et al., 2017; Soininen et al., 2007). Ground beetles in fragmented habitats show a higher dispersal power, expressed as the higher frequency of macropterous or dimorphic species compared to more preserved habitats, to allow dispersal to favourable sites when conditions turn difficult (Ribera et al., 2001). In line with these studies, we showed that most of the similarities among agricultural and urban areas in ground beetle communities resulted from the dominance of habitat-generalists and good dispersers (*Amara aenea*, *Calathus cinctus*, *Laemostenus complanatus*, *Orthomus berytensis*) (Brigić et al., 2016; Pizzolotto et al., 2008; Suárez et al., 2018), likely due to their better capacities to maintain populations in altered areas than poor dispersers (Niemelä, 2001). In contrast, more poor dispersal species (e.g., *Percus strictus ellipticus*, *Laemostenus carinatus*; personally verified) were found in natural habitats than disturbed ones, contributing to explain the compositional differences among these land-use types.

As observed in other studies, disturbance has a stronger effect on ant species composition than on species richness (Martinez & Amar, 2014). Disturbance-adapted species can disperse across open habitats and colonize new areas, potentially boosting species pools (Filgueiras et al., 2021). The higher the management intensity, the lower the dissimilarity of ant species composition due to the high presence of disturbance-tolerant species (Escobar-Ramírez et al., 2020; Martins et al., 2022). Coherently, we found a reduction of ant compositional differences as disturbance increases due to the presence of highly-tolerant species absent or rare in natural SWOFs: this is a broad and heterogeneous group of ants, generally linked to open or thermophilous habitats (*Aphaenogaster senilis, Hypoponera eduardi, Linepithema humile, Messor, Temnothorax sardous, Tapinoma madeirense*), or highly disturbed areas and cities (*Tetramorium immigrans*, *Tapinoma magnum*) (Reyes-López, et al., 2003; Castracani et al., 2010; 2020; Seifert, 2018; Zara et al., 2021). Most of the ant species characterizing natural SWOFs are associated with moister, cooler conditions or better-developed leaf litter layer (*Aphaenogaster ichnusa*, *Aphaenogaster spinosa*, *Myrmica spinosior*, *Stenamma debile*, *Temnothorax tuberum*) (Seifert, 2018; Galkowski et al., 2019; Zara et al., 2021). Others were detected in most SWOFs irrespective of disturbance levels. Among these, the social parasite *Plagiolepis xene*. In the past, this species was suspected of poor dispersal capability and fragmented populations, and its presence in Sardinia was recently discovered (Mardulyn et al., 2014; Schifani et al., 2021a). We collected it across the whole disturbance gradient alongside its host *P. pygmaea*. Since *P. xene* was the only social parasite species we found, we did not detect a higher presence of socially parasitic ants in natural SWOFs, yet these were the only ones not to host alien species. This pattern only partly resembles what found by Bernal & Espadaler (2013), who suggested social parasite and invasive ant species as indicators of low-disturbance and high-disturbance habitats respectively. The success of *P. xene* in disturbed areas apparently depends on the high plasticity of its host *P. pygmaea*, and highlights that not all socially parasitic ants are good indicators of low disturbance (see *Tetramorium atratulum* (Schenck, 1852) as a futher example, Zhang et al. 2019). Unfortunately, dispersal ranges of ant sexuals responsible for colony foundation are currently undocumented in most cases (Seifert, 2018), while they would be crucial to understand how ants can deal with habitat fragmentation by exploiting ecological corridors such as SWOFs. However, SWOFs investigated during this study hosted at least 35 ant species, approximately 45% of the region's diversity (Schifani et al., 2021a, b) and significantly different communities (including both open/dry habitat and forest/moist habitat specialists, see Castracani et al., 2010; Zara et al., 2021). These results highlighted the importance that small wood patches (or sometimes even isolated trees) may have to ant conservation similarly to what is observed in non-Mediterranean regions (Majer & Delabie, 1999; Gove et al., 2005; Nooten et al., 2021).

5. CONCLUSIONS

Not all species are fully reliant on large patches (Fischer and Lindenmayer, 2002) and small patches cannot provide sufficient habitat for viable populations of any organism type: taxa differ in their responses to habitat fragmentation and land-use intensification (Gosling et al., 2016; McKinney, 2008). Our data demonstrated that SWOFs play an important role in supporting viable populations of ground-dwelling invertebrates, particularly in agricultural and urban land-use types of this Mediterranean fragmented landscape. Although further investigation is required to assess how similar the ecological trends we documented in Sardinia are to those from other Mediterranean areas, this finding re-iterates the high conservation value of green areas surrounded by altered areas as focal habitat for species conservation (Fattorini, 2014), reinforcing the idea that few large patches are not always better than several small (Fattorini, 2020; Le Roux et al., 2015).

If on the one hand, small patches can provide suitable habitats for the vast majority of ground-dwelling invertebrate groups, on the other, an increase in disturbance level exacerbates a reduction of compositional changes in the investigated area, potentially leading to cascading effects concerning dispersal, foraging resources and related dynamic interactions (Driscoll et al., 2013).

Cascading effects could make the conservation outlook bleak as land use intensifies, underlining the need to preserve these remaining patches to avoid homogenization from driving a generalized biodiversity loss (Buhk et al., 2017; McKinney, 2006), and extinction of entire communities in the long-term (Gámez-Virués et al., 2015).

Notwithstanding that the impacts of human disturbance are neither temporary nor entirely avoidable (Araia et al., 2020), solutions to preserve species and communities with the inclusion of wildlife in agricultural (Simons and Weisser, 2017) and urban areas (Apfelbeck et al., 2020, 2019) are possible and needed (Capotorti et al., 2020). In this perspective, an improved understanding of land-use effects on multi-diversity patterns living in small patches will help land-manager to adopt successfully nature-based solutions to biodiversity loss offsets.

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FIGURE LEGENDS

Fig. 1. Study area located in the Metropolitan City of Cagliari (Sardinia, Southern Italy) (a), and sampling scheme adopted for the study (b-d). At the first level (b), we find the land-use types along the gradient of land-use intensification from hilly natural areas to urbanised coastline zones (natural and semi-natural, agricultural, urban and artificial areas). At the second level (c), we categorized SWOFs according to the embedding land use. At the third level (d), the sample units (plots and traps) were arranged along a linear transect within each SWOF.

Fig. 2. Sample-based rarefaction (solid line) and its extrapolation (dashed line) to 22 samples (twice the maximum sample size) including 95% confidence intervals (shaded regions) obtained by bootstrapping based on 200 replications. For each taxonomic group, panels show diversity quantified in terms of Hill-numbers of order q (0: Species richness, 1: Shannon diversity and 2: Simpson diversity). A total of 30 SWOFs were considered in three land-use types: 11 SWOFs in natural and semi-natural areas (NAT), and agricultural areas (AGR), 8 SWOFs in urban and artificial areas (URB).

Fig. 3. Summary of differences among land-use types calculated for each taxonomic group by PERMANOVA pairwise tests based on Euclidean distances of untransformed species richness values, PERMANOVA pairwise tests and BETA Tukey's post hoc tests based on Bray-Curtis distances on square-root transformed abundance data (cover percentage for vascular plants; absolute abundance and annual activity density data (aAD) for invertebrates) at SWOF level (Table A.4-A.16 and Fig. A.6-A.7 in Appendix S1). NA for taxa where the land use (LU) resulted not significant in the final models (see Table A.5, A.8 and A.10 in Appendix S1).

FIGURES

Fig. 1. Study area located in the Metropolitan City of Cagliari (Sardinia, Southern Italy) (a), and sampling scheme adopted for the study (b-d). At the first level (b), we find the land-use types along the gradient of land-use intensification from hilly natural areas to urbanised coastline zones (natural and semi-natural, agricultural, urban and artificial areas). At the second level (c), we categorized SWOFs according to the embedding land use. At the third level (d), the sample units (plots and traps) were arranged along a linear transect within each SWOF.

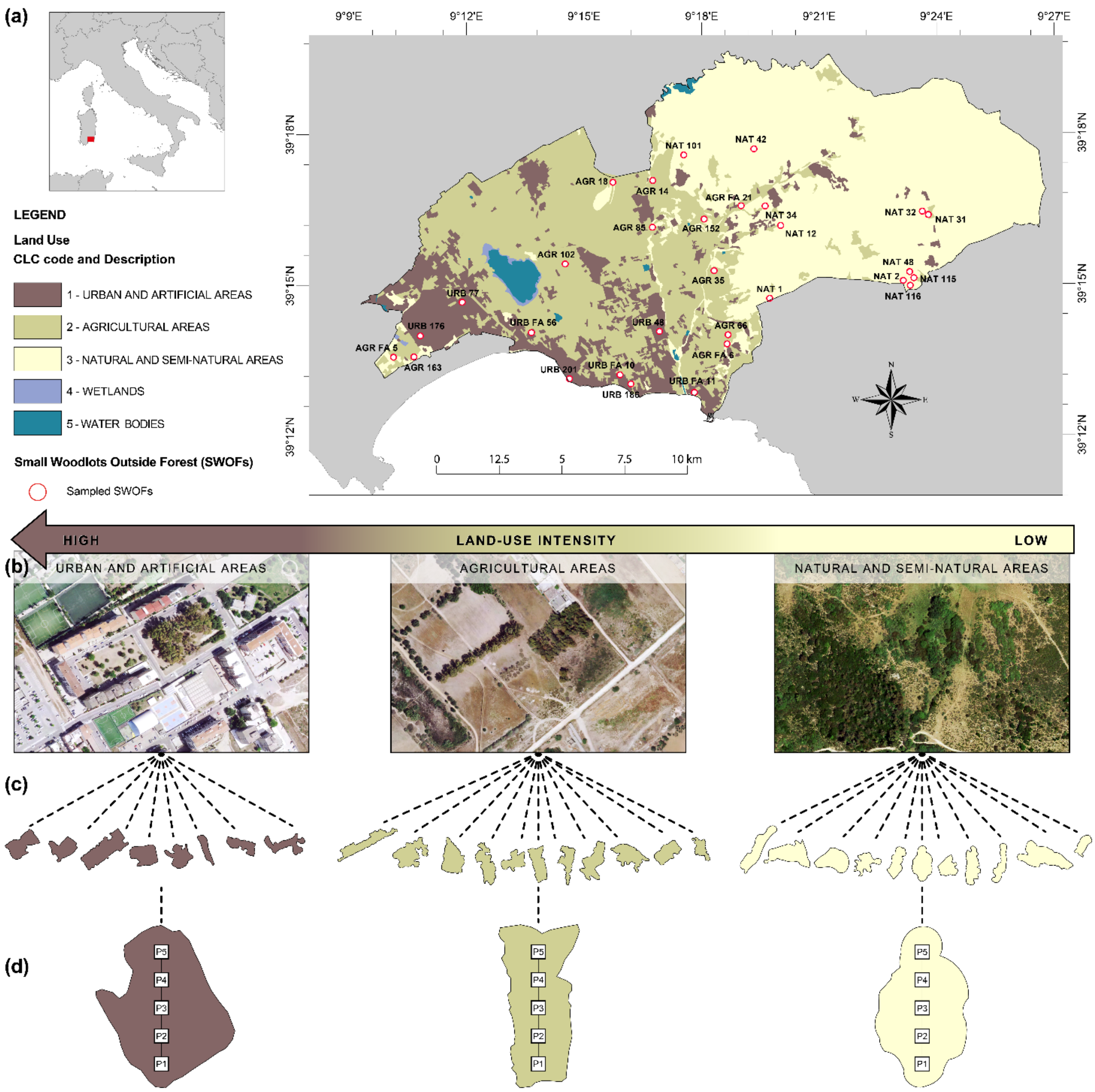
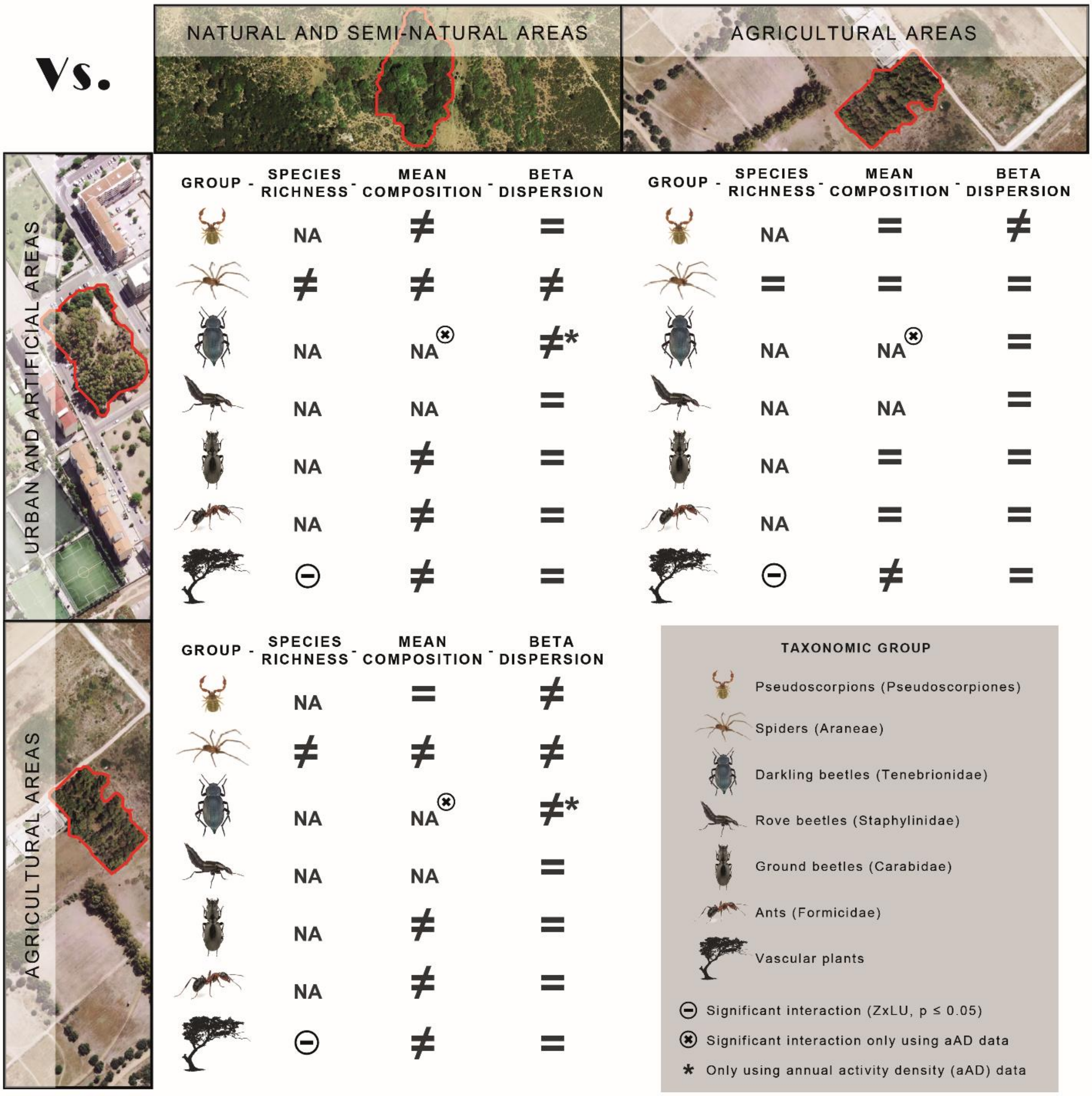
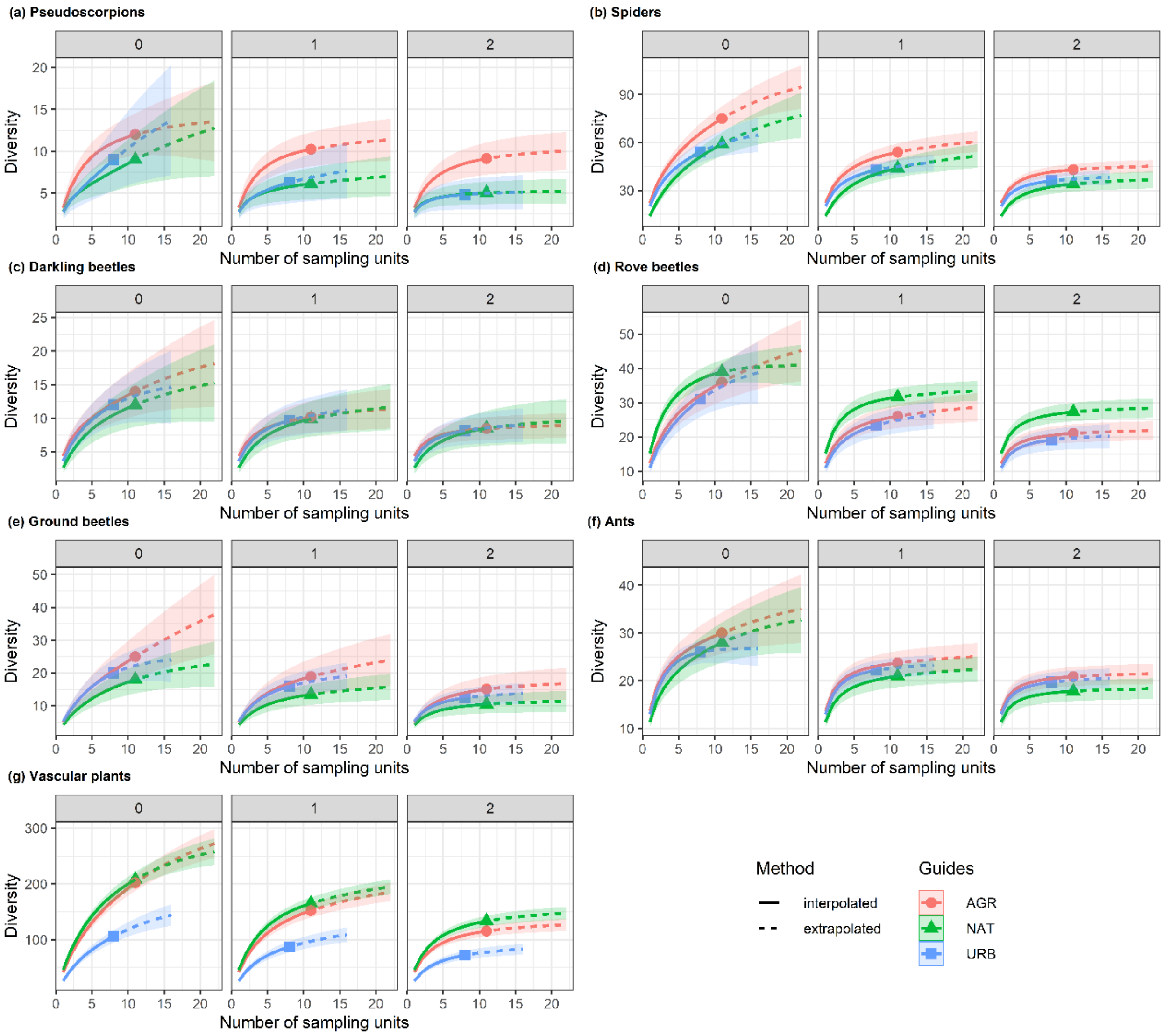


Fig. 2. Sample-based rarefaction (solid line) and its extrapolation (dashed line) to 22 samples (twice the maximum sample size) including 95% confidence intervals (shaded regions) obtained by bootstrapping based on 200 replications. For each taxonomic group, panels show diversity quantified in terms of Hill-numbers of order q (0: Species richness, 1: Shannon diversity and 2: Simpson diversity). A total of 30 SWOFs were considered in three land-use types: 11 SWOFs in natural and semi-natural areas (NAT), and agricultural areas (AGR), 8 SWOFs in urban and artificial areas (URB).



Vs.
NATURAL AND SEMI-NATURAL AREAS
AGRICULTURAL AREAS
URBAN AND ARTIFICIAL AREAS
AGRICULTURAL AREAS
GROUP - SPECIES RICHNESS - MEAN COMPOSITION - BETA DISPERSION
NA
TAXONOMIC GROUP
Pseudoscorpions (Pseudoscorpiones)
Spiders (Araneae)
Darkling beetles (Tenebrionidae)
Rove beetles (Staphylinidae)
Ground beetles (Carabidae)
Ants (Formicidae)
Vascular plants
Significant interaction (ZxLU, p ≤ 0.05)
Significant interaction only using aAD data
* Only using annual activity density (aAD) data



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Appendix A

Land-use intensification reduces multi-taxa diversity patterns of Small Woodlots Outside Forests in a Mediterranean area

Erika Bazzato[1*], Erik Lallai[1], Michele Caria[1], Enrico Schifani[2], Davide Cillo[3], Cesare Ancona[4], Federico Alamanni[1], Paolo Pantini[5], Simona Maccherini[6], Giovanni Bacaro[7], Michela Marignani[1]

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1. MATERIALS AND METHODS

1.1. Site locations and features

A proportional stratified random sampling was carried out to select a total of 30 Small Woodlots Outside Forests (hereafter SWOFs; Italian National Forest Inventory; http://www.infc.it) distributed along a land-use intensification gradient (NAT, AGR, URB) in Sardinia, Southern Italy (Table A.1). SWOFs embedded in NAT areas were characterized by the presence of dead and decaying trees, a significant cover of leaf litter, shrubs and herbs and a high variation of tree stem diameter (DBH) (reference omitted for blind review). SWOFs in AGR areas showed a structure similar to NAT ones, while urban small woodlots were marked by the absence of the shrub layer and the presence of high human trampling disturbance (reference omitted for blind review).

Table A.1 List of the 30 Small Woodlots Outside Forests sampled along the gradient of land-use intensification in Sardinia (Southern Italy). Geographic coordinates (Latitude, and Longitude), Municipality, locality, altitude (m a.s.l.), the nearest distance (m) among patches, and the dominant plant species are shown.

Site code	Latitude	Longitude	Municipality	Locality	Altitude (m a.s.l.)	Nearest Distance (m)	Dominant plant species
AGR_14	39.2844	9.2791	Maracalagonis	Corongiu, Sirigragiu	81	1423.83	*Eucalyptus tereticornis* Sm.
AGR_18	39.2838	9.2622	Maracalagonis	Corongiu, Carroghedda	85	1423.83	*Eucalyptus camaldulensis* Dehnh. subsp. *camaldulensis*
AGR_35	39.2545	9.3051	Quartucciu	Piscina Nuxedda	52	1839.69	*Olea europaea* L.
AGR_66	39.2332	9.3110	Quartu S.E.	Cani Nieddu, Frapponti	84	261.90	*Olea europaea* L.
AGR_85	39.2688	9.2789	Maracalagonis	Corongiu	60	1647.67	*Eucalyptus camaldulensis* Dehnh. subsp. *camaldulensis*
AGR_102	39.2568	9.2418	Quartu S.E.	Simbirizzi, Sa Guardia Lada	35	2658.75	*Eucalyptus camaldulensis* Dehnh. subsp. *camaldulensis*
AGR_152	39.2715	9.3009	Maracalagonis	Gruxi Lillius, Bacca Aruis	99	1373.01	*Eucalyptus camaldulensis* Dehnh. subsp. *camaldulensis*
AGR_163	39.2261	9.1774	Quartu S.E.	Stagno di Quartu, C. D'Aquila	3	687.10	*Olea europaea* L.
AGR_FA_5	39.2260	9.1687	Quartu S.E.	Stagno Quartu, Bingia Spada	5	687.10	*Eucalyptus camaldulensis* Dehnh. subsp. *camaldulensis*
AGR_FA_6	39.2301	9.3105	Quartu S.E.	Str. Comunale Cani Nieddu	68	261.90	*Olea europaea* L.

AGR_FA_21	39.2759	9.3167	Maracalagonis	Riu Piscina Nuxedda	80	833.64	*Eucalyptus camaldulensis* Dehnh. subsp. *camaldulensis*
NAT_1	39.2452	9.3287	Quartucciu	Corti de Perda	120	1915.42	*Eucalyptus camaldulensis* Dehnh. subsp. *camaldulensis*
NAT_2	39.2491	9.3889	Maracalagonis	Sette Fratelli, Codoleddu	700	243.42	*Salix atrocinerea* Brot. subsp. *atrocinerea*
NAT_12	39.2693	9.3335	Maracalagonis	Riu Monte Nieddu	140	816.85	*Eucalyptus camaldulensis* Dehnh. subsp. *camaldulensis*
NAT_31	39.2727	9.3963	Sinnai	Sette Fratelli, Monte Cresia	663	182.11	*Arbutus unedo* L.
NAT_32	39.2739	9.3938	Sinnai	Sette Fratelli, Monte Cresia	677	182.11	*Arbutus unedo* L.
NAT_34	39.2758	9.3270	Maracalagonis	Villagio dei Gigli	120	816.85	*Eucalyptus camaldulensis* Dehnh. subsp. *camaldulensis*
NAT_42	39.2947	9.3223	Sinnai	Burranca	150	2060.91	*Eucalyptus camaldulensis* Dehnh. subsp. *camaldulensis*
NAT_48	39.2520	9.3917	Maracalagonis	Sette Fratelli, Codoleddu	714	203.57	*Salix atrocinerea* Brot. subsp. *atrocinerea*
NAT_101	39.2927	9.2923	Maracalagonis	Corongiu, Sedda Brandanu	140	1438.60	*Populus canescens* (Aiton) Sm.
NAT_115	39.2499	9.3934	Maracalagonis	Sette Fratelli, Codoleddu	706	203.57	*Salix atrocinerea* Brot. subsp. *atrocinerea*
NAT_116	39.2474	9.3918	Maracalagonis	Sette Fratelli, Codoleddu	700	243.42	*Arbutus unedo* L.; *Quercus suber* L.
URB_48	39.2344	9.2818	Quartu S.E.	Via delle Bouganvillee	22	2097.94	Tamarix canariensis Willd.
URB_77	39.2442	9.1979	Quartu S.E.	Sant'Antonio, Via Belgio	9	1896.98	*Eucalyptus camaldulensis* Dehnh. subsp. *camaldulensis*
URB_176	39.2330	9.1801	Quartu S.E.	Is Arenas, Via Pizzetti	6	733.65	*Pinus halepensis* Mill. subsp. *halepensis*; *Robinia pseudoacacia* L.; *Melia azedarach* L.; *Ailanthus altissima* (Mill.) Swingle; *Ceratonia siliqua* L.
URB_186	39.2171	9.2696	Quartu S.E.	Sant'Andrea, Via Rimini	4	462.58	*Pinus halepensis* Mill. subsp. *halepensis*
URB_201	39.2188	9.2434	Quartu S.E.	Foxi, Via Ischia	1	1790.29	*Olea europaea* L.
URB_FA_10	39.2200	9.2649	Quartu S.E.	Porticciolo, Via Riccione	11	462.58	*Pinus pinea* L.
URB_FA_11	39.2142	9.2965	Quartu S.E.	Via Lago di Varese	2	2087.45	*Eucalyptus camaldulensis* Dehnh. subsp. *camaldulensis*
URB_FA_56	39.2341	9.2274	Quartu S.E.	Margine Rosso, Via Valenzia	37	2125.91	*Pinus halepensis* Mill. subsp. *halepensis*

1.2. Pitfall trap design and trapping effort

We recorded data of vascular plants and six groups of ground-dwelling invertebrates: pseudoscorpions (Arachnida, Pseudoscorpiones), spiders (Arachnida, Araneae), darkling beetles (Insecta, Coleoptera, Tenebrionidae), rove beetles (Insecta, Coleoptera, Staphylinidae), ground beetles (Insecta, Coleoptera, Carabidae), and ants (Insecta, Hymenopera, Formicidae). Ground-dwelling invertebrates were collected using pitfall traps, located in the centre of each five-replicated plot. Pitfall traps are considered a standard, cost-effective and reliable method for sampling mobile, surface-dwelling arthropods (Skvarla et al., 2014; Yi et al., 2012). Following Brandmayr et al. (2005), traps were made by transparent plastic cups, 9 cm in diameter and 11 cm deep, with a small hole near the top to allow the rainwater drainage. Each trap was filled with white wine vinegar saturated with sodium chloride as a preservation method.

Since some traps were found overturned or tampered (101 out of 1350 placed traps: 5 traps for each of the 30 sampled SWOFs, for nine sampling sessions), before analyses, invertebrate abundances were expressed both as absolute abundance (aA, number of collected individuals) and as annual activity density (aAD; Brandmayr et al., 2005).

Detailed descriptions of pitfall trap design and trapping effort for each of the 30 Small Woodlots Outside Forests sampled along the gradient of land-use intensification were reported in Table A.2.Table A.2 Detailed descriptions of pitfall trap design and trapping effort for each of the 30 Small Woodlots Outside Forests sampled along the gradient of land-use intensification in Sardinia (Southern Italy).

Site code	Transect length (m)	Inter-trap spacing (m)	Average sampling Interval (Days)	Average number of active traps per sampling session	Total number of active traps in a year sample	Total trapping effort (TE)
AGR_14	40	8	36.89	4.78	43	105.33
AGR_18	100	20	39.22	5.00	45	117.67
AGR_35	80	16	35.89	4.89	44	105.00
AGR_66	80	16	39.22	4.44	40	99.40
AGR_85	92	18	39.33	5.00	45	118.00
AGR_102	155	31	38.89	5.00	45	116.67
AGR_152	96	19	38.89	4.78	43	108.00

AGR_163	57	11	36.44	4.89	44	107.00
AGR_FA_5	67	13	36.44	4.78	43	104.13
AGR_FA_6	80	16	36.33	5.00	45	109.00
AGR_FA_21	76	15	37.88	4.13	33	81.13
NAT_1	150	30	35.56	4.78	43	102.00
NAT_2	67	13	34.33	4.56	41	93.93
NAT_12	151	30	38.56	4.56	41	98.33
NAT_31	85	17	35.00	4.89	44	103.07
NAT_32	56	11	35.56	4.11	37	87.00
NAT_34	75	15	37.56	3.56	32	78.53
NAT_42	90	18	35.56	4.67	42	99.80
NAT_48	60	12	34.67	4.78	43	99.47
NAT_101	40	8	36.89	4.67	42	102.13
NAT_115	83	17	33.17	4.67	28	62.53
NAT_116	48	11	34.33	5.00	45	103.00
URB_48	45	9	39.11	4.78	43	110.60
URB_77	94	19	39.56	4.11	37	95.87
URB_176	95	19	39.56	4.44	40	102.87
URB_186	70	14	36.67	4.78	43	104.00
URB_201	67	13	36.22	5.00	45	108.67
URB_FA_10	57	11	36.33	5.00	45	109.00
URB_FA_11	92	18	36.67	4.89	44	107.00
URB_FA_56	111	22	37.22	4.89	44	108.53

2. RESULTS

3.1. General results and species richness

Fig. A.1 Bar plots show patterns of variation in species richness across the three land-use types. For each taxonomic group, data at SWOF level were used to show the mean value and standard error bar for each land-use type.

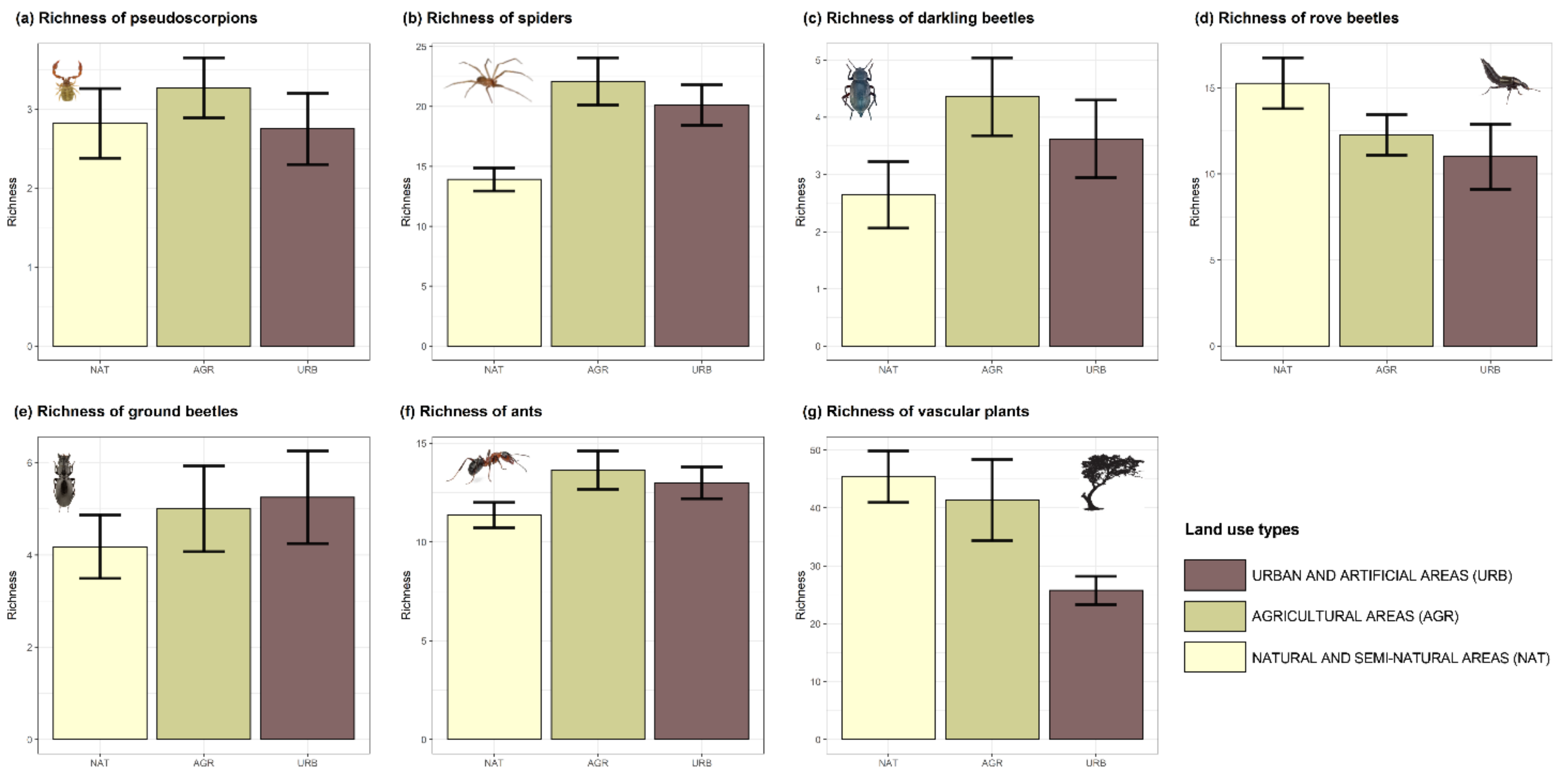

Fig. A.2 Bar plots show patterns of variation in species abundance across the three land-use types. For each taxonomic group, abundances (aA for invertebrates, and cover percentage for vascular plants) at SWOF level were used to show the mean value and standard error bar for each land-use type.

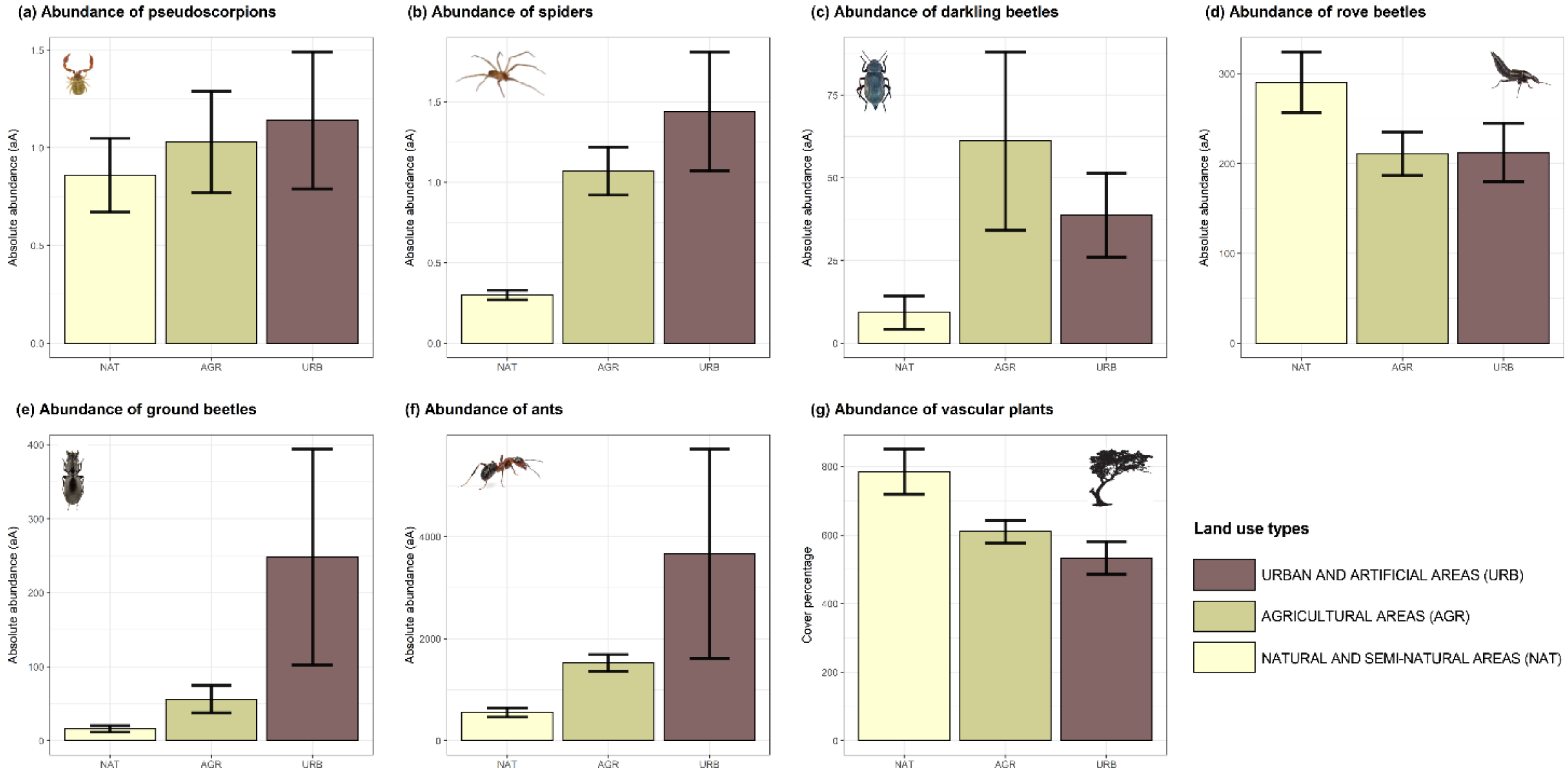

Fig. A.3 Patterns of variation in the annual activity density (aAD) of ground-dwelling invertebrates (pseudoscorpions, spiders, darkling beetles, rove beetles, ground beetles, and ants) across the three land-use types in Sardinia (Southern Italy). The aAD at SWOF level were used to show the mean value and standard error bar for each land-use type: natural and semi-natural areas (NAT), agricultural areas (AGR), urban and artificial areas (URB).

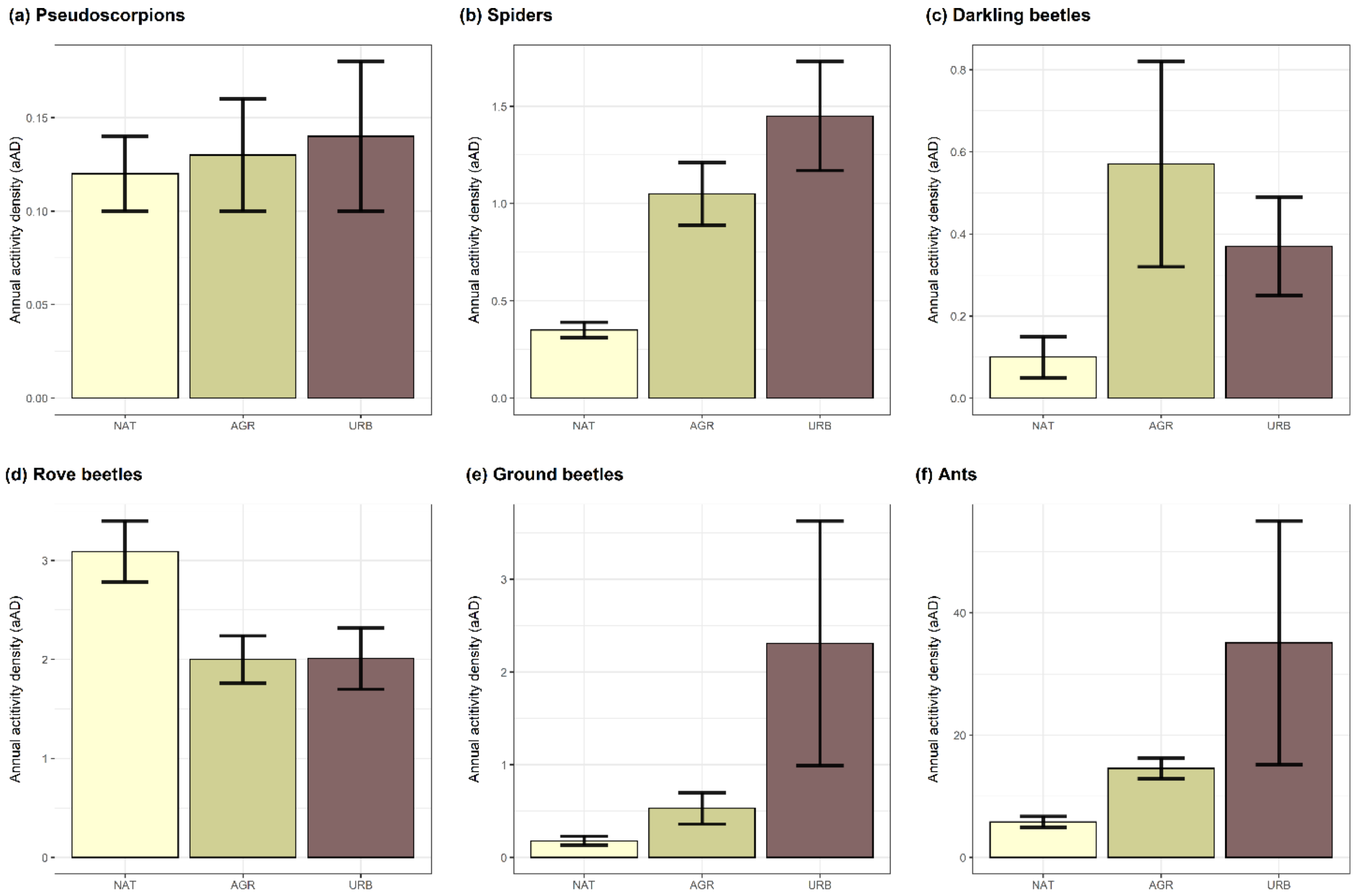

Table A.3 Comparison of empirical diversities and asymptotic estimated diversities (with estimated bootstrap standard error, SE) for Hill numbers of order q (0: Species richness, 1: Shannon diversity and 2: Simpson diversity) calculated using the sample-based rarefaction and extrapolation approach based on the sample size considered in the three land-use types. The estimated asymptotes are calculated via the functions ChaoSpecies() for q = 0, ChaoEntropy() for q = 1, and EstSimpson() for q = 2 (Chao et al., 2014).

Taxonomic group	Land-use type	Diversity measure	Empirical diversity	Estimated diversity	S.E.
Pseudoscorpions	NAT	Species richness	9.000	18.091	9.254
Pseudoscorpions)	NAT	Shannon diversity	6.141	7.937	1.682
Pseudoscorpions	NAT	Simpson diversity	5.031	5.375	0.823
Pseudoscorpions	AGR	Species richness	12.000	14.045	3.117
Pseudoscorpions	AGR	Shannon diversity	10.242	12.164	1.398
Pseudoscorpions	AGR	Simpson diversity	9.127	10.897	1.463
Pseudoscorpions	URB	Species richness	9.000	22.125	11.869
Pseudoscorpions	URB	Shannon diversity	6.255	9.670	2.595
Pseudoscorpions	URB	Simpson diversity	4.840	5.308	1.192
Spiders	NAT	Species richness	59.000	92.136	17.482
Spiders	NAT	Shannon diversity	43.927	58.613	5.233
Spiders	NAT	Simpson diversity	33.975	39.535	3.098
Spiders	AGR	Species richness	75.000	108.601	16.314
Spiders	AGR	Shannon diversity	53.882	66.069	3.821

Spiders	AGR	Simpson diversity	42.945	47.317	2.861
Spiders	URB	Species richness	54.000	69.794	9.657
Spiders	URB	Shannon diversity	42.619	51.115	3.374
Spiders	URB	Simpson diversity	35.951	40.375	2.233
Darkling beetles	NAT	Species richness	12.000	17.682	6.903
Darkling beetles	NAT	Shannon diversity	9.887	13.273	2.496
Darkling beetles	NAT	Simpson diversity	8.495	10.636	1.969
Darkling beetles	AGR	Species richness	14.000	22.182	9.289
Darkling beetles	AGR	Shannon diversity	10.205	12.536	1.942
Darkling beetles	AGR	Simpson diversity	8.471	9.247	1.092
Darkling beetles	URB	Species richness	12.000	15.646	4.326
Darkling beetles	URB	Shannon diversity	9.687	12.408	2.306
Darkling beetles	URB	Simpson diversity	8.165	9.726	1.533
Rove beetles	NAT	Species richness	39.000	41.045	2.315
Rove beetles	NAT	Shannon diversity	31.644	34.511	1.520
Rove beetles	NAT	Simpson diversity	27.296	29.543	1.344
Rove beetles	AGR	Species richness	36.000	55.205	14.996
Rove beetles	AGR	Shannon diversity	26.089	31.031	2.617
Rove beetles	AGR	Simpson diversity	21.069	22.619	1.603
Rove beetles	URB	Species richness	31.000	43.323	9.185

Rove beetles	URB	Shannon diversity	23.459	29.108	2.894
Rove beetles	URB	Simpson diversity	19.168	21.324	1.855
Ground beetles	NAT	Species richness	18.000	25.273	6.851
Ground beetles	NAT	Shannon diversity	13.469	17.605	2.196
Ground beetles	NAT	Simpson diversity	10.475	12.154	1.710
Ground beetles	AGR	Species richness	25.000	76.136	45.342
Ground beetles	AGR	Shannon diversity	18.927	32.796	8.986
Ground beetles	AGR	Simpson diversity	15.050	18.584	3.299
Ground beetles	URB	Species richness	20.000	25.062	4.485
Ground beetles	URB	Shannon diversity	15.927	21.197	2.638
Ground beetles	URB	Simpson diversity	12.423	15.192	1.890
Ants	NAT	Species richness	28.000	35.273	6.851
Ants	NAT	Shannon diversity	20.971	23.417	1.510
Ants	NAT	Simpson diversity	17.816	18.829	0.992
Ants	AGR	Species richness	30.000	41.136	12.001
Ants	AGR	Shannon diversity	23.748	26.201	1.547
Ants	AGR	Simpson diversity	20.872	21.986	1.107
Ants	URB	Species richness	26.000	26.788	1.318
Ants	URB	Shannon diversity	22.191	23.918	1.085
Ants	URB	Simpson diversity	19.737	21.235	1.159

Vascular plants	NAT	Species richness	208.000	282.792	21.298
Vascular plants	NAT	Shannon diversity	165.176	218.103	8.018
Vascular plants	NAT	Simpson diversity	133.227	164.989	6.315
Vascular plants	AGR	Species richness	202.000	333.878	35.385
Vascular plants	AGR	Shannon diversity	152.174	218.642	11.721
Vascular plants	AGR	Simpson diversity	115.463	140.443	6.795
Vascular plants	URB	Species richness	106.000	176.083	25.352
Vascular plants	URB	Shannon diversity	87.054	132.097	10.179
Vascular plants	URB	Simpson diversity	72.170	96.856	6.539

Table A.4 Full model results of permutational univariate analysis of covariance, including the land use (LU), altitude (Z) and two-way interaction effects (ZxLU). Estimates of components of variation were calculated after removing terms with a negative estimate, for which contributions were set to zero (Anderson, 2017). Analyses were based on the Euclidean distance of species richness data at SWOF level of each taxonomic group: pseudoscorpions (Pseudoscorpiones), spiders (Araneae), darkling beetles (Tenebrionidae), rove beetles (Staphylinidae), ground beetles (Carabidae), ants (Formicidae), and vascular plants. Significance codes: (**) $p \leq 0.01$, (*) $p \leq 0.05$.

Taxonomic group	Source of variation	Df	SS	MS	Pseudo-F and p-value	Variance components (%)
Pseudoscorpions	Z	1	1.43	1.43	0.81	0.00
	LU	2	1.24	0.62	0.35	0.00
	ZxLU	2	1.00	0.50	0.29	0.00
	Residuals	24	42.18	1.76	-	100.00
	Total	29	50.97	-	-	100.00
Spiders	Z	1	20.66	20.66	0.82	0.00
	LU	2	235.00	117.50	4.66*	29.15
	ZxLU	2	73.86	36.93	1.47	44.01

	Residuals	24	604.98	25.21	-	26.83
	Total	29	1085.40	-	-	100.00
	Z	1	0.09	0.09	0.02	0.00
	LU	2	2.66	1.33	0.32	0.00
Darkling beetles	ZxLU	2	0.29	0.15	0.04	0.00
	Residuals	24	98.88	4.12	-	100.00
	Total	29	129.47	-	-	100.00
	Z	1	0.12	0.12	0.01	0.00
	LU	2	10.31	5.15	0.22	0.00
Rove beetles	ZxLU	2	1.97	0.99	0.04	0.00
	Residuals	24	573.65	23.90	-	100.00
	Total	29	684.97	-	-	100.00
	Z	1	0.54	0.54	0.07	0.00
	LU	2	14.41	7.20	0.90	0.00
Ground beetles	ZxLU	2	1.29	0.65	0.08	0.00
	Residuals	24	193.14	8.05	-	100.00
	Total	29	209.37	-	-	100.00
	Z	1	0.00	0.00	0.00	0.00
	LU	2	13.16	6.58	0.97	0.00
Ants	ZxLU	2	17.30	8.65	1.28	56.01
	Residuals	24	162.13	6.76	-	43.99
	Total	29	210.97	-	-	100.00
	Z	1	178.01	178.01	0.82	0.00
	LU	2	2907.40	1453.70	6.69**	18.69
Vascular plants	ZxLU	2	2231.80	1115.90	5.14*	67.51
	Residuals	24	5213.50	217.23	-	13.80
	Total	29	9816.70	-	-	100.00

Table A.5 Final model results of permutational multivariate analysis of covariance (PERMANCOVA), including the effects of land use (LU) and altitude (Z) after the omission of the interaction term (ZxLU) due to a lack of statistical significance in the full models (see Table A.4). Estimates of components of variation were calculated after removing terms with a negative estimate, for which contributions were set to zero (Anderson, 2017). Analyses were based on the Euclidean distance of species richness data at SWOF level of each taxonomic group: pseudoscorpions (Pseudoscorpiones), spiders (Araneae), darkling beetles (Tenebrionidae), rove beetles (Staphylinidae), ground beetles (Carabidae), and ants (Formicidae). Significance codes: (***) $p \leq 0.001$, (**) $p \leq 0.01$, (*) $p \leq 0.05$.

Taxonomic group	Source of variation	Df	SS	MS	Pseudo-F and p-value	Variance components (%)
Pseudoscorpions	Z	1	6.14	6.14	3.70	28.65
	LU	2	3.73	1.86	1.12	8.33
	Residuals	26	43.18	1.66		63.02
	Total	29	50.97			100.00
Spiders	Z	1	11.85	11.85	0.45	0.00
	LU	2	263.88	131.94	5.05*	43.26
	Residuals	26	678.84	26.11		56.74
	Total	29	1085.40			100.00
Darkling beetles	Z	1	13.79	13.79	3.62	30.92
	LU	2	3.97	1.99	0.52	0.00
	Residuals	26	99.18	3.81		69.08
	Total	29	129.47			100.00
Rove beetles	Z	1	14.74	14.74	0.67	0.00
	LU	2	14.99	7.49	0.34	0.00
	Residuals	26	575.63	22.14		100.00
	Total	29	684.97			100.00
Ground beetles	Z	1	8.70	8.70	1.16	10.07
	LU	2	14.93	7.46	1.00	0.00
	Residuals	26	194.43	7.48		89.93
	Total	29	209.37			100.00
Ants	Z	1	1.67	1.67	0.24	0.00

LU	2	22.50	11.25	1.63		23.11
Residuals	26	179.42	6.90			76.89
Total	29	210.97				100.00

Table A.6 PERMANOVA t statistic and significance values of pairwise tests for the main effect of land use (LU in Table A.5), examined after the omission of the two-way interaction term (ZxLU) from the full models in Table A.4 (Anderson, 2017). Analyses were based on the Euclidean distance of species richness data at SWOF level of each taxonomic group: pseudoscorpions (Pseudoscorpiones), spiders (Araneae), darkling beetles (Tenebrionidae), rove beetles (Staphylinidae), ground beetles (Carabidae), and ants (Formicidae). Land-use types: natural and semi-natural areas (NAT), agricultural areas (AGR), urban and artificial areas (URB). Significance code: (**) $p \leq 0.01$. NA for taxa where LU resulted not significant in the final models (see Table A.5)

	Pairs of levels of “land use" factor		
Taxonomic group	NAT versus AGR	NAT versus URB	AGR versus URB
Pseudoscorpions	NA	NA	NA
Spiders	3.07**	3.17**	0.89
Darkling beetles	NA	NA	NA
Rove beetles	NA	NA	NA
Ground beetles	NA	NA	NA
Ants	NA	NA	NA

3.2. Species composition

Fig. A.4 Non-metric multidimensional scaling (NMDS) of community composition of each taxonomic group analysed separately based on Bray-Curtis dissimilarity on square-root transformed abundance data (aA for invertebrates and cover percentage for vascular plants) at SWOF level. In the plots, points are sampled SWOFs with lines connecting to land use centroids; coloured ellipses represent standard deviation-based confidence intervals (e.g., 95% confidence interval) from the centroid of each land-use type: natural and semi-natural areas (NAT), agricultural areas (AGR), urban and artificial surfaces (URB).

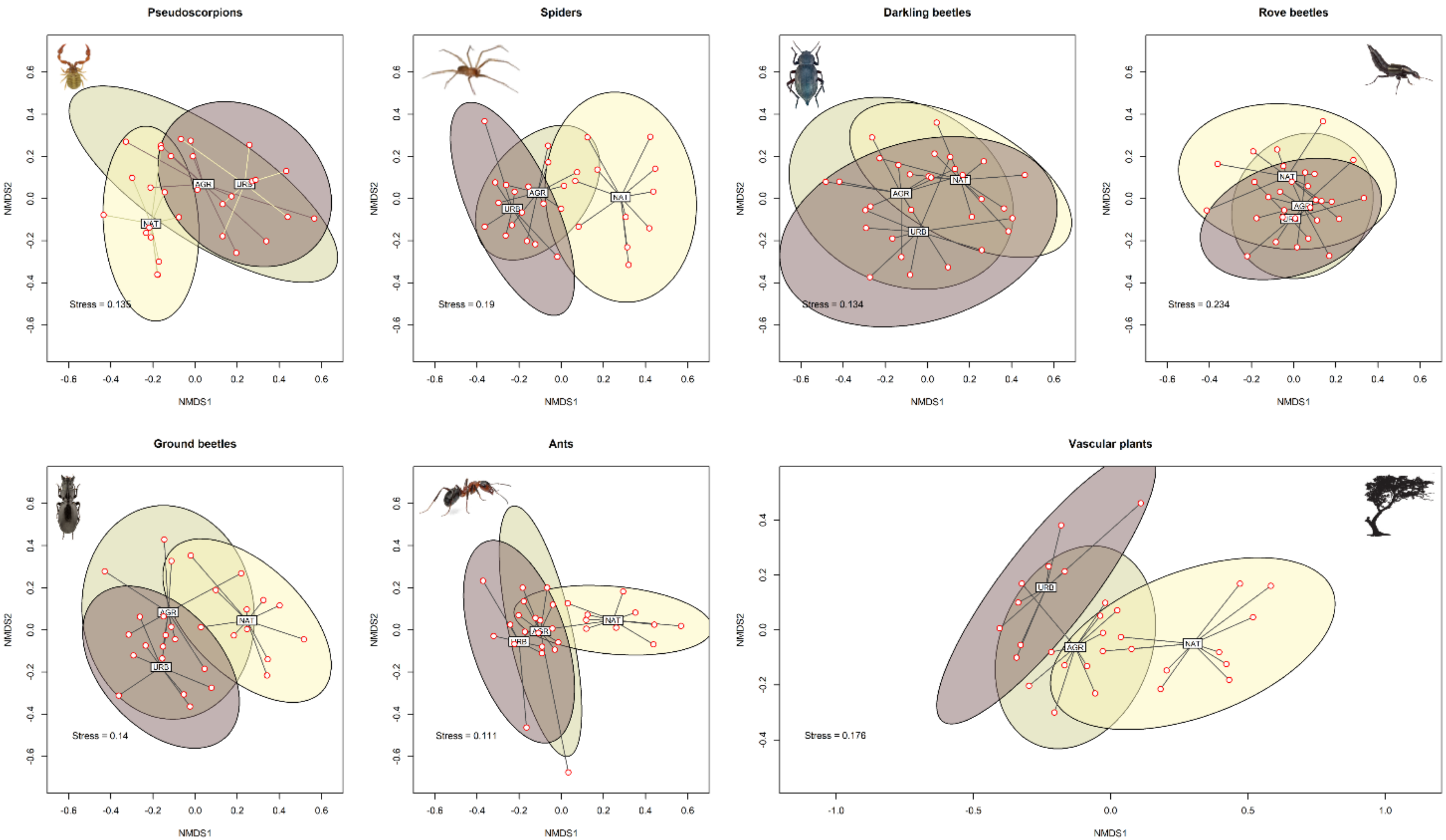
Pseudoscorpions
Stress = 0.135
Spiders
Stress = 0.19
Darkling beetles
Stress = 0.134
Rove beetles
Stress = 0.234
Ground beetles
Stress = 0.14
Ants
Stress = 0.111
Vascular plants
Stress = 0.176
AGR
URB
NAT
NMDS1
NMDS2

Fig. A.5 Non-metric multidimensional scaling (NMDS) of community composition of each ground-dwelling invertebrate analyzed separately based on Bray-Curtis dissimilarity on square-root transformed annual activity density data (aAD) at SWOF level. In the plots, points are sampled SWOFs with lines connecting to land use centroids; coloured ellipses represent standard deviation-based confidence intervals (e.g., 95% confidence interval) from the centroid of each land-use type: natural and semi-natural areas (NAT), agricultural areas (AGR), urban and artificial surfaces (URB). Each panel shows a different taxonomic group sampled from 30 SWOFs at the three land-use types in Sardinia (Southern Italy): pseudoscorpions (Pseudoscorpiones), spiders (Araneae), darkling beetles (Tenebrionidae), rove beetles (Staphylinidae), ground beetles (Carabidae), ants (Formicidae), and vascular plants.

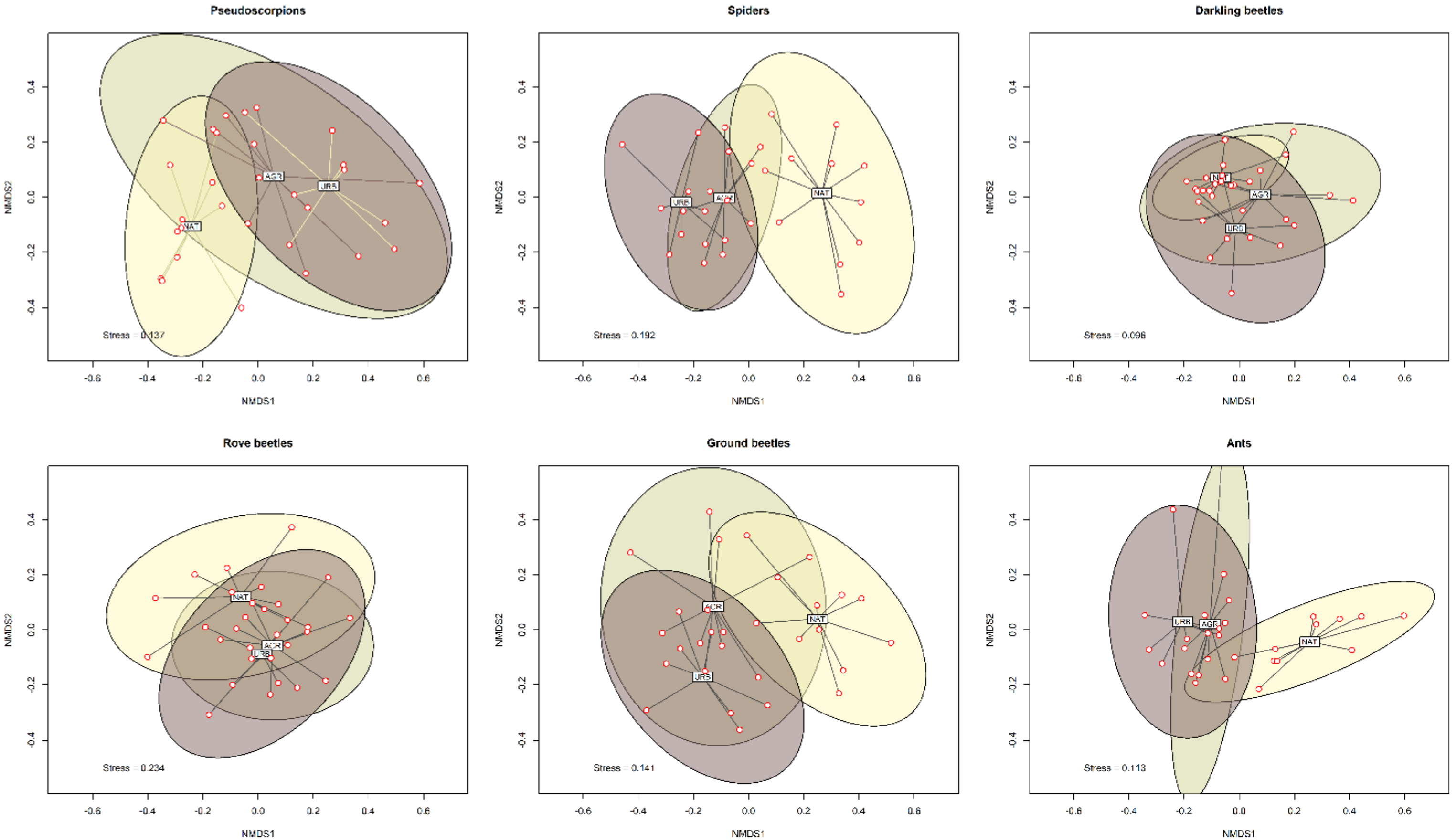

Table A.7 Full model results of permutational multivariate analysis of covariance (PERMANCOVA), including the land use (LU), altitude (Z) and two-way interaction effects (ZxLU). Estimates of components of variation were calculated after removing terms with a negative estimate, for which contributions were set to zero (Anderson, 2017). Analyses were based on the Bray-Curtis distances on square-root transformed abundance data (aA for invertebrates and cover percentage for vascular plants) of each taxonomic group: pseudoscorpions (Pseudoscorpiones), spiders (Araneae), darkling beetles (Tenebrionidae), rove beetles (Staphylinidae), ground beetles (Carabidae), ants (Formicidae), and vascular plants. Significance codes: (***) $p \leq 0.001$, (**) $p \leq 0.01$, (*) $p \leq 0.05$.

Taxonomic group	Source of variation	Df	SS	MS	Pseudo-F and p-value	Variance components (%)
Pseudoscorpions	Z	1	2074.60	2074.60	0.93	0.00
	LU	2	10774.00	5387.00	2.41**	19.12
	ZxLU	2	7121.90	3561.00	1.59	52.50
	Residuals	24	53699.00	2237.50	-	28.38
	Total	29	94212.00	-	-	100.00
Spiders	Z	1	2055.70	2055.70	1.07	19.07
	LU	2	8277.00	4138.50	2.15***	15.87
	ZxLU	2	5337.70	2668.80	1.39	39.03
	Residuals	24	46119.00	1921.60	-	26.02
	Total	29	73132.00	-	-	100.00
Darkling beetles	Z	1	3593.00	3593.00	1.81	42.86
	LU	2	8767.40	4383.70	2.21*	10.71
	ZxLU	2	5967.00	2983.50	1.50	29.26
	Residuals	24	47673.00	1986.40	-	17.17
	Total	29	69611.00	-	-	100.00
Rove beetles	Z	1	474.05	474.05	0.44	0.00
	LU	2	2147.50	1073.70	0.99	0.00
	ZxLU	2	1259.40	629.68	0.58	0.00
	Residuals	24	26140.00	1089.20	-	100.00
	Total	29	32624.00	-	-	100.00
Ground beetles	Z	1	2953.80	2953.80	0.99	0.00

	LU	2	11407.00	5703.40	1.92*	35.28
	ZxLU	2	5315.80	2657.90	0.90	0.00
	Residuals	24	71248.00	2968.70	-	64.72
	Total	29	109650.00	-	-	100.00
Ants	Z	1	1521.50	1521.50	0.93	0.00
	LU	2	6874.60	3437.30	2.10*	37.32
	ZxLU	2	3079.70	1539.90	0.94	0.00
	Residuals	24	39287.00	1637.00	-	62.68
	Total	29	66827.00	-	-	100.00
Vascular plants	Z	1	3632.80	3632.80	1.25	35.01
	LU	2	11351.00	5675.30	1.95***	13.97
	ZxLU	2	6864.40	3432.20	1.18	25.84
	Residuals	24	69687.00	2903.60	-	25.18
	Total	29	107620.00	-	-	100.00

Table A.8 Final model results of permutational multivariate analysis of covariance (PERMANCOVA), including the effects of land use (LU) and altitude (Z) after the omission of the interaction term (ZxLU) due to a lack of statistical significance in the full models (see Table A.7). Analyses were based on the Bray-Curtis distances on square-root transformed abundance data (aA for invertebrates and cover percentage for vascular plants) of each taxonomic group: pseudoscorpions (Pseudoscorpiones), spiders (Araneae), darkling beetles (Tenebrionidae), rove beetles (Staphylinidae), ground beetles (Carabidae), ants (Formicidae), and vascular plants. Significance codes: (***) $p \leq 0.001$, (**) $p \leq 0.01$, (*) $p \leq 0.05$.

Taxonomic group	Source of variation	Df	SS	MS	Pseudo-F and p-value	Variance components (%)
Pseudoscorpions	Z	1	8007.30	8007.30	3.42*	23.19
	LU	2	10626.00	5313.00	2.27*	22.98
	Residuals	26	60821.00	2339.30	-	53.83
	Total	29	94212.00	-	-	100.00
Spiders	Z	1	4787.50	4787.50	2.42**	18.63
	LU	2	9299.00	4649.50	2.35***	24.85

	Residuals	26	51457.00	1979.10	-	56.51
	Total	29	73132.00	-	-	100.00
Darkling beetles	Z	1	5377.00	5377.00	2.61*	21.96
	LU	2	5879.40	2939.70	1.42	15.45
	Residuals	26	53640.00	2063.10	-	62.59
	Total	29	69611.00	-	-	100.00
Rove beetles	Z	1	1897.20	1897.20	1.8*	17.85
	LU	2	2393.90	1197.00	1.14	10.06
	Residuals	26	27399.00	1053.80	-	72.09
	Total	29	32624.00	-	-	100.00
Ground beetles	Z	1	6802.60	6802.60	2.31**	17.63
	LU	2	15376.00	7688.20	2.61**	26.74
	Residuals	26	76564.00	2944.80	-	55.64
	Total	29	109650.00	-	-	100.00
Ants	Z	1	7396.80	7396.80	4.54***	26.34
	LU	2	7987.20	3993.60	2.45**	23.07
	Residuals	26	42367.00	1629.50	-	50.59
	Total	29	66827.00	-	-	100.00
Vascular plants	Z	1	9050.10	9050.10	3.07***	21.95
	LU	2	13057.00	6528.50	2.22***	23.00
	Residuals	26	76552.00	2944.30	-	55.05
	Total	29	107620.00	-	-	100.00

Table A.9 Full model results of permutational multivariate analysis of covariance (PERMANCOVA), including the land use (LU), altitude (Z) and two-way interaction effects (ZxLU). Estimates of components of variation were calculated after removing terms with a negative estimate, for which contributions were set to zero (Anderson, 2017). Analyses were based on the Bray-Curtis distances on square-root transformed annual activity density data (aAD) of the six ground-dwelling invertebrates: pseudoscorpions (Pseudoscorpiones), spiders (Araneae), darkling beetles (Tenebrionidae), rove beetles (Staphylinidae), ground beetles (Carabidae), and ants (Formicidae). Significance codes: (**) $p \leq 0.01$, (*) $p \leq 0.05$.

Taxonomic group	Source of variation	Df	SS	MS	Pseudo-F and p-value	Variance components (%)
Pseudoscorpions	Z	1	2062.80	2062.80	0.91	0.00
	LU	2	10821.00	5410.40	2.39*	19.11
	ZxLU	2	7157.40	3578.70	1.58	52.34
	Residuals	24	54323.00	2263.50	-	28.55
	Total	29	94442.00	-	-	100.00
Spiders	Z	1	2096.60	2096.60	1.10	21.25
	LU	2	8294.10	4147.00	2.17**	15.16
	ZxLU	2	5462.40	2731.20	1.43	38.87
	Residuals	24	45908.00	1912.80	-	24.71
	Total	29	72696.00	-	-	100.00
Darkling beetles	Z	1	805.34	805.34	1.78	33.86
	LU	2	3213.40	1606.70	3.55**	12.53
	ZxLU	2	2201.80	1100.90	2.43*	39.79
	Residuals	24	10866.00	452.73	-	13.82
	Total	29	17242.00	-	-	100.00
Rove beetles	Z	1	464.97	464.97	0.43	0.00
	LU	2	2261.10	1130.60	1.05	10.82
	ZxLU	2	1268.80	634.38	0.59	0.00
	Residuals	24	25949.00	1081.20	-	89.18
	Total	29	33032.00	-	-	100.00
Ground beetles	Z	1	2947.90	2947.90	0.99	0.00
	LU	2	11394.00	5697.00	1.91**	35.11
	ZxLU	2	5317.10	2658.60	0.89	0.00
	Residuals	24	71652.00	2985.50	-	64.89
	Total	29	109880.00	-	-	100.00
Ants	Z	1	1536.90	1536.90	0.94	0.00

	LU	2	6902.50	3451.30	2.11**	37.47
	ZxLU	2	3107.70	1553.80	0.95	0.00
	Residuals	24	39196.00	1633.20	-	62.53
	Total	29	66409.00	-	-	100.00

Table A.10 Final model results of permutational multivariate analysis of covariance (PERMANCOVA), including the effects of land use (LU) and altitude (Z) after the omission of the interaction term (ZxLU) due to a lack of statistical significance in the full models (see Table A.9). Analyses were based on the Bray-Curtis distances on square-root transformed annual activity density data (aAD) of ground-dwelling invertebrates: pseudoscorpions (Pseudoscorpiones), spiders (Araneae), rove beetles (Staphylinidae), ground beetles (Carabidae), and ants (Formicidae). Significance codes: (***) $p \leq 0.001$, (**) $p \leq 0.01$, (*) $p \leq 0.05$.

Taxonomic group	Source of variation	Df	SS	MS	Pseudo-F and p-value	Variance components (%)
Pseudoscorpions	Z	1	7880.10	7880.10	3.33**	22.91
	LU	2	10625.00	5312.70	2.25*	22.91
	Residuals	26	61480.00	2364.60	-	54.18
	Total	29	94442.00	-	-	100.00
Spiders	Z	1	4825.70	4825.70	2.44***	18.82
	LU	2	9140.10	4570.00	2.31***	24.56
	Residuals	26	51370.00	1975.80	-	56.61
	Total	29	72696.00	-	-	100.00
Rove beetles	Z	1	1969.70	1969.70	1.88*	18.12
	LU	2	2537.90	1268.90	1.21	12.16
	Residuals	26	27218.00	1046.80	-	69.72
	Total	29	33032.00	-	-	100.00
Ground beetles	Z	1	6785.10	6785.10	2.29**	17.57
	LU	2	15306.00	7653.10	2.59***	26.61
	Residuals	26	76969.00	2960.40	-	55.82
	Total	29	109880.00	-	-	100.00

Ants	Z	1	7294.10	7294.10	4.48***	26.23
	LU	2	7917.40	3958.70	2.43***	23.01
	Residuals	26	42304.00	1627.10	-	50.76
	Total	29	66409.00	-	-	100.00

Table A.11 PERMANOVA t statistic and significance values of pairwise tests for the main effect of land use (LU in Table A.8), examined after the omission of the two-way interaction term (ZxLU) from the full models in Table A.7 (Anderson, 2017). Analyses were based on the Bray-Curtis distances on square-root transformed abundance data (aA for invertebrates and cover percentage for vascular plants) of each taxonomic group: pseudoscorpions (Pseudoscorpiones), spiders (Araneae), darkling beetles (Tenebrionidae), rove beetles (Staphylinidae), ground beetles (Carabidae), ants (Formicidae), and vascular plants. Land-use types: natural and semi-natural areas (NAT), agricultural areas (AGR), urban and artificial areas (URB). Significance codes: (***) $p \leq 0.001$, (**) $p \leq 0.01$, (*) $p \leq 0.05$. NA for taxa where LU resulted not significant in the final models (see Table A.8).

	Pairs of levels of “land use" factor		
Taxonomic group	NAT versus AGR	NAT versus URB	AGR versus URB
Pseudoscorpions	1.03	2.31***	0.80
Spiders	1.44*	1.91***	1.08
Darkling beetles	NA	NA	NA
Rove beetles	NA	NA	NA
Ground beetles	1.59**	2.00***	1.08
Ants	1.81***	2.01***	0.78
Vascular plants	1.28*	1.64***	1.36**

Table A.12 PERMANOVA t statistic and significance values of pairwise tests for the main effect of land use (LU in Table A.10), examined after the omission of the two-way interaction term (ZxLU) from the full models in Table A.9 (Anderson, 2017). Analyses were based on the Bray-Curtis distances on square-root transformed annual activity density data (aAD) of ground-dwelling invertebrates: pseudoscorpions (Pseudoscorpiones), spiders (Araneae), rove beetles (Staphylinidae), ground beetles (Carabidae), and ants (Formicidae). Land-use types: natural and semi-natural areas (NAT), agricultural areas (AGR), urban and artificial areas (URB). Significance codes: (***) $p \leq 0.001$, (**) $p \leq 0.01$, (*) $p \leq 0.05$. NA for taxa where LU resulted not significant in the final models (see Table A.10).

Taxonomic group	Pairs of levels of “land use" factor NAT versus AGR	NAT versus URB	AGR versus URB
Pseudoscorpions	1.02	2.29**	0.80
Spiders	1.44**	1.89***	1.09
Rove beetles	NA	NA	NA
Ground beetles	1.58*	1.99***	1.07
Ants	1.81***	2.00***	0.79

Table A.13 Mean beta diversity calculated separately for each taxonomic group using `*betadispersion2*´ R function (Bacaro et al., 2013, 2012) based on Bray-Curtis distances on square-root transformed abundance data (aA for invertebrates and cover percentage for vascular plants) at SWOF level. Taxonomic groups sampled from 30 SWOFs at the three land-use types (LU) in Sardinia (Southern Italy): pseudoscorpions (Pseudoscorpiones), spiders (Araneae), darkling beetles (Tenebrionidae), rove beetles (Staphylinidae), ground beetles (Carabidae), ants (Formicidae), and vascular plants.

Taxonomic group	NAT	AGR	URB
Pseudoscorpions	0.58	0.78	0.65
Spiders	0.69	0.59	0.62
Darkling beetles	0.62	0.62	0.68
Rove beetles	0.48	0.44	0.45
Ground beetles	0.73	0.80	0.74
Ants	0.56	0.58	0.63
Vascular plants	0.79	0.76	0.82

Table A.14 Mean beta diversity calculated separately for each taxonomic group using `*betadispersion2*´ R function (Bacaro et al., 2013, 2012) based on Bray-Curtis distances on square-root transformed annual activity density data (aAD) at SWOF level. Taxonomic groups sampled from 30 SWOFs at the three land-use types (LU) in Sardinia (Southern Italy): pseudoscorpions (Pseudoscorpiones), spiders (Araneae), darkling beetles (Tenebrionidae), rove beetles (Staphylinidae), ground beetles (Carabidae), and ants (Formicidae).

Taxonomic group	NAT	AGR	URB
Pseudoscorpions	0.59	0.79	0.65
Spiders	0.69	0.59	0.61
Darkling beetles	0.22	0.34	0.34
Rove beetles	0.47	0.44	0.45
Ground beetles	0.73	0.81	0.74
Ants	0.55	0.58	0.63

Table A.15 Differences in beta diversity among land-use types obtained using `*betadispersion2*´ R function (Bacaro et al., 2013, 2012) based on Bray-Curtis dissimilarity on square-root transformed abundance data (aA for invertebrates and cover percentage for vascular plants) at SWOF level. Analyses were conducted separately for each taxonomic group sampled from 30 SWOFs at the three land-use types in Sardinia (Southern Italy): pseudoscorpions (Pseudoscorpiones), spiders (Araneae), darkling beetles (Tenebrionidae), rove beetles (Staphylinidae), ground beetles (Carabidae), ants (Formicidae), and vascular plants. Significance code: (***) $p \leq 0.001$.

Taxonomic group	Source of variation	Df	SS	MS	F Model and p-value
Pseudoscorpions	Land use	2	1.13	0.57	11.99***
	Residuals	135	6.39	0.05	-
Spiders	Land use	2	0.27	0.13	12.17***
	Residuals	135	1.49	0.01	-
Darkling beetles	Land use	2	0.09	0.04	1.43
	Residuals	135	4.15	0.03	-
Rove beetles	Land use	2	0.03	0.02	1.98
	Residuals	135	1.07	0.01	-
Ground beetles	Land use	2	0.17	0.08	2.11
	Residuals	135	5.31	0.04	-

Ants	Land use	2	0.09	0.05	1.68
	Residuals	135	3.76	0.03	-
Vascular plants	Land use	2	0.09	0.05	2.96
	Residuals	135	2.08	0.02	-

Table A.16 Differences in beta diversity among land-use types obtained using `*betadispersion2*´ R function (Bacaro et al., 2013, 2012) based on Bray-Curtis dissimilarity on square-root transformed annual activity density data (aAD) at SWOF level, analysed separately for each invertebrate group sampled from 30 SWOFs at the three land-use types in Sardinia (Southern Italy): pseudoscorpions (Pseudoscorpiones), spiders (Araneae), darkling beetles (Tenebrionidae), rove beetles (Staphylinidae), ground beetles (Carabidae), and ants (Formicidae). Significance code: (***) $p \leq 0.001$.

Taxonomic group	Source of variation	Df	SS	MS	F Model and p-value
Pseudoscorpions	Land use	2	1.07	0.53	11.81***
	Residuals	135	6.10	0.05	-
Spiders	Land use	2	0.29	0.15	13.12***
	Residuals	135	1.51	0.01	-
Darkling beetles	Land use	2	0.47	0.23	17.35***
	Residuals	135	1.81	0.01	-
Rove beetles	Land use	2	0.02	0.01	1.25
	Residuals	135	1.07	0.01	-
Ground beetles	Land use	2	0.17	0.09	2.22
	Residuals	135	5.24	0.04	-
Ants	Land use	2	0.11	0.05	1.97

Residuals	135	3.76	0.03	-

Fig. A.6 Results of the Tukey HSD test on beta dispersion analyses (beta diversity analyses) among land-use types calculated for each taxonomic group, separately, based on Bray-Curtis distances on square-root transformed abundance data (aA for invertebrates and cover percentage for vascular plants) at SWOF level. Land-use types: natural and semi-natural areas (NAT), agricultural areas (AGR), urban and artificial surfaces (URB).

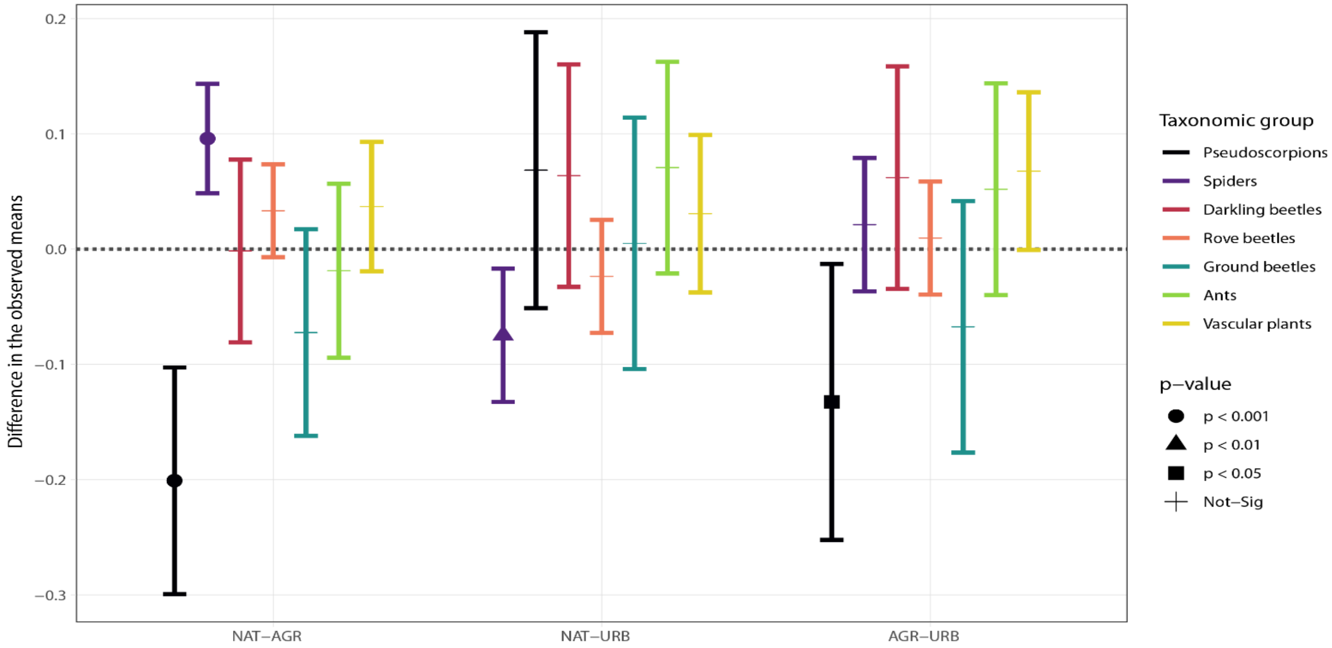

Fig. A.7 Results of the Tukey HSD test on beta dispersion analyses (beta diversity analyses) among land-use types calculated for each taxonomic group, separately, based on Bray-Curtis distances on square-root transformed abundance data (aAD for invertebrates and cover percentage for vascular plants) at SWOF level. Land-use types: natural and semi-natural areas (NAT), agricultural areas

(AGR), urban and artificial surfaces (URB). Taxonomic groups sampled from 30 SWOFs at the three land-use types (LU) in Sardinia (Southern Italy): pseudoscorpions (Pseudoscorpiones), spiders (Araneae), darkling beetles (Tenebrionidae), rove beetles (Staphylinidae), ground beetles (Carabidae), ants (Formicidae), and vascular plants.

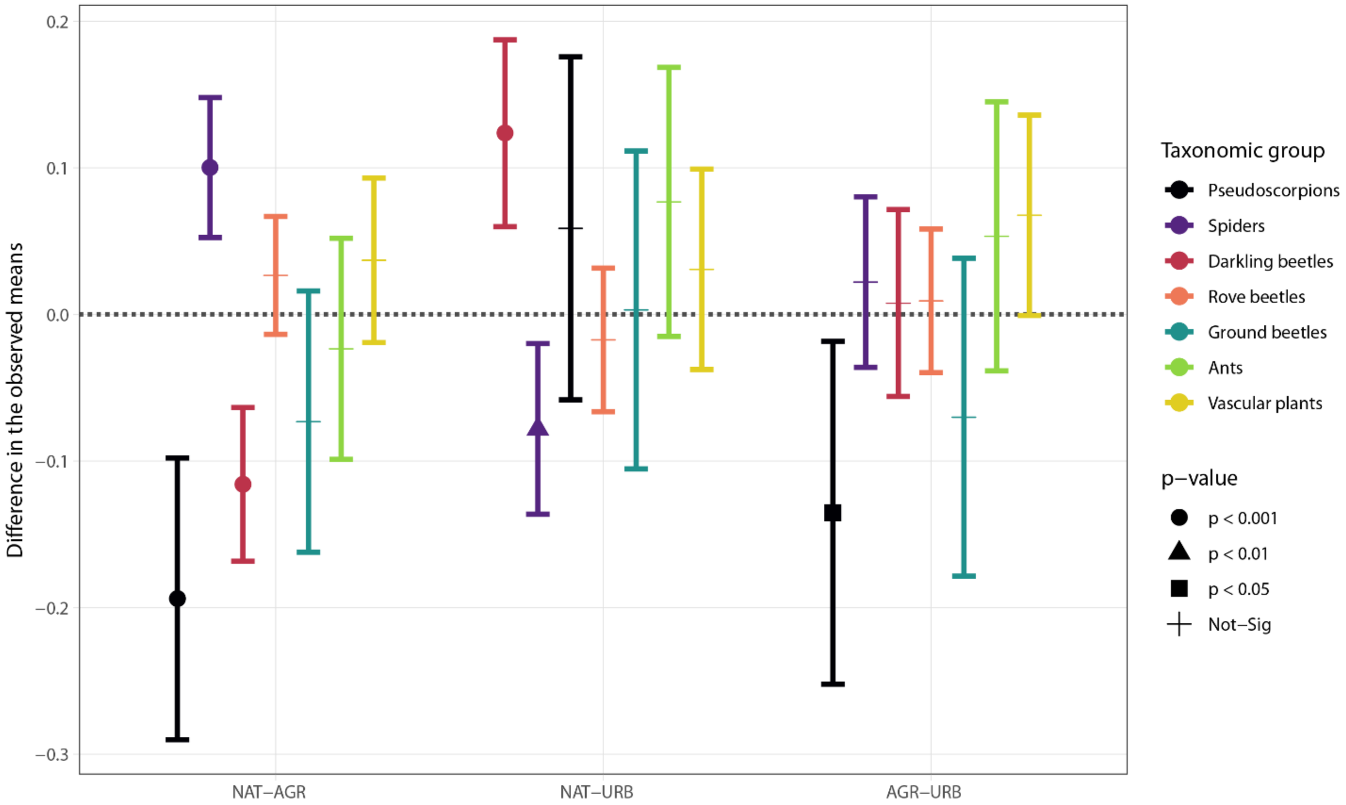

Table A.17 Results of the SIMilarity PERcentages (SIMPER) analysis based on Bray-Curtis distances on square-root transformed abundance data (cover percentage for vascular plants, and absolute abundance - aA, number of collected individuals - for invertebrates) at SWOF level for each of the seven taxonomic groups sampled from 30 Small Woodlots Outside Forest in Sardinia (Southern Italy): pseudoscorpions (Pseudoscorpiones), spiders (Araneae), darkling beetles (Tenebrionidae), rove beetles (Staphylinidae), ground beetles (Carabidae), ants (Formicidae), and vascular plants.

Abbreviations: Av. Abund. = average abundance; Av. Diss. = average dissimilarity (%); Diss/SD = dissimilarity/standard deviation; Contrib. = contribution to overall dissimilarity (%); Cum. = cumulative dissimilarity (%). Results of a cut-off level of 90% were showed only for pseudoscorpions, darkling beetles, rove beetles, ground beetles and ants. For spiders and vascular plants, only the cumulative dissimilarity of up to 70% was showed.

	NAT vs. AGR	NAT	AGR				
Taxonomic group	Species	Av. Abund.	Av. Abund.	Av. Diss.	Diss/SD	Contrib. (%)	Cum. (%)
Pseudoscorpions	*Hysterochelifer tuberculatus* (Lucas. 1849)	1.87	0.09	18.55	1.17	22.64	22.64
Pseudoscorpions	*Occidenchthonius berninii* (Callaini. 1983)	1.17	1.29	13.82	1.09	16.88	39.52
Pseudoscorpions	*Ephippiochthonius siculus* (Beier. 1961)	0.56	0.93	9.72	1.01	11.86	51.38
Pseudoscorpions	*Roncus caralitanus* Gardini. 1981	0.95	0.44	8.71	1.24	10.63	62.02
Pseudoscorpions	*Pselaphochernes lacertosus* (L. Koch. 1873)	0.00	0.96	8.61	0.70	10.51	72.53
Pseudoscorpions	*Geogarypus italicus* Gardini. Galli & Zinni. 2017	0.09	0.42	4.48	0.62	5.47	77.99
Pseudoscorpions	*Geogarypus minor* (L. Koch. 1873)	0.09	0.40	3.91	0.73	4.78	82.77
Pseudoscorpions	*Neobisium incertum* Chamberlin. 1930	0.09	0.33	3.52	0.54	4.29	87.06
Pseudoscorpions	*Chthonius leoi* (Callaini. 1988)	0.00	0.44	2.95	0.45	3.60	90.66

	AGR vs. URB	AGR	URB				
Taxonomic group	Species	Av. Abund.	Av. Abund.	Av. Diss.	Diss/SD	Contrib. (%)	Cum. (%)
Pseudoscorpions	*Pselaphochernes lacertosus* (L. Koch. 1873)	0.96	2.11	17.49	1.42	22.95	22.95
Pseudoscorpions	*Occidenchthonius berninii* (Callaini. 1983)	1.29	0.18	12.28	0.93	16.11	39.05
Pseudoscorpions	*Ephippiochthonius siculus* (Beier. 1961)	0.93	0.90	9.15	1.13	12.00	51.05
Pseudoscorpions	*Chthonius leoi* (Callaini. 1988)	0.44	0.83	7.97	0.82	10.45	61.50
Pseudoscorpions	*Hysterochelifer* cf. *spinosus* (Beier. 1930)	0.31	0.41	5.02	0.65	6.58	68.08
Pseudoscorpions	*Roncus caralitanus* Gardini. 1981	0.44	0.31	4.92	0.65	6.45	74.53
Pseudoscorpions	*Calocheiridius olivieri* (Simon. 1879)	0.18	0.43	4.62	0.48	6.06	80.59
Pseudoscorpions	*Geogarypus minor* (L. Koch. 1873)	0.40	0.00	3.67	0.68	4.81	85.40
Pseudoscorpions	*Geogarypus italicus* Gardini. Galli & Zinni. 2017	0.42	0.00	3.63	0.54	4.76	90.17

	NAT vs. URB	NAT	URB				
Taxonomic group	Species	Av. Abund.	Av. Abund.	Av. Diss.	Diss/SD	Contrib. (%)	Cum. (%)
Pseudoscorpions	*Pselaphochernes lacertosus* (L. Koch. 1873)	0.00	2.11	20.17	1.44	22.68	22.68
Pseudoscorpions	*Hysterochelifer tuberculatus* (Lucas. 1849)	1.87	0.31	18.91	1.14	21.27	43.95
Pseudoscorpions	*Occidenchthonius berninii* (Callaini. 1983)	1.17	0.18	10.88	1.00	12.24	56.19
Pseudoscorpions	*Ephippiochthonius siculus* (Beier. 1961)	0.56	0.90	10.14	1.42	11.41	67.60

Pseudoscorpions	*Roncus caralitanus* Gardini. 1981	0.95	0.31	9.96	1.34	11.20	78.80
Pseudoscorpions	*Chthonius leoi* (Callaini. 1988)	0.00	0.83	6.78	0.69	7.63	86.43
Pseudoscorpions	*Calocheiridius olivieri* (Simon. 1879)	0.13	0.43	4.25	0.47	4.78	91.21

Taxonomic group	NAT vs. AGR Species	Group NAT Av. Abund.	Group AGR Av. Abund.	Av. Diss.	Diss/SD	Contrib. (%)	Cum. (%)
Spiders	*Zodarion elegans* (Simon. 1873)	1.40	4.43	5.41	1.35	7.38	7.38
Spiders	*Zelotes fuscorufus* (Simon. 1878)	0.86	2.51	3.35	1.49	4.57	11.94
Spiders	*Zelotes tenuis* (L. Koch. 1866)	0.42	2.01	3.13	1.19	4.27	16.22
Spiders	*Scytodes velutina* Heineken & Lowe. 1832	0.57	1.93	3.09	1.25	4.21	20.43
Spiders	*Dysdera crocata* C. L. Koch. 1838	0.49	1.71	2.61	1.25	3.56	23.99
Spiders	*Ozyptila confluens* (C. L. Koch. 1845)	1.23	2.25	2.58	1.58	3.52	27.51
Spiders	*Zelotes callidus* (Simon. 1878)	0.13	1.47	2.22	1.65	3.03	30.54
Spiders	*Marinarozelotes barbatus* (L. Koch. 1866)	0.09	1.45	2.03	1.01	2.77	33.31
Spiders	*Lycosoides coarctata* (Dufour. 1831)	0.00	1.19	1.98	1.27	2.70	36.01
Spiders	*Harpactea* sp. *corticalis* group	1.66	1.00	1.86	1.38	2.54	38.54
Spiders	*Zelotes sardus* (Canestrini. 1873)	0.78	1.29	1.84	1.40	2.51	41.05
Spiders	*Marinarozelotes lyonneti* (Audouin. 1826)	0.00	1.19	1.81	0.95	2.46	43.52
Spiders	*Zodarion pusio* Simon. 1914	0.00	1.08	1.74	0.56	2.38	45.89
Spiders	*Liophrurillus flavitarsis* (Lucas. 1846)	0.74	0.79	1.51	1.09	2.06	47.95
Spiders	*Palliduphantes angustiformis* (Simon. 1884)	1.31	1.72	1.47	1.25	2.01	49.96
Spiders	*Zodarion pseudonigriceps* Bosmans & Pantini. 2019	0.71	0.16	1.36	0.65	1.85	51.81
Spiders	*Centromerus isaiai* Bosmans. 2015	0.78	0.09	1.35	0.95	1.84	53.65
Spiders	*Zodarion ruffoi* Caporiacco. 1951	0.22	0.73	1.26	0.79	1.72	55.37
Spiders	*Evarcha jucunda* (Lucas. 1846)	0.36	0.59	1.22	0.87	1.66	57.03
Spiders	*Euophrys* sp.	0.40	0.66	1.21	1.08	1.65	58.68
Spiders	*Loxosceles rufescens* (Dufour. 1820)	0.09	0.75	1.17	1.15	1.59	60.27
Spiders	*Silhouettella loricatula* (Roewer. 1942)	0.09	0.75	1.14	1.20	1.56	61.82
Spiders	*Urozelotes rusticus* (L. Koch. 1872)	0.00	0.68	1.06	0.58	1.45	63.27
Spiders	*Spermophorides elevata* (Simon. 1873)	0.48	0.43	1.01	0.95	1.38	64.65
Spiders	*Euryopis episinoides* (Walckenaer. 1847)	0.36	0.56	0.99	1.01	1.35	66.01
Spiders	*Cyrba algerina* (Lucas. 1846)	0.00	0.57	0.88	0.67	1.20	67.20
Spiders	*Cybaeodes marinae* Di Franco. 1989	0.40	0.27	0.86	0.87	1.17	68.38
Spiders	*Euophrys rufibarbis* (Simon. 1868)	0.09	0.44	0.86	0.75	1.17	69.55

Taxonomic group	AGR vs. URB Species	Group AGR Av. Abund.	Group URB Av. Abund.	Av. Diss.	Diss/SD	Contrib. (%)	Cum. (%)
Spiders	*Zodarion elegans* (Simon. 1873)	4.43	4.41	6.65	1.26	10.49	10.49
Spiders	*Marinarozelotes barbatus* (L. Koch. 1866)	1.45	2.37	2.62	1.31	4.14	14.63
Spiders	*Zelotes fuscorufus* (Simon. 1878)	2.51	0.83	2.61	1.53	4.12	18.75
Spiders	*Dysdera crocata* C. L. Koch. 1838	1.71	2.55	2.38	1.17	3.75	22.50
Spiders	*Zelotes tenuis* (L. Koch. 1866)	2.01	2.46	2.30	1.34	3.62	26.12
Spiders	*Scytodes velutina* Heineken & Lowe. 1832	1.93	0.89	2.24	1.29	3.53	29.65
Spiders	*Lycosoides coarctata* (Dufour. 1831)	1.19	2.63	2.17	1.03	3.42	33.08
Spiders	*Zelotes callidus* (Simon. 1878)	1.47	1.77	1.92	1.51	3.04	36.11
Spiders	*Ozyptila confluens* (C. L. Koch. 1845)	2.25	2.24	1.89	1.27	2.99	39.10
Spiders	*Heser nilicola* (O. Pickard-Cambridge. 1874)	0.49	1.79	1.88	1.70	2.97	42.07
Spiders	*Zodarion ruffoi* Caporiacco. 1951	0.73	1.55	1.67	1.34	2.63	44.70
Spiders	*Zodarion pusio* Simon. 1914	1.08	0.61	1.55	0.74	2.45	47.15
Spiders	*Harpactea* sp. *corticalis* group	1.00	0.87	1.53	1.05	2.42	49.56
Spiders	*Urozelotes rusticus* (L. Koch. 1872)	0.68	1.17	1.51	1.13	2.38	51.95
Spiders	*Nurscia albomaculata* (Lucas. 1846)	0.00	1.15	1.46	1.25	2.30	54.25
Spiders	*Zelotes sardus* (Canestrini. 1873)	1.29	0.76	1.39	1.33	2.19	56.43
Spiders	*Marinarozelotes lyonneti* (Audouin. 1826)	1.19	0.59	1.35	1.11	2.13	58.57
Spiders	*Gnaphosa alacris* Simon. 1878	0.09	0.99	1.28	0.65	2.02	60.58
Spiders	*Euophrys* sp.	0.66	1.06	1.10	1.21	1.74	62.32
Spiders	*Palliduphantes angustiformis* (Simon. 1884)	1.72	1.91	1.09	1.14	1.73	64.05
Spiders	*Loxosceles rufescens* (Dufour. 1820)	0.75	0.96	1.07	1.16	1.69	65.74
Spiders	*Cyrba algerina* (Lucas. 1846)	0.57	0.45	1.03	0.72	1.63	67.36
Spiders	*Alopecosa albofasciata* (Brullé. 1832)	0.22	0.83	1.02	0.88	1.61	68.97

Taxonomic group	NAT vs. URB Species	Group NAT Av. Abund.	Group URB Av. Abund.	Av. Diss.	Diss/SD	Contrib. (%)	Cum. (%)
Spiders	*Zodarion elegans* (Simon. 1873)	1.40	4.41	7.67	0.88	9.44	9.44
Spiders	*Lycosoides coarctata* (Dufour. 1831)	0.00	2.63	4.27	1.55	5.26	14.70
Spiders	*Dysdera crocata* C. L. Koch. 1838	0.49	2.55	3.54	1.30	4.35	19.05
Spiders	*Marinarozelotes barbatus* (L. Koch. 1866)	0.09	2.37	3.51	1.22	4.32	23.37
Spiders	*Zelotes tenuis* (L. Koch. 1866)	0.42	2.46	3.45	1.76	4.24	27.62
Spiders	*Ozyptila confluens* (C. L. Koch. 1845)	1.23	2.24	2.73	1.56	3.36	30.98
Spiders	*Heser nilicola* (O. Pickard-Cambridge. 1874)	0.00	1.79	2.72	2.05	3.34	34.32
Spiders	*Harpactea* sp. *corticalis* group	1.66	0.87	2.66	1.60	3.27	37.59

Spiders	*Zelotes callidus* (Simon. 1878)	0.13	1.77	2.58	1.15	3.18	40.77
Spiders	*Zodarion ruffoi* Caporiacco. 1951	0.22	1.55	2.23	1.43	2.75	43.51
Spiders	*Nurscia albomaculata* (Lucas. 1846)	0.00	1.15	1.97	1.22	2.42	45.93
Spiders	*Scytodes velutina* Heineken & Lowe. 1832	0.57	0.89	1.87	0.95	2.30	48.24
Spiders	*Zelotes fuscorufus* (Simon. 1878)	0.86	0.83	1.87	0.99	2.30	50.54
Spiders	*Urozelotes rusticus* (L. Koch. 1872)	0.00	1.17	1.78	1.08	2.19	52.73
Spiders	*Palliduphantes angustiformis* (Simon. 1884)	1.31	1.91	1.67	1.08	2.06	54.80
Spiders	*Gnaphosa alacris* Simon. 1878	0.00	0.99	1.67	0.64	2.06	56.85
Spiders	*Euophrys* sp.	0.40	1.06	1.64	1.20	2.02	58.87
Spiders	*Loxosceles rufescens* (Dufour. 1820)	0.09	0.96	1.57	1.08	1.93	60.80
Spiders	*Liophrurillus flavitarsis* (Lucas. 1846)	0.74	0.43	1.39	0.89	1.71	62.51
Spiders	*Centromerus isaiai* Bosmans. 2015	0.78	0.00	1.32	0.92	1.63	64.14
Spiders	*Zelotes sardus* (Canestrini. 1873)	0.78	0.76	1.32	1.23	1.63	65.76
Spiders	*Alopecosa albofasciata* (Brullé. 1832)	0.09	0.83	1.31	0.86	1.61	67.38
Spiders	*Zodarion pseudonigriceps* Bosmans & Pantini. 2019	0.71	0.00	1.17	0.57	1.44	68.81
Spiders	*Marinarozelotes lyonneti* (Audouin. 1826)	0.00	0.59	0.94	0.93	1.15	69.97

	NAT vs. AGR	NAT	AGR				
Taxonomic group	Species	Av. Abund.	Av. Abund.	Av. Diss.	Diss/SD	Contrib. (%)	Cum. (%)
Darkling beetles	*Tentyria grossa sardiniensis* Ardoin. 1973	0.74	3.95	19.79	1.09	24.50	24.50
Darkling beetles	*Pimelia* (*Pimelia*) *goryi goryi* Solier. 1836	1.38	1.68	13.94	1.16	17.25	41.75
Darkling beetles	*Stenosis sardoa sardoa* (Küster. 1848)	0.09	1.29	11.65	0.71	14.41	56.16
Darkling beetles	*Crypticus* (*Crypticus*) *gibbulus* (Quensel. 1806)	0.31	1.02	9.09	0.88	11.25	67.42
Darkling beetles	*Akis trilineata barbara* Solier. 1837	0.18	1.27	6.87	0.79	8.50	75.91
Darkling beetles	*Scaurus atratus* Fabricius. 1775	0.43	0.84	4.93	1.07	6.10	82.02
Darkling beetles	*Asida* (*Asida*) *androgyna* Leo. 2012	0.31	0.00	2.89	0.51	3.58	85.59
Darkling beetles	*Dichillus* (*Dichillus*) *corsicus* (Solier. 1838)	0.00	0.09	1.51	0.29	1.87	87.46
Darkling beetles	*Probaticus ebeninus ebeninus* (Villa. 1838)	0.13	0.00	1.39	0.27	1.72	89.18
Darkling beetles	*Lagria* (*Lagria*) *hirta* (Linnaeus. 1758)	0.09	0.00	1.25	0.26	1.55	90.73

	AGR vs. URB	AGR	URB				
Taxonomic group	Species	Av. Abund.	Av. Abund.	Av. Diss.	Diss/SD	Contrib. (%)	Cum. (%)
Darkling beetles	*Tentyria grossa sardiniensis* Ardoin. 1973	3.95	2.24	18.38	1.19	24.44	24.44
Darkling beetles	*Stenosis sardoa sardoa* (Küster. 1848)	1.29	2.96	14.43	1.13	19.18	43.62
Darkling beetles	*Pimelia* (*Pimelia*) *goryi goryi* Solier. 1836	1.68	0.43	9.71	1.02	12.90	56.52
Darkling beetles	*Crypticus* (*Crypticus*) *gibbulus* (Quensel. 1806)	1.02	0.87	5.82	0.80	7.74	64.26

Darkling beetles	*Akis trilineata barbara* Solier. 1837	1.27	0.18	5.23	0.72	6.96	71.22
Darkling beetles	*Scaurus atratus* Fabricius. 1775	0.84	0.60	4.88	0.76	6.49	77.71
Darkling beetles	*Opatroides punctulatus* Brullé. 1832	0.18	0.80	4.10	0.66	5.45	83.16
Darkling beetles	*Gonocephalum* (*Gonocephalum*) *rusticum* (A. G. Olivier. 1811)	0.09	0.80	3.94	0.60	5.24	88.39
Darkling beetles	*Probaticus ebeninus cassolai* (Ardoin. 1973)	0.00	0.30	2.68	0.45	3.56	91.96

	NAT vs. URB	NAT	URB				
Taxonomic group	Species	Av. Abund.	Av. Abund.	Av. Diss.	Diss/SD	Contrib. (%)	Cum. (%)
Darkling beetles	*Stenosis sardoa sardoa* (Küster. 1848)	0.09	2.96	19.28	1.32	21.66	21.66
Darkling beetles	*Tentyria grossa sardiniensis* Ardoin. 1973	0.74	2.24	14.86	1.04	16.70	38.36
Darkling beetles	*Pimelia* (*Pimelia*) *goryi goryi* Solier. 1836	1.38	0.43	12.19	0.80	13.69	52.05
Darkling beetles	*Crypticus* (*Crypticus*) *gibbulus* (Quensel. 1806)	0.31	0.87	6.87	0.84	7.72	59.77
Darkling beetles	*Probaticus ebeninus cassolai* (Ardoin. 1973)	0.00	0.30	5.67	0.38	6.37	66.14
Darkling beetles	*Scaurus atratus* Fabricius. 1775	0.43	0.60	5.48	0.67	6.15	72.29
Darkling beetles	*Opatroides punctulatus* Brullé. 1832	0.00	0.80	4.95	0.60	5.56	77.85
Darkling beetles	*Gonocephalum* (*Gonocephalum*) *rusticum* (A. G. Olivier. 1811)	0.00	0.80	4.80	0.56	5.39	83.24
Darkling beetles	*Lagria* (*Lagria*) *hirta* (Linnaeus. 1758)	0.09	0.13	3.77	0.38	4.24	87.48
Darkling beetles	*Asida* (*Asida*) *androgyna* Leo. 2012	0.31	0.00	3.30	0.48	3.70	91.18

	NAT vs. AGR	NAT	AGR				
Taxonomic group	Species	Av. Abund.	Av. Abund.	Av. Diss.	Diss/SD	Contrib. (%)	Cum. (%)
Rove beetles	*Atheta* (gruppo I) *laticollis* (Stephens. 1832)	11.00	9.14	3.79	1.42	7.94	7.94
Rove beetles	*Atheta* (*Atheta*) *castanoptera* (Mannerheim. 1831)	6.65	6.44	2.96	1.31	6.19	14.14
Rove beetles	*Atheta* (gruppo I) *oblita* (Erichson. 1839)	3.29	2.88	2.95	1.25	6.17	20.31
Rove beetles	*Ocypus olens* (O.F. Müller. 1764)	1.93	2.03	2.29	1.15	4.79	25.10
Rove beetles	*Othius punctulatus* (Goeze. 1777)	2.02	0.34	2.07	1.01	4.34	29.44
Rove beetles	*Lordithon exoletus* (Erichson. 1839)	1.88	0.81	1.79	1.31	3.75	33.19
Rove beetles	*Atheta* (*Dimetrota*) *atramentaria* (Gyllenhal. 1810)	0.29	1.55	1.79	0.77	3.74	36.93
Rove beetles	*Ischnosoma splendidum* (Gravenhorst. 1806)	1.41	1.49	1.76	1.34	3.69	40.62
Rove beetles	*Heterothops dissimilis* (Gravenhorst. 1802)	2.07	1.65	1.67	1.45	3.51	44.13
Rove beetles	*Quedius brevicornis* Thomson. 1860	1.55	0.09	1.65	1.00	3.46	47.59
Rove beetles	*Quedius* (*Raphirus*) *humeralis* Stephens. 1832	1.48	1.04	1.62	1.18	3.40	50.99
Rove beetles	*Aleochara erythroptera* Gravenhorst. 1806	1.00	1.09	1.60	1.11	3.35	54.33
Rove beetles	*Sepedophilus nigripennis* (Stephens. 1832	0.62	1.23	1.52	0.79	3.18	57.52
Rove beetles	*Quedius* (*Raphirus*) *semiaeneus* (Stephens. 1833)	1.19	0.94	1.51	1.17	3.16	60.68

Rove beetles	*Tachyporus nitidulus* (Fabricius. 1781)	3.42	3.26	1.45	1.34	3.03	63.71
Rove beetles	*Proteinus atomarius* Erichson. 1840	1.26	0.31	1.40	0.76	2.93	66.64
Rove beetles	*Habrocerus capillaricornis* (Gravenhorst. 1806)	0.50	0.81	1.12	0.81	2.35	68.99
Rove beetles	*Omalium rugatum* Rey. 1880	1.04	0.00	1.12	0.81	2.35	71.34
Rove beetles	*Proteinus brachypterus* (Fabricius. 1792)	0.97	0.00	1.06	0.68	2.22	73.56
Rove beetles	*Philonthus carbonarius* (Gravenhorst. 1802)	0.53	0.77	1.03	0.80	2.15	75.71
Rove beetles	*Philonthus cognatus* (Stephens. 1832)	0.93	0.09	1.02	0.95	2.13	77.84
Rove beetles	*Quedius* (*Quedius*) *pallipes* (Lucas. 1849)	0.56	0.67	0.98	0.81	2.06	79.90
Rove beetles	*Ocypus ophthalmicus* (Scopoli. 1763)	0.31	0.71	0.94	0.72	1.97	81.87
Rove beetles	*Ocypus morsitans cerdo* Erichson. 1840	0.92	0.00	0.88	0.56	1.85	83.72
Rove beetles	*Quedius* (*Raphirus*) *semiobscurus* (Marsham. 1802)	0.41	0.56	0.85	0.83	1.79	85.51
Rove beetles	*Aleochara bilineata* Gyllenhal. 1810	0.79	0.00	0.83	0.74	1.74	87.25
Rove beetles	*Amarochara cribripennis* Mulsant & Rey. 1874	0.43	0.25	0.64	0.75	1.35	88.60
Rove beetles	*Atheta* (gruppo II) *trinotata* (Kraatz. 1856)	0.00	0.58	0.58	0.46	1.22	89.81
Rove beetles	*Astrapaeus ulmi* (Rossi. 1790)	0.44	0.13	0.58	0.46	1.21	91.02

	AGR vs. URB	AGR	URB				
Taxonomic group	Species	Av. Abund.	Av. Abund.	Av. Diss.	Diss/SD	Contrib. (%)	Cum. (%)
Rove beetles	*Atheta* (gruppo I) *laticollis* (Stephens. 1832)	9.14	9.84	4.23	1.07	9.49	9.49
Rove beetles	*Atheta* (gruppo I) *oblita* (Erichson. 1839)	2.88	3.81	3.54	1.20	7.94	17.43
Rove beetles	*Atheta* (*Atheta*) *castanoptera* (Mannerheim. 1831)	6.44	5.59	3.24	1.02	7.27	24.70
Rove beetles	*Ocypus olens* (O.F. Müller. 1764)	2.03	1.73	2.34	1.13	5.25	29.94
Rove beetles	*Tachyporus nitidulus* (Fabricius. 1781)	3.26	2.73	2.27	1.39	5.08	35.02
Rove beetles	*Atheta* (*Dimetrota*) *atramentaria* (Gyllenhal. 1810)	1.55	0.43	2.16	0.84	4.85	39.87
Rove beetles	*Sepedophilus nigripennis* (Stephens. 1832	1.23	0.91	2.01	0.85	4.51	44.38
Rove beetles	*Heterothops dissimilis* (Gravenhorst. 1802)	1.65	2.13	1.90	1.38	4.26	48.64
Rove beetles	*Philonthus carbonarius* (Gravenhorst. 1802)	0.77	1.39	1.85	1.24	4.15	52.80
Rove beetles	*Quedius* (*Raphirus*) *humeralis* Stephens. 1832	1.04	0.83	1.64	1.03	3.67	56.46
Rove beetles	*Quedius* (*Raphirus*) *semiaeneus* (Stephens. 1833)	0.94	1.04	1.61	1.08	3.62	60.08
Rove beetles	*Ischnosoma splendidum* (Gravenhorst. 1806)	1.49	0.68	1.59	1.28	3.56	63.64
Rove beetles	*Aleochara erythroptera* Gravenhorst. 1806	1.09	0.00	1.40	0.72	3.15	66.79
Rove beetles	*Habrocerus capillaricornis* (Gravenhorst. 1806)	0.81	0.22	1.18	0.76	2.64	69.43
Rove beetles	*Lordithon exoletus* (Erichson. 1839)	0.81	0.25	1.08	0.77	2.43	71.86
Rove beetles	*Quedius* (*Quedius*) *pallipes* (Lucas. 1849)	0.67	0.43	1.07	0.79	2.39	74.25
Rove beetles	*Quedius brevicornis* Thomson. 1860	0.09	0.71	0.92	0.62	2.07	76.32

Rove beetles	*Philonthus cognatus* (Stephens. 1832)	0.09	0.80	0.91	0.82	2.04	78.37
Rove beetles	*Ocypus ophthalmicus* (Scopoli. 1763)	0.71	0.00	0.86	0.53	1.94	80.31
Rove beetles	*Quedius* (*Raphirus*) *semiobscurus* (Marsham. 1802)	0.56	0.22	0.79	0.80	1.76	82.07
Rove beetles	*Othius punctulatus* (Goeze. 1777)	0.34	0.38	0.78	0.65	1.76	83.83
Rove beetles	*Meotica filaria* (Fauvel. 1898)	0.22	0.41	0.69	0.56	1.56	85.38
Rove beetles	*Atheta* (gruppo II) *trinotata* (Kraatz. 1856)	0.58	0.00	0.67	0.46	1.50	86.88
Rove beetles	*Proteinus atomarius* Erichson. 1840	0.31	0.00	0.48	0.31	1.07	87.95
Rove beetles	*Quedius* (*Raphirus*) *nemoralis* Stephens. 1832	0.20	0.22	0.47	0.45	1.06	89.00
Rove beetles	*Cordalia obscura* (Gravenhorst. 1802)	0.00	0.41	0.47	0.37	1.05	90.05

	NAT vs. URB	NAT	URB				
Taxonomic group	Species	Av. Abund.	Av. Abund.	Av. Diss.	Diss/SD	Contrib. (%)	Cum. (%)
Rove beetles	*Atheta* (gruppo I) *laticollis* (Stephens. 1832)	11.00	9.84	4.31	1.28	8.91	8.91
Rove beetles	*Atheta* (*Atheta*) *castanoptera* (Mannerheim. 1831)	6.65	5.59	4.04	1.25	8.35	17.26
Rove beetles	*Atheta* (gruppo I) *oblita* (Erichson. 1839)	3.29	3.81	3.02	1.13	6.25	23.51
Rove beetles	*Othius punctulatus* (Goeze. 1777)	2.02	0.38	2.20	0.95	4.54	28.05
Rove beetles	*Tachyporus nitidulus* (Fabricius. 1781)	3.42	2.73	2.18	1.47	4.51	32.56
Rove beetles	*Ocypus olens* (O.F. Müller. 1764)	1.93	1.73	2.00	1.22	4.13	36.69
Rove beetles	*Heterothops dissimilis* (Gravenhorst. 1802)	2.07	2.13	1.97	1.30	4.07	40.77
Rove beetles	*Lordithon exoletus* (Erichson. 1839)	1.88	0.25	1.93	1.36	3.99	44.76
Rove beetles	*Quedius brevicornis* Thomson. 1860	1.55	0.71	1.82	1.06	3.76	48.52
Rove beetles	*Quedius* (*Raphirus*) *humeralis* Stephens. 1832	1.48	0.83	1.67	1.12	3.45	51.97
Rove beetles	*Quedius* (*Raphirus*) *semiaeneus* (Stephens. 1833)	1.19	1.04	1.65	1.10	3.41	55.38
Rove beetles	*Philonthus carbonarius* (Gravenhorst. 1802)	0.53	1.39	1.57	1.14	3.24	58.63
Rove beetles	*Ischnosoma splendidum* (Gravenhorst. 1806)	1.41	0.68	1.56	1.12	3.22	61.85
Rove beetles	*Proteinus atomarius* Erichson. 1840	1.26	0.00	1.30	0.72	2.68	64.52
Rove beetles	*Philonthus cognatus* (Stephens. 1832)	0.93	0.80	1.28	1.18	2.64	67.17
Rove beetles	*Sepedophilus nigripennis* (Stephens. 1832	0.62	0.91	1.23	0.83	2.55	69.71
Rove beetles	*Omalium rugatum* Rey. 1880	1.04	0.00	1.17	0.81	2.43	72.14
Rove beetles	*Ocypus morsitans cerdo* Erichson. 1840	0.92	0.40	1.12	0.72	2.32	74.46
Rove beetles	*Aleochara erythroptera* Gravenhorst. 1806	1.00	0.00	1.12	0.81	2.31	76.77
Rove beetles	*Proteinus brachypterus* (Fabricius. 1792)	0.97	0.00	1.11	0.68	2.30	79.07
Rove beetles	*Aleochara bilineata* Gyllenhal. 1810	0.79	0.00	0.87	0.73	1.80	80.87
Rove beetles	*Quedius* (*Quedius*) *pallipes* (Lucas. 1849)	0.56	0.43	0.84	0.83	1.73	82.60
Rove beetles	*Habrocerus capillaricornis* (Gravenhorst. 1806)	0.50	0.22	0.69	0.60	1.42	84.02

Rove beetles	*Atheta* (*Dimetrota*) *atramentaria* (Gyllenhal. 1810)	0.29	0.43	0.65	0.68	1.35	85.37
Rove beetles	*Astrapaeus ulmi* (Rossi. 1790)	0.44	0.18	0.63	0.48	1.31	86.67
Rove beetles	*Quedius* (*Raphirus*) *semiobscurus* (Marsham. 1802)	0.41	0.22	0.62	0.57	1.29	87.97
Rove beetles	*Amarochara cribripennis* Mulsant & Rey. 1874	0.43	0.00	0.58	0.62	1.20	89.16
Rove beetles	*Phacophallus parumpunctatus* (Gyllenhal. 1827)	0.54	0.00	0.56	0.58	1.16	90.32

	NAT vs. AGR	NAT	AGR				
Taxonomic group	Species	Av. Abund.	Av. Abund.	Av. Diss.	Diss/SD	Contrib. (%)	Cum. (%)
Ground beetles	*Laemostenus* (*Laemostenus*) *complanatus* (Dejean. 1828)	0.55	3.74	18.25	0.97	20.09	20.09
Ground beetles	*Laemostenus* (*Actenipus*) *carinatus* (Chaudoir. 1859)	1.27	0.00	9.14	0.95	10.06	30.14
Ground beetles	*Percus* (*Percus*) *strictus ellipticus* (Porta. 1901)	1.25	0.09	8.28	0.97	9.12	39.26
Ground beetles	*Calathus* (*Neocalathus*) *cinctus* Motschulsky. 1850	0.00	1.21	6.64	0.94	7.31	46.57
Ground beetles	*Percus* (*Percus*) *strictus oberleitneri* (Dejean. 1831)	0.31	0.87	6.43	0.75	7.08	53.64
Ground beetles	*Carabus* (*Macrothorax*) *morbillosus constantinus* Kraatz. 1899	0.58	0.52	5.34	0.70	5.87	59.52
Ground beetles	*Calathus* (*Neocalathus*) *mollis* (Marsham. 1802)	0.00	1.37	4.82	0.54	5.31	64.83
Ground beetles	*Agonum* gr. *viduum*	0.81	0.00	4.46	0.59	4.91	69.74
Ground beetles	*Laemostenus* (*Pristonychus*) *algerinus algerinus* (Gory. 1833)	0.34	0.36	3.46	0.70	3.80	73.54
Ground beetles	*Calathus* (*Neocalathus*) *solieri* Bassi. 1834	0.13	0.72	2.72	0.44	2.99	76.53
Ground beetles	*Paranchus albipes* (Fabricius. 1796)	0.60	0.00	2.44	0.44	2.69	79.22
Ground beetles	*Orthomus berytensis* (Reiche & Saulcy. 1855)	0.00	0.75	2.25	0.44	2.47	81.70
Ground beetles	*Calosoma* (*Campalita*) *maderae maderae* (Fabricius. 1775)	0.18	0.27	1.75	0.65	1.92	83.62
Ground beetles	*Ocys harpaloides* (Audinet-Serville. 1821)	0.30	0.13	1.71	0.41	1.88	85.51
Ground beetles	*Zabrus* (*Zabrus*) *ignavus ignavus* Csiki. 1907	0.09	0.09	1.58	0.39	1.73	87.24
Ground beetles	*Calosoma* (*Calosoma*) *sycophanta* (Linnaeus. 1758)	0.09	0.09	1.52	0.38	1.67	88.91
Ground beetles	*Leistus* (*Sardoleistus*) *sardous* Baudi di Selve. 1883	0.27	0.00	1.50	0.43	1.65	90.55

	AGR vs. URB	AGR	URB				
Taxonomic group	Species	Av. Abund.	Av. Abund.	Av. Diss.	Diss/SD	Contrib. (%)	Cum. (%)
Ground beetles	*Laemostenus* (*Laemostenus*) *complanatus* (Dejean. 1828)	3.74	9.85	27.78	1.73	33.84	33.84
Ground beetles	*Orthomus berytensis* (Reiche & Saulcy. 1855)	0.75	2.54	8.07	0.84	9.83	43.68
Ground beetles	*Calathus* (*Neocalathus*) *cinctus* Motschulsky. 1850	1.21	2.52	7.89	1.12	9.62	53.29
Ground beetles	*Calosoma* (*Campalita*) *maderae maderae* (Fabricius. 1775)	0.27	0.97	4.71	0.66	5.74	59.04
Ground beetles	*Percus* (*Percus*) *strictus oberleitneri* (Dejean. 1831)	0.87	0.00	4.52	0.54	5.51	64.54
Ground beetles	*Calathus* (*Neocalathus*) *mollis* (Marsham. 1802)	1.37	0.34	4.07	0.53	4.96	69.50
Ground beetles	*Carabus* (*Macrothorax*) *morbillosus constantinus* Kraatz. 1899	0.52	0.30	3.46	0.53	4.21	73.71

Ground beetles	*Laemostenus* (*Pristonychus*) *algerinus algerinus* (Gory. 1833)	0.36	0.56	2.29	0.66	2.79	76.50
Ground beetles	*Calathus* (*Neocalathus*) *solieri* Bassi. 1834	0.72	0.18	2.28	0.43	2.78	79.28
Ground beetles	*Phyla tethys* (Netolitzky. 1926)	0.09	0.46	1.58	0.59	1.93	81.21
Ground beetles	*Licinus* (*Licinus*) *punctatulus* (Fabricius. 1792)	0.00	0.34	1.54	0.47	1.88	83.09
Ground beetles	*Microlestes abeillei sardous* Holdhaus. 1912	0.09	0.13	1.54	0.38	1.87	84.96
Ground beetles	*Phyla rectangula* (Jacquelin du Val. 1852)	0.00	0.35	1.50	0.52	1.82	86.78
Ground beetles	*Tschitscherinellus cordatus* (Dejean 1825)	0.39	0.00	1.04	0.41	1.26	88.04
Ground beetles	*Acinopus* (*Acinopus*) *picipes* (Olivier. 1795)	0.09	0.00	0.93	0.24	1.13	89.18
Ground beetles	*Amara* (*Amara*) *aenea* (De Geer. 1774)	0.00	0.18	0.93	0.35	1.13	90.31

	NAT vs. URB	NAT	URB				
Taxonomic group	Species	Av. Abund.	Av. Abund.	Av. Diss.	Diss/SD	Contrib. (%)	Cum. (%)
Ground beetles	*Laemostenus* (*Laemostenus*) *complanatus* (Dejean. 1828)	0.55	9.85	28.66	1.64	30.36	30.36
Ground beetles	*Orthomus berytensis* (Reiche & Saulcy. 1855)	0.00	2.54	8.28	0.79	8.78	39.13
Ground beetles	*Laemostenus* (*Actenipus*) *carinatus* (Chaudoir. 1859)	1.27	0.00	8.06	0.84	8.54	47.67
Ground beetles	*Percus* (*Percus*) *strictus ellipticus* (Porta. 1901)	1.25	0.00	7.51	0.83	7.95	55.63
Ground beetles	*Calosoma* (*Campalita*) *maderae maderae* (Fabricius. 1775)	0.18	0.97	5.46	0.72	5.78	61.40
Ground beetles	*Calathus* (*Neocalathus*) *cinctus* Motschulsky. 1850	0.00	2.52	4.67	0.69	4.95	66.36
Ground beetles	*Agonum* gr. *viduum*	0.81	0.00	3.94	0.54	4.17	70.53
Ground beetles	*Carabus* (*Macrothorax*) *morbillosus constantinus* Kraatz. 1899	0.58	0.30	3.76	0.71	3.99	74.52
Ground beetles	*Laemostenus* (*Pristonychus*) *algerinus algerinus* (Gory. 1833)	0.34	0.56	2.88	0.62	3.05	77.57
Ground beetles	*Percus* (*Percus*) *strictus oberleitneri* (Dejean. 1831)	0.31	0.00	2.31	0.41	2.45	80.02
Ground beetles	*Paranchus albipes* (Fabricius. 1796)	0.60	0.00	2.17	0.42	2.29	82.31
Ground beetles	*Licinus* (*Licinus*) *punctatulus* (Fabricius. 1792)	0.00	0.34	1.76	0.48	1.86	84.17
Ground beetles	*Phyla rectangula* (Jacquelin du Val. 1852)	0.00	0.35	1.70	0.53	1.80	85.97
Ground beetles	*Phyla tethys* (Netolitzky. 1926)	0.00	0.46	1.50	0.53	1.59	87.56
Ground beetles	*Microlestes abeillei sardous* Holdhaus. 1912	0.00	0.13	1.48	0.35	1.57	89.13
Ground beetles	*Leistus* (*Sardoleistus*) *sardous* Baudi di Selve. 1883	0.27	0.00	1.32	0.40	1.40	90.53

	NAT vs. AGR	NAT	AGR				
Taxonomic group	Species	Av. Abund.	Av. Abund.	Av. Diss.	Diss/SD	Contrib. (%)	Cum. (%)
Ants	*Pheidole pallidula* (Nylander. 1849)	8.66	17.48	9.76	1.28	13.82	13.82
Ants	*Aphaenogaster senilis* Mayr. 1853	1.10	13.47	8.39	1.59	11.88	25.70
Ants	*Tetramorium semilaeve* André. 1883	1.84	8.90	5.06	1.13	7.17	32.87
Ants	*Aphaenogaster spinosa* Emery. 1878	7.53	0.00	5.01	1.61	7.09	39.96

Ants	*Lasius niger* (Linnaeus. 1758)	1.98	7.02	4.56	0.78	6.45	46.41
Ants	*Linepithema humile* (Mayr. 1868)	0.09	4.83	4.16	0.38	5.90	52.31
Ants	*Crematogaster scutellaris* (Olivier. 1792)	9.68	7.52	3.79	1.32	5.36	57.67
Ants	*Camponotus aethiops* (Latreille. 1798)	4.38	6.29	3.62	1.23	5.12	62.79
Ants	*Aphaenogaster ichnusa* Santschi. 1925	5.07	0.27	3.45	0.97	4.89	67.68
Ants	*Camponotus lateralis* (Olivier. 1792)	2.45	4.63	2.68	1.10	3.79	71.47
Ants	*Plagiolepis pygmaea* (Latreille. 1798)	4.22	4.03	2.60	1.38	3.69	75.16
Ants	*Myrmica spinosior* Santschi. 1931	2.80	0.00	2.18	0.58	3.08	78.24
Ants	*Solenopsis fugax* Latreille. 1798	1.41	3.25	1.92	0.78	2.72	80.97
Ants	*Tapinoma simrothi* Krausse. 1911	1.32	2.13	1.69	0.92	2.39	83.36
Ants	*Tapinoma madeirense* Forel. 1895	0.22	2.12	1.32	0.73	1.88	85.23
Ants	*Messor minor* (André. 1883)	0.36	1.82	1.24	1.01	1.75	86.99
Ants	*Messor capitatus* (Latreille. 1798)	0.18	1.85	1.17	0.88	1.66	88.65
Ants	*Formica cunicularia* Latreille. 1798	1.11	0.99	1.07	0.90	1.51	90.16

	AGR vs. URB	AGR	URB				
Taxonomic group	Species	Av. Abund.	Av. Abund.	Av. Diss.	Diss/SD	Contrib. (%)	Cum. (%)
Ants	*Lasius niger* (Linnaeus. 1758)	7.02	20.86	9.03	0.74	14.74	14.74
Ants	*Pheidole pallidula* (Nylander. 1849)	17.48	16.62	7.78	1.43	12.71	27.45
Ants	*Linepithema humile* (Mayr. 1868)	4.83	7.32	5.91	0.56	9.65	37.10
Ants	*Tapinoma magnum* Mayr. 1861	0.00	10.31	5.48	0.70	8.94	46.04
Ants	*Tetramorium semilaeve* André. 1883	8.90	3.72	4.08	1.21	6.66	52.70
Ants	*Aphaenogaster senilis* Mayr. 1853	13.47	14.88	3.83	1.20	6.25	58.95
Ants	*Camponotus aethiops* (Latreille. 1798)	6.29	0.58	3.05	1.01	4.98	63.93
Ants	*Crematogaster scutellaris* (Olivier. 1792)	7.52	4.70	2.62	1.38	4.28	68.21
Ants	*Camponotus lateralis* (Olivier. 1792)	4.63	3.33	2.31	1.18	3.77	71.98
Ants	*Plagiolepis pygmaea* (Latreille. 1798)	4.03	3.63	1.81	1.25	2.96	74.94
Ants	*Solenopsis fugax* Latreille. 1798	3.25	3.55	1.71	0.99	2.78	77.72
Ants	*Tapinoma simrothi* Krausse. 1911	2.13	2.12	1.52	0.90	2.48	80.20
Ants	*Tapinoma madeirense* Forel. 1895	2.12	2.32	1.51	0.91	2.46	82.66
Ants	*Messor capitatus* (Latreille. 1798)	1.85	1.84	1.32	0.98	2.16	84.82
Ants	*Temnothorax exilis* (Emery. 1869)	1.53	2.02	1.25	1.01	2.05	86.87
Ants	*Tetramorium immigrans* Santschi. 1927	0.35	2.17	1.16	0.45	1.89	88.76
Ants	*Messor minor* (André. 1883)	1.82	1.23	1.09	1.05	1.79	90.55

Taxonomic group	NAT vs. URB Species	NAT Av. Abund.	URB Av. Abund.	Av. Diss.	Diss/SD	Contrib. (%)	Cum. (%)
Ants	*Lasius niger* (Linnaeus. 1758)	1.98	20.86	9.24	0.65	12.23	12.23
Ants	*Aphaenogaster senilis* Mayr. 1853	1.10	14.88	8.44	3.21	11.18	23.41
Ants	*Pheidole pallidula* (Nylander. 1849)	8.66	16.62	8.35	1.32	11.05	34.46
Ants	*Tapinoma magnum* Mayr. 1861	0.00	10.31	6.91	0.69	9.15	43.62
Ants	*Aphaenogaster spinosa* Emery. 1878	7.53	0.25	4.82	1.49	6.38	49.99
Ants	*Linepithema humile* (Mayr. 1868)	0.09	7.32	4.80	0.42	6.35	56.34
Ants	*Crematogaster scutellaris* (Olivier. 1792)	9.68	4.70	3.85	1.30	5.09	61.44
Ants	*Aphaenogaster ichnusa* Santschi. 1925	5.07	0.00	3.47	0.95	4.59	66.03
Ants	*Plagiolepis pygmaea* (Latreille. 1798)	4.22	3.63	2.80	1.15	3.70	69.73
Ants	*Tetramorium semilaeve* André. 1883	1.84	3.72	2.58	0.95	3.41	73.15
Ants	*Camponotus aethiops* (Latreille. 1798)	4.38	0.58	2.55	1.56	3.37	76.52
Ants	*Camponotus lateralis* (Olivier. 1792)	2.45	3.33	2.27	0.92	3.01	79.52
Ants	*Myrmica spinosior* Santschi. 1931	2.80	0.00	2.15	0.57	2.85	82.37
Ants	*Solenopsis fugax* Latreille. 1798	1.41	3.55	1.55	1.19	2.05	84.42
Ants	*Tapinoma simrothi* Krausse. 1911	1.32	2.12	1.54	0.85	2.04	86.47
Ants	*Temnothorax exilis* (Emery. 1869)	0.45	2.02	1.39	0.73	1.84	88.31
Ants	*Tapinoma madeirense* Forel. 1895	0.22	2.32	1.25	0.70	1.65	89.96
Ants	*Tetramorium immigrans* Santschi. 1927	0.00	2.17	1.24	0.39	1.65	91.61

Taxonomic group	NAT vs. AGR Species	NAT Av. Abund.	AGR Av. Abund.	Av. Diss.	Diss/SD	Contrib. (%)	Cum. (%)
Vascular plants	*Olea europaea* L.	1.01	8.51	3.92	1.04	4.48	4.48
Vascular plants	*Arbutus unedo* L.	7.10	0.00	3.85	0.78	4.39	8.87
Vascular plants	*Eucalyptus camaldulensis* Dehnh. subsp. *camaldulensis*	4.17	7.20	3.48	1.11	3.97	12.84
Vascular plants	*Pistacia lentiscus* L.	2.47	6.60	2.71	1.51	3.09	15.93
Vascular plants	*Erica arborea* L.	4.84	0.00	2.53	0.78	2.88	18.81
Vascular plants	*Oloptum miliaceum* (L.) Röser & H.R.Hamasha	0.15	4.56	2.43	0.78	2.77	21.58
Vascular plants	*Salix atrocinerea* Brot. subsp. *atrocinerea*	4.68	0.00	2.08	0.59	2.37	23.95
Vascular plants	*Asphodelus ramosus* L. subsp. *ramosus*	3.99	0.96	1.68	1.31	1.92	25.87
Vascular plants	*Rubus ulmifolius* Schott	3.69	0.00	1.66	1.00	1.90	27.77
Vascular plants	*Erica terminalis* Salisb.	3.69	0.00	1.66	0.57	1.89	29.66
Vascular plants	*Rubia peregrina* L.	3.77	0.86	1.63	1.00	1.86	31.51
Vascular plants	*Asparagus acutifolius* L.	2.32	3.38	1.50	1.21	1.71	33.22

Vascular plants	*Cistus monspeliensis* L.	2.50	0.51	1.18	0.91	1.34	34.57
Vascular plants	*Pinus halepensis* Mill. subsp. *halepensis*	1.15	1.52	1.09	0.54	1.24	35.81
Vascular plants	*Sonchus tenerrimus* L.	0.30	2.37	1.03	1.41	1.17	36.98
Vascular plants	*Geranium purpureum* Vill.	1.76	1.12	0.99	1.07	1.13	38.11
Vascular plants	*Arundo donax* L.	0.67	1.69	0.96	0.60	1.10	39.20
Vascular plants	*Cistus salviifolius* L.	1.80	0.00	0.87	0.55	1.00	40.20
Vascular plants	*Asparagus albus* L.	0.18	1.83	0.83	1.05	0.95	41.15
Vascular plants	*Eucalyptus tereticornis* Sm.	0.00	1.55	0.83	0.31	0.94	42.09
Vascular plants	*Oxalis pes-caprae* L.	0.03	1.56	0.82	0.56	0.94	43.03
Vascular plants	*Smilax aspera* L.	1.70	0.35	0.81	0.73	0.92	43.95
Vascular plants	*Trifolium campestre* Schreb.	1.44	1.13	0.80	1.07	0.91	44.87
Vascular plants	*Carex distachya* Desf.	1.61	0.05	0.77	0.79	0.88	45.75
Vascular plants	*Carex hispida* Willd.	1.72	0.00	0.76	0.60	0.86	46.61
Vascular plants	*Oloptum thomasii* (Duby) Banfi & Galasso	0.66	1.06	0.72	0.46	0.82	47.44
Vascular plants	*Cynodon dactylon* (L.) Pers.	0.49	0.82	0.65	0.42	0.74	48.18
Vascular plants	*Acacia saligna* (Labill.) H.L.Wendl.	0.04	1.30	0.65	0.44	0.74	48.92
Vascular plants	*Quercus suber* L.	1.09	0.00	0.64	0.40	0.73	49.65
Vascular plants	*Populus canescens* (Aiton) Sm.	1.53	0.00	0.63	0.31	0.72	50.37
Vascular plants	*Phillyrea latifolia* L.	1.30	0.00	0.62	0.33	0.71	51.08
Vascular plants	*Brachypodium distachyon* (L.) P.Beauv.	1.14	1.08	0.62	1.16	0.71	51.79
Vascular plants	*Myrtus communis* L.	1.40	0.00	0.58	0.39	0.66	52.45
Vascular plants	*Asparagus horridus* L.	0.00	1.04	0.56	0.46	0.64	53.09
Vascular plants	*Cynosurus effusus* Link	1.06	0.00	0.53	0.66	0.60	53.69
Vascular plants	*Pteridium aquilinum* (L.) Kuhn subsp. *aquilinum*	1.15	0.00	0.52	0.46	0.59	54.28
Vascular plants	*Bromus hordeaceus* L. subsp. *hordeaceus*	1.18	0.00	0.52	0.53	0.59	54.87
Vascular plants	*Hypochaeris achyrophorus* L.	0.66	1.00	0.51	1.09	0.58	55.45
Vascular plants	*Stachys major* (L.) Bartolucci & Peruzzi	0.30	0.96	0.49	0.82	0.56	56.01
Vascular plants	*Ceratonia siliqua* L.	0.67	0.50	0.49	0.49	0.56	56.57
Vascular plants	*Dioscorea communis* (L.) Caddick & Wilkin	0.64	0.61	0.48	0.48	0.55	57.12
Vascular plants	*Agrostis stolonifera* L. subsp. *stolonifera*	1.10	0.00	0.48	0.44	0.55	57.67
Vascular plants	*Ornithopus compressus* L.	0.93	0.17	0.48	0.94	0.55	58.22
Vascular plants	*Cistus creticus* L. subsp. *eriocephalus* (Viv.) Greuter & Burdet	0.80	0.41	0.48	0.62	0.54	58.76
Vascular plants	*Juniperus oxycedrus* L.	0.00	1.12	0.46	0.46	0.53	59.29
Vascular plants	*Phillyrea angustifolia* L.	1.08	0.00	0.46	0.45	0.52	59.81
Vascular plants	*Rhamnus alaternus* L. subsp. *alaternus*	0.35	0.73	0.45	0.60	0.52	60.33
Vascular plants	*Cynosurus echinatus* L.	0.69	0.71	0.45	0.88	0.52	60.85

Vascular plants	*Anisantha madritensis* (L.) Nevski subsp. *madritensis*	0.64	0.45	0.44	0.69	0.50	61.35
Vascular plants	*Torilis africana* Spreng.	0.94	0.39	0.44	1.13	0.50	61.85
Vascular plants	*Scirpoides holoschoenus* (L.) Soják	0.99	0.00	0.43	0.75	0.49	62.33
Vascular plants	*Ranunculus macrophyllus* Desf.	0.95	0.00	0.41	0.59	0.47	62.81
Vascular plants	*Pulicaria odora* (L.) Rchb.	0.80	0.00	0.41	0.61	0.47	63.27
Vascular plants	*Holcus lanatus* L. subsp. *lanatus*	0.93	0.00	0.41	0.59	0.47	63.74
Vascular plants	*Nerium oleander* L. subsp. *oleander*	0.81	0.00	0.40	0.31	0.45	64.19
Vascular plants	*Dactylis glomerata* L. subsp. *hispanica* (Roth) Nyman	0.08	0.88	0.38	0.46	0.44	64.63
Vascular plants	*Briza maxima* L.	0.80	0.26	0.38	1.01	0.43	65.06
Vascular plants	*Allium subhirsutum* L. subsp. *subhirsutum*	0.44	0.47	0.37	0.64	0.42	65.48
Vascular plants	*Trifolium angustifolium* L. subsp. *angustifolium*	0.33	0.74	0.36	1.24	0.41	65.90
Vascular plants	*Daucus carota* L.	0.29	0.61	0.36	0.67	0.41	66.31
Vascular plants	*Lonicera implexa* Aiton subsp. *implexa*	0.68	0.20	0.36	0.54	0.41	66.72
Vascular plants	*Scorpiurus muricatus* L.	0.42	0.55	0.36	0.74	0.41	67.13
Vascular plants	*Lavandula stoechas* L. subsp. *stoechas*	0.77	0.00	0.35	0.53	0.40	67.53
Vascular plants	*Eucalyptus gomphocephala* DC.	0.73	0.00	0.35	0.31	0.40	67.93
Vascular plants	*Rosa sempervirens* L.	0.72	0.00	0.35	0.46	0.40	68.33
Vascular plants	*Urospermum dalechampii* (L.) F.W.Schmidt	0.47	0.43	0.35	0.76	0.40	68.73
Vascular plants	*Avena sterilis* L. subsp. *sterilis*	0.16	0.62	0.34	0.57	0.39	69.12
Vascular plants	*Lysimachia arvensis* (L.) U.Manns & Anderb. subsp. *latifolia* (L.) Peruzzi	0.23	0.83	0.34	1.10	0.39	69.51
Vascular plants	*Trifolium ligusticum* Loisel.	0.67	0.00	0.34	0.73	0.39	69.90

	AGR vs. URB	AGR	URB				
Taxonomic group	Species	Av. Abund.	Av. Abund.	Av. Diss.	Diss/SD	Contrib. (%)	Cum. (%)
Vascular plants	*Olea europaea* L.	8.51	2.07	4.78	1.01	5.66	5.66
Vascular plants	*Eucalyptus camaldulensis* Dehnh. subsp. *camaldulensis*	7.20	4.10	4.03	1.10	4.76	10.42
Vascular plants	*Pistacia lentiscus* L.	6.60	0.16	3.66	1.70	4.34	14.76
Vascular plants	*Pinus halepensis* Mill. subsp. *halepensis*	1.52	6.20	3.58	1.05	4.24	19.00
Vascular plants	*Oloptum miliaceum* (L.) Röser & H.R.Hamasha	4.56	1.75	2.88	0.84	3.41	22.41
Vascular plants	*Sonchus tenerrimus* L.	2.37	5.34	2.25	1.04	2.66	25.07
Vascular plants	*Hordeum murinum* L.	0.33	3.14	1.85	0.63	2.19	27.26
Vascular plants	*Pinus pinea* L.	0.00	3.14	1.84	0.52	2.17	29.44
Vascular plants	*Acacia saligna* (Labill.) H.L.Wendl.	1.30	2.18	1.78	0.67	2.10	31.54
Vascular plants	*Asparagus acutifolius* L.	3.38	1.00	1.61	1.08	1.90	33.45
Vascular plants	*Tamarix canariensis* Willd.	0.00	2.24	1.34	0.37	1.58	35.03

Vascular plants	*Cynodon dactylon* (L.) Pers.	0.82	1.48	1.32	0.49	1.57	36.60
Vascular plants	*Brachypodium distachyon* (L.) P.Beauv.	1.08	1.65	1.19	0.82	1.41	38.01
Vascular plants	*Oxalis pes-caprae* L.	1.56	0.82	1.04	0.62	1.23	39.24
Vascular plants	*Cynosurus echinatus* L.	0.71	1.38	1.03	0.56	1.21	40.46
Vascular plants	*Eucalyptus tereticornis* Sm.	1.55	0.00	1.02	0.31	1.20	41.66
Vascular plants	*Geranium molle* L.	0.27	1.67	1.02	0.64	1.20	42.86
Vascular plants	*Asparagus albus* L.	1.83	0.00	1.00	1.01	1.19	44.05
Vascular plants	*Lolium rigidum* Gaudin subsp. *rigidum*	0.31	1.68	0.96	0.62	1.14	45.19
Vascular plants	*Arundo donax* L.	1.69	0.00	0.93	0.51	1.11	46.30
Vascular plants	*Galactites tomentosus* Moench	0.48	1.28	0.89	0.61	1.05	47.35
Vascular plants	*Hedypnois rhagadioloides* (L.) F.W.Schmidt	0.69	1.39	0.87	1.00	1.03	48.38
Vascular plants	*Geranium purpureum* Vill.	1.12	0.63	0.86	0.64	1.02	49.40
Vascular plants	*Anisantha sterilis* (L.) Nevski	0.14	1.30	0.85	0.55	1.00	50.40
Vascular plants	*Asparagus horridus* L.	1.04	0.28	0.78	0.56	0.93	51.32
Vascular plants	*Hypochaeris achyrophorus* L.	1.00	0.65	0.61	1.18	0.72	52.05
Vascular plants	*Anisantha madritensis* (L.) Nevski subsp. *madritensis*	0.45	0.81	0.61	0.86	0.72	52.77
Vascular plants	*Avena barbata* Pott ex Link	0.77	0.77	0.61	0.96	0.72	53.49
Vascular plants	*Melaleuca alternifolia* (Maiden & Betche) Cheel	0.00	1.05	0.60	0.37	0.71	54.20
Vascular plants	*Polycarpon tetraphyllum* (L.) L. subsp. *diphyllum* (Cav.) O.Bolòs & Font Quer	0.06	1.10	0.59	0.57	0.70	54.90
Vascular plants	*Lagurus ovatus* L. subsp. *ovatus*	0.51	0.89	0.59	0.90	0.70	55.59
Vascular plants	*Urospermum picroides* (L.) Scop. ex F.W.Schmidt	0.46	0.84	0.58	0.85	0.69	56.28
Vascular plants	*Oloptum thomasii* (Duby) Banfi & Galasso	1.06	0.00	0.58	0.31	0.68	56.96
Vascular plants	*Melia azedarach* L.	0.00	1.15	0.56	0.37	0.66	57.63
Vascular plants	*Vicia sativa* L.	0.32	0.74	0.56	0.49	0.66	58.29
Vascular plants	*Plantago lagopus* L.	0.36	0.98	0.56	0.86	0.66	58.95
Vascular plants	*Trifolium campestre* Schreb.	1.13	0.00	0.55	0.71	0.65	59.60
Vascular plants	*Glebionis coronaria* (L.) Spach	0.67	0.39	0.55	0.45	0.65	60.25
Vascular plants	*Juniperus oxycedrus* L.	1.12	0.00	0.54	0.46	0.64	60.89
Vascular plants	*Ceratonia siliqua* L.	0.50	0.68	0.53	0.48	0.63	61.52
Vascular plants	*Tolpis virgata* (Desf.) Bertol. subsp. *virgata*	0.31	0.79	0.53	0.53	0.62	62.14
Vascular plants	*Arisarum vulgare* O.Targ.Tozz. subsp. *vulgare*	0.34	0.67	0.53	0.67	0.62	62.77
Vascular plants	*Ligustrum* sp.	0.00	0.74	0.52	0.37	0.61	63.38
Vascular plants	*Stachys major* (L.) Bartolucci & Peruzzi	0.96	0.00	0.52	0.74	0.61	63.99
Vascular plants	*Ailanthus altissima* (Mill.) Swingle	0.00	1.05	0.51	0.37	0.60	64.59
Vascular plants	*Medicago truncatula* Gaertn.	0.61	0.63	0.51	0.93	0.60	65.19

Vascular plants	*Crepis vesicaria* L. subsp. *vesicaria*	0.00	0.81	0.50	0.37	0.59	65.78
Vascular plants	*Avena sterilis* L. subsp. *sterilis*	0.62	0.43	0.50	0.72	0.59	66.37
Vascular plants	*Rubia peregrina* L.	0.86	0.00	0.48	0.64	0.57	66.94
Vascular plants	*Lysimachia arvensis* (L.) U.Manns & Anderb. subsp. *latifolia* (L.) Peruzzi	0.83	0.57	0.48	1.22	0.57	67.51
Vascular plants	*Beta vulgaris* L. subsp. *maritima* (L.) Arcang.	0.00	0.91	0.48	0.37	0.57	68.08
Vascular plants	*Medicago praecox* DC.	0.46	0.54	0.47	0.89	0.55	68.63
Vascular plants	*Asphodelus ramosus* L. subsp. *ramosus*	0.96	0.00	0.46	0.60	0.54	69.17
Vascular plants	*Chenopodiastrum murale* (L.) S.Fuentes. Uotila & Borsch	0.41	0.51	0.45	0.68	0.53	69.71

	NAT vs. URB	NAT	URB				
Taxonomic group	Species	Av. Abund.	Av. Abund.	Av. Diss.	Diss/SD	Contrib. (%)	Cum. (%)
Vascular plants	*Arbutus unedo* L.	7.10	0.00	4.20	0.79	4.47	4.47
Vascular plants	*Pinus halepensis* Mill. subsp. *halepensis*	1.15	6.20	3.33	1.10	3.54	8.00
Vascular plants	*Eucalyptus camaldulensis* Dehnh. subsp. *camaldulensis*	4.17	4.10	2.82	1.04	3.00	11.00
Vascular plants	*Erica arborea* L.	4.84	0.00	2.75	0.79	2.93	13.93
Vascular plants	*Sonchus tenerrimus* L.	0.30	5.34	2.65	1.19	2.82	16.75
Vascular plants	*Salix atrocinerea* Brot. subsp. *atrocinerea*	4.68	0.00	2.23	0.60	2.38	19.12
Vascular plants	*Asphodelus ramosus* L. subsp. *ramosus*	3.99	0.00	2.09	1.64	2.22	21.34
Vascular plants	*Rubia peregrina* L.	3.77	0.00	1.90	1.04	2.02	23.36
Vascular plants	*Rubus ulmifolius* Schott	3.69	0.00	1.79	1.02	1.90	25.27
Vascular plants	*Erica terminalis* Salisb.	3.69	0.00	1.78	0.57	1.90	27.17
Vascular plants	*Pinus pinea* L.	0.00	3.14	1.64	0.53	1.75	28.91
Vascular plants	*Hordeum murinum* L.	0.00	3.14	1.59	0.60	1.69	30.61
Vascular plants	*Olea europaea* L.	1.01	2.07	1.34	0.61	1.43	32.04
Vascular plants	*Cistus monspeliensis* L.	2.50	0.00	1.24	0.85	1.32	33.36
Vascular plants	*Acacia saligna* (Labill.) H.L.Wendl.	0.04	2.18	1.23	0.54	1.31	34.67
Vascular plants	*Tamarix canariensis* Willd.	0.00	2.24	1.19	0.37	1.27	35.93
Vascular plants	*Pistacia lentiscus* L.	2.47	0.16	1.19	0.72	1.27	37.20
Vascular plants	*Asparagus acutifolius* L.	2.32	1.00	1.16	1.08	1.23	38.43
Vascular plants	*Brachypodium distachyon* (L.) P.Beauv.	1.14	1.65	1.10	0.91	1.17	39.60
Vascular plants	*Geranium purpureum* Vill.	1.76	0.63	0.99	1.06	1.06	40.66
Vascular plants	*Cistus salviifolius* L.	1.80	0.00	0.95	0.55	1.01	41.67
Vascular plants	*Cynosurus echinatus* L.	0.69	1.38	0.94	0.57	1.00	42.67
Vascular plants	*Cynodon dactylon* (L.) Pers.	0.49	1.48	0.93	0.46	0.99	43.66
Vascular plants	*Oloptum miliaceum* (L.) Röser & H.R.Hamasha	0.15	1.75	0.91	0.87	0.96	44.62

Vascular plants	*Geranium molle* L.	0.03	1.67	0.88	0.60	0.93	45.55
Vascular plants	*Lolium rigidum* Gaudin subsp. *rigidum*	0.00	1.68	0.86	0.60	0.91	46.46
Vascular plants	*Carex distachya* Desf.	1.61	0.00	0.83	0.78	0.89	47.35
Vascular plants	*Carex hispida* Willd.	1.72	0.00	0.81	0.61	0.87	48.22
Vascular plants	*Smilax aspera* L.	1.70	0.00	0.80	0.67	0.85	49.07
Vascular plants	*Trifolium campestre* Schreb.	1.44	0.00	0.76	0.89	0.81	49.88
Vascular plants	*Galactites tomentosus* Moench	0.27	1.28	0.75	0.58	0.80	50.68
Vascular plants	*Hedypnois rhagadioloides* (L.) F.W.Schmidt	0.05	1.39	0.73	0.87	0.78	51.45
Vascular plants	*Anisantha sterilis* (L.) Nevski	0.00	1.30	0.72	0.52	0.77	52.22
Vascular plants	*Quercus suber* L.	1.09	0.00	0.70	0.40	0.74	52.96
Vascular plants	*Populus canescens* (Aiton) Sm.	1.53	0.00	0.68	0.31	0.72	53.68
Vascular plants	*Phillyrea latifolia* L.	1.30	0.00	0.67	0.33	0.72	54.40
Vascular plants	*Myrtus communis* L.	1.40	0.00	0.62	0.40	0.66	55.06
Vascular plants	*Ceratonia siliqua* L.	0.67	0.68	0.59	0.53	0.62	55.69
Vascular plants	*Cynosurus effusus* Link	1.06	0.00	0.57	0.66	0.61	56.29
Vascular plants	*Bromus hordeaceus* L. subsp. *hordeaceus*	1.18	0.04	0.57	0.55	0.60	56.89
Vascular plants	*Pteridium aquilinum* (L.) Kuhn subsp. *aquilinum*	1.15	0.00	0.56	0.47	0.60	57.49
Vascular plants	*Torilis africana* Spreng.	0.94	0.43	0.54	1.13	0.58	58.07
Vascular plants	*Melaleuca alternifolia* (Maiden & Betche) Cheel	0.00	1.05	0.54	0.37	0.57	58.64
Vascular plants	*Polycarpon tetraphyllum* (L.) L. subsp. *diphyllum* (Cav.) O.Bolòs & Font Quer	0.04	1.10	0.53	0.57	0.57	59.21
Vascular plants	*Anisantha madritensis* (L.) Nevski subsp. *madritensis*	0.64	0.81	0.53	1.01	0.56	59.77
Vascular plants	*Agrostis stolonifera* L. subsp. *stolonifera*	1.10	0.00	0.52	0.44	0.55	60.32
Vascular plants	*Ornithopus compressus* L.	0.93	0.00	0.51	0.91	0.54	60.87
Vascular plants	*Melia azedarach* L.	0.00	1.15	0.51	0.37	0.54	61.41
Vascular plants	*Lagurus ovatus* L. subsp. *ovatus*	0.31	0.89	0.50	0.82	0.54	61.95
Vascular plants	*Hypochaeris achyrophorus* L.	0.66	0.65	0.50	0.98	0.53	62.48
Vascular plants	*Phillyrea angustifolia* L.	1.08	0.00	0.49	0.45	0.52	63.00
Vascular plants	*Plantago lagopus* L.	0.00	0.98	0.47	0.72	0.50	63.50
Vascular plants	*Ailanthus altissima* (Mill.) Swingle	0.00	1.05	0.47	0.37	0.49	64.00
Vascular plants	*Scirpoides holoschoenus* (L.) Soják	0.99	0.00	0.46	0.75	0.49	64.48
Vascular plants	*Ligustrum* sp.	0.00	0.74	0.45	0.37	0.48	64.97
Vascular plants	*Urospermum picroides* (L.) Scop. ex F.W.Schmidt	0.03	0.84	0.45	0.75	0.48	65.45
Vascular plants	*Ranunculus macrophyllus* Desf.	0.95	0.00	0.45	0.59	0.47	65.92
Vascular plants	*Pulicaria odora* (L.) Rchb.	0.80	0.00	0.44	0.61	0.47	66.39
Vascular plants	*Crepis vesicaria* L. subsp. *vesicaria*	0.00	0.81	0.44	0.37	0.47	66.86

Vascular plants	*Holcus lanatus* L. subsp. *lanatus*	0.93	0.00	0.44	0.60	0.47	67.33
Vascular plants	*Briza maxima* L.	0.80	0.00	0.44	1.04	0.47	67.80
Vascular plants	*Beta vulgaris* L. subsp. *maritima* (L.) Arcang.	0.00	0.91	0.43	0.37	0.46	68.26
Vascular plants	*Nerium oleander* L. subsp. *oleander*	0.81	0.00	0.43	0.31	0.46	68.72
Vascular plants	*Arisarum vulgare* O.Targ.Tozz. subsp. *vulgare*	0.21	0.67	0.43	0.62	0.46	69.17
Vascular plants	*Oxalis pes-caprae* L.	0.03	0.82	0.42	1.17	0.45	69.62

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Declaration of interests

☒The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

☐The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: