The human handprint in shaping plant diversity in urban environments

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Abstract

Urban plant assemblages comprise mixtures of native and non-native species distributed across a variety of urban green space (UGS) types, yet we lack an integrated understanding of how plant diversity and composition varies across UGS that differ in the degree to which communities arise through self-assembly versus human facilitation. Here, we address the gap based on a comprehensive dataset of 180 plant communities sampled across three Swiss cities (Zurich, Geneva, and Lugano) and five UGS types— allotments, private gardens, parks, residential estates, and ruderal areas— to quantify α- and β-diversity patterns and their underlying social-ecological drivers. To identify drivers of plant diversity and composition, we used landscape predictors, such as climatic conditions and built environment, and local predictors, such as maintenance and conservation management performed by UGS managers, and habitat design. We found that plant community composition does partially differentiate among UGS types. While private gardens, parks, and real estate showed greater overlap, ruderal sites and allotments exhibited distinct species communities. Yet, these two UGS types are also the ones most threatened by urban densification, highlighting potential conflicts between urban densification and biodiversity conservation. Moreover, although the non-native plant richness increased along a human investment gradient, native plant richness remained stable. Lastly, by jointly analyzing alpha and beta diversity, our study shows that urban social-ecological conditions can simultaneously constrain local species richness, while promoting compositional differentiation among sites. By integrating ecological and social dimensions, this study provides a unique greenspace-wide perspective that can inform biodiversity-oriented urban planning and management.

Keywords: Urban biodiversity, Native and non-native plants, Meta community, Alpha and Beta diversity, Gardening, Urban green spaces, Plant assemblages, Urban vegetation

Introduction

While urbanisation is widely recognised as a key driver of biodiversity loss (Grimm *et al.*, 2008), urban systems can also substantially support biodiversity (Aronson *et al.*, 2014) and are increasingly integrated into conservation planning (Kowarik *et al.*, 2025; Soanes & Lentini, 2019). Cities host a diverse network of urban green spaces (hereinafter, UGS), such as parks, green roofs, and gardens (Aronson *et al.*, 2017). These UGS are highly heterogeneous in their ecological and social features, such as ownership, purpose, local diversity, and degree of disturbance (Aronson *et al.*, 2017). However, they can be arranged along a continuum of human investment (see Swan *et al.*, 2011), which reflects the extent to which environmental or human processes drive plant community assembly. While there is variation among different UGS in terms of human investment, an arrangement remains useful for capturing the varying contribution of human versus self-assembly in shaping plant communities. For example, in ruderal areas, plant communities are often driven by environmental processes and are therefore often referred to as self-assembled, whereas in highly engineered UGSs such as gardens and parks, human-related processes are a major or even the main determinant of plant communities (Aronson *et al.*, 2017; Cilliers *et al.*, 2013). Hence, distinct UGS can differ substantially in their plant communities (Chang *et al.*, 2021; Matson *et al.*, 1997; Vega & Küffer, 2021) due to the varying environmental and human-related processes that directly and indirectly facilitate and exclude certain species (Swan *et al.*, 2021). Despite numerous studies on urban plant diversity, most of them focus on a single UGS type (Cavender-Bares *et al.*, 2020; Chang *et al.*, 2021), a single habitat (English *et al.*, 2022; Stewart *et al.*, 2009; Vega & Küffer, 2021), or alpha diversity (Threlfall *et al.*, 2016; Zhang *et al.*, 2024). Therefore, the general understanding of how urban plant diversity, including both native and non-native species, is structured between and within different UGS types remains largely unresolved. A better understanding of the joint influence of environmental and human processes on plant diversity within and across UGS types is required for improving green space management for both human well-being and biodiversity.

Different UGS types have distinct characteristics that ultimately shape how they are designed and managed, thereby influencing the composition and configuration of their plant communities (Avolio *et al*., 2021; Swan *et al*., 2011, 2021). Firstly, UGS have distinct purposes, such as recreation, aesthetics, food production, or conservation. UGS also differ in their degree of human investment, with natural remnants requiring minimal management, whereas highly designed UGS, such as gardens, demand active management, for instance, by selective planting, active irrigation, or fertilisation (Aronson *et al*., 2017; Swan *et al*., 2011, 2021). Secondly, UGS can be further distinguished by ownership and, by extension, the type and number of gardeners. For instance, while individually-managed UGS (e.g., gardens) often emphasize aesthetics, recreation, or food production with high human investment and strong control over plant composition, UGS managed by external companies, facility management or municipalities, such as greenery around residential estates and parks, serve broader societal functions like recreation, often with lower biodiversity and less direct individual management (Swan *et al*., 2021). Thus, understanding citywide plant assemblages requires the systematic assessment of plant communities within and across multiple UGS types (Cui *et al*., 2023; Dylewski *et al*., 2023).

The heterogeneous mosaics of UGS types can be investigated using metacommunity theory (Leibold *et al*., 2004; Wilson, 1992). Thereby, three main spatial scales can be used to study diversity gradients: the within-site diversity (alpha diversity), the between-site diversity (beta-diversity), and the total, regional diversity (gamma diversity), which results from both alpha and beta diversities (Koleff *et al*., 2003; Lande, 1996). Furthermore, beta diversity reflects two non-mutually exclusive patterns (Baselga, 2010): nestedness, in which species-poor sites form subsets of richer ones, and turnover, in which species are replaced across sites (Harrison *et al*., 1992). In UGS, nestedness is expected where strong environmental filtering or anthropogenic pressures cause species loss without replacements (e.g., frequent mowing or ornamental monocultures), resulting in species-pool sites containing subsets of richer communities (Muvengwi *et al*., 2025). Conversely, turnover is likely to occur when UGS differ in environmental conditions, land-use history, or management, leading to species replacement rather than simple loss (Muvengwi *et al*., 2025). Overall, plant community assembly is shaped by multiple processes, with plants' origin playing a key role.

The origin status of the plant species is a relevant feature that can be used as a grouping feature for understanding plant community assembly. Between 30% and 80% of the urban plants are non-native, making them sometimes an important component of city-wide plant diversity *per se* (Bayón *et al*., 2021; Casanelles-Abella *et al*., 2021; Frey & Moretti, 2019; Salinitro *et al*., 2018). Native plant species primarily reflect natural regional species pools and are mostly shaped by environmental filtering and dispersal limitation, whereas non-native plant species are often introduced and promoted through horticultural practices and plant trade (Aronson *et al*., 2017; Cavender-Bares *et al*., 2020). Consequently, origin status can serve as a useful proxy for different assembly pathways, especially when considering multiple UGS types: first, native and non-native plants are not equally distributed across UGS types, with non-native plants more prevalent in highly engineered UGS types that focus on, e.g., aesthetics and food production, such as allotments (Aronson *et al*., 2017). In contrast, native plants might be more dominant in UGS with self-assembled communities, for example, ruderal areas, unless under the effects of invasion (Aronson *et al*., 2017). Second, the influence of social-ecological factors might be particularly UGS-dependent for the case of non-native plants. For example, in ruderal areas, non-native plants can occur naturally and are thereby influenced by the surrounding environment, mediating their dispersal; however, they might be removed by humans to support conservation goals. In contrast, in designed UGS such as gardens, non-native species may be deliberately promoted for their aesthetic value and are thereby not influenced by the surroundings (Avolio *et al*., 2021). Although a general understanding of the influence of the origin status on plant diversity patterns exists, it remains poorly tested how these effects vary across UGS types.

Both natural and anthropogenic processes influence urban plant communities (Avolio *et al*., 2021; Seitz *et al*., 2022; Sexton *et al*., 2025; Swan *et al*., 2011, 2021). Key anthropogenic processes include management of the UGS (e.g., planting, weeding, watering, and fertilising; Seitz *et al*., 2022), the design of the UGS (Zhang *et al*., 2023), as well as the surrounding urban matrix (Aronson *et al*., 2014). Management can be broadly divided into two main types of gardening practices, depending on whether they facilitate or restrict plant diversity (Hu & Lima, 2024). On the one hand, conservation management (i.e. conservation gardening, such as reduced mowing frequency or delayed mowing regime) promotes a wide range of native and non-native plant species and is expected to increase alpha diversity (Munschek *et al.*, 2023). On the other hand, maintenance management, like weeding, fertilization, or irrigation, focuses on specific outcomes, such as uniform lawns or homogeneous ornamental plantings, and is expected to reduce alpha diversity. UGS design mediates these effects through habitat diversity within the UGS, whereby structurally diverse sites provide greater niche availability and generally support higher alpha diversity (Chang *et al.*, 2021). Both the type of management and the habitat diversity depend on the individual or institutional preferences and decisions that shape UGSs (Swan *et al.*, 2011, 2021). At larger spatial scales, differences in management and design among UGS are expected to increase beta diversity, whereas similar management regimes and standardized designs should lead to community homogenization and reduced beta diversity. The built environment primarily affects dispersal processes by limiting the natural colonization, often reducing alpha diversity. Thus, while non-native species are less dispersal-limited because they are actively introduced, e.g., for aesthetic purposes, native plants are more reliant on natural dispersal processes (Aronson *et al.*, 2014). Finally, the relative strength of these drivers is expected to vary along the continuum of human investment in UGS and plant species origin status (Swan *et al.*, 2021).

Here, we investigate how UGS types mediate city-wide plant diversity and what social-ecological drivers shape urban plant communities across UGS types (Fig. 1). We used a large dataset on urban plant diversity from three Swiss cities, collected across 180 sites from five main types of UGS, representing a continuum of human investment, UGS purposes, and distinct ownership. Specifically, we ask the following research questions: (RQ1) Do different UGS types exhibit distinct patterns of alpha and beta diversity, and how do these patterns contribute to overall city-wide gamma diversity? (RQ2) How do social-ecological drivers contribute to shaping plant species diversity patterns across UGS types? (RQ3) Do native and non-native plants respond similarly to these social-ecological drivers?

We hypothesise the following: UGS with higher human investment will show higher alpha diversity, primarily driven by increased non-native plant richness (H1) (Aronson *et al.*, 2014; Avolio *et* *al*., 2021; Swan *et al*., 2011, 2021). Conservation management and higher habitat diversity will increase alpha diversity, whereas maintenance management will reduce alpha diversity by limiting spontaneous establishment (Hu & Lima, 2024) and a densely built environment by limiting dispersal possibilities (Aronson *et al*., 2014) (H2a). Furthermore, differences in conservation management, maintenance management, and habitat diversity will increase beta diversity due to individual or institutional preferences and decisions, whereas differences in the built environment will increase beta diversity as variation in urbanisation creates varying dispersal filters that promote compositional differences (Swan *et al*., 2021) (H2b). Finally, we expect the social-ecological drivers to affect native and non-native species differently across UGS types (H3) (Swan *et al*., 2021).

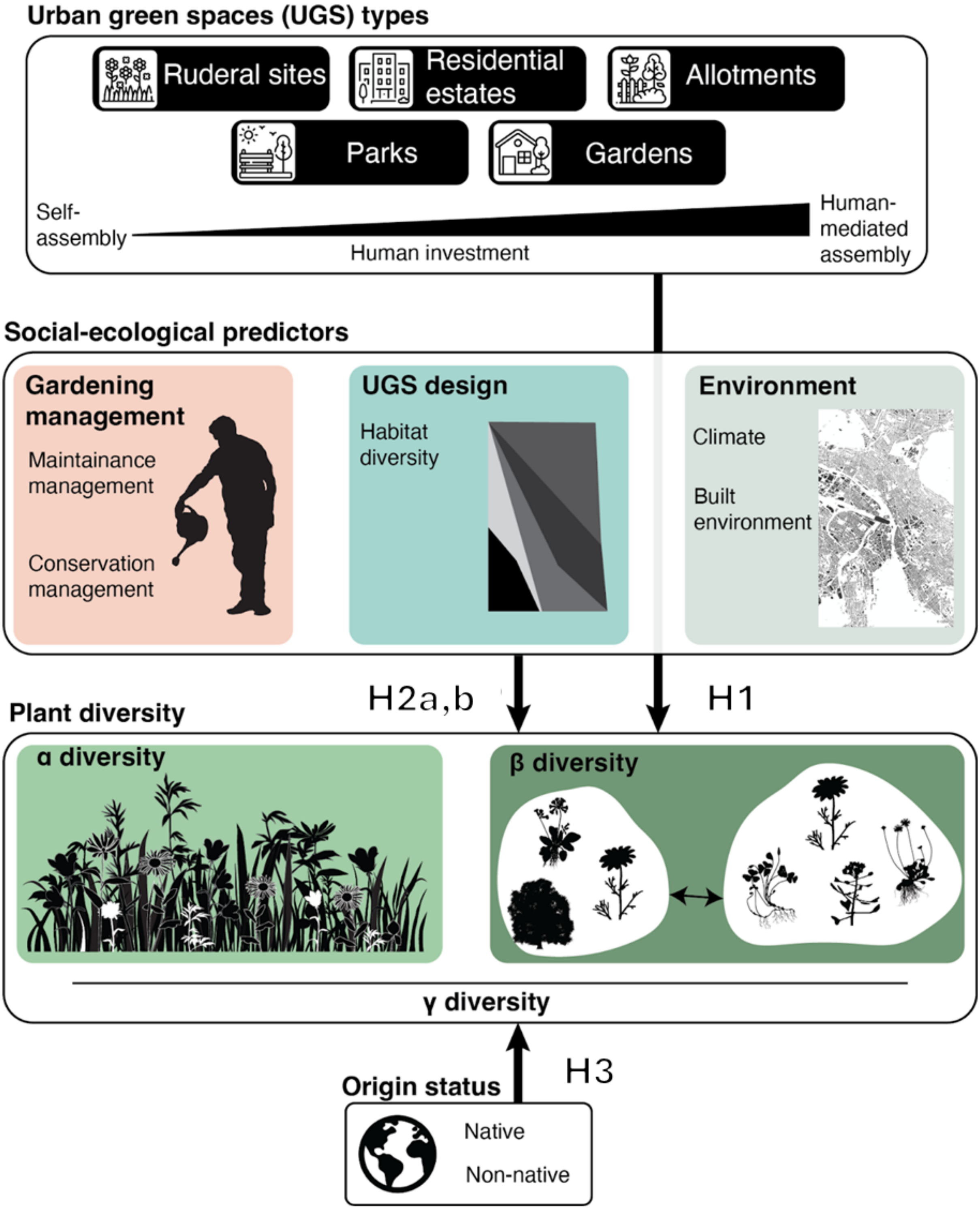

Figure 1: Study overview. Five UGS types, here distributed along a human investment gradient from self-assembly to human-mediated assembly (note that the distribution within the gradient is simplified and serves as an example), were selected to disentangle the effects of gardening management, UGS design, and the surrounding environment on alpha and beta plant diversity, while accounting for differences between native and non-native species. H1-H3: hypothesis. Icons credit: phylopic.

Methods

Studied cities, UGS types, and site selection

We investigated plant diversity across UGS in three Swiss cities, namely Geneva, Lugano, and Zurich, representing a range of climatic and urbanisation contexts (see Text S1 for details; Federal Statistical Office, 2025). Within each city, we distinguished five UGS types differing in ownership, management and ecological character: allotments, private gardens, green areas in residential estates (hereinafter called residential estates), parks and ruderal areas, following Swan *et al.* (2011, 2021) (see Text S2 for details). We selected 12 sites per UGS types and city, resulting in a total of 180 study sites (60 sites per city; Fig. S1). Site selection followed a stratified sampling design based on two criteria: the degree of landscape urbansiation within a 500 m radius, classified from the European Land Cover Map at 10 m resolution (Casanelles-Abella et al., 2024; Venter & Sydenham, 2021; see Text S3 for details) and local vegetation structural diversity. This ensured coverage of the full urbanisation gradient within each city and UGS type.

Vegetation survey

We sampled plant communities across sites using 100 m^2 vegetation plots. To account for variation in the size and habitat design of the UGS, plots were subdivided accordingly (Baldock *et al.* 2019; see also Text S4 for details). Surveys were conducted between May and June 2023, with each site visited once. Within each plot, both flowering and vegetative plants were included to increase detection completeness. Therefore, and due to consistent sampling windows across the three cities, any undetected species are likely comparable among them and represent a handful of very early flowering species (e.g, *Crocus* spp.). Taxonomic assignments primarily followed the Checklist of the National Data and Information Centre of the Swiss Flora InfoFlorra (Juillerat *et al.,* 2017) and the World Flora Online database (WFO, 2025). Species were then assigned an origin status following Casanelles-Abella *et al*. (2021), whereby species native to continental Europe were classified as native and those with natural distributions outside of Europe as non-native. Based on this classification, plant communities were partitioned into three species pools: all species ("all"), native species only ("native"), and non-native species only ("non-native").

Environment and garden management predictors

Regarding the environmental predictors, we used the SWECO25 dataset, a Swiss-wide database at 25-meter resolution (Külling *et al.*, 2024), and collected seven predictors representing two main groups of drivers: built environment (see Text S5 for details) and climate. More specifically, for climate, we used the annual mean temperature, annual precipitation, aridity index, evapotranspiration, growing degree days above 0, and the normalised difference water index. We calculated the mean value within buffers extending outward from the site boundaries with a radius of 150, 500, and 1000 meters (QGIS 3.44.0).

Regarding gardening predictors, we quantified how site owners manage their green space by extending the Likert-style questionnaire from Tresch *et al.* (2019), including 42 questions. The questions addressed three main aspects of management: (1) degree of disturbance, (2) the time investment by managers in their UGSs, and (3) biodiversity-friendly practices (see Text S6, Table S1). To summarise the information from the questionnaires into informative metrics, we linked these to two management metrics, namely maintenance management and conservation management. Maintenance management was inferred using the questions related to the degree of disturbance, reflecting efficiency-oriented management practices, such as frequent mowing and pruning. Conservation management was inferred by the time investment, because it can reflect stronger ecological care (Bennett *et al.*, 2018), and the biodiversity-friendly practices, reflecting management practices that enhance biodiversity, such as reducing pesticide use. Questions were recorded to ensure that higher values corresponded to greater disturbance levels, greater time investment, and lower biodiversity-friendly practices. These indices were standardised to the 0-1 range (see Text S6 for details), making them comparable across sites.

Furthermore, because UGS structures are human-designed, habitat diversity is likely to reflect underlying management decisions (Avolio *et al.*, 2021; Swan *et al.*, 2011, 2021). Accordingly, we quantified habitat diversity using Shannon diversity based on habitat proportions (see Text S7 for details). The Shannon-Diversity was then calculated from the proportions of flowerbeds, lawn, meadow, ruderal, woodland, shrubs, single trees, and wetlands, excluding impervious surfaces.

Statistical analyses

All analyses were conducted using R v. 4.3.1 (R Core Team, 2023) and RStudio v. 2023.6.1.524 (Posit team, 2023) using the packages *DHARMa* v.0.4.7 (Hartig, 2016), *glmmTMB* v.1.1.11 (Brooks *et al*., 2017), HillR (Li, 2018), *indicspecies v.1.8.0 (*Cáceres & Legendre, 2009), *MuMIn* v.1.48.4 (Bartoń, 2010), and *performance v.0.15.3* (Lüdecke *et al.,* 2019).

We calculated alpha and beta diversity for all three plant species pools using Hill numbers (q= 0), which is based on occurrence data. Specifically, alpha diversity corresponds to species richness, while beta diversity follows the multiplicative framework (beta = gamma / alpha) and represents pairwise dissimilarity values. Thereby, alpha is calculated as the mean species richness across two sites and gamma as the total richness of the pooled sites. This provides a comprehensive overview of plant diversity across distinct UGS and is more closely related to plant conservation and diversification goals. Furthermore, to quantify the relative contribution of alpha and beta diversity to the UGS-specific gamma diversity, we first applied an additive partitioning approach where beta diversity is calculated as the difference between UGS type-specific gamma diversity and the mean species richness within each UGS type. Alpha and beta diversity were then expressed as proportions of gamma diversity, allowing direct comparison of their relative contributions. Second, following Baselga (2010), we used Jaccard dissimilarities to decompose community variation into turnover and nestedness components, which were then used to further partition beta diversity.

We analysed the differences in alpha and beta diversity across UGS types, with UGS types as a fixed effect and city as a random effect. Specifically, species richness was modelled using a generalised linear mixed model (GLMM) with a Poisson distribution, changing to a negative binomial when over-dispersion occurred. Beta diversity, the pairwise dissimilarity values, was analysed using a linear mixed model (LMM) for the entire plant pool and the native plant pool, and a GLMM with a beta distribution and a logit link function for the one-inflated non-native plant pool. Pairwise comparisons among UGS types were performed using a Tukey-adjusted post hoc test based on estimated marginal means (EMMs).

To assess the differences of the plant communities across the five UGS types, we performed a Principal Coordinates Analysis (PCoA) for all three plant species pools. The ordination was based on the pairwise dissimilarity values. Differences in community composition among the UGS types were tested using a permutational analysis of variance (PERMANOVA) with 999 permutations. To evaluate differences in dispersion among UGS types, we applied a multivariate homogeneity of dispersion analysis using distances to group centroids, followed by a permutation-based test with 999 permutations. Pairwise differences in dispersion were assessed using Tukey's HSD post hoc comparison.

We tested the association between plant species and UGS types by calculating the indicator species of the different UGS types using the framework of de Cáceres & Legendre (2009). Specifically, we used the presence-absence community matrix and tested the association between a species and the UGS types by calculating the specificity A and the fidelity B (Dufrêne & Legendre, 1997) and the significance by using a permutation test with 999 permutations for every plant pool. Following Dufrêne & Legendre (1997) and Cáceres et al. (2010), we considered strong indicator species as those with indicator values >0.5, which can arise from different combinations of specificity and fidelity.

To assess the effects of environmental and gardening variables on alpha and beta diversity, we used GLMMs by fitting separate models for each UGS type and plant pool to avoid loss of interpretability. Predictor selection was based on correlation analysis and variance inflation factors (VIF), excluding highly correlated variables ($r > 70$) (Fig. S2- S7). We retained four main predictors: built environment within 150 meters, and three gardening-related variables (degree of disturbance, time investment, and habitat diversity) (Fig. S8, S9). Additionally, we included annual mean temperature within a 150-meter buffer, as a proxy for city-level effects. Thereby, the annual mean temperature does not consider local effects, such as urban heat islands, but was nevertheless included to reflect regional differences among cities. For alpha diversity, species richness was used as the response variable, with the scaled four main predictors and the annual mean temperature to account for spatial autocorrelation as fixed effects. To support the use of the annual mean temperature instead of the city variable, we first checked whether the model residuals varied among cities and second, compared the models with and without city as a random effect based on the lower Akaike information criterion for small sample size (AICc). Models were fitted using a Poisson distribution, switching to a negative binomial distribution when overdispersion was detected. For beta diversity, the response variable was the pairwise species-richness dissimilarities, with pairwise Euclidean distances of the four main predictors as fixed effects. Different from alpha diversity, we included the annual mean temperature within a 150-meter buffer and both site identities as random effects to account for a potential city-level variation and for non-independence among the data points. Depending on the data distribution, beta diversity was modelled using either a one-inflated beta distribution (ordbeta, logit link) or a Gaussian distribution. For both the alpha and beta diversity analysis, we ran all model combinations while constraining the model set to include at least one fixed effect. Then, we used the AICc (Burnham & Anderson, 2004) and selected the model with the lowest score (Table S2-S7). We estimated model performance using diagnostic plots, tested for over- and underdispersion, uniformity, and zero-inflation. Moreover, for alpha diversity, we tested for spatial autocorrelation using Moran's I.

Results

In total, we recorded 1'082 plant species, of which 635 were native, and 447 were non-native plants. Focusing on species richness among UGS types and across different plant pools, we observed a decreasing pattern in plant species in the non-native plant species pool (Fig. 2A, 2B). Specifically, in the native plant pool, the UGS ranked the following: allotments (47.68 ± 6.43 SE), residential estates (46.67 ± 6.31), private gardens (44.63 ± 6.04), parks (37.61 ± 5.11) and ruderal sites (33.61 ± 4.57) (Fig. 2A, Table S8, S9), while for the non-native plant pool they ranked from allotments (20.71 ± 1.96), private gardens (12.69 ± 1.27), residential estates (6.95 ± 0.76), parks (5.67 ± 0.64) and ruderal areas (3.70 ± 0.46) (Fig. 2B, Table S8, S9).

Community dissimilarities were consistently high across all UGS types, with little variation among UGS types and large variation within them (Fig. 2A, 2B; Table S10, S11). Specifically, for the native plant species pool, ruderal areas had the highest community dissimilarity (0.75 ± 0.02 SE), followed by parks (0.67 ± 0.02), allotments (0.67 ± 0.02), private gardens (0.66 ± 0.02), and residential estates (0.61 ± 0.02) (Fig. 2A, 2B; Table S10, S11). For the non-native plant species pool, private gardens exhibited the highest community dissimilarity (0.84 ± 0.01), followed by parks (0.81 ± 0.01), residential estates (0.77 ± 0.01), allotments (0.70 ± 0.01), and lastly ruderal sites (0.67 ± 0.01) (Fig. 2A, 2B; Table S10, S11).

Species diversity partitioning revealed that gamma diversity was consistently dominated by beta-diversity across all UGS types, with the different plant pools accounting for >84% of the variation (Fig. 2A, 2B; Table S12). Particularly, turnover explained the majority of beta diversity across UGS types and plant origin (between 0.84% and 0.94%), while alpha diversity contributed between 0.05% and 0.14%, and nestedness contributed between 0.01% and 0.02% (Fig. 2B, 2C, Table S12).

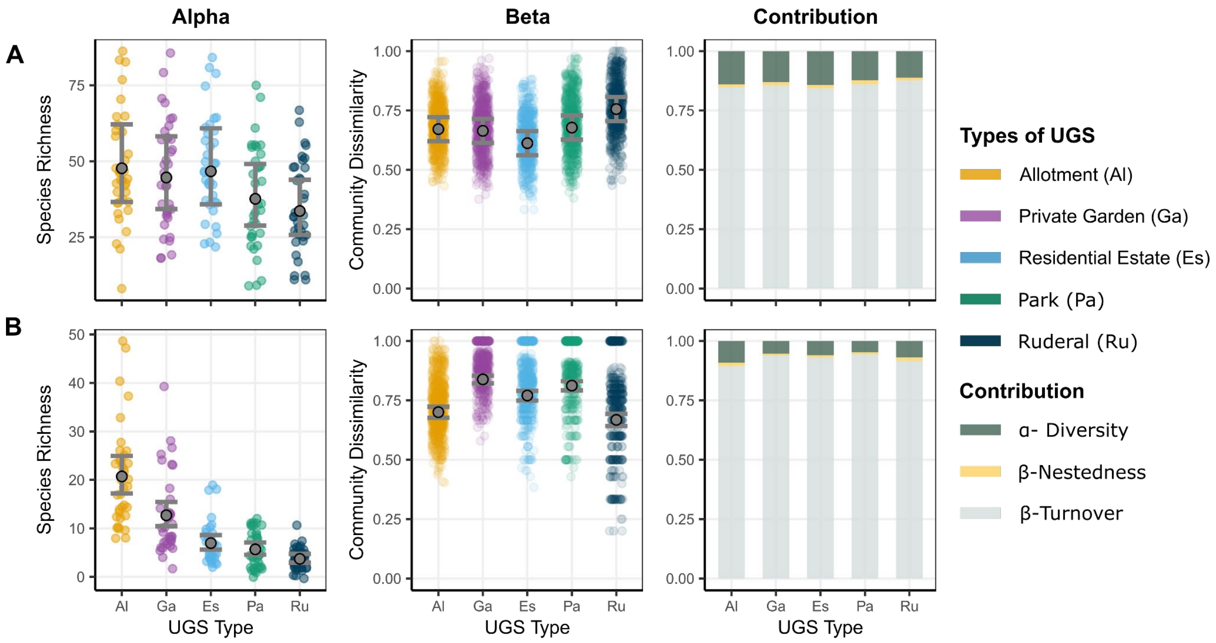

Figure 2. Urban plant diversity patterns. Alpha and beta diversity, based on Hill-number (q=0), and their contribution to the gamma diversity per urban greenspace type for A) the native community, B) the non-native community. Black points show estimated marginal means, while the error bars indicate 95% confidence intervals.

The two principal components of the PCoA explained the total variance (PC1: 12,3% - 13.4%, PC2: 9% -11.3%) (Fig. 3, Table S13-15). While allotments clustered separately from the other UGS across all plant categories, ruderal sites were only clustered in all plants and native plants. Private gardens, residential estates, and parks were always mixed regardless of the plant species pool considered (Fig. 3, Table S13-15).

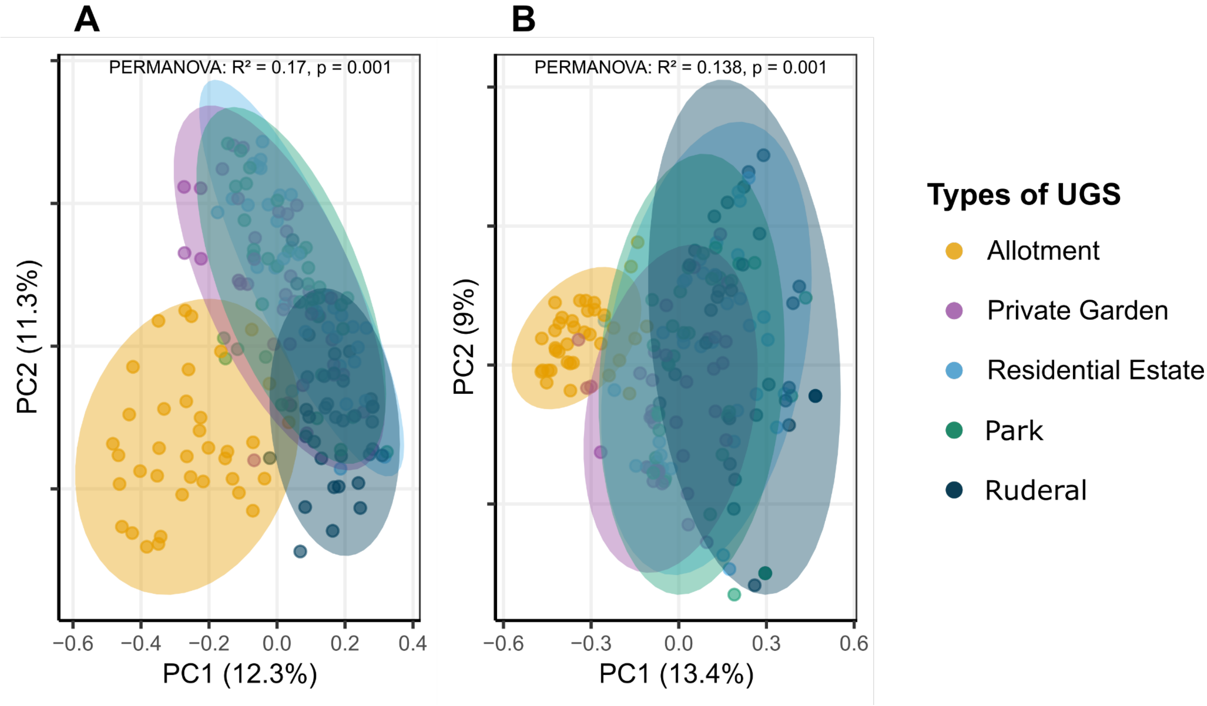

Figure 3. Plant community composition across the five types of UGS. Principal Coordinates Analysis (PCoA) on the assemblages of species occurrences for A) native community plants, B) non-native community plants. Differences in community composition among UGS types were tested using a PERMANOVA with 999 permutations, and dispersion among groups was also evaluated using a homogeneity of multivariate dispersion test. Each point represents a sampling site while the ellipses indicate 95% confidence intervals.

The Indicator values analyses revealed significant associations between native and non-native plant species and UGS types (Table S16 -S18). Specifically, we found 26 native and 11 non-native plant species that were significantly associated with a single UGS type. These plant species were differently distributed across the UGS types. More specifically, allotments were significantly associated with 20 native and 11 non-native plants, private gardens with one native, residential estates with four native plants and parks with one plant (Table S16 -S18).

Drivers of alpha diversity

The GLMMs on the alpha diversity indicated context dependencies of variable influence regarding the UGS type and the plants' origin, namely native and non-native (Fig. 4). Species richness of native plants in allotments decreased with the degree of disturbance and the built environment within 150 meters. In private gardens, richness increased with habitat diversity and decreased with the degree of disturbance, the built environment and annual mean temperature within 150 meters. In residential estates, richness increased with habitat diversity and decreased with annual mean temperature within 150 meters. In parks, richness increased with habitat diversity and time investment, and decreased with disturbance, the built environment and annual mean temperature within 150 meters. Lastly, in ruderal areas, richness decreased with built environment and annual mean temperature within 150 meters (Fig. 4A, Table S19 -S21).

Regarding the non-native plant pool, allotments' non-native plant richness decreased with the built environment within 150 meters. In private gardens, richness increased with habitat diversity. In residential estates, richness increased with habitat diversity and annual mean temperature within 150 meters. In parks, richness increased with time investment and annual mean temperature within 150 meters. In ruderal areas, richness increased with annual mean temperature within 150 meters. (Fig. 4B, Table S19 -S21). Lastly, the direction of all significant predictors was consistent across UGS types and plant origin status. Specifically, time investment and habitat diversity positively affected plant species richness, whereas degree of disturbance and the built environment within 150 meters negatively affected it (Fig. 4, Table S19 -S21).

Drivers of beta diversity

Similar to the alpha diversity, the GLMMs on the beta diversity indicated context dependencies of variable influence regarding the UGS type and the plants' origin (Fig. 4). Beta diversity of native plants in allotments and private gardens increased with dissimilar degrees of disturbance and dissimilar built environment within 150 meters. In residential estates, it increased with dissimilar habitat diversity and dissimilar degrees of disturbance. In parks, it increased with dissimilar degrees of disturbance, built environment within 150 meters, and decreased with dissimilar time investment. Lastly, in ruderal areas, it increased with dissimilar habitat diversity (Fig. 4, Table S22 -S24).

Non-native beta diversity of allotments increased with dissimilar degrees of disturbance. In private gardens, it increased with dissimilar habitat diversity. In residential estates, it increased with dissimilar degrees of disturbance. In parks, it decreased with dissimilar habitat diversity and increased with dissimilar built environment within 150 meters and dissimilar degree of disturbance. Lastly, in ruderal areas, it increased with dissimilar time investment (Fig. 4, Table S22 -S24).

Concerning plant origin status, different predictors shaped native and non-native beta diversity across the UGS types (Fig. 4). Dissimilar time investment had a negative effect on native beta diversity in parks but a positive effect on non-native beta diversity in ruderal areas. Dissimilar habitat diversity had a positive influence on native beta diversity in residential estates and ruderal areas, and a negative influence on non-native beta diversity in parks. Dissimilar degrees of disturbances had a positive influence on native beta diversity in allotments, private gardens, residential estates, and parks, and on non-native beta diversity in allotments, residential estates, and parks (Fig. 4, Table S22 -S24). The increasing dissimilarity in the built environment within a 150-meter radius had a positive effect on native beta diversity in allotments, private gardens, and parks, as well as on non-native beta diversity in parks (Fig. 4, Table S22 -S24).

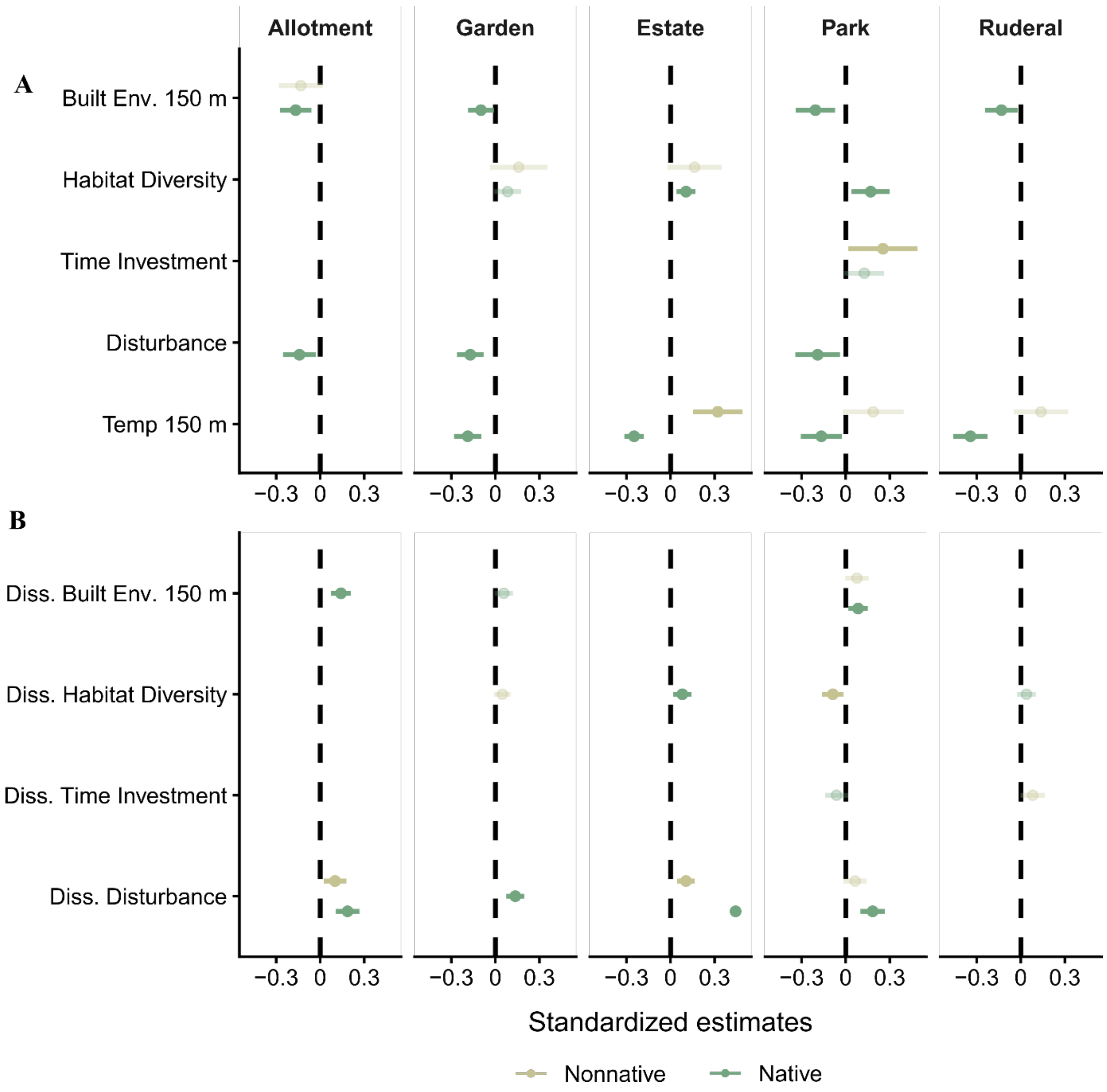

Figure 4: Drivers of urban plants across UGS types. Standardised estimates with their 95% confidence interval from the top-performing model depicting the relationships of (a) alpha and (b) beta diversity metrics with the selected predictors: disturbance, time investment, habitat diversity, and built environment. Models are presented separately for each UGS type and for the native pool and the non-native pool, with non-significant effects displayed with increased transparency.

Discussion

Here, we investigated the richness, the distribution of plants across UGS types, the role of plant origin (native versus non-native), and the drivers of urban plant communities. We found that species richness increases along a human-investment gradient, attributable to higher occurrences of non-native plants, and that allotments and ruderal areas contain distinct species communities. In contrast, private gardens, residential estates, and parks share similar plant communities (RQ1). Furthermore, habitat diversity and conservation management (represented by time investment) increased plant richness, whereas built environment and maintenance management (represented by degree of disturbance) reduced it. Moreover, differences in habitat diversity, conservation and maintenance management, and built environment increased in beta diversity (RQ2). Lastly, the plants' origin responded differently to the built environment only: it negatively affected native plant communities across several UGS types, whereas it had a negative effect only on non-native plant communities in one UGS type (RQ3).

Plant communities across UGS types

The increase in species richness along the human investment gradient, due to the higher occurrence of non-native plants, confirms our first hypothesis (H1) and aligns with previous findings that urban areas often accumulate non-native species, resulting in elevated species richness (Aronson *et al.*, 2014; McKinney, 2006; Pyšek *et al.*, 2004). Interestingly, while non-native plant richness increased, native plant richness remained stable along the human investment gradient. This suggests that non-native species do not necessarily replace native species, allowing co-existence under managed conditions. This contrasts with classical assumptions that non-native introductions inevitably reduce native species richness (Aronson *et al.*, 2014; Dylewski *et al.*, 2023; McKinney, 2006) and highlights that the potential homogenization effects of non-natives can be mediated. Distinct plant communities (beta diversity) within and between UGS types contributed to high plant heterogeneity at the city scale. Within UGS types, variation in plant communities was primarily driven by species turnover rather than by differences in species richness, consistent with previous findings that urban plant beta diversity is largely mediated by compositional replacement among sites (Lososová *et al.*, 2016). Although there is redundancy in plant communities across private gardens, residential estates, and parks, allotments and ruderal areas exhibit distinct plant assemblages, thereby promoting the diversification of native and non-native flora within a city. Therefore, considering the different forms of UGS types is relevant for enhancing urban plant biodiversity (English *et al*., 2022), especially allotments and ruderal areas.

The clustering of private gardens, residential estates, and parks might reflect a combination of similar ecological conditions and social objectives, as these UGS types are often designed and maintained for recreation, aesthetics, and safety (Swan *et al*., 2021), resulting in similar habitats and a core of common plant species (McKinney, 2006). While some of these habitats can act as filters that tend to reduce diversity and increase homogeneity, e.g., lawns or trees (Ouyang *et al*., 2023), other habitats can diversify plant communities, e.g., meadows or floral beds. Specifically, lawns can impose strong environmental filtering through frequent mowing, soil compaction, and nutrient inputs, creating high-disturbance intensity that limits species establishment and persistence (Ignatieveta *et al.,* 2015; Shea *et al*., 2004). This is further supported by the 26 indicator species, which are typically found in lawns, e.g., *Bellis perennis, Festuca rubra, Trifolium repens, and Ajuga reptans,* and are shared within the group of private gardens, residential estates, and parks (Table S14). On the other hand, habitats such as meadows, driven by self-assembly, and flower beds and ornamental plantings, driven by active planting, can increase local plant diversity. However, it is important to consider that in these habitats plant communities may still become homogenised if similar plants are repeatedly selected and planted (Pearse *et al*., 2018) or if environmental factors (soil conditions, invasion, competition) exert a strong filtering. Overall, our results indicate that the simplification effect of certain habitats can, at least in part, be compensated for by transformation into other habitat types. Such transformations align with the concepts of ecological restoration, which aims to facilitate urban biodiversity (Klaus & Kiehl, 2021) and are likely to be more cost-efficient than creating novel UGS types.

Effects of social-ecological drivers

Our results showed positive effects of conservation management and habitat diversity and negative effects of maintenance management and built environment on species richness, confirming H2a, as well as an increasing beta diversity with differences in these socio-ecological variables, confirming H2b. In particular, conservation management and high habitat diversity facilitate spontaneous establishment and niche availability, thereby enhancing local species richness (Avolio *et al*., 2021; Chang *et al*., 2021; Seitz *et al*., 2022). In contrast, maintenance management simplifies plant communities by favouring disturbance-tolerant or intentionally planted species, while built environments can reduce colonisation opportunities by limiting dispersal from surrounding habitat (Aronson *et al*., 2014; Seitz *et al*., 2022). Our results also provide empirical support for the conceptual framework of Swan *et al*. (2021), indicating that variation in social-ecological drivers promotes compositional differentiation and thereby contributes to high citywide diversity. Together, by jointly analysing alpha and beta diversity, our study shows that urban social-ecological conditions can simultaneously constrain local species richness while promoting compositional differentiation among sites, highlighting scale-dependent mechanisms shaping urban plant diversity. Consequently, urban plant diversity conservation should not only aim to minimise local constraints on plant diversity, but also to maintain a diverse mosaic of management regimes and habitat conditions across the city.

Native and non-native plants

The social-ecological drivers only partly supported our expectation that native and non-native species would respond differently across UGS types (H3). The negative effect of the built environment on native plant richness, together with the contrasting effects of temperature on native and non-native richness, underscores the usefulness of distinguishing between native and non-native plants when studying assembly processes in an urban context. Because temperature variation was distinct across the three cities, it likely captures multiple aspects of urban environmental and cultural context. Consequently, the observed relationship can not only be attributed to temperature effects but might also reflect differences in cultural practices, such as ornamental plant preferences or management regimes in general. Aligning with Casanelles-Abella *et al*. *(*2025), such city-specific differences suggest that urban contexts play a key role in determining whether urban plant diversity becomes homogenised.

Limitations and future prospects

Our study had some limitations regarding woody vegetation that is known to benefit from a quite high diversity in cities (Augustinus *et al*., 2024). Specifically, large UGS types, such as parks and residential estates, are expected to exhibit a strong species-area effect (Alós Ortí et al., 2022). Larger sites are likely to harbour more woody species simply because of greater space availability, which may appear sparsely distributed within the UGS (Alós Ortí *et al*., 2022), whereas smaller UGS types may be structurally constrained. Hence, our stratified random sampling design likely undersampled woody vegetation, and conclusions regarding woody plant assemblages should be interpreted cautiously.

While we focused on taxonomic diversity, other biodiversity dimensions could provide complementary insights (Dylewski *et al*., 2023). Hence, future research should include functional and phylogenetic diversity, enabling a more comprehensive link to ecosystem functioning or evolutionary history (Lososová *et al.,* 2016). Integrating such dimensions would allow a more mechanistic understanding of how social and ecological drivers select and filter plant species, e.g., via specific functional and sociocultural plant traits (Chang *et al*., 2024), and how plant assemblages in different UGS types contribute to ecosystem processes such as primary production, leaf litter decomposition, and tolerance to disturbance, as well as to the conservation of evolutionary lineages within cities (Nava-Díaz *et al., 2022)*. Finally, our study opens questions regarding the influence of novel plant assemblages on associated trophic levels (Zivanovic & Luck, 2016). Particularly, differences in plant species taxonomic, functional, and phylogenetic diversity are expected to influence associated fauna, including pollinating and herbivore insects, birds, or soil organisms (Chong *et al*., 2014; Mata *et al*., 2017; Threlfall *et al*., 2017; Tresch *et al*., 2019).

Conclusion

Overall, cities host a diverse array of native and non-native plants across UGS types, reflecting multiple layers of human influence, including ownership, design, preferences, and management styles. Our results stress the importance of maintaining and transforming multiple UGS types within a city as they jointly contribute to plant diversity at the city scale. Generally, a greater diversity of UGS types provides a range of designs and management regimes, which in turn supports higher plant diversity but also likely enhances the diversity of other trophic levels (Zivanovic & Luck, 2016). In a context of limited space and ongoing densification, it becomes critical to develop strategies to enhance biodiversity within the existing network of UGSs. These strategies include the preservation of diverse UGS that differ in design, management and user purposes (Casanelles-Abella & Egerer, 2026), particularly those under strong pressure to be transformed to other urban uses such as gardens (Keshavarz et al., 2016) or ruderal sites (Chowdhury et al., 2023). Moreover, besides preserving existing priority UGS types, biodiversity can also be enhanced at the management level through the transformation of established UGS (e.g., parks, residential estates) via restoration and rehabilitation actions (Klaus & Kiehl, 2021), for example, conversion of lawns to grasslands and meadows or the restoration of wetlands (Dushkova & Ignatieva, 2025). Despite this potential of enhancing plant diversity within a city, we need to be aware that changes in the economy, politics, or social norms will affect management and UGS design, ultimately requiring continuous promotion of biodiverse UGS to enhance plant diversity and thereby support people and nature.

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Declaration of generative AI use

Statement: During the preparation of this work, the author(s) used ChatGPT to assist with streamlining RCode, refining complicated sentences, and improving the overall clarity of the text. Perplexity and SCite were used to search for relevant scientific literature. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the published article.

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Appendix A. Supplementary Data

Supplementary Text

Supplementary tables

Supplementary Figures

Text S1. Cities

The study was conducted in three major Swiss cities representing the three main languages of the country, Zurich (German-speaking), Geneva (French-speaking), and Lugano (Italian-speaking). Zurich is located in northern Switzerland at approximately 47.37N, 8.54 E, at an elevation of about 408m above sea level (a.s.l) and has a population of roughly 436’551 inhabitants. Geneva lies in southwestern Switzerland at approximately 46.20N, 6.14E, at an elevation of approximately 375 m a.s.l. and has a population of about 209’061 inhabitants. Lugano is located in southern Switzerland at approximately 46.00N, 8.95E, at an elevation of approximately 273 m a.s.l with around 63’629 inhabitants (Swiss Federal Statistical Office, 2026).

Text S2. UGS types

These UGS also follow the proposed framework of Swan *et al*. (2021), as they differ in purpose and ownership structure and follow a human-investment gradient. Adjusted to our study system, allotments, historically set up for personal food production in times of poverty (Barthel *et al*., 2015), nowadays serve multiple purposes, ranging from food production to recreation, health, and social cohesion in cities. Furthermore, allotments are managed individually and can exert strong control over species composition. Private gardens are cultivated areas designed for personal use and enjoyment, directly connected to the dwelling. Thereby, private gardens can cover similar purposes as allotments, are managed individually, and exhibit a high degree of control over the species (Locke *et al*., 2018). Green areas in real estate represent a modern approach to urban development, emphasizing the incorporation of natural elements within residential areas to enhance livability and environmental quality (Borysiak *et al*., 2025). Thus, the purpose of green areas in real estate is directly connected to the dwelling, is institutional in ownership, and is believed to have high control over species composition (Borysiak *et al*., 2025). Parks play a crucial role in urban infrastructure by providing recreational opportunities, promoting physical health, and enhancing social interactions among residents (Lin *et al*., 2014). They are owned by the municipality and have medium control over species composition. In contrast, ruderal areas, which represent green spaces that are not or only minimally maintained, can provide unexpected ecological niches, supporting diverse plant and animal species that thrive in less-managed environments (Aronson *et al.,* 2017). These ruderal areas can vary in ownership, ranging from individual to governmental, but all exhibit low control over species composition (Swan *et al*., 2021).

Text S3. Site selection

Specifically, sites were classified as high when more than 60% of the area within a 500-meter radius was covered by impervious surface, and as low when the proportion was below this threshold, using the European Land Cover Map at 10m resolution (Venter & Sydenham, 2021). Vegetation structural diversity at each site was considered high if the proportion of lawn was less than 75% of the area and at least five different habitat types were present (e.g., meadow, shrubland, trees, flower beds, vegetable beds, wetland). It was considered low if the proportion of lawn exceeded 75% and/or fewer than five habitat types were present. Subplots were then merged to obtain a single list of plant species.

Text S4. Vegetation plot

In allotments, the whole area was covered as they typically have a size of ca. 100 m^2. In private gardens, we divided the 100 m^2 into two 50 m2 subplots following the approach from Baldock *et al*. (2019). One subplot was placed in the periphery (along the border), often designed for sight protection, and the second subplot was placed in the centre of the private garden, covering different purposes, such as aesthetics and recreation. For ruderal sites, we randomly placed the 100 m^2 plot. Finally, as parks and real estates often have a larger area and contain multiple habitats (e.g. lawn, shrubland, woodland, meadows, flowerbeds), we first produced a habitat map based on nine habitat categories (following Price *et al*., 2023) **(Text S5)** and divided the 100 m^2 plot into "n" subplots (n being the number of habitat mapped), with the size of each subplot being proportional to the habitat area (e.g. if a site was composed by 30% shrubs and 70% meadows, we divided the plot into two subplots of 30 m^2 and 70 m^2).

Text S5. Impervious surface
To obtain the proportion of the impervious surface in the surroundings of the UGS, we used the Habitat Map of Switzerland (Bronwyn Price *et al.,* 2021), which classified every surface in Switzerland into nine standardized sets of habitat types. Specifically, we classified grasslands, woodland edges, tall herb communities, shrubs, forests, pioneer vegetation of disturbed areas, and plantation and cropland (land cover classes 4-8) as vegetated areas, and subtracted this proportion from one to get the impervious surface. Within a buffer of 150, 50,0 and 1000 meters around the focal UGS, excluding the specific site, we calculated the proportion of the impervious surface (QGIS 3.44.0)

Text S6. Management Index calculation

Within each habitat category, a management score was calculated separately for each of the three management indices by summing the values of the relevant questions. The resulting habitat score was then standardized by dividing it by the maximum possible score within that habitat. Finally, for each study site and index, we calculated a single metric by summing the scores across the habitats and dividing them by the number of habitats. (Eq. 1).

$$MI = \frac{1}{H}\sum_{h=1}^{H}\left(\frac{\sum_{i=1}^{n_h} x_{hi}}{\sum_{i=1}^{n_h} x_{hi}^{max}}\right)$$

where *h* is the habitat category, *i* is the management question, n_h *is* the number of questions in a habitat, x_{hi} is the observed value for management question, x_{hi}^{max} is the maximum possible value for that question, and *H* is the number of habitat categories.

Text S7. Habitat mapping
We considered the following nine habitat types: flowerbeds, lawn, meadow, ruderal, woodland, shrubs, single trees, wetlands, and impervious surfaces. Flowerbeds are cultivated and often highly designed habitats for aesthetic purposes, featuring native and non-native plants. Lawns are habitats with mowing frequencies larger than once per month. Meadows are habitats with two to four mowing events per year. Shrubs include hedgerows and other vegetation formations dominated by shrubs. Woodlands are vegetation formations dominated by trees, often with an understory of herbs and shrubs. Single trees include sparse individual trees and the vegetation beneath them. Wetlands are habitats characterized by high water levels and adapted vegetation. Ruderal habitats include spontaneous vegetation in designed areas or abandoned lots. Impervious surfaces include both built-up surfaces, paths, and rocks.

Supplementary tables

Table S1. Management Questionnaire.
The questionnaire, distributed to participants, assesses gardening activity. It can be divided into five different habitats (lawn, meadow, vegetable garden, flowerbed, trees and shrubs), and one additional category that covers diverse activities. Within each habitat category, there is a set of questions addressing timing, frequency, and how certain management practices are conducted. (TimeCut: Timing of Cutting; FreqCut: Frequency of cutting; HowCut: How is cutted; FreqFertil: Frequency of fertilizing; WhichFertil: type of fertilizers; FreqWatering: Frequency of watering; HowWatering: How is watered; FreqRehabilitate: Frequency of rehabilitation; FreqProtectant: Frequency of protectant; WhatProtectant: Type of protectant). These questions can be further divided into three categories covering different aspects of gardening activities: Dist.: Disturbance; Time: Time investment; Div: Biodiversity friendly.

Lawn

Cat.			Questions	Answers
Dist.	Time	Div.	Habitat	No
				Yes
x		x	TimeCut	April
				May
				Early June
				Late June
				July or later
x			FreqCut	1-2x per year
				3-4x per year
				5-8x per year
				9-20x per year
				>20 x per year
	x		HowCut	Sythe
				Lawnmower
				Automatic lawnmower
x	x	x	Flowerstripe	Never
				Rarely
				Sometimes
				Often
				Always
x			FreqFertil	Never
				1x per 4-5years
				1x per 2-3years
				1x per year
				> 1x per year
		x	WhichFertil	Never
				Organic
				Mineral
x			FreqWatering	Always
				If nec.
				If nec. and 1x / wk (Su)
				If nec. and 2x / wk (Su)
				If nec. and > 2x / week (Su)
	x		HowWatering	Never
				Watering can
				Garden hose
				Irrigation system
x			FreqRehabilitate	Never
				Every 6-10 years
				Every 4-5years
				Every 2-3 years
				Anually
x			FreqProtectant	Never
				< 1x per year
				1-3x per year
				4-10x per year
				> 10x per year
		x	WhatProtectant	Never
				Organic
				Conventionell

Meadow

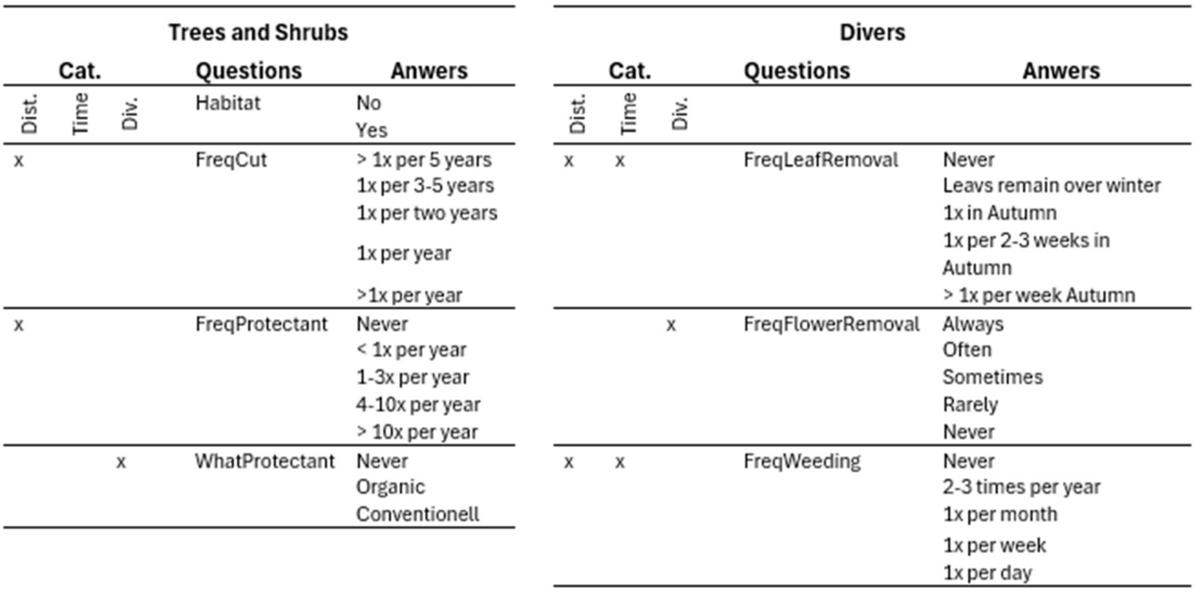
Cat.			Questions	Anwers
Dist.	Time	Div.	Habitat	No
				Yes
x		x	TimeCut	April
				May
				Early June
				Late June
				July or later
x			FreqCut	< 1x per year
				1x per year
				2x per year
				3x per year
				>3x per year
	x		HowCut	Sythe
				Lawnmower
				Automatic lawnmower
x	x	x	Flowerstripe	Never
				Rarely
				Sometimes
				Often
				Always
x			FreqFertil	Never
				1x per 4-5years
				1x per 2-3years
				1x per year
				> 1x per year
		x	WhichFertil	Never
				Organic
				Mineral
x			FreqRehabilitate	Never
				1x per 6-10 years
				1x per 4-5years
				1x per 2-3 years
				1x per year
x			FreqWatering	Always
				If nec.
				If nec. and 1x / wk (Su)
				If nec. and 2x / wk (Su)
				If nec. and > 2x / week (Su)
	x		HowWatering	Never
				Watering can
				Garden hose
				Irrigation system

Table S1. Management Questionnaire (Continuation)

Vegetable Garden				
Cat.			Questions	Anwers
Dist.	Time	Div.	Habitat	No Yes
x			FreqFertil	Never 1x per 2-3 years 1 x per year 2-3x per year >3x per year
		x	WhichFertil	Never Organic Mineral
x			FreqWatering	Always If nec. If nec. and 1x / wk (Su) If nec. and 2x / wk (Su) If nec. and > 2x / week (Su)
	x		HowWatering	Never Watering can Garden hose Irrigation system
x			FreqMulch	Never Rarely Sometimes Often Always
x			FreqManuring	Never Rarely Sometimes Often Always
x			FreqTurnover	Never < 3x per year 1x per two years 1x per year > 1x per year
x			FreqProtectant	Never < 1x per year 1-3x per year 4-10x per year > 10x per year
		x	WhatProtectant	Never Organic Conventionell

Flowerbed				
Cat.			Questions	Anwers
Dist.	Time	Div.	Habitat	No Yes
x			FreqFertil	Never 1x per 2-3 years 1x per year 2-3x per year >3x per year
		x	WhichFertil	Never Organic Mineral
x			FreqWatering	Always If nec. If nec. and 1x / wk (Su) If nec. and 2x / wk (Su) If nec. and > 2x / week (Su)
	x		HowWatering	Never Watering can Garden hose Irrigation system
x			FreqProtectant	Never < 1x per year 1-3x per year 4-10x per year > 10x per year
		x	WhatProtectant	Never Organic Conventionell
x			FreqTurnover	Never 1x per >2 years 1x per 2 years 1x per year > 1x per year

Table S1. Management Questionnaire (Continuation)



Trees and Shrubs

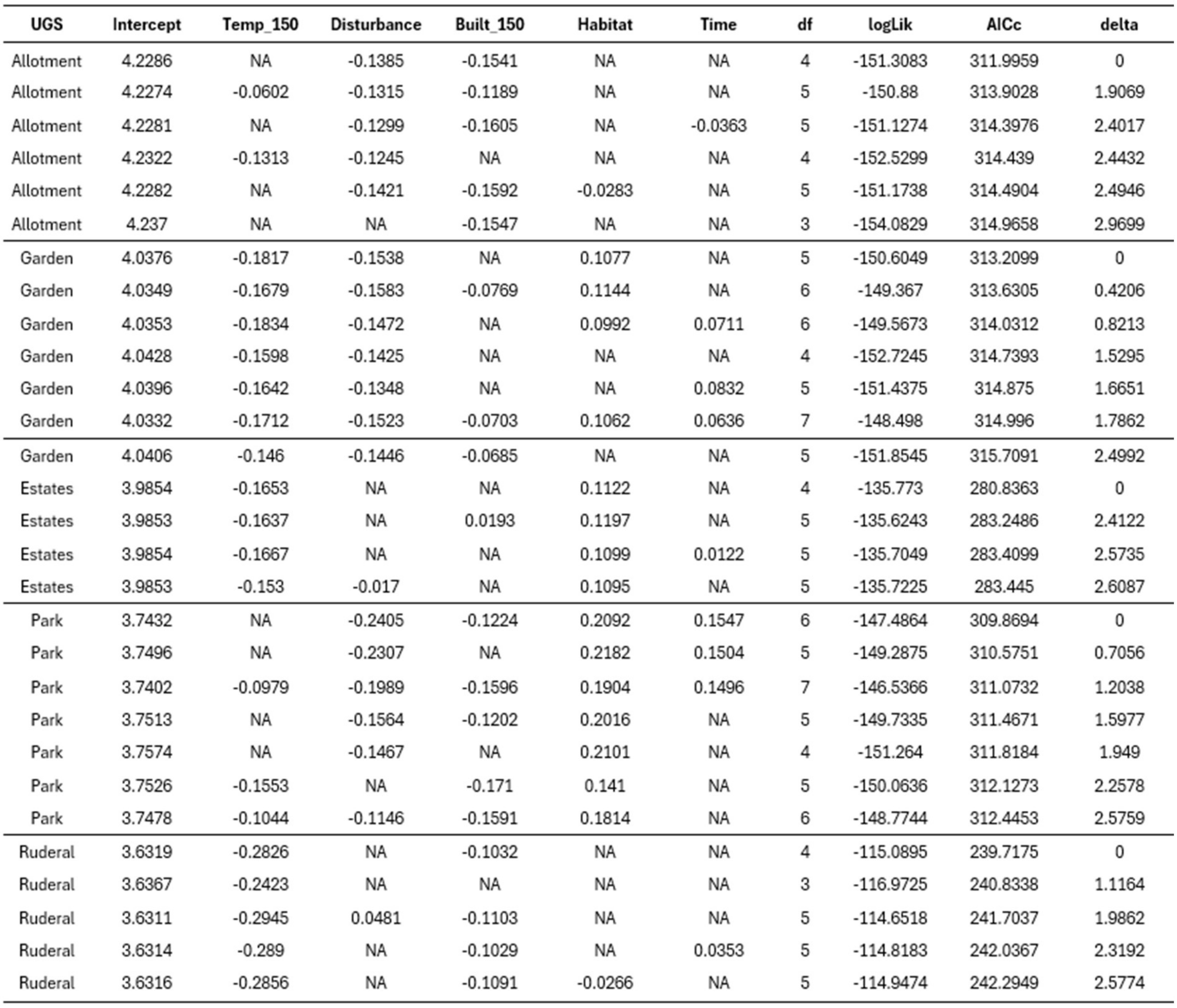
Cat.			Questions	Anwers
Dist.	Time	Div.	Habitat	No Yes
x			FreqCut	> 1x per 5 years 1x per 3-5 years 1x per two years 1x per year >1x per year
x			FreqProtectant	Never < 1x per year 1-3x per year 4-10x per year > 10x per year
		x	WhatProtectant	Never Organic Conventionell

Divers

Cat.			Questions	Anwers
Dist.	Time	Div.		
x	x		FreqLeafRemoval	Never Leavs remain over winter 1x in Autumn 1x per 2-3 weeks in Autumn > 1x per week Autumn
		x	FreqFlowerRemoval	Always Often Sometimes Rarely Never
x	x		FreqWeeding	Never 2-3 times per year 1x per month 1x per week 1x per day

Table S2. Model selection alpha all

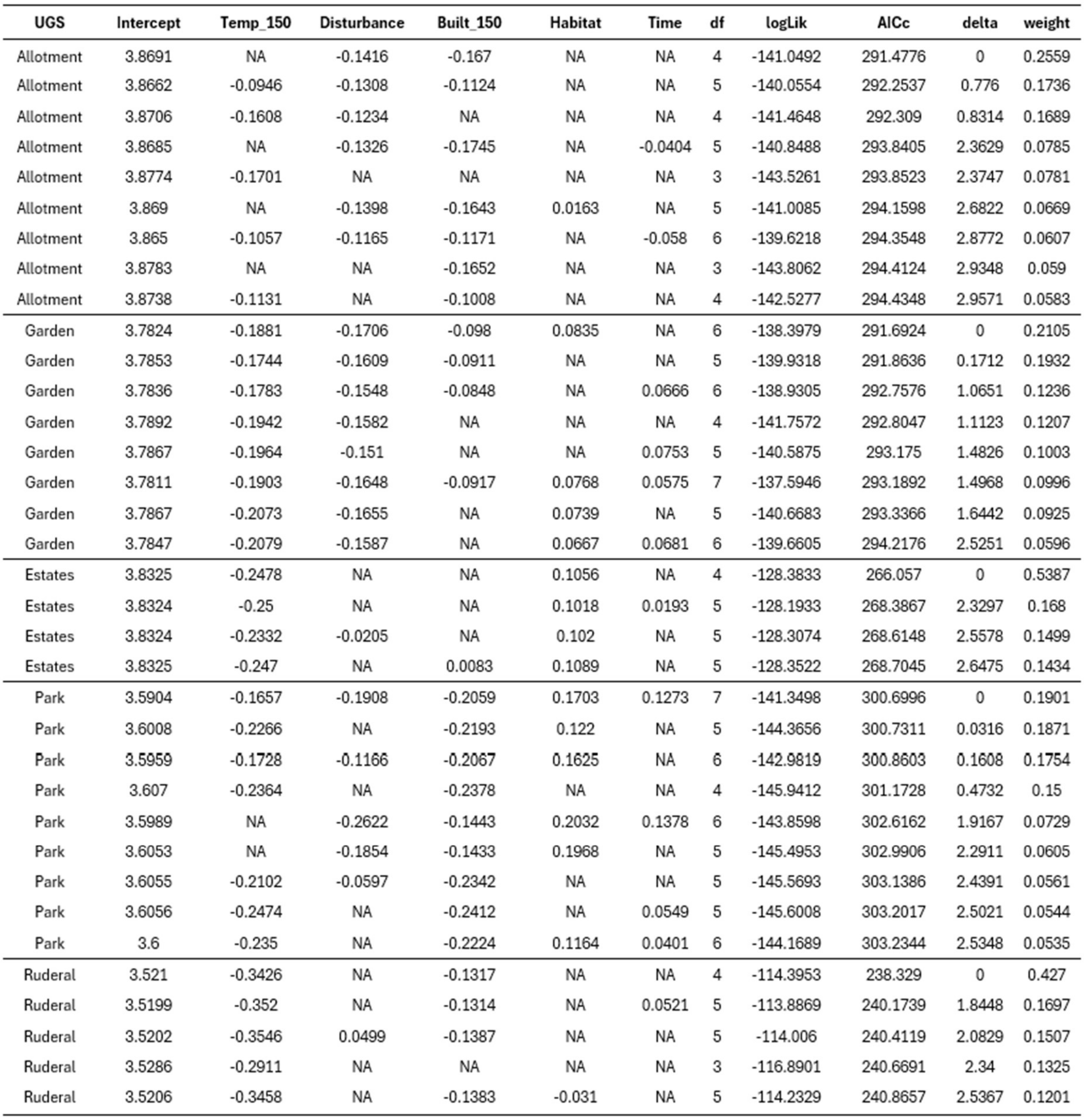
Top models assessing the effect of management (Disturbance, Time: Time Investment, and Habitat: Habitat diversity) and urban intensity (Built (150): Built Environment within a 150-meter radius) on species richness of all the species. models are ranked by corrected Akaike's Information Criterion (AICc)



UGS	Intercept	Temp_150	Disturbance	Built_150	Habitat	Time	df	logLik	AICc	delta
Allotment	4.2286	NA	-0.1385	-0.1541	NA	NA	4	-151.3083	311.9959	0
Allotment	4.2274	-0.0602	-0.1315	-0.1189	NA	NA	5	-150.88	313.9028	1.9069
Allotment	4.2281	NA	-0.1299	-0.1605	NA	-0.0363	5	-151.1274	314.3976	2.4017
Allotment	4.2322	-0.1313	-0.1245	NA	NA	NA	4	-152.5299	314.439	2.4432
Allotment	4.2282	NA	-0.1421	-0.1592	-0.0283	NA	5	-151.1738	314.4904	2.4946
Allotment	4.237	NA	NA	-0.1547	NA	NA	3	-154.0829	314.9658	2.9699
Garden	4.0376	-0.1817	-0.1538	NA	0.1077	NA	5	-150.6049	313.2099	0
Garden	4.0349	-0.1679	-0.1583	-0.0769	0.1144	NA	6	-149.367	313.6305	0.4206
Garden	4.0353	-0.1834	-0.1472	NA	0.0992	0.0711	6	-149.5673	314.0312	0.8213
Garden	4.0428	-0.1598	-0.1425	NA	NA	NA	4	-152.7245	314.7393	1.5295
Garden	4.0396	-0.1642	-0.1348	NA	NA	0.0832	5	-151.4375	314.875	1.6651
Garden	4.0332	-0.1712	-0.1523	-0.0703	0.1062	0.0636	7	-148.498	314.996	1.7862
Garden	4.0406	-0.146	-0.1446	-0.0685	NA	NA	5	-151.8545	315.7091	2.4992
Estates	3.9854	-0.1653	NA	NA	0.1122	NA	4	-135.773	280.8363	0
Estates	3.9853	-0.1637	NA	0.0193	0.1197	NA	5	-135.6243	283.2486	2.4122
Estates	3.9854	-0.1667	NA	NA	0.1099	0.0122	5	-135.7049	283.4099	2.5735
Estates	3.9853	-0.153	-0.017	NA	0.1095	NA	5	-135.7225	283.445	2.6087
Park	3.7432	NA	-0.2405	-0.1224	0.2092	0.1547	6	-147.4864	309.8694	0
Park	3.7496	NA	-0.2307	NA	0.2182	0.1504	5	-149.2875	310.5751	0.7056
Park	3.7402	-0.0979	-0.1989	-0.1596	0.1904	0.1496	7	-146.5366	311.0732	1.2038
Park	3.7513	NA	-0.1564	-0.1202	0.2016	NA	5	-149.7335	311.4671	1.5977
Park	3.7574	NA	-0.1467	NA	0.2101	NA	4	-151.264	311.8184	1.949
Park	3.7526	-0.1553	NA	-0.171	0.141	NA	5	-150.0636	312.1273	2.2578
Park	3.7478	-0.1044	-0.1146	-0.1591	0.1814	NA	6	-148.7744	312.4453	2.5759
Ruderal	3.6319	-0.2826	NA	-0.1032	NA	NA	4	-115.0895	239.7175	0
Ruderal	3.6367	-0.2423	NA	NA	NA	NA	3	-116.9725	240.8338	1.1164
Ruderal	3.6311	-0.2945	0.0481	-0.1103	NA	NA	5	-114.6518	241.7037	1.9862
Ruderal	3.6314	-0.289	NA	-0.1029	NA	0.0353	5	-114.8183	242.0367	2.3192
Ruderal	3.6316	-0.2856	NA	-0.1091	-0.0266	NA	5	-114.9474	242.2949	2.5774

Table S3. Model selection alpha native

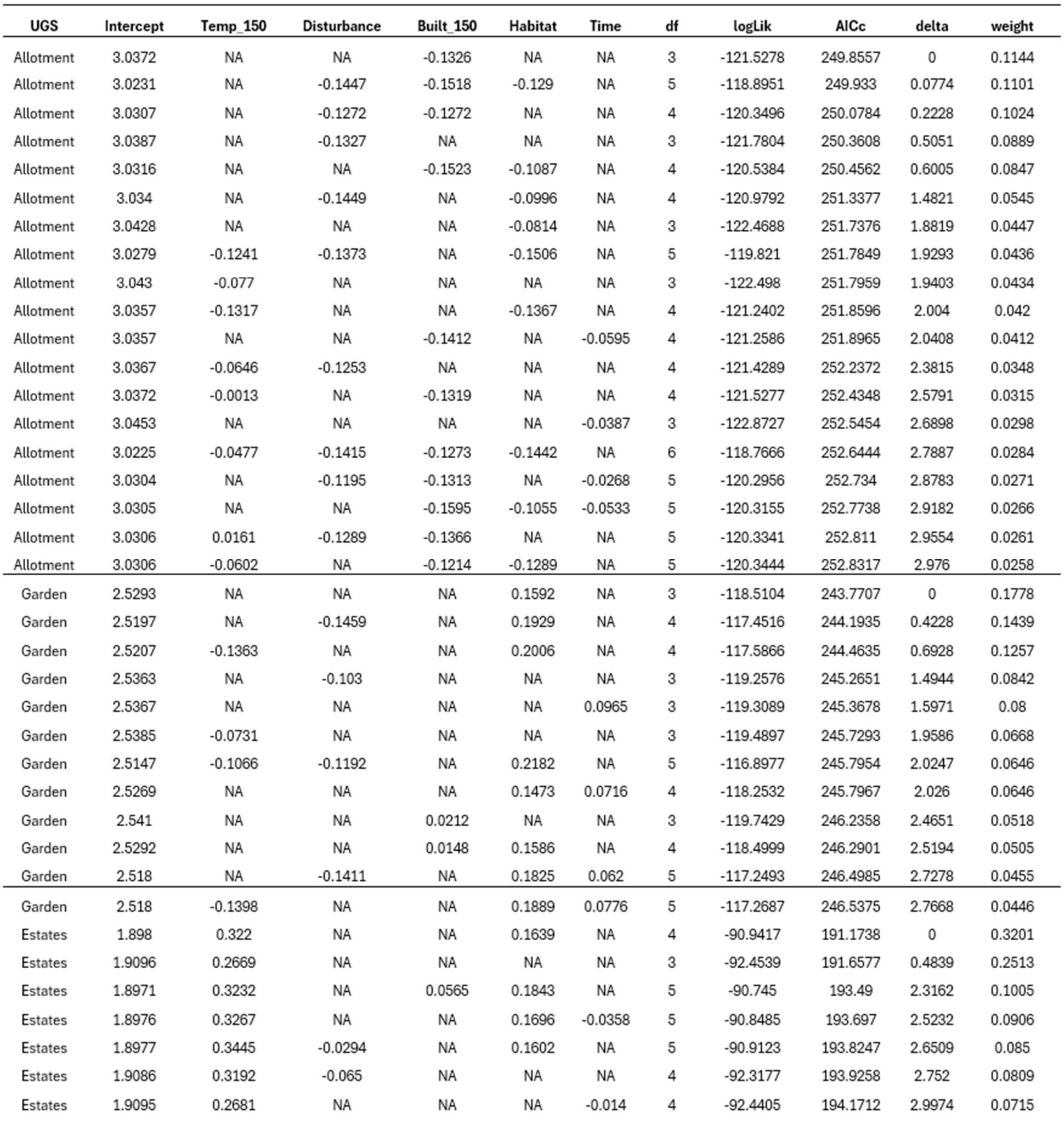
Top models assessing the effect of management (Disturbance, Time: Time Investment, and Habitat: Habitat diversity) and urban intensity (Built (150): Built Environment within a 150-meter radius) on species richness of native species. models are ranked by corrected Akaike’s Information Criterion (AICc).



UGS	Intercept	Temp_150	Disturbance	Built_150	Habitat	Time	df	logLik	AICc	delta	weight
Allotment	3.8691	NA	-0.1416	-0.167	NA	NA	4	-141.0492	291.4776	0	0.2559
Allotment	3.8662	-0.0946	-0.1308	-0.1124	NA	NA	5	-140.0554	292.2537	0.776	0.1736
Allotment	3.8706	-0.1608	-0.1234	NA	NA	NA	4	-141.4648	292.309	0.8314	0.1689
Allotment	3.8685	NA	-0.1326	-0.1745	NA	-0.0404	5	-140.8488	293.8405	2.3629	0.0785
Allotment	3.8774	-0.1701	NA	NA	NA	NA	3	-143.5261	293.8523	2.3747	0.0781
Allotment	3.869	NA	-0.1398	-0.1643	0.0163	NA	5	-141.0085	294.1598	2.6822	0.0669
Allotment	3.865	-0.1057	-0.1165	-0.1171	NA	-0.058	6	-139.6218	294.3548	2.8772	0.0607
Allotment	3.8783	NA	NA	-0.1652	NA	NA	3	-143.8062	294.4124	2.9348	0.059
Allotment	3.8738	-0.1131	NA	-0.1008	NA	NA	4	-142.5277	294.4348	2.9571	0.0583
Garden	3.7824	-0.1881	-0.1706	-0.098	0.0835	NA	6	-138.3979	291.6924	0	0.2105
Garden	3.7853	-0.1744	-0.1609	-0.0911	NA	NA	5	-139.9318	291.8636	0.1712	0.1932
Garden	3.7836	-0.1783	-0.1548	-0.0848	NA	0.0666	6	-138.9305	292.7576	1.0651	0.1236
Garden	3.7892	-0.1942	-0.1582	NA	NA	NA	4	-141.7572	292.8047	1.1123	0.1207
Garden	3.7867	-0.1964	-0.151	NA	NA	0.0753	5	-140.5875	293.175	1.4826	0.1003
Garden	3.7811	-0.1903	-0.1648	-0.0917	0.0768	0.0575	7	-137.5946	293.1892	1.4968	0.0996
Garden	3.7867	-0.2073	-0.1655	NA	0.0739	NA	5	-140.6683	293.3366	1.6442	0.0925
Garden	3.7847	-0.2079	-0.1587	NA	0.0667	0.0681	6	-139.6605	294.2176	2.5251	0.0596
Estates	3.8325	-0.2478	NA	NA	0.1056	NA	4	-128.3833	266.057	0	0.5387
Estates	3.8324	-0.25	NA	NA	0.1018	0.0193	5	-128.1933	268.3867	2.3297	0.168
Estates	3.8324	-0.2332	-0.0205	NA	0.102	NA	5	-128.3074	268.6148	2.5578	0.1499
Estates	3.8325	-0.247	NA	0.0083	0.1089	NA	5	-128.3522	268.7045	2.6475	0.1434
Park	3.5904	-0.1657	-0.1908	-0.2059	0.1703	0.1273	7	-141.3498	300.6996	0	0.1901
Park	3.6008	-0.2266	NA	-0.2193	0.122	NA	5	-144.3656	300.7311	0.0316	0.1871
Park	3.5959	-0.1728	-0.1166	-0.2067	0.1625	NA	6	-142.9819	300.8603	0.1608	0.1754
Park	3.607	-0.2364	NA	-0.2378	NA	NA	4	-145.9412	301.1728	0.4732	0.15
Park	3.5989	NA	-0.2622	-0.1443	0.2032	0.1378	6	-143.8598	302.6162	1.9167	0.0729
Park	3.6053	NA	-0.1854	-0.1433	0.1968	NA	5	-145.4953	302.9906	2.2911	0.0605
Park	3.6055	-0.2102	-0.0597	-0.2342	NA	NA	5	-145.5693	303.1386	2.4391	0.0561
Park	3.6056	-0.2474	NA	-0.2412	NA	0.0549	5	-145.6008	303.2017	2.5021	0.0544
Park	3.6	-0.235	NA	-0.2224	0.1164	0.0401	6	-144.1689	303.2344	2.5348	0.0535
Ruderal	3.521	-0.3426	NA	-0.1317	NA	NA	4	-114.3953	238.329	0	0.427
Ruderal	3.5199	-0.352	NA	-0.1314	NA	0.0521	5	-113.8869	240.1739	1.8448	0.1697
Ruderal	3.5202	-0.3546	0.0499	-0.1387	NA	NA	5	-114.006	240.4119	2.0829	0.1507
Ruderal	3.5286	-0.2911	NA	NA	NA	NA	3	-116.8901	240.6691	2.34	0.1325
Ruderal	3.5206	-0.3458	NA	-0.1383	-0.031	NA	5	-114.2329	240.8657	2.5367	0.1201

Table S4. Model selection alpha non-native

Top models assessing the effect of management (Disturbance, Time: Time Investment, and Habitat: Habitat diversity) and urban intensity (Built (150): Built Environment within a 150-meter radius) on species richness of non-native species. models are ranked by corrected Akaike's Information Criterion (AICc).

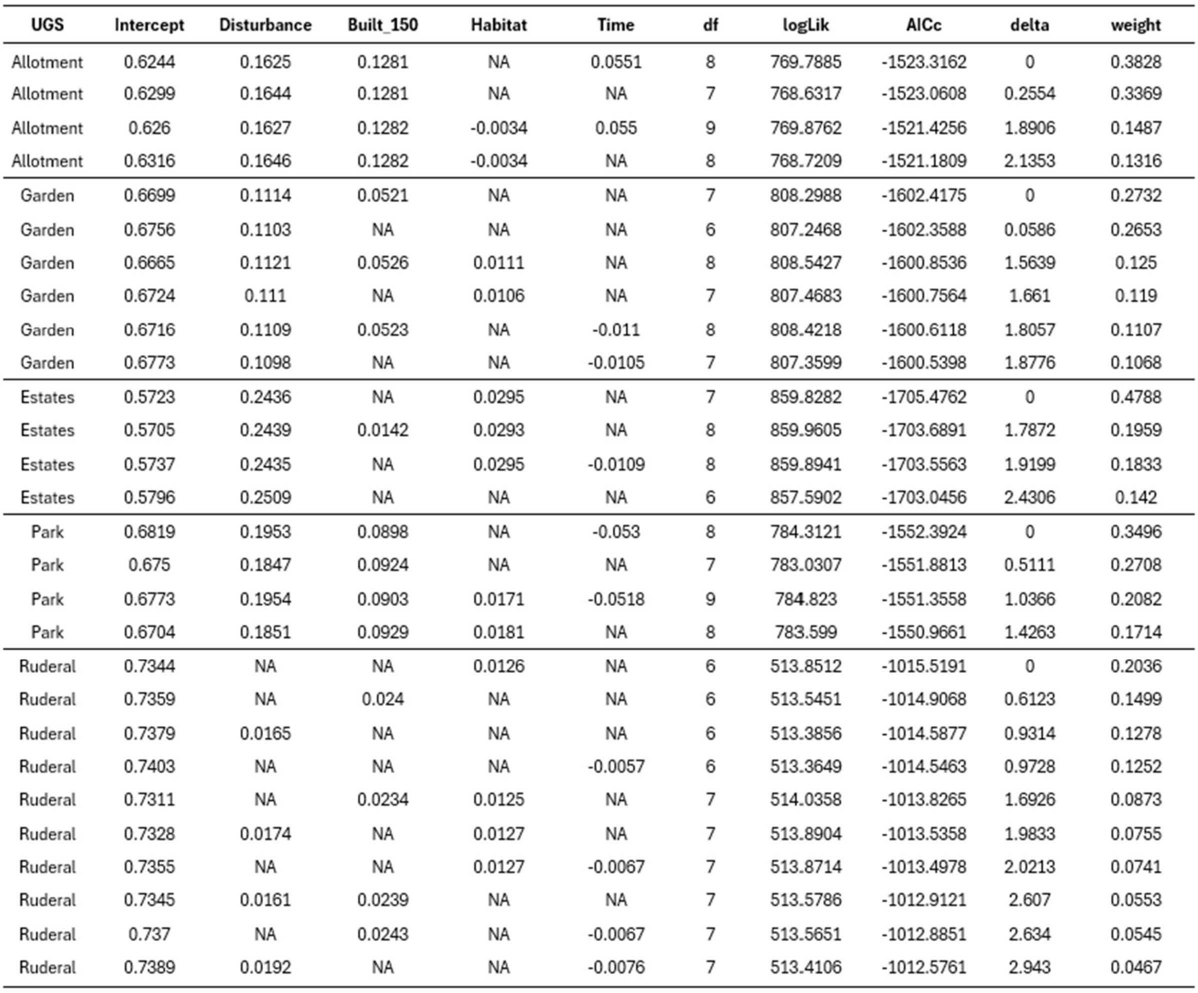


UGS	Intercept	Temp_150	Disturbance	Built_150	Habitat	Time	df	logLik	AICc	delta	weight
Allotment	3.0372	NA	NA	-0.1326	NA	NA	3	-121.5278	249.8557	0	0.1144
Allotment	3.0231	NA	-0.1447	-0.1518	-0.129	NA	5	-118.8951	249.933	0.0774	0.1101
Allotment	3.0307	NA	-0.1272	-0.1272	NA	NA	4	-120.3496	250.0784	0.2228	0.1024
Allotment	3.0387	NA	-0.1327	NA	NA	NA	3	-121.7804	250.3608	0.5051	0.0889
Allotment	3.0316	NA	NA	-0.1523	-0.1087	NA	4	-120.5384	250.4562	0.6005	0.0847
Allotment	3.034	NA	-0.1449	NA	-0.0996	NA	4	-120.9792	251.3377	1.4821	0.0545
Allotment	3.0428	NA	NA	NA	-0.0814	NA	3	-122.4688	251.7376	1.8819	0.0447
Allotment	3.0279	-0.1241	-0.1373	NA	-0.1506	NA	5	-119.821	251.7849	1.9293	0.0436
Allotment	3.043	-0.077	NA	NA	NA	NA	3	-122.498	251.7959	1.9403	0.0434
Allotment	3.0357	-0.1317	NA	NA	-0.1367	NA	4	-121.2402	251.8596	2.004	0.042
Allotment	3.0357	NA	NA	-0.1412	NA	-0.0595	4	-121.2586	251.8965	2.0408	0.0412
Allotment	3.0367	-0.0646	-0.1253	NA	NA	NA	4	-121.4289	252.2372	2.3815	0.0348
Allotment	3.0372	-0.0013	NA	-0.1319	NA	NA	4	-121.5277	252.4348	2.5791	0.0315
Allotment	3.0453	NA	NA	NA	NA	-0.0387	3	-122.8727	252.5454	2.6898	0.0298
Allotment	3.0225	-0.0477	-0.1415	-0.1273	-0.1442	NA	6	-118.7666	252.6444	2.7887	0.0284
Allotment	3.0304	NA	-0.1195	-0.1313	NA	-0.0268	5	-120.2956	252.734	2.8783	0.0271
Allotment	3.0305	NA	NA	-0.1595	-0.1055	-0.0533	5	-120.3155	252.7738	2.9182	0.0266
Allotment	3.0306	0.0161	-0.1289	-0.1366	NA	NA	5	-120.3341	252.811	2.9554	0.0261
Allotment	3.0306	-0.0602	NA	-0.1214	-0.1289	NA	5	-120.3444	252.8317	2.976	0.0258
Garden	2.5293	NA	NA	NA	0.1592	NA	3	-118.5104	243.7707	0	0.1778
Garden	2.5197	NA	-0.1459	NA	0.1929	NA	4	-117.4516	244.1935	0.4228	0.1439
Garden	2.5207	-0.1363	NA	NA	0.2006	NA	4	-117.5866	244.4635	0.6928	0.1257
Garden	2.5363	NA	-0.103	NA	NA	NA	3	-119.2576	245.2651	1.4944	0.0842
Garden	2.5367	NA	NA	NA	NA	0.0965	3	-119.3089	245.3678	1.5971	0.08
Garden	2.5385	-0.0731	NA	NA	NA	NA	3	-119.4897	245.7293	1.9586	0.0668
Garden	2.5147	-0.1066	-0.1192	NA	0.2182	NA	5	-116.8977	245.7954	2.0247	0.0646
Garden	2.5269	NA	NA	NA	0.1473	0.0716	4	-118.2532	245.7967	2.026	0.0646
Garden	2.541	NA	NA	0.0212	NA	NA	3	-119.7429	246.2358	2.4651	0.0518
Garden	2.5292	NA	NA	0.0148	0.1586	NA	4	-118.4999	246.2901	2.5194	0.0505
Garden	2.518	NA	-0.1411	NA	0.1825	0.062	5	-117.2493	246.4985	2.7278	0.0455
Garden	2.518	-0.1398	NA	NA	0.1889	0.0776	5	-117.2687	246.5375	2.7668	0.0446
Estates	1.898	0.322	NA	NA	0.1639	NA	4	-90.9417	191.1738	0	0.3201
Estates	1.9096	0.2669	NA	NA	NA	NA	3	-92.4539	191.6577	0.4839	0.2513
Estates	1.8971	0.3232	NA	0.0565	0.1843	NA	5	-90.745	193.49	2.3162	0.1005
Estates	1.8976	0.3267	NA	NA	0.1696	-0.0358	5	-90.8485	193.697	2.5232	0.0906
Estates	1.8977	0.3445	-0.0294	NA	0.1602	NA	5	-90.9123	193.8247	2.6509	0.085
Estates	1.9086	0.3192	-0.065	NA	NA	NA	4	-92.3177	193.9258	2.752	0.0809
Estates	1.9095	0.2681	NA	NA	NA	-0.014	4	-92.4405	194.1712	2.9974	0.0715

Park	1.6927	0.1874	NA	NA	NA	0.2544	4	-92.9785	195.2472	0	0.143
Park	1.6779	0.186	NA	NA	0.1908	0.2394	5	-91.6553	195.3106	0.0634	0.1386
Park	1.7093	NA	NA	NA	NA	0.2864	3	-94.4891	195.7283	0.481	0.1125
Park	1.6936	NA	NA	NA	0.1953	0.2722	4	-93.24	195.7703	0.5231	0.1101
Park	1.6689	0.2384	-0.1786	NA	0.2467	0.3079	6	-90.7986	196.4937	1.2465	0.0767
Park	1.7013	0.218	NA	NA	0.2119	NA	4	-93.7178	196.726	1.4787	0.0683
Park	1.6714	0.2351	NA	0.1281	0.2074	0.2353	6	-91.0368	196.9702	1.723	0.0604
Park	1.7189	0.2207	NA	NA	NA	NA	3	-95.17	197.0901	1.8428	0.0569
Park	1.6885	0.2252	NA	0.0976	NA	0.2512	5	-92.6393	197.2787	2.0315	0.0518
Park	1.691	0.2092	-0.0747	NA	NA	0.2847	5	-92.8201	197.6401	2.3929	0.0432
Park	1.6607	0.3012	-0.1994	0.1486	0.2721	0.3129	7	-89.9151	197.8301	2.5829	0.0393
Park	1.7253	NA	NA	NA	0.2224	NA	3	-95.6811	198.1122	2.865	0.0341
Park	1.6943	0.27	NA	0.1344	0.2294	NA	5	-93.1015	198.203	2.9558	0.0326
Park	1.692	NA	-0.0681	NA	0.218	0.3017	5	-93.113	198.226	2.9788	0.0323
Ruderal	1.2752	0.1378	NA	NA	NA	NA	2	-61.0376	126.5038	0	0.1393
Ruderal	1.2654	0.1614	NA	NA	NA	-0.1482	3	-59.9413	126.7715	0.2678	0.1219
Ruderal	1.2777	NA	NA	NA	NA	-0.1204	2	-61.3626	127.1538	0.65	0.1007
Ruderal	1.2679	0.1842	NA	0.1354	NA	NA	3	-60.1951	127.2791	0.7753	0.0946
Ruderal	1.2683	NA	0.163	NA	NA	-0.2096	3	-60.3654	127.6197	1.1159	0.0797
Ruderal	1.2572	0.2166	NA	0.1392	NA	-0.1462	4	-59.0617	127.6619	1.1581	0.0781
Ruderal	1.2574	0.1497	0.1421	NA	NA	-0.23	4	-59.1657	127.8699	1.3661	0.0704
Ruderal	1.2825	NA	NA	0.0635	NA	NA	2	-61.8723	128.1732	1.6694	0.0605
Ruderal	1.2832	NA	0.0525	NA	NA	NA	2	-61.9425	128.3136	1.8098	0.0564
Ruderal	1.2845	NA	NA	NA	0.0059	NA	2	-62.0942	128.6169	2.1131	0.0484
Ruderal	1.2749	0.1327	0.0233	NA	NA	NA	3	-61.0068	128.9025	2.3987	0.042
Ruderal	1.2751	0.138	NA	NA	0.0083	NA	3	-61.0339	128.9566	2.4529	0.0409
Ruderal	1.2767	NA	NA	0.0502	NA	-0.1128	3	-61.2207	129.3302	2.8264	0.0339
Ruderal	1.2649	0.1626	NA	NA	0.0234	-0.1516	4	-59.9117	129.362	2.8582	0.0334

Table S5. Model selection beta all

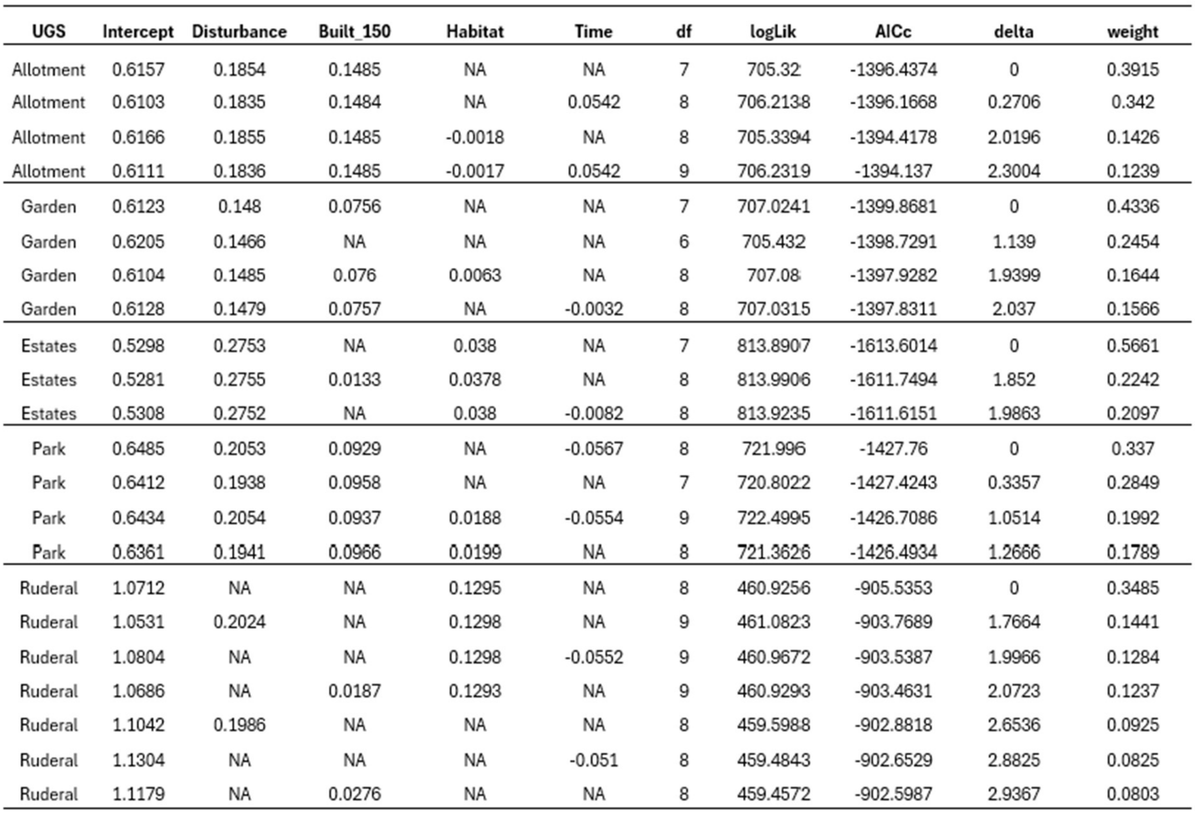
Top models assessing the effect of management (Disturbance, Time: Time Investment, and Habitat: Habitat diversity) and urban intensity (Built (150): Built Environment within a 150-meter radius) on beta diversity of all species. models are ranked by corrected Akaike's Information Criterion (AICc).



UGS	Intercept	Disturbance	Built_150	Habitat	Time	df	logLik	AICc	delta	weight
Allotment	0.6244	0.1625	0.1281	NA	0.0551	8	769.7885	-1523.3162	0	0.3828
Allotment	0.6299	0.1644	0.1281	NA	NA	7	768.6317	-1523.0608	0.2554	0.3369
Allotment	0.626	0.1627	0.1282	-0.0034	0.055	9	769.8762	-1521.4256	1.8906	0.1487
Allotment	0.6316	0.1646	0.1282	-0.0034	NA	8	768.7209	-1521.1809	2.1353	0.1316
Garden	0.6699	0.1114	0.0521	NA	NA	7	808.2988	-1602.4175	0	0.2732
Garden	0.6756	0.1103	NA	NA	NA	6	807.2468	-1602.3588	0.0586	0.2653
Garden	0.6665	0.1121	0.0526	0.0111	NA	8	808.5427	-1600.8536	1.5639	0.125
Garden	0.6724	0.111	NA	0.0106	NA	7	807.4683	-1600.7564	1.661	0.119
Garden	0.6716	0.1109	0.0523	NA	-0.011	8	808.4218	-1600.6118	1.8057	0.1107
Garden	0.6773	0.1098	NA	NA	-0.0105	7	807.3599	-1600.5398	1.8776	0.1068
Estates	0.5723	0.2436	NA	0.0295	NA	7	859.8282	-1705.4762	0	0.4788
Estates	0.5705	0.2439	0.0142	0.0293	NA	8	859.9605	-1703.6891	1.7872	0.1959
Estates	0.5737	0.2435	NA	0.0295	-0.0109	8	859.8941	-1703.5563	1.9199	0.1833
Estates	0.5796	0.2509	NA	NA	NA	6	857.5902	-1703.0456	2.4306	0.142
Park	0.6819	0.1953	0.0898	NA	-0.053	8	784.3121	-1552.3924	0	0.3496
Park	0.675	0.1847	0.0924	NA	NA	7	783.0307	-1551.8813	0.5111	0.2708
Park	0.6773	0.1954	0.0903	0.0171	-0.0518	9	784.823	-1551.3558	1.0366	0.2082
Park	0.6704	0.1851	0.0929	0.0181	NA	8	783.599	-1550.9661	1.4263	0.1714
Ruderal	0.7344	NA	NA	0.0126	NA	6	513.8512	-1015.5191	0	0.2036
Ruderal	0.7359	NA	0.024	NA	NA	6	513.5451	-1014.9068	0.6123	0.1499
Ruderal	0.7379	0.0165	NA	NA	NA	6	513.3856	-1014.5877	0.9314	0.1278
Ruderal	0.7403	NA	NA	NA	-0.0057	6	513.3649	-1014.5463	0.9728	0.1252
Ruderal	0.7311	NA	0.0234	0.0125	NA	7	514.0358	-1013.8265	1.6926	0.0873
Ruderal	0.7328	0.0174	NA	0.0127	NA	7	513.8904	-1013.5358	1.9833	0.0755
Ruderal	0.7355	NA	NA	0.0127	-0.0067	7	513.8714	-1013.4978	2.0213	0.0741
Ruderal	0.7345	0.0161	0.0239	NA	NA	7	513.5786	-1012.9121	2.607	0.0553
Ruderal	0.737	NA	0.0243	NA	-0.0067	7	513.5651	-1012.8851	2.634	0.0545
Ruderal	0.7389	0.0192	NA	NA	-0.0076	7	513.4106	-1012.5761	2.943	0.0467

Table S6. Model selection beta native

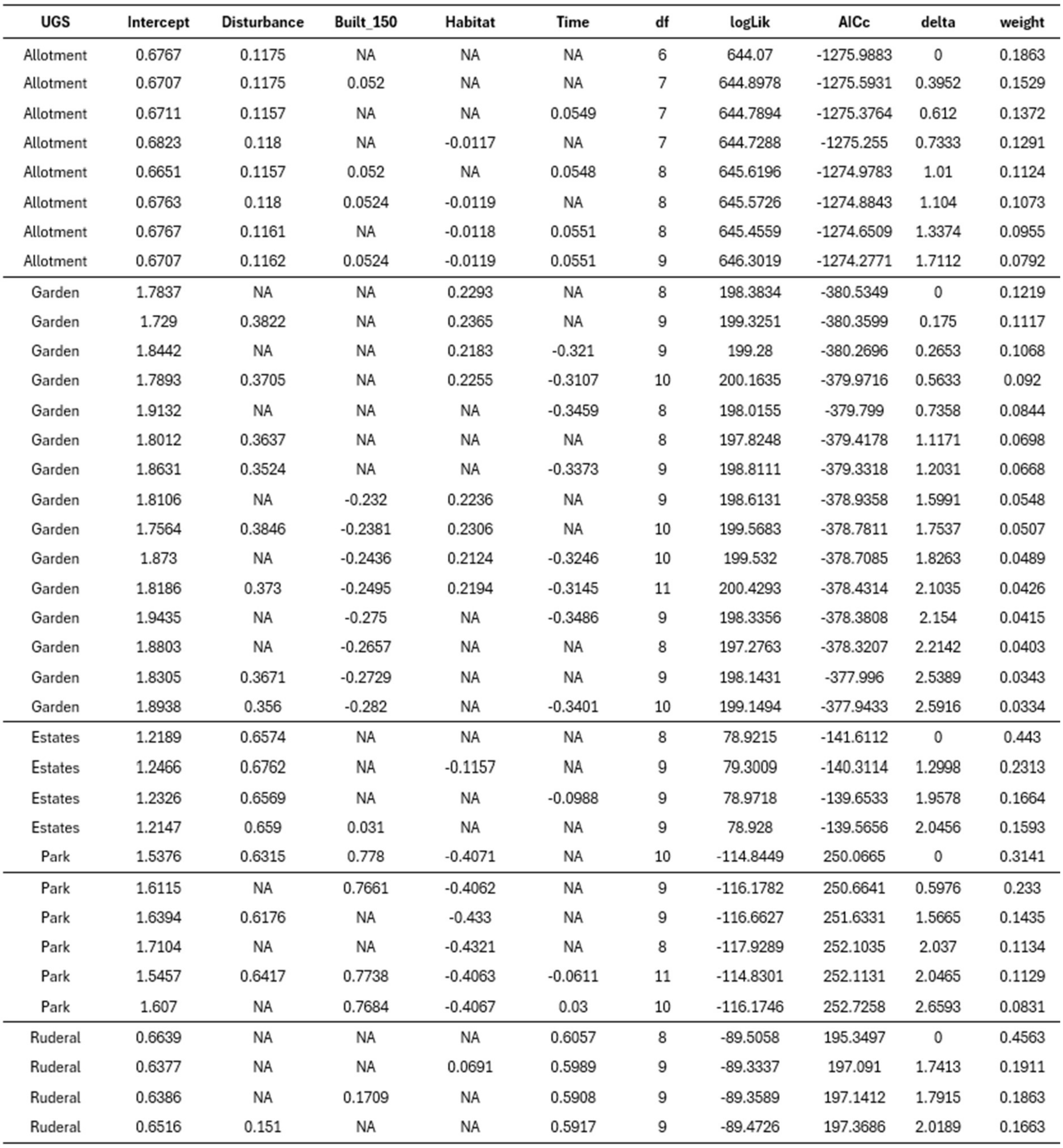
Top models assessing the effect of management (Disturbance, Time: Time Investment, and Habitat: Habitat diversity) and urban intensity (Built (150): Built Environment within a 150-meter radius) on beta diversity of native species. models are ranked by corrected Akaike's Information Criterion (AICc).



UGS	Intercept	Disturbance	Built_150	Habitat	Time	df	logLik	AICc	delta	weight
Allotment	0.6157	0.1854	0.1485	NA	NA	7	705.32	-1396.4374	0	0.3915
Allotment	0.6103	0.1835	0.1484	NA	0.0542	8	706.2138	-1396.1668	0.2706	0.342
Allotment	0.6166	0.1855	0.1485	-0.0018	NA	8	705.3394	-1394.4178	2.0196	0.1426
Allotment	0.6111	0.1836	0.1485	-0.0017	0.0542	9	706.2319	-1394.137	2.3004	0.1239
Garden	0.6123	0.148	0.0756	NA	NA	7	707.0241	-1399.8681	0	0.4336
Garden	0.6205	0.1466	NA	NA	NA	6	705.432	-1398.7291	1.139	0.2454
Garden	0.6104	0.1485	0.076	0.0063	NA	8	707.08	-1397.9282	1.9399	0.1644
Garden	0.6128	0.1479	0.0757	NA	-0.0032	8	707.0315	-1397.8311	2.037	0.1566
Estates	0.5298	0.2753	NA	0.038	NA	7	813.8907	-1613.6014	0	0.5661
Estates	0.5281	0.2755	0.0133	0.0378	NA	8	813.9906	-1611.7494	1.852	0.2242
Estates	0.5308	0.2752	NA	0.038	-0.0082	8	813.9235	-1611.6151	1.9863	0.2097
Park	0.6485	0.2053	0.0929	NA	-0.0567	8	721.996	-1427.76	0	0.337
Park	0.6412	0.1938	0.0958	NA	NA	7	720.8022	-1427.4243	0.3357	0.2849
Park	0.6434	0.2054	0.0937	0.0188	-0.0554	9	722.4995	-1426.7086	1.0514	0.1992
Park	0.6361	0.1941	0.0966	0.0199	NA	8	721.3626	-1426.4934	1.2666	0.1789
Ruderal	1.0712	NA	NA	0.1295	NA	8	460.9256	-905.5353	0	0.3485
Ruderal	1.0531	0.2024	NA	0.1298	NA	9	461.0823	-903.7689	1.7664	0.1441
Ruderal	1.0804	NA	NA	0.1298	-0.0552	9	460.9672	-903.5387	1.9966	0.1284
Ruderal	1.0686	NA	0.0187	0.1293	NA	9	460.9293	-903.4631	2.0723	0.1237
Ruderal	1.1042	0.1986	NA	NA	NA	8	459.5988	-902.8818	2.6536	0.0925
Ruderal	1.1304	NA	NA	NA	-0.051	8	459.4843	-902.6529	2.8825	0.0825
Ruderal	1.1179	NA	0.0276	NA	NA	8	459.4572	-902.5987	2.9367	0.0803

Table S7. Model selection beta non-native

Top models assessing the effect of management (Disturbance, Time: Time Investment, and Habitat: Habitat diversity) and urban intensity (Built (150): Built Environment within a 150-meter radius) on beta diversity of non-native species. models are ranked by corrected Akaike's Information Criterion (AICc).



UGS	Intercept	Disturbance	Built_150	Habitat	Time	df	logLik	AICc	delta	weight
Allotment	0.6767	0.1175	NA	NA	NA	6	644.07	-1275.9883	0	0.1863
Allotment	0.6707	0.1175	0.052	NA	NA	7	644.8978	-1275.5931	0.3952	0.1529
Allotment	0.6711	0.1157	NA	NA	0.0549	7	644.7894	-1275.3764	0.612	0.1372
Allotment	0.6823	0.118	NA	-0.0117	NA	7	644.7288	-1275.255	0.7333	0.1291
Allotment	0.6651	0.1157	0.052	NA	0.0548	8	645.6196	-1274.9783	1.01	0.1124
Allotment	0.6763	0.118	0.0524	-0.0119	NA	8	645.5726	-1274.8843	1.104	0.1073
Allotment	0.6767	0.1161	NA	-0.0118	0.0551	8	645.4559	-1274.6509	1.3374	0.0955
Allotment	0.6707	0.1162	0.0524	-0.0119	0.0551	9	646.3019	-1274.2771	1.7112	0.0792
Garden	1.7837	NA	NA	0.2293	NA	8	198.3834	-380.5349	0	0.1219
Garden	1.729	0.3822	NA	0.2365	NA	9	199.3251	-380.3599	0.175	0.1117
Garden	1.8442	NA	NA	0.2183	-0.321	9	199.28	-380.2696	0.2653	0.1068
Garden	1.7893	0.3705	NA	0.2255	-0.3107	10	200.1635	-379.9716	0.5633	0.092
Garden	1.9132	NA	NA	NA	-0.3459	8	198.0155	-379.799	0.7358	0.0844
Garden	1.8012	0.3637	NA	NA	NA	8	197.8248	-379.4178	1.1171	0.0698
Garden	1.8631	0.3524	NA	NA	-0.3373	9	198.8111	-379.3318	1.2031	0.0668
Garden	1.8106	NA	-0.232	0.2236	NA	9	198.6131	-378.9358	1.5991	0.0548
Garden	1.7564	0.3846	-0.2381	0.2306	NA	10	199.5683	-378.7811	1.7537	0.0507
Garden	1.873	NA	-0.2436	0.2124	-0.3246	10	199.532	-378.7085	1.8263	0.0489
Garden	1.8186	0.373	-0.2495	0.2194	-0.3145	11	200.4293	-378.4314	2.1035	0.0426
Garden	1.9435	NA	-0.275	NA	-0.3486	9	198.3356	-378.3808	2.154	0.0415
Garden	1.8803	NA	-0.2657	NA	NA	8	197.2763	-378.3207	2.2142	0.0403
Garden	1.8305	0.3671	-0.2729	NA	NA	9	198.1431	-377.996	2.5389	0.0343
Garden	1.8938	0.356	-0.282	NA	-0.3401	10	199.1494	-377.9433	2.5916	0.0334
Estates	1.2189	0.6574	NA	NA	NA	8	78.9215	-141.6112	0	0.443
Estates	1.2466	0.6762	NA	-0.1157	NA	9	79.3009	-140.3114	1.2998	0.2313
Estates	1.2326	0.6569	NA	NA	-0.0988	9	78.9718	-139.6533	1.9578	0.1664
Estates	1.2147	0.659	0.031	NA	NA	9	78.928	-139.5656	2.0456	0.1593
Park	1.5376	0.6315	0.778	-0.4071	NA	10	-114.8449	250.0665	0	0.3141
Park	1.6115	NA	0.7661	-0.4062	NA	9	-116.1782	250.6641	0.5976	0.233
Park	1.6394	0.6176	NA	-0.433	NA	9	-116.6627	251.6331	1.5665	0.1435
Park	1.7104	NA	NA	-0.4321	NA	8	-117.9289	252.1035	2.037	0.1134
Park	1.5457	0.6417	0.7738	-0.4063	-0.0611	11	-114.8301	252.1131	2.0465	0.1129
Park	1.607	NA	0.7684	-0.4067	0.03	10	-116.1746	252.7258	2.6593	0.0831
Ruderal	0.6639	NA	NA	NA	0.6057	8	-89.5058	195.3497	0	0.4563
Ruderal	0.6377	NA	NA	0.0691	0.5989	9	-89.3337	197.091	1.7413	0.1911
Ruderal	0.6386	NA	0.1709	NA	0.5908	9	-89.3589	197.1412	1.7915	0.1863
Ruderal	0.6516	0.151	NA	NA	0.5917	9	-89.4726	197.3686	2.0189	0.1663

Table S8. Alpha EMM

Estimated Marginal Means (EMM) for alpha diversity across the plant pools and the UGS, and their EMM, standard error (SE), degrees of freedom (df) and the lower (LCL) and upper control limit (UCL)

Plant Pool	UGS	EMM	SE	df	LCL	UCL
All	Al	68.421	7.378	Inf	55.386	84.523
	Es	54.201	5.890	Inf	43.804	67.066
	Ga	57.506	6.241	Inf	46.487	71.136
	Pa	43.577	4.761	Inf	35.177	53.984
	Ru	37.675	4.133	Inf	30.386	46.713
Native	Al	47.683	6.434	Inf	36.601	62.119
	Es	46.671	6.312	Inf	35.805	60.836
	Ga	44.629	6.040	Inf	34.231	58.186
	Pa	37.612	5.108	Inf	28.823	49.081
	Ru	33.608	4.574	Inf	25.740	43.883
Non-native	Al	20.713	1.963	Inf	17.203	24.941
	Es	6.954	0.757	Inf	5.618	8.607
	Ga	12.692	1.271	Inf	10.430	15.444
	Pa	5.673	0.641	Inf	4.547	7.079
	Ru	3.702	0.458	Inf	2.904	4.718

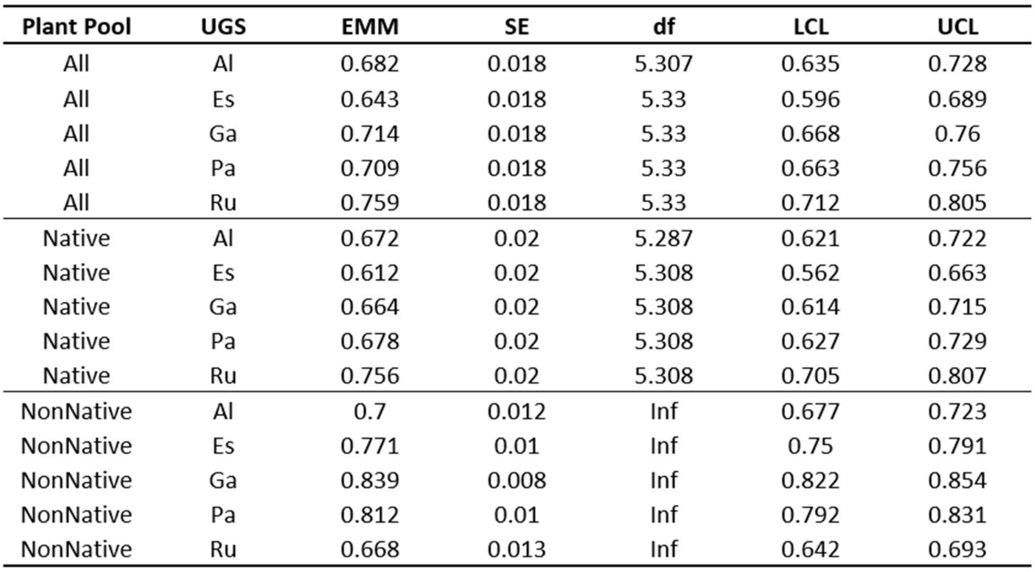
Table S9. Alpha Post-hoc

Post-hoc test for alpha diversity across all plant pools and all the UGS combinations (Al: Allotment; Ga: Private Garden; Es: Real Estate; Pa: Parks; Ru: Ruderal area), their estimate, standard error (SE), degrees of freedom (df), t-ratio value, and the p-value.

Plant Pool	contrast	ratio	SE	df	null	z-ratio	p-value
All	Al / Es	1.262	0.100	Inf	1.000	2.951	0.026
	Al / Ga	1.190	0.094	Inf	1.000	2.206	0.177
	Al / Pa	1.570	0.125	Inf	1.000	5.658	0.000
	Al / Ru	1.816	0.146	Inf	1.000	7.418	0.000
	Es / Ga	0.943	0.075	Inf	1.000	-0.741	0.947
	Es / Pa	1.244	0.101	Inf	1.000	2.698	0.054
	Es / Ru	1.439	0.117	Inf	1.000	4.467	0.000
	Ga / Pa	1.320	0.106	Inf	1.000	3.437	0.005
	Ga / Ru	1.526	0.124	Inf	1.000	5.207	0.000
	Pa / Ru	1.157	0.095	Inf	1.000	1.769	0.392
Native	Al / Es	1.022	0.082	Inf	1.000	0.266	0.999
	Al / Ga	1.068	0.086	Inf	1.000	0.819	0.925
	Al / Pa	1.268	0.103	Inf	1.000	2.910	0.030
	Al / Ru	1.419	0.117	Inf	1.000	4.259	0.000
	Es / Ga	1.046	0.085	Inf	1.000	0.551	0.982
	Es / Pa	1.241	0.102	Inf	1.000	2.632	0.065
	Es / Ru	1.389	0.114	Inf	1.000	3.984	0.001
	Ga / Pa	1.187	0.097	Inf	1.000	2.082	0.228
	Ga / Ru	1.328	0.110	Inf	1.000	3.435	0.005
	Pa / Ru	1.119	0.093	Inf	1.000	1.349	0.660
Non-native	Al / Es	2.979	0.386	Inf	1.000	8.414	0.000
	Al / Ga	1.632	0.200	Inf	1.000	4.000	0.001
	Al / Pa	3.651	0.486	Inf	1.000	9.726	0.000
	Al / Ru	5.596	0.797	Inf	1.000	12.083	0.000
	Es / Ga	0.548	0.073	Inf	1.000	-4.499	0.000
	Es / Pa	1.226	0.175	Inf	1.000	1.421	0.614
	Es / Ru	1.878	0.286	Inf	1.000	4.148	0.000
	Ga / Pa	2.237	0.307	Inf	1.000	5.875	0.000
	Ga / Ru	3.429	0.501	Inf	1.000	8.430	0.000
	Pa / Ru	1.533	0.237	Inf	1.000	2.757	0.046

Table S10. Beta EMM

Estimated Marginal Means (EMM) for beta diversity across the plant pools and the UGS, and their EMM, standard error (SE), degrees of freedom (df), and the lower (LCL) and upper control limit (UCL)



Plant Pool	UGS	EMM	SE	df	LCL	UCL
All	Al	0.682	0.018	5.307	0.635	0.728
All	Es	0.643	0.018	5.33	0.596	0.689
All	Ga	0.714	0.018	5.33	0.668	0.76
All	Pa	0.709	0.018	5.33	0.663	0.756
All	Ru	0.759	0.018	5.33	0.712	0.805
Native	Al	0.672	0.02	5.287	0.621	0.722
Native	Es	0.612	0.02	5.308	0.562	0.663
Native	Ga	0.664	0.02	5.308	0.614	0.715
Native	Pa	0.678	0.02	5.308	0.627	0.729
Native	Ru	0.756	0.02	5.308	0.705	0.807
NonNative	Al	0.7	0.012	Inf	0.677	0.723
NonNative	Es	0.771	0.01	Inf	0.75	0.791
NonNative	Ga	0.839	0.008	Inf	0.822	0.854
NonNative	Pa	0.812	0.01	Inf	0.792	0.831
NonNative	Ru	0.668	0.013	Inf	0.642	0.693

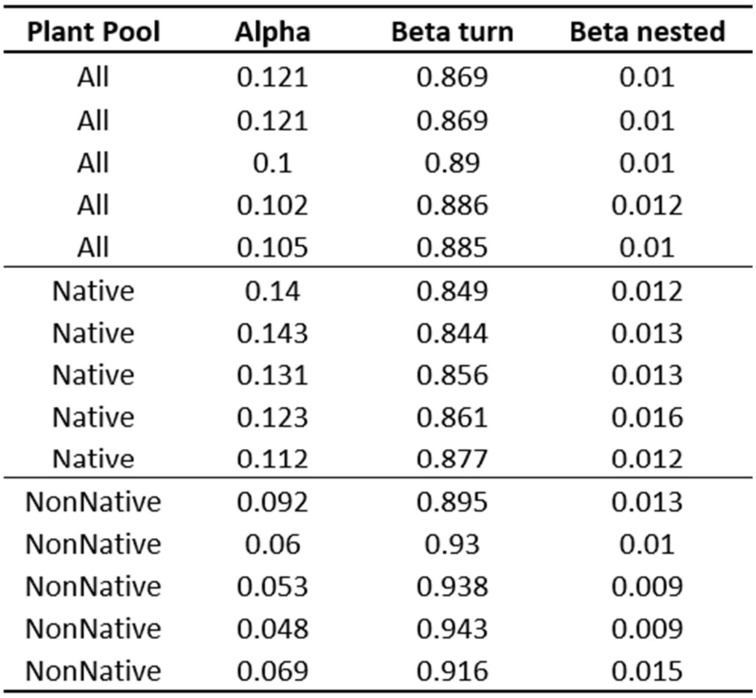
Table S11. Beta Post-hoc

Post-hoc test for beta diversity across all plant pools and all the UGS combinations (Al: Allotment; Ga: Private Garden; Es: Real Estate; Pa: Parks; Ru: Ruderal area), their estimate, standard error (SE), degrees of freedom (df), t-ratio value, and the p-value.

Plant Pool	contrast	estimate	SE	df	t.ratio	p.value
All	Al - Es	0.039	0.005	3176.02	7.7	0
All	Al - Ga	-0.032	0.005	3176.02	-6.324	0
All	Al - Pa	-0.027	0.005	3176.02	-5.404	0
All	Al - Ru	-0.077	0.005	3176.02	-15.193	0
All	Es - Ga	-0.071	0.005	3176	-13.835	0
All	Es - Pa	-0.066	0.005	3176	-12.927	0
All	Es - Ru	-0.116	0.005	3176	-22.584	0
All	Ga - Pa	0.005	0.005	3176	0.908	0.894
All	Ga - Ru	-0.045	0.005	3176	-8.749	0
All	Pa - Ru	-0.05	0.005	3176	-9.657	0
Native	Al - Es	0.059	0.005	3176.019	10.999	0
Native	Al - Ga	0.007	0.005	3176.019	1.33	0.673
Native	Al - Pa	-0.007	0.005	3176.019	-1.217	0.741
Native	Al - Ru	-0.085	0.005	3176.019	-15.731	0
Native	Es - Ga	-0.052	0.005	3176	-9.539	0
Native	Es - Pa	-0.066	0.005	3176	-12.052	0
Native	Es - Ru	-0.144	0.005	3176	-26.37	0
Native	Ga - Pa	-0.014	0.005	3176	-2.513	0.088
Native	Ga - Ru	-0.092	0.005	3176	-16.831	0
Native	Pa - Ru	-0.078	0.005	3176	-14.319	0
NonNative	Al / Es	0.696	0.024	Inf	-10.521	0
NonNative	Al / Ga	0.45	0.016	Inf	-22.013	0
NonNative	Al / Pa	0.54	0.023	Inf	-14.294	0
NonNative	Al / Ru	1.162	0.04	Inf	4.35	0
NonNative	Es / Ga	0.647	0.026	Inf	-10.752	0
NonNative	Es / Pa	0.776	0.036	Inf	-5.452	0
NonNative	Es / Ru	1.67	0.065	Inf	13.154	0
NonNative	Ga / Pa	1.201	0.058	Inf	3.82	0.001
NonNative	Ga / Ru	2.582	0.105	Inf	23.232	0
NonNative	Pa / Ru	2.151	0.1	Inf	16.509	0

Table S12 Diversity partitioning

Diversity Contribution across all plant pools and UGS types, with their alpha species richness, beta turnover, and beta nestedness.



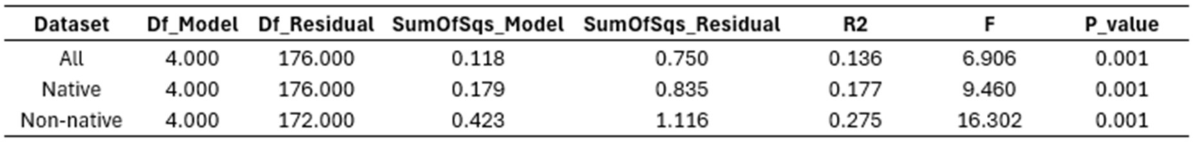
Plant Pool	Alpha	Beta turn	Beta nested
All	0.121	0.869	0.01
All	0.121	0.869	0.01
All	0.1	0.89	0.01
All	0.102	0.886	0.012
All	0.105	0.885	0.01
Native	0.14	0.849	0.012
Native	0.143	0.844	0.013
Native	0.131	0.856	0.013
Native	0.123	0.861	0.016
Native	0.112	0.877	0.012
NonNative	0.092	0.895	0.013
NonNative	0.06	0.93	0.01
NonNative	0.053	0.938	0.009
NonNative	0.048	0.943	0.009
NonNative	0.069	0.916	0.015

Table S13. Permanova
Results from the PERMANOVA analyses

Plant.Pool	Df_Model	Df_Residual	SumofSquareModel	SumofSquareResiduals	R2	F.statistic	p.value
All	4	176	9.425	46.042	0.17	9.007	0.001
Native	4	176	8.866	43.317	0.17	9.006	0.001
Non-native	4	172	9.837	61.41	0.138	6.888	0.001

Table S14. Dispersion test

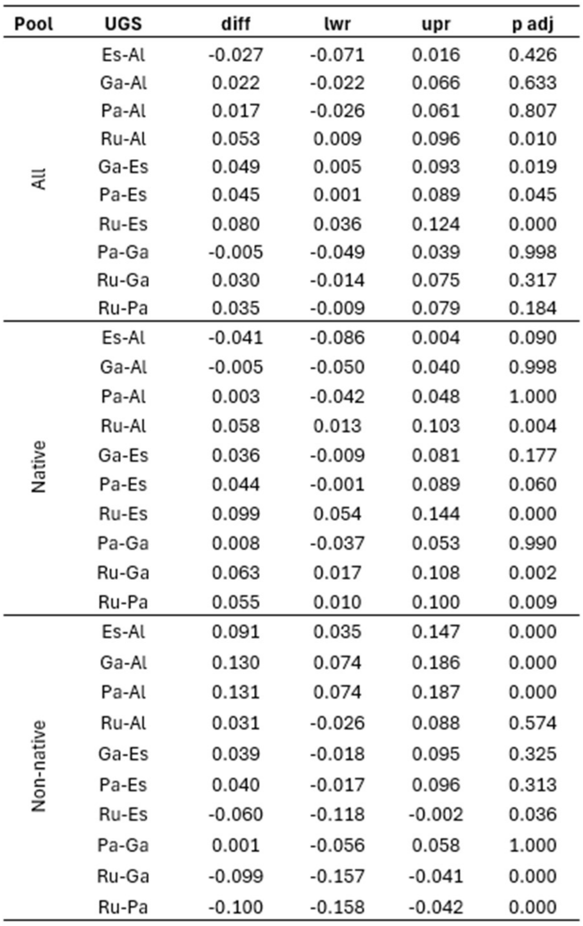
Results from the analysis of multivariate homogeneity of group dispersions



Dataset	Df_Model	Df_Residual	SumOfSqs_Model	SumOfSqs_Residual	R2	F	P_value
All	4.000	176.000	0.118	0.750	0.136	6.906	0.001
Native	4.000	176.000	0.179	0.835	0.177	9.460	0.001
Non-native	4.000	172.000	0.423	1.116	0.275	16.302	0.001

Table S15. TukeyHSD on dispersion

Results from the TukeyHSD analysis on multivariate homogeneity of group dispersions



Pool	UGS	diff	lwr	upr	p adj
All	Es-Al	-0.027	-0.071	0.016	0.426
	Ga-Al	0.022	-0.022	0.066	0.633
	Pa-Al	0.017	-0.026	0.061	0.807
	Ru-Al	0.053	0.009	0.096	0.010
	Ga-Es	0.049	0.005	0.093	0.019
	Pa-Es	0.045	0.001	0.089	0.045
	Ru-Es	0.080	0.036	0.124	0.000
	Pa-Ga	-0.005	-0.049	0.039	0.998
	Ru-Ga	0.030	-0.014	0.075	0.317
	Ru-Pa	0.035	-0.009	0.079	0.184
Native	Es-Al	-0.041	-0.086	0.004	0.090
	Ga-Al	-0.005	-0.050	0.040	0.998
	Pa-Al	0.003	-0.042	0.048	1.000
	Ru-Al	0.058	0.013	0.103	0.004
	Ga-Es	0.036	-0.009	0.081	0.177
	Pa-Es	0.044	-0.001	0.089	0.060
	Ru-Es	0.099	0.054	0.144	0.000
	Pa-Ga	0.008	-0.037	0.053	0.990
	Ru-Ga	0.063	0.017	0.108	0.002
	Ru-Pa	0.055	0.010	0.100	0.009
Non-native	Es-Al	0.091	0.035	0.147	0.000
	Ga-Al	0.130	0.074	0.186	0.000
	Pa-Al	0.131	0.074	0.187	0.000
	Ru-Al	0.031	-0.026	0.088	0.574
	Ga-Es	0.039	-0.018	0.095	0.325
	Pa-Es	0.040	-0.017	0.096	0.313
	Ru-Es	-0.060	-0.118	-0.002	0.036
	Pa-Ga	0.001	-0.056	0.058	1.000
	Ru-Ga	-0.099	-0.157	-0.041	0.000
	Ru-Pa	-0.100	-0.158	-0.042	0.000

Table S16. Indicator species of all plants.

	Species	A	B	Statistic	p
All					
Allotment	*Allium cepa*	0.879	0.811	0.844	0.001
	Lactuca sativa	0.879	0.811	0.844	0.001
	Solanum lycopersicum	0.816	0.865	0.840	0.001
	Cucurbita pepo	0.898	0.730	0.809	0.001
	Brassica oleracea	0.961	0.676	0.806	0.001
	Portulaca oleracea	0.890	0.676	0.776	0.001
	Phaseolus vulgaris	0.957	0.622	0.771	0.001
	Cucumis sativus	0.848	0.622	0.726	0.001
	Capsicum annuum	0.911	0.568	0.719	0.001
	Beta vulgaris	0.817	0.622	0.713	0.001
	Digitaria sanguinalis	0.843	0.595	0.708	0.001
	Senecio vulgaris	0.769	0.649	0.706	0.001
	Solanum tuberosum	0.811	0.595	0.694	0.001
	Petroselinum crispum	0.836	0.568	0.689	0.001
	Fragaria × ananassa	0.781	0.595	0.681	0.001
	Apium graveolens	0.902	0.514	0.681	0.001
	Solanum melongena	0.796	0.541	0.656	0.001
	Cucurbita maxima	0.940	0.432	0.637	0.001
	Mentha spicata	0.886	0.432	0.619	0.001
	Euphorbia peplus	0.561	0.676	0.616	0.001
	Rosmarinus officinalis	0.778	0.486	0.615	0.001
	Salvia officinalis	0.725	0.514	0.610	0.001
	Galinsoga quadriradiata	0.768	0.459	0.594	0.001
	Rubus idaeus	0.661	0.486	0.567	0.001
	Borago officinalis	0.773	0.378	0.541	0.001
	Allium schoenoprasum	0.709	0.405	0.536	0.001
	Ocimum basilicum	0.854	0.324	0.526	0.001
	Melissa officinalis	0.601	0.459	0.525	0.001
	Oxalis stricta	0.580	0.459	0.516	0.001
	Lysimachia arvensis	0.609	0.432	0.513	0.001
	Foeniculum vulgare	0.717	0.351	0.502	0.001
	Persicaria maculosa	0.678	0.351	0.488	0.001
	Ribes rubrum	0.781	0.297	0.482	0.001
	Lathyrus oleraceus	0.829	0.270	0.473	0.001
	Rheum rhabarbarum	0.829	0.270	0.473	0.001
	Poa annua	0.272	0.811	0.470	0.010
	Allium ampeloprasum	0.728	0.297	0.465	0.001
	Helianthus annuus	0.728	0.297	0.465	0.001
	Allium sativum	1.000	0.216	0.465	0.001
	Sonchus asper	0.443	0.486	0.464	0.001
	Sonchus oleraceus	0.350	0.568	0.445	0.001
	Euphorbia lathyris	0.814	0.243	0.445	0.001
	Vicia faba	0.886	0.216	0.438	0.001
	Vitis vinifera	0.709	0.270	0.438	0.001
	Veronica persica	0.279	0.676	0.434	0.023
	Nigella damascena	0.745	0.243	0.426	0.001
	Prunus domestica	0.619	0.270	0.409	0.001
	Thymus vulgaris	0.686	0.243	0.409	0.002
	Raphanus raphanistrum subsp. sativus	0.872	0.189	0.406	0.001
	Tagetes erecta	0.872	0.189	0.406	0.001
	Cymbalaria muralis	1.000	0.162	0.403	0.002
	Cynara cardunculus	1.000	0.162	0.403	0.001
	Stellaria media	0.366	0.432	0.398	0.013
	Epilobium hirsutum	0.722	0.216	0.395	0.002
	Chenopodium album	0.637	0.243	0.393	0.002
	Ficus carica	0.637	0.243	0.393	0.001
	Aquilegia vulgaris	0.493	0.297	0.383	0.007
	Diplotaxis tenuifolia	0.854	0.162	0.372	0.005
	Mentha × piperita	0.854	0.162	0.372	0.001

Table S16. Continuation

	Setaria viridis	0.854	0.162	0.372	0.003
	Tanacetum parthenium	0.854	0.162	0.372	0.002
	Paeonia lactiflora	1.000	0.135	0.368	0.001
	Tropaeolum majus	1.000	0.135	0.368	0.001
	Lavandula angustifolia	0.452	0.297	0.366	0.010
	Euphorbia maculata	0.694	0.189	0.362	0.004
	Ribes uva-crispa	0.694	0.189	0.362	0.002
	Urtica dioica	0.416	0.297	0.352	0.021
	Ribes nigrum	0.745	0.162	0.348	0.001
	Valeriana locusta	0.493	0.243	0.346	0.019
	Calendula officinalis	0.829	0.135	0.335	0.004
	Echinochloa crus-galli	0.829	0.135	0.335	0.005
	Cucurbita moschata	1.000	0.108	0.329	0.013
	Digitaria ischaemum	1.000	0.108	0.329	0.011
	Galinsoga parviflora	1.000	0.108	0.329	0.007
	Spinacia oleracea	1.000	0.108	0.329	0.005
	Symphyotrichum novi-belgii	1.000	0.108	0.329	0.008
	Tragopogon porrifolius	1.000	0.108	0.329	0.004
	Zea mays	1.000	0.108	0.329	0.004
	Rubus fruticosus	0.443	0.243	0.328	0.031
	Alcea rosea	0.661	0.162	0.327	0.016
	Cichorium intybus	0.493	0.216	0.327	0.029
	Malva sylvestris	0.532	0.189	0.317	0.028
	Chaenorhinum minus	0.593	0.162	0.310	0.034
	Valeriana rubra	0.593	0.162	0.310	0.030
	Centaurea cyanus	0.709	0.135	0.309	0.026
	Eruca vesicaria	0.709	0.135	0.309	0.026
	Kickxia elatine	0.709	0.135	0.309	0.026
	Linaria vulgaris	0.709	0.135	0.309	0.032
	Brassica rapa	0.796	0.108	0.293	0.018
	Citrullus lanatus	0.796	0.108	0.293	0.045
	Coriandrum sativum	0.796	0.108	0.293	0.033
	Amaranthus blitum subsp. emarginatus	1.000	0.081	0.285	0.032
	Calendula arvensis	1.000	0.081	0.285	0.039
	Delphinium ajacis	1.000	0.081	0.285	0.038
	Dianthus barbatus	1.000	0.081	0.285	0.042
	Ipomoea batatas	1.000	0.081	0.285	0.038
	Nigella arvensis	1.000	0.081	0.285	0.042
	Rudbeckia laciniata	1.000	0.081	0.285	0.034
	Stachys byzantina	1.000	0.081	0.285	0.046
	Zinnia elegans	1.000	0.081	0.285	0.041
Private Garden	*Viola reichenbachiana*	0.503	0.500	0.502	0.001
	Bellis perennis	0.291	0.861	0.500	0.002
	Prunella vulgaris	0.297	0.806	0.489	0.003
	Primula vulgaris	0.383	0.611	0.483	0.001
	Fragaria vesca	0.415	0.528	0.468	0.001
	Oxalis corniculata	0.318	0.667	0.460	0.003
	Veronica chamaedrys	0.381	0.528	0.448	0.002
	Carex sylvatica	0.500	0.389	0.441	0.001
	Geranium robertianum	0.485	0.389	0.435	0.002
	Ilex aquifolium	0.611	0.306	0.432	0.001
	Prunus laurocerasus	0.500	0.333	0.408	0.002
	Circaea lutetiana	0.604	0.250	0.389	0.001
	Brachypodium sylvaticum	0.407	0.361	0.383	0.010
	Hydrangea macrophylla	0.535	0.250	0.366	0.001
	Potentilla sterilis	0.530	0.250	0.364	0.006
	Convallaria majalis	0.578	0.222	0.358	0.002
	Corylus avellana	0.456	0.278	0.356	0.014
	Polygonatum multiflorum	0.750	0.167	0.354	0.002
	Allium ursinum	0.540	0.194	0.324	0.016

Table S16. Continuation

	Lysimachia nummularia	0.540	0.194	0.324	0.021
	Bergenia crassifolia	0.720	0.139	0.316	0.006
	Aegopodium podagraria	0.448	0.222	0.316	0.017
	Syringa vulgaris	0.503	0.194	0.313	0.018
	Dryopteris filix-mas	0.469	0.194	0.302	0.027
	Nerium oleander	0.804	0.111	0.299	0.009
	Anemonoides nemorosa	0.800	0.111	0.298	0.026
	Lamium galeobdolon	0.625	0.139	0.295	0.050
	Cotoneaster horizontalis	1.000	0.083	0.289	0.039
	Diospyros kaki	0.670	0.111	0.273	0.030
	Eriocapitella hupehensis	0.507	0.139	0.265	0.032
	Delosperma cooperi	0.755	0.083	0.251	0.045
	Euonymus fortunei	0.755	0.083	0.251	0.034
	Malus domestica	0.755	0.083	0.251	0.032
	Petrosedum rupestre	0.755	0.083	0.251	0.042
	Primula auricula	0.755	0.083	0.251	0.032
	Brachypodium pinnatum	0.607	0.083	0.225	0.030
	Prunus persica	0.607	0.083	0.225	0.040
Real Estate	*Trifolium dubium*	0.510	0.750	0.618	0.001
	Festuca rubra	0.297	0.972	0.538	0.001
	Trifolium repens	0.258	0.972	0.501	0.001
	Hypochaeris radicata	0.296	0.806	0.489	0.002
	Plantago lanceolata	0.273	0.861	0.485	0.004
	Taraxacum officinale	0.234	0.944	0.470	0.016
	Potentilla reptans	0.264	0.833	0.469	0.012
	Hedera helix	0.284	0.722	0.453	0.019
	Carex muricata	0.329	0.611	0.448	0.005
	Ajuga reptans	0.370	0.472	0.418	0.007
	Agrostis capillaris	0.312	0.500	0.395	0.045
	Crepis capillaris	0.306	0.500	0.391	0.044
	Carpinus betulus	0.446	0.333	0.385	0.007
	Alopecurus pratensis	0.750	0.167	0.354	0.005
	Pilosella officinarum	0.393	0.306	0.347	0.044
	Ligustrum vulgare	0.400	0.278	0.333	0.043
	Lonicera ligustrina var. pileata	0.714	0.139	0.315	0.015
	Prunus spinosa	0.423	0.222	0.307	0.050
	Briza media	0.545	0.167	0.302	0.030
	Pyracantha coccinea	0.800	0.111	0.298	0.023
	Sagina procumbens	0.440	0.194	0.292	0.044
	Carex pendula	1.000	0.083	0.289	0.023
	Carum carvi	1.000	0.083	0.289	0.031
	Cornus sericea	1.000	0.083	0.289	0.037
	Viburnum opulus	0.576	0.111	0.253	0.035
Park	*Plantago major*	0.365	0.778	0.533	0.001
	Lolium perenne	0.255	0.917	0.483	0.008
	Capsella bursa-pastoris	0.385	0.361	0.373	0.006
	Chaerophyllum temulum	1.000	0.111	0.333	0.004
	Fagus sylvatica	0.800	0.111	0.298	0.015
	Juncus tenuis	0.607	0.083	0.225	0.038
Ruderal	*Trifolium pratense*	0.280	0.806	0.475	0.005
	Arrhenatherum elatius	0.350	0.639	0.473	0.001
	Lotus corniculatus	0.385	0.556	0.463	0.001
	Elymus repens	0.348	0.528	0.428	0.003
	Silene nutans	0.800	0.222	0.422	0.001
	Daucus carota	0.330	0.528	0.417	0.007
	Salvia pratensis	0.449	0.361	0.403	0.001
	Medicago sativa	0.528	0.278	0.383	0.004
	Bromus sterilis	0.328	0.444	0.382	0.028

Table S16. Continuation

	Rubus caesius	0.617	0.222	0.370	0.005
	Vicia hirsuta	0.700	0.194	0.369	0.002
	Onobrychis viciifolia	0.571	0.222	0.356	0.003
	Vicia sativa	0.409	0.306	0.353	0.017
	Galium verum	0.417	0.278	0.340	0.029
	Bromus erectus	0.400	0.278	0.334	0.046
	Anthyllis vulneraria	0.667	0.167	0.333	0.010
	Crepis biennis	0.429	0.250	0.328	0.033
	Rumex crispus	0.471	0.222	0.323	0.034
	Trifolium campestre	0.714	0.139	0.315	0.015
	Centaurea scabiosa	0.548	0.167	0.302	0.023
	Lathyrus pratensis	0.548	0.167	0.302	0.017
	Echium vulgare	0.503	0.167	0.290	0.022
	Silene latifolia subsp. alba	0.503	0.167	0.290	0.021
	Festuca ovina	0.670	0.111	0.273	0.038
Es + Ga + Pa	*Bellis perennis*	0.643	0.833	0.732	0.001
	Festuca rubra	0.520	0.833	0.658	0.001
	Trifolium dubium	0.896	0.472	0.650	0.001
	Trifolium repens	0.466	0.907	0.650	0.001
	Lolium perenne	0.469	0.870	0.639	0.001
	Hypochaeris radicata	0.552	0.713	0.627	0.001
	Hedera helix	0.566	0.676	0.618	0.001
	Prunella vulgaris	0.540	0.704	0.616	0.001
	Plantago major	0.584	0.574	0.579	0.001
	Carex muricata	0.584	0.500	0.540	0.002
	Veronica chamaedrys	0.674	0.398	0.518	0.005
	Veronica arvensis	0.505	0.528	0.516	0.015
	Prunus laurocerasus	1.000	0.222	0.471	0.001
	Ajuga reptans	0.616	0.352	0.466	0.016
	Carex sylvatica	0.813	0.241	0.442	0.001
	Veronica filiformis	0.665	0.269	0.423	0.016
	Veronica serpyllifolia	0.698	0.250	0.418	0.009
	Ligustrum vulgare	0.793	0.213	0.411	0.006
	Ilex aquifolium	1.000	0.167	0.408	0.005
	Trachycarpus fortunei	1.000	0.167	0.408	0.005
	Carpinus betulus	0.733	0.222	0.404	0.013
	Taxus baccata	0.867	0.176	0.391	0.013
	Quercus robur	1.000	0.148	0.385	0.012
	Ranunculus ficaria	1.000	0.093	0.304	0.035
	Rhododendron ponticum	1.000	0.093	0.304	0.043
	Tilia platyphyllos	1.000	0.083	0.289	0.047

Table S17. Indicator species of native plants.

	Species	A	B	Statistic	p
Native					
Allotment	*Allium cepa*	0.879	0.811	0.844	0.001
	Cucurbita pepo	0.898	0.730	0.809	0.001
	Brassica oleracea	0.961	0.676	0.806	0.001
	Portulaca oleracea	0.890	0.676	0.776	0.001
	Beta vulgaris	0.817	0.622	0.713	0.001
	Digitaria sanguinalis	0.843	0.595	0.708	0.001
	Senecio vulgaris	0.769	0.649	0.706	0.001
	Petroselinum crispum	0.836	0.568	0.689	0.001
	Apium graveolens	0.902	0.514	0.681	0.001
	Solanum melongena	0.796	0.541	0.656	0.001
	Mentha spicata	0.886	0.432	0.619	0.001
	Euphorbia peplus	0.561	0.676	0.616	0.001
	Rosmarinus officinalis	0.778	0.486	0.615	0.001
	Salvia officinalis	0.725	0.514	0.610	0.001
	Rubus idaeus	0.661	0.486	0.567	0.001
	Borago officinalis	0.773	0.378	0.541	0.001
	Allium schoenoprasum	0.709	0.405	0.536	0.001
	Melissa officinalis	0.601	0.459	0.525	0.001
	Lysimachia arvensis	0.609	0.432	0.513	0.001
	Foeniculum vulgare	0.717	0.351	0.502	0.001
	Persicaria maculosa	0.678	0.351	0.488	0.002
	Lathyrus oleraceus	0.829	0.270	0.473	0.001
	Poa annua	0.272	0.811	0.470	0.008
	Allium ampeloprasum	0.728	0.297	0.465	0.001
	Sonchus asper	0.443	0.486	0.464	0.001
	Sonchus oleraceus	0.350	0.568	0.445	0.003
	Vicia faba	0.886	0.216	0.438	0.001
	Thymus vulgaris	0.686	0.243	0.409	0.002
	Cymbalaria muralis	1.000	0.162	0.403	0.001
	Cynara cardunculus	1.000	0.162	0.403	0.001
	Stellaria media	0.366	0.432	0.398	0.013
	Epilobium hirsutum	0.722	0.216	0.395	0.001
	Chenopodium album	0.637	0.243	0.393	0.002
	Ficus carica	0.637	0.243	0.393	0.001
	Aquilegia vulgaris	0.493	0.297	0.383	0.006
	Diplotaxis tenuifolia	0.854	0.162	0.372	0.003
	Mentha × piperita	0.854	0.162	0.372	0.003
	Setaria viridis	0.854	0.162	0.372	0.003
	Lavandula angustifolia	0.452	0.297	0.366	0.015
	Ribes uva-crispa	0.694	0.189	0.362	0.004
	Urtica dioica	0.416	0.297	0.352	0.020
	Valeriana locusta	0.493	0.243	0.346	0.012
	Calendula officinalis	0.829	0.135	0.335	0.009
	Echinochloa crus-galli	0.829	0.135	0.335	0.007
	Digitaria ischaemum	1.000	0.108	0.329	0.010
	Rubus fruticosus	0.443	0.243	0.328	0.029
	Cichorium intybus	0.493	0.216	0.327	0.020
	Malva sylvestris	0.532	0.189	0.317	0.022
	Chaenorhinum minus	0.593	0.162	0.310	0.028
	Centaurea cyanus	0.709	0.135	0.309	0.022
	Eruca vesicaria	0.709	0.135	0.309	0.010
	Kickxia elatine	0.709	0.135	0.309	0.022
	Linaria vulgaris	0.709	0.135	0.309	0.012
	Brassica rapa	0.796	0.108	0.293	0.034
	Coriandrum sativum	0.796	0.108	0.293	0.029
	Calendula arvensis	1.000	0.081	0.285	0.041
	Nigella arvensis	1.000	0.081	0.285	0.040
	Ruta graveolens	1.000	0.081	0.285	0.039
	Dianthus barbatus	1.000	0.081	0.285	0.037

Table S17. Continuation

Private Garden	*Viola reichenbachiana*	0.503	0.500	0.502	0.001
	Prunella vulgaris	0.297	0.806	0.489	0.004
	Primula vulgaris	0.383	0.611	0.483	0.001
	Fragaria vesca	0.415	0.528	0.468	0.001
	Oxalis corniculata	0.318	0.667	0.460	0.004
	Veronica chamaedrys	0.381	0.528	0.448	0.003
	Carex sylvatica	0.500	0.389	0.441	0.001
	Geranium robertianum	0.485	0.389	0.435	0.002
	Ilex aquifolium	0.611	0.306	0.432	0.001
	Circaea lutetiana	0.604	0.250	0.389	0.001
	Brachypodium sylvaticum	0.407	0.361	0.383	0.009
	Potentilla sterilis	0.530	0.250	0.364	0.009
	Convallaria majalis	0.578	0.222	0.358	0.002
	Corylus avellana	0.456	0.278	0.356	0.012
	Polygonatum multiflorum	0.750	0.167	0.354	0.004
	Allium ursinum	0.540	0.194	0.324	0.012
	Lysimachia nummularia	0.540	0.194	0.324	0.018
	Aegopodium podagraria	0.448	0.222	0.316	0.013
	Dryopteris filix-mas	0.469	0.194	0.302	0.034
	Nerium oleander	0.804	0.111	0.299	0.005
	Anemonoides nemorosa	0.800	0.111	0.298	0.030
	Lamium galeobdolon	0.625	0.139	0.295	0.042
	Petrosedum rupestre	0.755	0.083	0.251	0.022
	Primula auricula	0.755	0.083	0.251	0.023
	Malus domestica	0.755	0.083	0.251	0.025
	Brachypodium pinnatum	0.607	0.083	0.225	0.037
Real Estate	*Trifolium dubium*	0.510	0.750	0.618	0.001
	Festuca rubra	0.297	0.972	0.538	0.001
	Trifolium repens	0.258	0.972	0.501	0.002
	Bellis perennis	0.291	0.861	0.500	0.003
	Hypochaeris radicata	0.296	0.806	0.489	0.002
	Plantago lanceolata	0.273	0.861	0.485	0.007
	Taraxacum officinale	0.234	0.944	0.470	0.027
	Potentilla reptans	0.264	0.833	0.469	0.013
	Hedera helix	0.284	0.722	0.453	0.017
	Carex muricata	0.329	0.611	0.448	0.006
	Ajuga reptans	0.370	0.472	0.418	0.001
	Agrostis capillaris	0.312	0.500	0.395	0.036
	Crepis capillaris	0.306	0.500	0.391	0.047
	Carpinus betulus	0.446	0.333	0.385	0.006
	Alopecurus pratensis	0.750	0.167	0.354	0.005
	Pilosella officinarum	0.393	0.306	0.347	0.034
	Ligustrum vulgare	0.400	0.278	0.333	0.046
	Briza media	0.545	0.167	0.302	0.036
	Sagina procumbens	0.440	0.194	0.292	0.050
	Carex pendula	1.000	0.083	0.289	0.023
	Carum carvi	1.000	0.083	0.289	0.024
	Viburnum opulus	0.576	0.111	0.253	0.038
Park	*Plantago major*	0.365	0.778	0.533	0.001
	Lolium perenne	0.255	0.917	0.483	0.007
	Capsella bursa-pastoris	0.385	0.361	0.373	0.011
	Chaerophyllum temulum	1.000	0.111	0.333	0.007
	Fagus sylvatica	0.800	0.111	0.298	0.029
Ruderal	*Trifolium pratense*	0.280	0.806	0.475	0.011
	Arrhenatherum elatius	0.350	0.639	0.473	0.001
	Lotus corniculatus	0.385	0.556	0.463	0.002
	Elymus repens	0.348	0.528	0.428	0.005

Table S17. Continuation

	Silene nutans	0.800	0.222	0.422	0.001
	Daucus carota	0.330	0.528	0.417	0.009
	Salvia pratensis	0.449	0.361	0.403	0.003
	Medicago sativa	0.528	0.278	0.383	0.005
	Bromus sterilis	0.328	0.444	0.382	0.031
	Rubus caesius	0.617	0.222	0.370	0.005
	Vicia hirsuta	0.700	0.194	0.369	0.003
	Onobrychis viciifolia	0.571	0.222	0.356	0.007
	Vicia sativa	0.409	0.306	0.353	0.016
	Galium verum	0.417	0.278	0.340	0.032
	Bromus erectus	0.400	0.278	0.334	0.044
	Anthyllis vulneraria	0.667	0.167	0.333	0.008
	Crepis biennis	0.429	0.250	0.328	0.048
	Rumex crispus	0.471	0.222	0.323	0.029
	Trifolium campestre	0.714	0.139	0.315	0.019
	Centaurea scabiosa	0.548	0.167	0.302	0.013
	Lathyrus pratensis	0.548	0.167	0.302	0.023
	Echium vulgare	0.503	0.167	0.290	0.027
	Silene latifolia subsp. alba	0.503	0.167	0.290	0.013
	Festuca ovina	0.670	0.111	0.273	0.023
Es + Ga + Pa	*Bellis perennis*	0.643	0.833	0.732	0.001
	Festuca rubra	0.520	0.833	0.658	0.001
	Trifolium dubium	0.896	0.472	0.650	0.001
	Trifolium repens	0.466	0.907	0.650	0.001
	Lolium perenne	0.469	0.870	0.639	0.001
	Hypochaeris radicata	0.552	0.713	0.627	0.001
	Hedera helix	0.566	0.676	0.618	0.001
	Prunella vulgaris	0.540	0.704	0.616	0.001
	Plantago major	0.584	0.574	0.579	0.001
	Carex muricata	0.584	0.500	0.540	0.001
	Veronica chamaedrys	0.674	0.398	0.518	0.003
	Veronica arvensis	0.505	0.528	0.516	0.018
	Ranunculus repens	0.479	0.500	0.489	0.039
	Ajuga reptans	0.616	0.352	0.466	0.010
	Carex sylvatica	0.813	0.241	0.442	0.005
	Veronica serpyllifolia	0.698	0.250	0.418	0.011
	Ligustrum vulgare	0.793	0.213	0.411	0.013
	Ilex aquifolium	1.000	0.167	0.408	0.004
	Carpinus betulus	0.733	0.222	0.404	0.015
	Taxus baccata	0.867	0.176	0.391	0.008
	Quercus robur	1.000	0.148	0.385	0.007
	Ranunculus ficaria	1.000	0.093	0.304	0.031
	Tilia platyphyllos	1.000	0.083	0.289	0.041

Table S18. Indicator species of non-native plants.

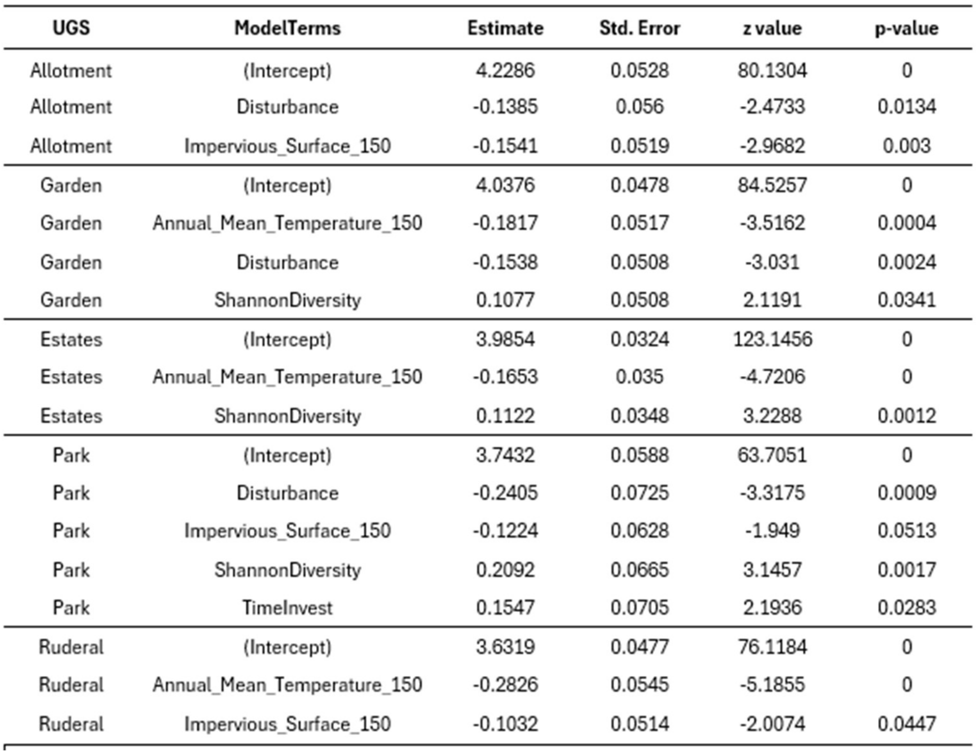
	Species	A	B	Statistic	p
Non-native					
Allotment	*Lactuca sativa*	0.879	0.811	0.844	0.001
	Solanum lycopersicum	0.816	0.865	0.840	0.001
	Phaseolus vulgaris	0.957	0.622	0.771	0.001
	Cucumis sativus	0.848	0.622	0.726	0.001
	Capsicum annuum	0.911	0.568	0.719	0.001
	Solanum tuberosum	0.811	0.595	0.694	0.001
	Fragaria × ananassa	0.781	0.595	0.681	0.001
	Cucurbita maxima	0.940	0.432	0.637	0.001
	Galinsoga quadriradiata	0.768	0.459	0.594	0.001
	Ocimum basilicum	0.854	0.324	0.526	0.001
	Oxalis stricta	0.580	0.459	0.516	0.001
	Ribes rubrum	0.781	0.297	0.482	0.001
	Rheum rhabarbarum	0.829	0.270	0.473	0.001
	Helianthus annuus	0.728	0.297	0.465	0.001
	Allium sativum	1.000	0.216	0.465	0.001
	Euphorbia lathyris	0.814	0.243	0.445	0.001
	Vitis vinifera	0.709	0.270	0.438	0.001
	Veronica persica	0.279	0.676	0.434	0.021
	Nigella damascena	0.745	0.243	0.426	0.001
	Prunus domestica	0.619	0.270	0.409	0.001
	Raphanus raphanistrum subsp. sativus	0.872	0.189	0.406	0.001
	Tagetes erecta	0.872	0.189	0.406	0.002
	Tanacetum parthenium	0.854	0.162	0.372	0.001
	Paeonia lactiflora	1.000	0.135	0.368	0.003
	Tropaeolum majus	1.000	0.135	0.368	0.001
	Euphorbia maculata	0.694	0.189	0.362	0.004
	Ribes nigrum	0.745	0.162	0.348	0.007
	Cucurbita moschata	1.000	0.108	0.329	0.009
	Galinsoga parviflora	1.000	0.108	0.329	0.007
	Spinacia oleracea	1.000	0.108	0.329	0.009
	Symphyotrichum novi-belgii	1.000	0.108	0.329	0.012
	Tragopogon porrifolius	1.000	0.108	0.329	0.010
	Zea mays	1.000	0.108	0.329	0.012
	Alcea rosea	0.661	0.162	0.327	0.012
	Valeriana rubra	0.593	0.162	0.310	0.024
	Citrullus lanatus	0.796	0.108	0.293	0.027
	Ipomoea batatas	1.000	0.081	0.285	0.044
	Amaranthus blitum subsp. emarginatus	1.000	0.081	0.285	0.030
	Delphinium ajacis	1.000	0.081	0.285	0.042
	Stachys byzantina	1.000	0.081	0.285	0.045
	Zinnia elegans	1.000	0.081	0.285	0.027
Private Garden	*Prunus laurocerasus*	0.500	0.333	0.408	0.004
	Hydrangea macrophylla	0.535	0.250	0.366	0.002
	Bergenia crassifolia	0.720	0.139	0.316	0.001
	Syringa vulgaris	0.503	0.194	0.313	0.019
	Cotoneaster horizontalis	1.000	0.083	0.289	0.029
	Diospyros kaki	0.670	0.111	0.273	0.031
	Eriocapitella hupehensis	0.507	0.139	0.265	0.028
	Delosperma cooperi	0.755	0.083	0.251	0.033
	Euonymus fortunei	0.755	0.083	0.251	0.037
	Prunus persica	0.607	0.083	0.225	0.039
Real Estate	*Lonicera ligustrina var. Pileata*	0.714	0.139	0.315	0.013
	Pyracantha coccinea	0.800	0.111	0.298	0.030
	Cornus sericea	1.000	0.083	0.289	0.033
Park	*Juncus tenuis*	0.607	0.083	0.225	0.050

Table S18. Continuation

Ruderal	*Festuca arundinacea*	0.320	0.444	0.377	0.050
	Koeleria pyramidata			0.268	0.042
Es + Ga + Pa	*Prunus laurocerasus*	1.000	0.222	0.471	0.001
	Veronica filiformis	0.665	0.269	0.423	0.015
	Trachycarpus fortunei	1.000	0.167	0.408	0.004
	Rhododendron ponticum	1.000	0.093	0.304	0.030

Table S19. Top Model Alpha all

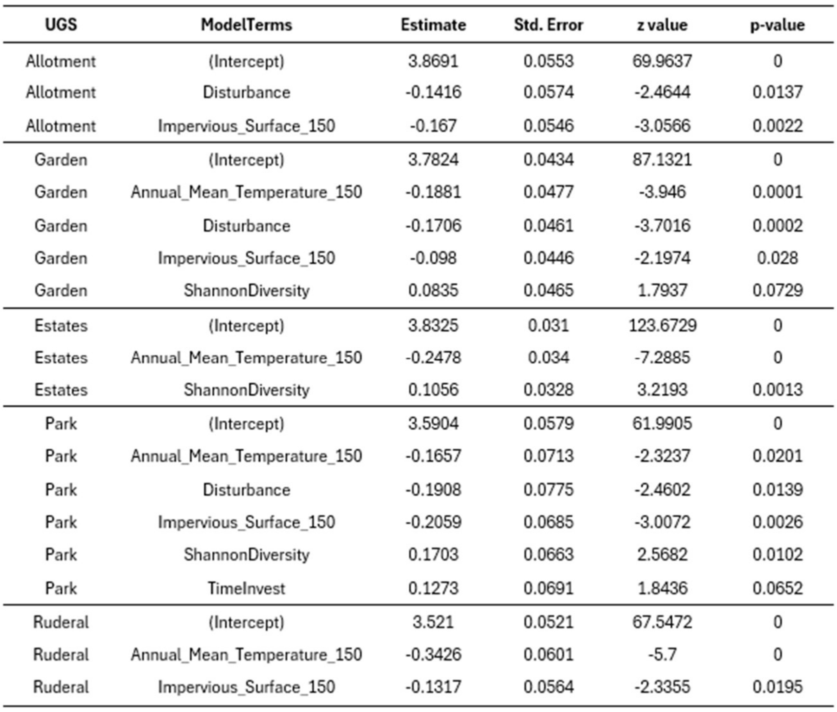
Top model on alpha diversity of all species across all UGS types, their estimate, the standard error (Std. error), z-value and p-value.



UGS	ModelTerms	Estimate	Std. Error	z value	p-value
Allotment	(Intercept)	4.2286	0.0528	80.1304	0
Allotment	Disturbance	-0.1385	0.056	-2.4733	0.0134
Allotment	Impervious_Surface_150	-0.1541	0.0519	-2.9682	0.003
Garden	(Intercept)	4.0376	0.0478	84.5257	0
Garden	Annual_Mean_Temperature_150	-0.1817	0.0517	-3.5162	0.0004
Garden	Disturbance	-0.1538	0.0508	-3.031	0.0024
Garden	ShannonDiversity	0.1077	0.0508	2.1191	0.0341
Estates	(Intercept)	3.9854	0.0324	123.1456	0
Estates	Annual_Mean_Temperature_150	-0.1653	0.035	-4.7206	0
Estates	ShannonDiversity	0.1122	0.0348	3.2288	0.0012
Park	(Intercept)	3.7432	0.0588	63.7051	0
Park	Disturbance	-0.2405	0.0725	-3.3175	0.0009
Park	Impervious_Surface_150	-0.1224	0.0628	-1.949	0.0513
Park	ShannonDiversity	0.2092	0.0665	3.1457	0.0017
Park	TimeInvest	0.1547	0.0705	2.1936	0.0283
Ruderal	(Intercept)	3.6319	0.0477	76.1184	0
Ruderal	Annual_Mean_Temperature_150	-0.2826	0.0545	-5.1855	0
Ruderal	Impervious_Surface_150	-0.1032	0.0514	-2.0074	0.0447

Table S20. Top Model Alpha native

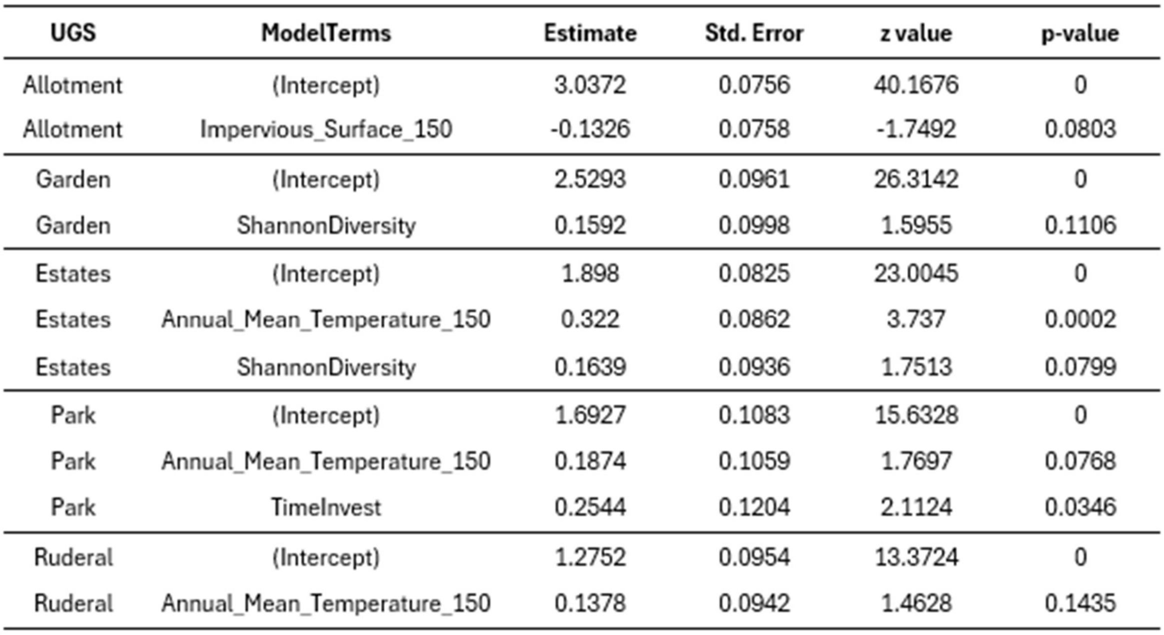
Top model on alpha diversity of native species across all UGS types, their estimate, the standard error (Std. error), z-value and p-value.



UGS	ModelTerms	Estimate	Std. Error	z value	p-value
Allotment	(Intercept)	3.8691	0.0553	69.9637	0
Allotment	Disturbance	-0.1416	0.0574	-2.4644	0.0137
Allotment	Impervious_Surface_150	-0.167	0.0546	-3.0566	0.0022
Garden	(Intercept)	3.7824	0.0434	87.1321	0
Garden	Annual_Mean_Temperature_150	-0.1881	0.0477	-3.946	0.0001
Garden	Disturbance	-0.1706	0.0461	-3.7016	0.0002
Garden	Impervious_Surface_150	-0.098	0.0446	-2.1974	0.028
Garden	ShannonDiversity	0.0835	0.0465	1.7937	0.0729
Estates	(Intercept)	3.8325	0.031	123.6729	0
Estates	Annual_Mean_Temperature_150	-0.2478	0.034	-7.2885	0
Estates	ShannonDiversity	0.1056	0.0328	3.2193	0.0013
Park	(Intercept)	3.5904	0.0579	61.9905	0
Park	Annual_Mean_Temperature_150	-0.1657	0.0713	-2.3237	0.0201
Park	Disturbance	-0.1908	0.0775	-2.4602	0.0139
Park	Impervious_Surface_150	-0.2059	0.0685	-3.0072	0.0026
Park	ShannonDiversity	0.1703	0.0663	2.5682	0.0102
Park	TimeInvest	0.1273	0.0691	1.8436	0.0652
Ruderal	(Intercept)	3.521	0.0521	67.5472	0
Ruderal	Annual_Mean_Temperature_150	-0.3426	0.0601	-5.7	0
Ruderal	Impervious_Surface_150	-0.1317	0.0564	-2.3355	0.0195

Table S21. Top Model Alpha non-native

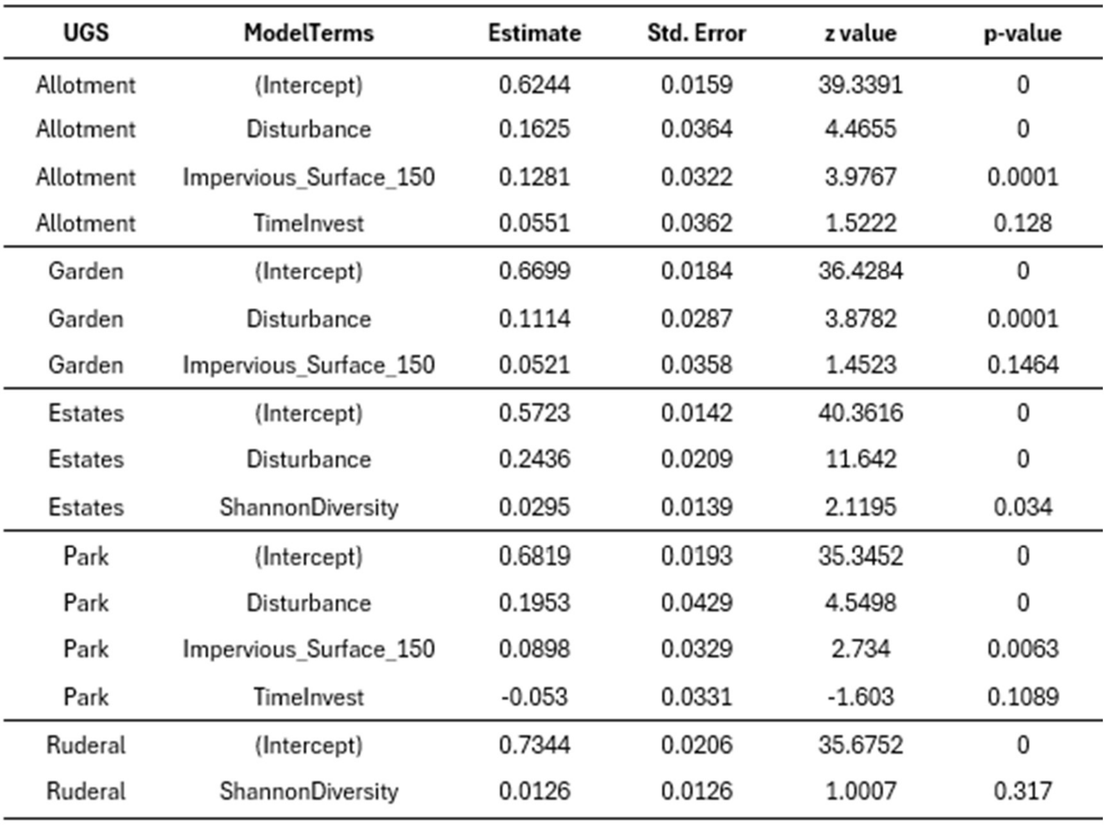
Top model on alpha diversity of non-native species across all UGS types, their estimate, the standard error (Std. error), z-value, and p-value.



UGS	ModelTerms	Estimate	Std. Error	z value	p-value
Allotment	(Intercept)	3.0372	0.0756	40.1676	0
Allotment	Impervious_Surface_150	-0.1326	0.0758	-1.7492	0.0803
Garden	(Intercept)	2.5293	0.0961	26.3142	0
Garden	ShannonDiversity	0.1592	0.0998	1.5955	0.1106
Estates	(Intercept)	1.898	0.0825	23.0045	0
Estates	Annual_Mean_Temperature_150	0.322	0.0862	3.737	0.0002
Estates	ShannonDiversity	0.1639	0.0936	1.7513	0.0799
Park	(Intercept)	1.6927	0.1083	15.6328	0
Park	Annual_Mean_Temperature_150	0.1874	0.1059	1.7697	0.0768
Park	TimeInvest	0.2544	0.1204	2.1124	0.0346
Ruderal	(Intercept)	1.2752	0.0954	13.3724	0
Ruderal	Annual_Mean_Temperature_150	0.1378	0.0942	1.4628	0.1435

Table S22. Top Model Beta all

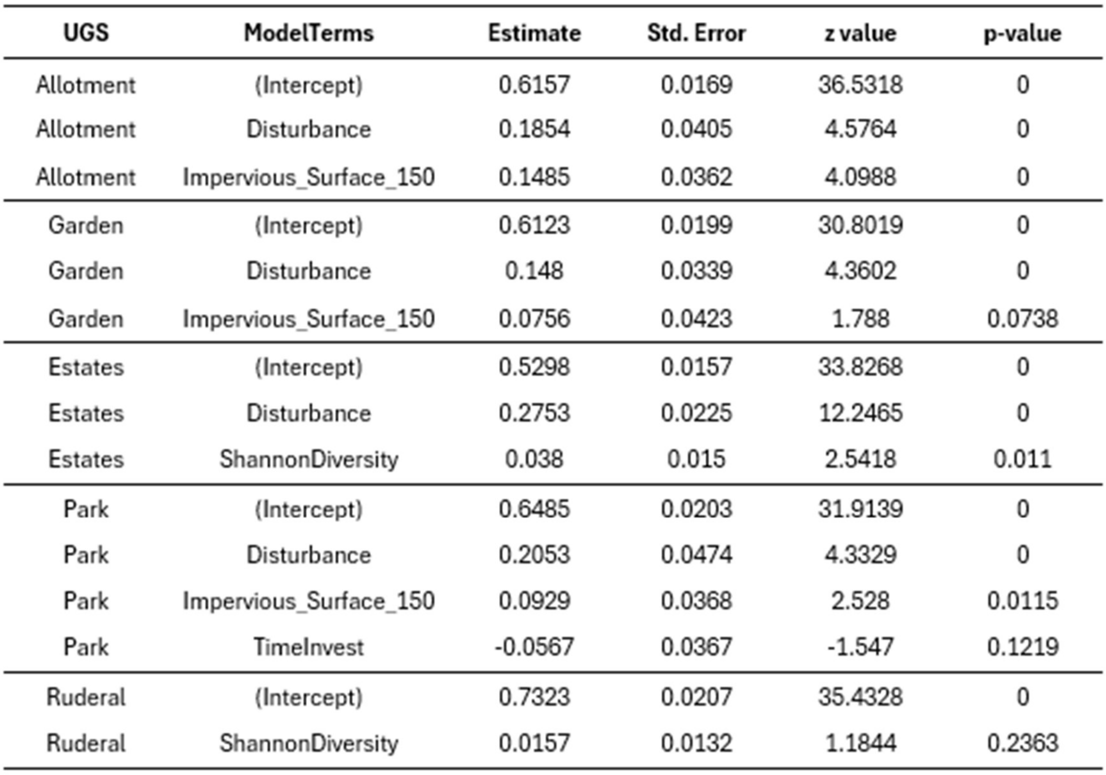
Top model on beta diversity of all species across all UGS types, their estimate, the standard error (Std. error), z-value, and p-value



UGS	ModelTerms	Estimate	Std. Error	z value	p-value
Allotment	(Intercept)	0.6244	0.0159	39.3391	0
Allotment	Disturbance	0.1625	0.0364	4.4655	0
Allotment	Impervious_Surface_150	0.1281	0.0322	3.9767	0.0001
Allotment	TimeInvest	0.0551	0.0362	1.5222	0.128
Garden	(Intercept)	0.6699	0.0184	36.4284	0
Garden	Disturbance	0.1114	0.0287	3.8782	0.0001
Garden	Impervious_Surface_150	0.0521	0.0358	1.4523	0.1464
Estates	(Intercept)	0.5723	0.0142	40.3616	0
Estates	Disturbance	0.2436	0.0209	11.642	0
Estates	ShannonDiversity	0.0295	0.0139	2.1195	0.034
Park	(Intercept)	0.6819	0.0193	35.3452	0
Park	Disturbance	0.1953	0.0429	4.5498	0
Park	Impervious_Surface_150	0.0898	0.0329	2.734	0.0063
Park	TimeInvest	-0.053	0.0331	-1.603	0.1089
Ruderal	(Intercept)	0.7344	0.0206	35.6752	0
Ruderal	ShannonDiversity	0.0126	0.0126	1.0007	0.317

Table S23. Top Model Beta native

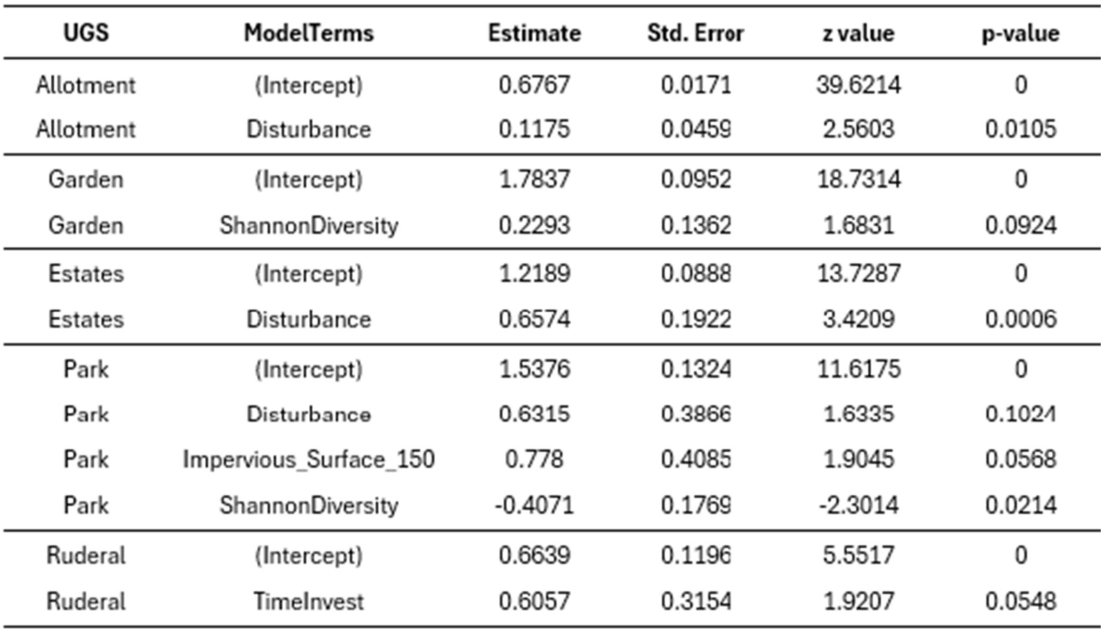
Top model on beta diversity of native species across all UGS types, their estimate, the standard error (Std. error), z-value, and p-value.



UGS	ModelTerms	Estimate	Std. Error	z value	p-value
Allotment	(Intercept)	0.6157	0.0169	36.5318	0
Allotment	Disturbance	0.1854	0.0405	4.5764	0
Allotment	Impervious_Surface_150	0.1485	0.0362	4.0988	0
Garden	(Intercept)	0.6123	0.0199	30.8019	0
Garden	Disturbance	0.148	0.0339	4.3602	0
Garden	Impervious_Surface_150	0.0756	0.0423	1.788	0.0738
Estates	(Intercept)	0.5298	0.0157	33.8268	0
Estates	Disturbance	0.2753	0.0225	12.2465	0
Estates	ShannonDiversity	0.038	0.015	2.5418	0.011
Park	(Intercept)	0.6485	0.0203	31.9139	0
Park	Disturbance	0.2053	0.0474	4.3329	0
Park	Impervious_Surface_150	0.0929	0.0368	2.528	0.0115
Park	TimeInvest	-0.0567	0.0367	-1.547	0.1219
Ruderal	(Intercept)	0.7323	0.0207	35.4328	0
Ruderal	ShannonDiversity	0.0157	0.0132	1.1844	0.2363

Table S24. Top Model Beta non-native

Top model on betadiversity of non-native species across all UGS types, their estimate, the standard error (Std. error), z-value and p-value.



UGS	ModelTerms	Estimate	Std. Error	z value	p-value
Allotment	(Intercept)	0.6767	0.0171	39.6214	0
Allotment	Disturbance	0.1175	0.0459	2.5603	0.0105
Garden	(Intercept)	1.7837	0.0952	18.7314	0
Garden	ShannonDiversity	0.2293	0.1362	1.6831	0.0924
Estates	(Intercept)	1.2189	0.0888	13.7287	0
Estates	Disturbance	0.6574	0.1922	3.4209	0.0006
Park	(Intercept)	1.5376	0.1324	11.6175	0
Park	Disturbance	0.6315	0.3866	1.6335	0.1024
Park	Impervious_Surface_150	0.778	0.4085	1.9045	0.0568
Park	ShannonDiversity	-0.4071	0.1769	-2.3014	0.0214
Ruderal	(Intercept)	0.6639	0.1196	5.5517	0
Ruderal	TimeInvest	0.6057	0.3154	1.9207	0.0548

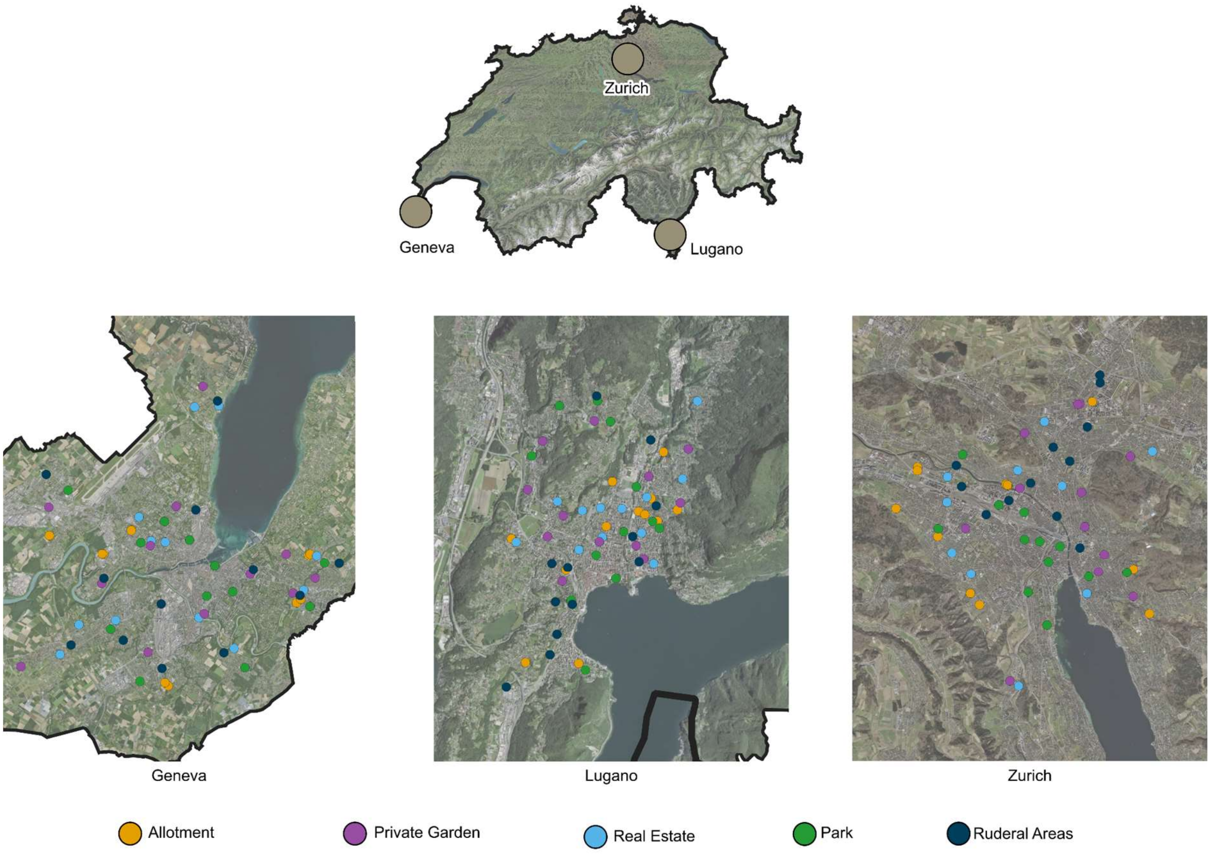
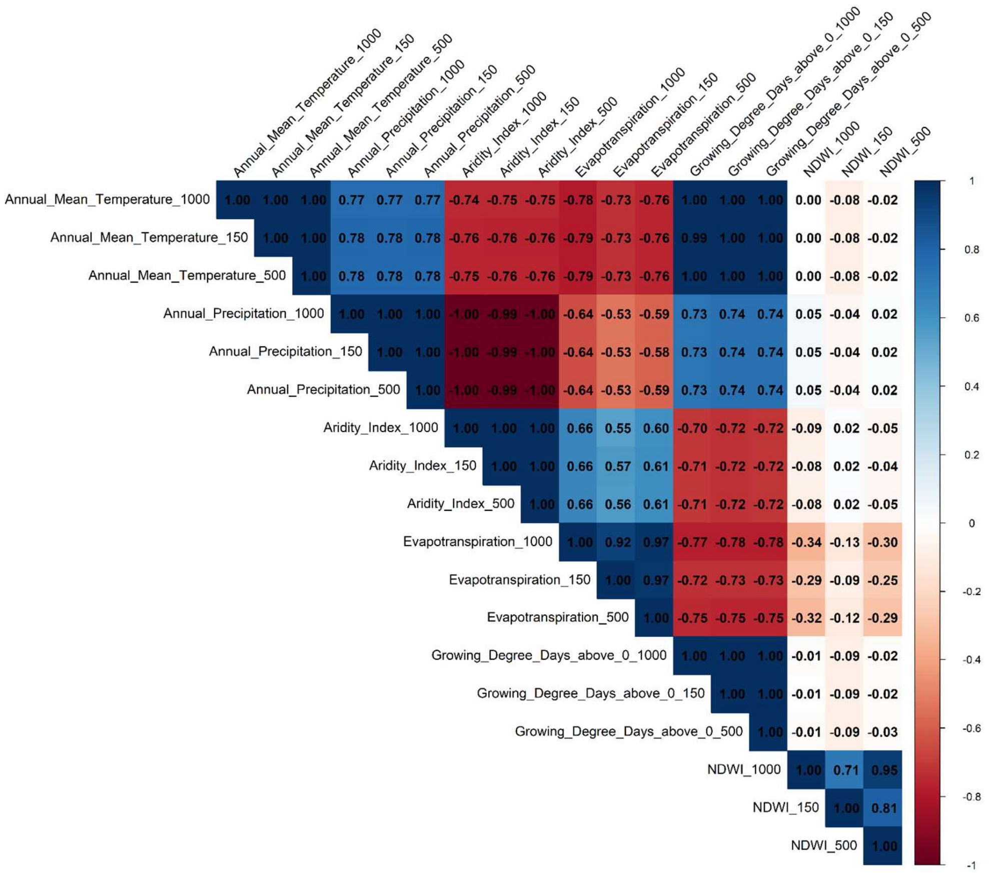


Figure S1. Distribution of study sites
Distribution of study sites within Switzerland and the different cities (Geneva, Lugano, and Zurich). The different UGS types are color-coded according to the legend.



	Annual_Mean_Temperature_1000	Annual_Mean_Temperature_150	Annual_Mean_Temperature_500	Annual_Precipitation_1000	Annual_Precipitation_150	Annual_Precipitation_500	Aridity_Index_1000	Aridity_Index_150	Aridity_Index_500	Evapotranspiration_1000	Evapotranspiration_150	Evapotranspiration_500	Growing_Degree_Days_above_0_1000	Growing_Degree_Days_above_0_150	Growing_Degree_Days_above_0_500	NDWI_1000	NDWI_150	NDWI_500
Annual_Mean_Temperature_1000	1.00	1.00	1.00	0.77	0.77	0.77	-0.74	-0.75	-0.75	-0.78	-0.73	-0.76	1.00	1.00	1.00	0.00	-0.08	-0.02
Annual_Mean_Temperature_150		1.00	1.00	0.78	0.78	0.78	-0.76	-0.76	-0.76	-0.79	-0.73	-0.76	0.99	1.00	1.00	0.00	-0.08	-0.02
Annual_Mean_Temperature_500			1.00	0.78	0.78	0.78	-0.75	-0.76	-0.76	-0.79	-0.73	-0.76	1.00	1.00	1.00	0.00	-0.08	-0.02
Annual_Precipitation_1000				1.00	1.00	1.00	-1.00	-0.99	-1.00	-0.64	-0.53	-0.59	0.73	0.74	0.74	0.05	-0.04	0.02
Annual_Precipitation_150					1.00	1.00	-1.00	-0.99	-1.00	-0.64	-0.53	-0.58	0.73	0.74	0.74	0.05	-0.04	0.02
Annual_Precipitation_500						1.00	-1.00	-0.99	-1.00	-0.64	-0.53	-0.59	0.73	0.74	0.74	0.05	-0.04	0.02
Aridity_Index_1000							1.00	1.00	1.00	0.66	0.55	0.60	-0.70	-0.72	-0.72	-0.09	0.02	-0.05
Aridity_Index_150								1.00	1.00	0.66	0.57	0.61	-0.71	-0.72	-0.72	-0.08	0.02	-0.04
Aridity_Index_500									1.00	0.66	0.56	0.61	-0.71	-0.72	-0.72	-0.08	0.02	-0.05
Evapotranspiration_1000										1.00	0.92	0.97	-0.77	-0.78	-0.78	-0.34	-0.13	-0.30
Evapotranspiration_150											1.00	0.97	-0.72	-0.73	-0.73	-0.29	-0.09	-0.25
Evapotranspiration_500												1.00	-0.75	-0.75	-0.75	-0.32	-0.12	-0.29
Growing_Degree_Days_above_0_1000													1.00	1.00	1.00	-0.01	-0.09	-0.02
Growing_Degree_Days_above_0_150														1.00	1.00	-0.01	-0.09	-0.02
Growing_Degree_Days_above_0_500															1.00	-0.01	-0.09	-0.03
NDWI_1000																1.00	0.71	0.95
NDWI_150																	1.00	0.81
NDWI_500																		1.00

Figure S2. Correlations among climate variables.

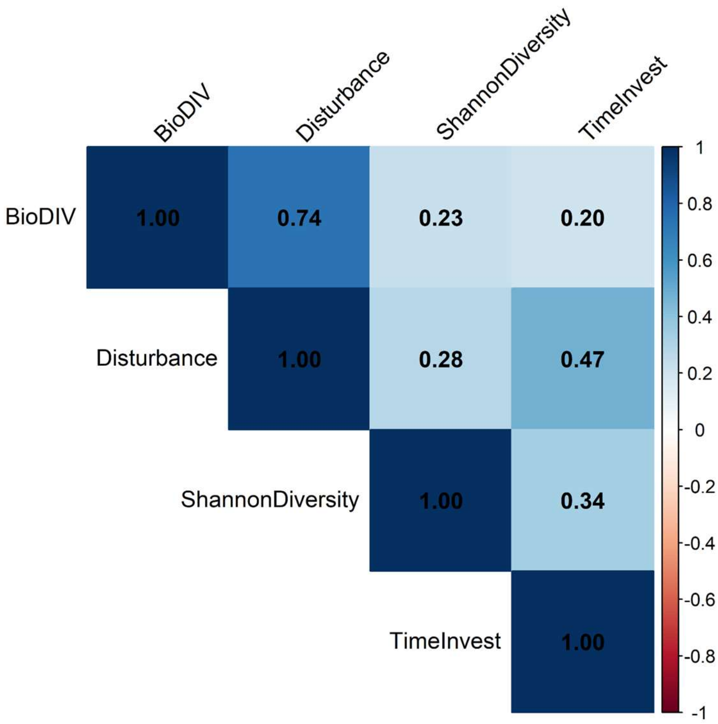


Figure S3. Correlation among management variables.

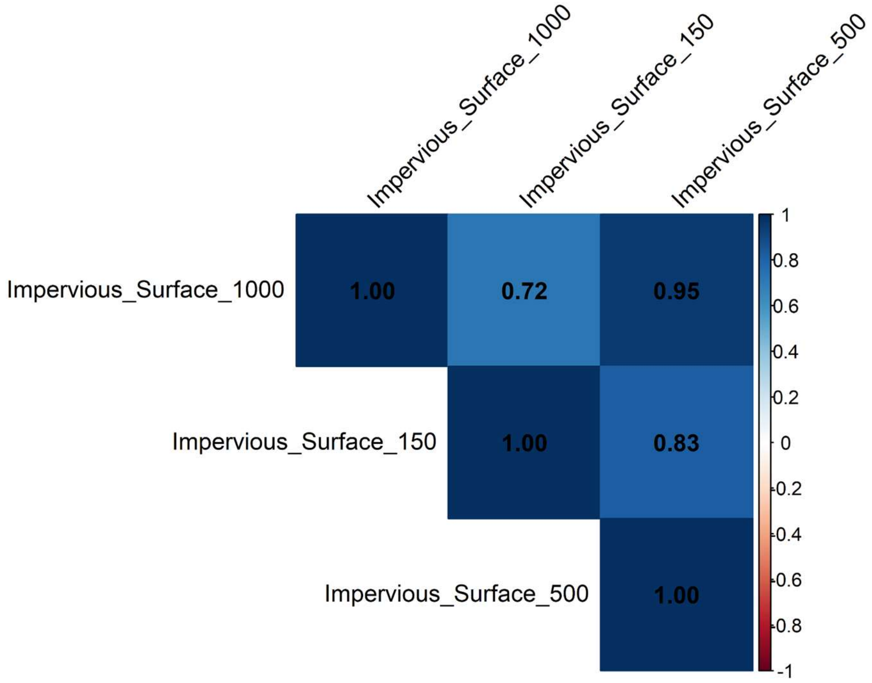
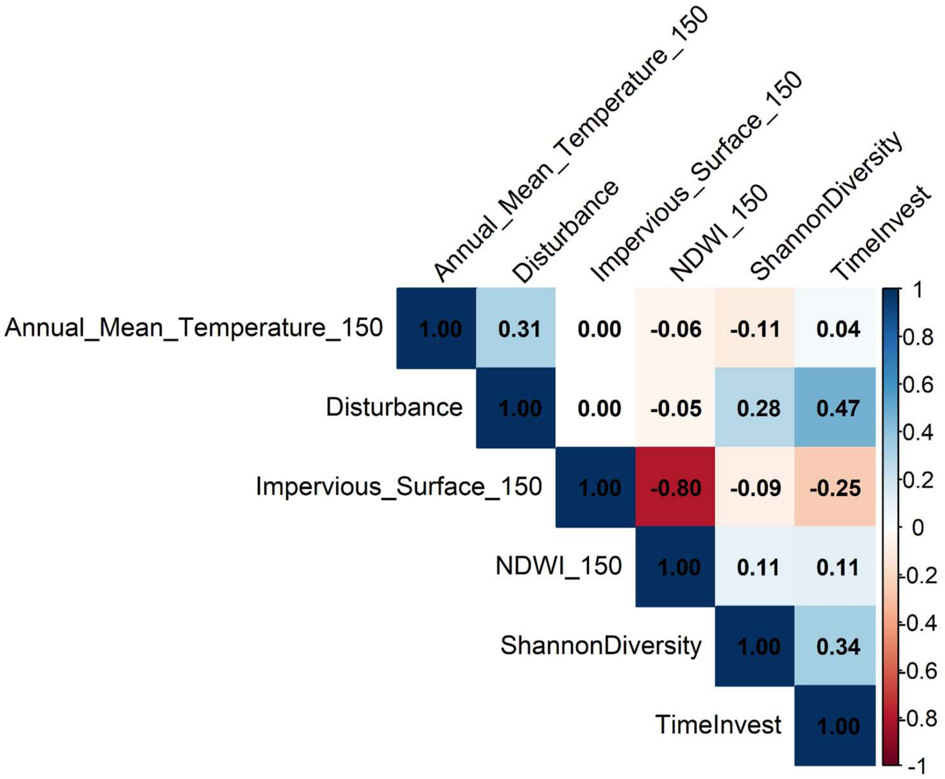


Figure S4. Correlation among urban intensity variables.



	Annual_Mean_Temperature_150	Disturbance	Impervious_Surface_150	NDWI_150	ShannonDiversity	TimeInvest
Annual_Mean_Temperature_150	1.00	0.31	0.00	-0.06	-0.11	0.04
Disturbance		1.00	0.00	-0.05	0.28	0.47
Impervious_Surface_150			1.00	-0.80	-0.09	-0.25
NDWI_150				1.00	0.11	0.11
ShannonDiversity					1.00	0.34
TimeInvest						1.00

Figure S5. Correlation among pre-selected variables.

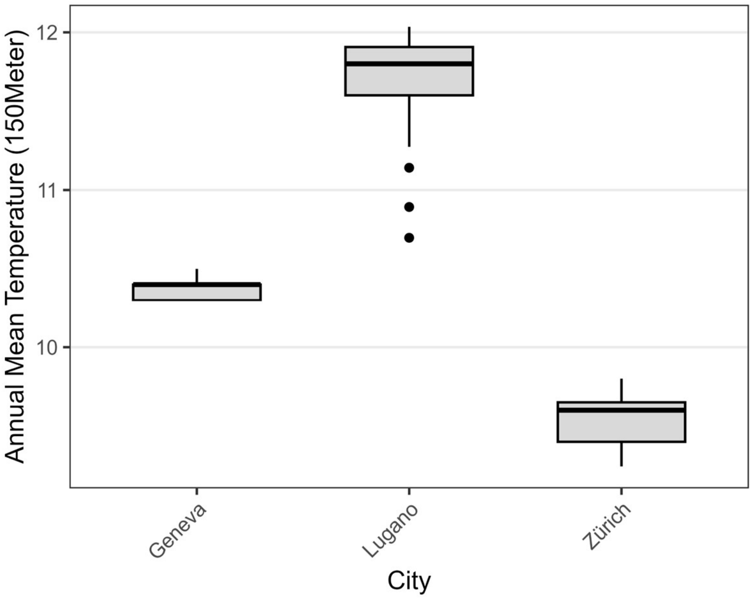


Figure S6. Variation of Annual Mean Temperature across the Cities.

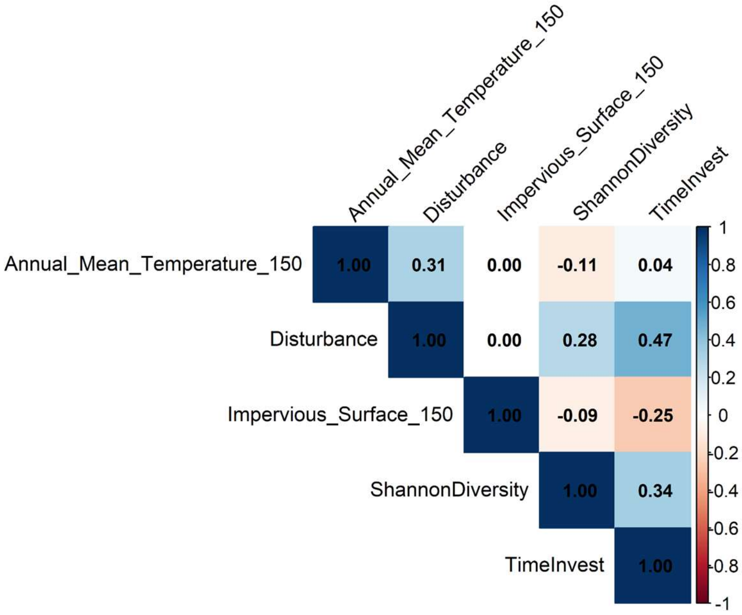


Figure S7. Correlation among selected variables.

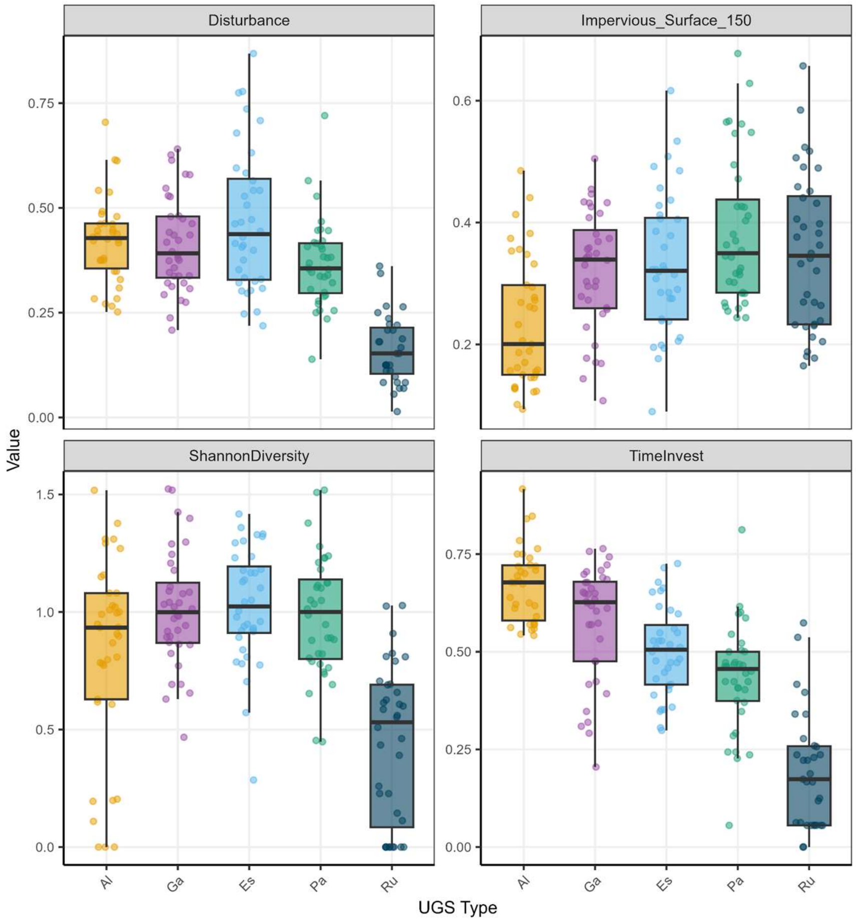


Figure S8. Predictor variability of the selected predictors across UGS types.

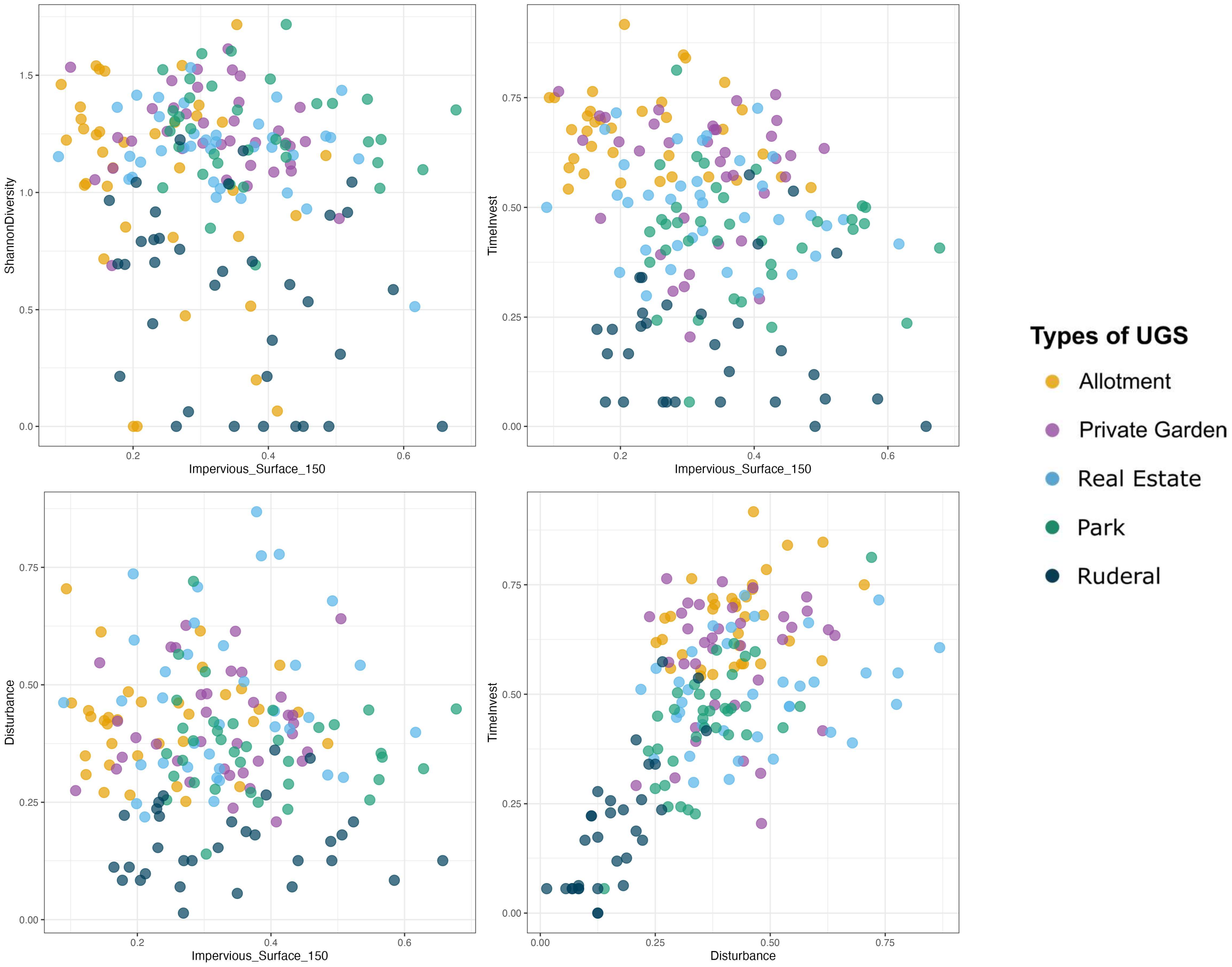


Figure S9. Relationship between variables

Relationship between the predictors, namely disturbance, habitat diversity, time investment, and built environment within 150-m radius (impervious surface).

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