ecologies

MDPI

Article

Distribution Patterns and Habitat Preferences of Five Globally Threatened and Endemic Montane Orthoptera (*Parnassiana* and *Oropodisma*)

Apostolis Stefanidis [1], Konstantinos Kougioumoutzis [2], Konstantina Zografou [1], Georgios Fotiadis [3], Luc Willemse [4], Olga Tzortzakaki [1] and Vassiliki Kati [1,*]

[1] Biodiversity Conservation Laboratory, Department of Biological Applications and Technology, University of Ioannina, Ioannina University Campus, 45110 Ioannina, Greece; stefapostolis@gmail.com (A.S.); ntinazografou@yahoo.co.uk (K.Z.); olgatzortz@gmail.com (O.T.)
[2] Department of Biology, University of Patras, 26504 Rio, Greece; kkougiou@aua.gr
[3] Department of Forestry and Natural Environment Management, Agricultural University of Athens, Dimokratias 3, 36100 Karpenisi, Greece; gfotiad95@gmail.com
[4] Naturalis Biodiversity Center, Darwinweg 2, 2333 CR Leiden, The Netherlands; luc.willemse1@gmail.com
* Correspondence: vkati@uoi.gr; Tel.: +30-265-100-7439

Abstract: Greece is a European hotspot for Orthoptera (378 species), yet it has been scarcely explored. We investigated the distribution and habitat preferences of the species of two endemic Orthoptera genera, *Parnassiana* and *Oropodisma*, in the montane ecosystems of central Greece. We conducted field surveys from 2021 to 2024 in 174 sites across seven mountains. The species of both genera preferred habitats above 1500 m, with species-specific preferences for microhabitat parameters: *Parnassiana* species favored moderate slopes with dense shrub cover, while *Oropodisma* species favored substrates with intermediate stone cover and relatively high vegetation cover. Species distribution models estimated the area of suitable habitat for *Parnassiana* to be 83 km^2 and *Oropodisma* at 169 km^2. The Normalized Difference Vegetation Index (NDVI) and potential evapotranspiration were the key environmental drivers of the habitat suitability for both genera. Generalized regression models showed that altitude positively influenced *Parnassiana* population density, peaking at 2200 m, whereas rock and soil cover negatively impacted *Oropodisma* population densities. The results emphasize the critical role of montane habitats in sustaining these species and provide essential data for future research and conservation strategies.

Keywords: bush crickets; grasshoppers; endemism; habitat suitability; insects; mountain ecosystems; Mediterranean basin

check for updates

Academic Editor: José Ramón Arévalo Sierra

Received: 26 November 2024
Revised: 3 January 2025
Accepted: 9 January 2025
Published: 11 January 2025

Citation: Stefanidis, A.; Kougioumoutzis, K.; Zografou, K.; Fotiadis, G.; Willemse, L.; Tzortzakaki, O.; Kati, V. Distribution Patterns and Habitat Preferences of Five Globally Threatened and Endemic Montane Orthoptera (*Parnassiana* and *Oropodisma*). *Ecologies* **2025**, *6*, 5. https://doi.org/10.3390/ecologies6010005

Correction Statement: This article has been republished with a minor change. The change does not affect the scientific content of the article and further details are available within the backmatter of the website version of this article.

Copyright: © 2025 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/licenses/by/4.0/).

1. Introduction

Orthoptera plays a vital role in the food chain as a protein source for a range of insectivorous animals from tropical agroecosystems to temperate grasslands [1,2], and their gut bacteria are essential for cellulose degradation and biomass conversion [3,4]. They are increasingly recognized as reliable bioindicators due to their sensitivity to environmental and climatic fluctuations [5,6]. Studies underscore their responsiveness to microhabitat features, such as vegetation structure and habitat patch size, which strongly influence their diversity and distribution [7]. This sensitivity extends to larger landscape factors, as studies reveal that Orthoptera populations respond significantly to habitat heterogeneity, with their abundance often reflecting local topographic diversity and climate interactions [8,9]. Such dynamics are particularly pronounced in Europe, where land-use changes and rewilding

efforts in areas of complex terrain have been shown to significantly affect Orthoptera assemblages in biodiversity hotspots [10,11], such as Greek mountain ecosystems.

Despite their ecological importance, Orthoptera remain under-researched in Europe [12]. This especially includes species endemic to biodiversity hotspots like mountain regions, where the diversity of topographies and microhabitats fosters unique ecological Orthoptera communities [13]. Mountainous regions, as global biodiversity hotspots rich in endemics [14], offer unique opportunities to study specialized Orthoptera populations and their habitat dependencies [15,16]. In Greece—a center of Orthoptera diversity—378 species, constituting 35% of Europe's total Orthoptera, have been documented, including 140 endemics, of which 95 are threatened [17]. The conservation needs of these species are pressing, as highlighted by recent extinction risk models specifically developed for high-altitude Greek Orthoptera species [18].

Current research in Greece has mostly focused on Orthoptera community ecology [13,19,20], but studies on the ecological requirements of endangered Orthoptera species remain limited [18,21]. This current study addresses this gap by targeting endemic and threatened montane Orthoptera species within the genera *Parnassiana* (Zeuner, 1941; Orthoptera: Tettigoniidae) and *Oropodisma* (Uvarov, 1942; Orthoptera: Acrididae).

The *Parnassiana* genus, entirely endemic to Greece, comprises 13 species, including five critically endangered (CR), three endangered (EN), and five vulnerable (VU) species according to the International Union for Conservation of Nature (IUCN) Red List [12]. The genus *Oropodisma*, a member of the Podismini tribe, includes ten species, all endangered (EN), with only one species occurring outside of Greece [12]. These genera inhabit restricted high-altitude areas characterized by small, isolated, and declining populations [17]. Understanding their geographical distributions and habitat preferences is essential for effective conservation [22,23]. The phylogenies of these genera remain incomplete with only a single cytogenetic study on *Parnassiana* being published [24]. Phylogenetic research is currently ongoing for the two genera, and preliminary results were available to us prior to forthcoming publications to identify the species across the seven mountains studied for three *Parnassiana* (Nefeli Kotitsa, *pers.com)* and two *Oropodisma* species (Joaquín Ortego, *pers.com)* (Table 1). We analyzed each species both individually and by genus considering the *Parnassiana complex* and *Oropodisma complex* (Figure S1).

Predictive models are widely used to assess patterns of species distribution across various fields of research [25]. Species distribution models (SDMs) combine occurrence records with key environmental variables to estimate potential distributions. SDMs reveal critical ecological insights and can effectively predict species ranges in diverse landscapes [26,27] and are particularly useful for the study of threatened species such as the endemic montane Orthoptera.

In this study, we try to integrate a range of abiotic factors known to improve the accuracy of niche models, aiming to pinpoint suitable habitats and identify environmental drivers affecting population densities. Considering Orthoptera's specific microhabitat preferences, particularly for certain vegetation structures [28], our analysis also assesses habitat characteristics most strongly correlated with species abundance. To achieve this, we employ linear regression, additive, and mixed modeling techniques. These approaches enable a comprehensive assessment of the relationships between environmental variables and species observations, ensuring robust and reliable predictions [29,30]. No prior research has addressed the distribution patterns and ecological requirements of the target species, highlighting an urgent need to identify suitable habitats to enhance conservation efforts [31,32]. This study aims to (a) delineate the current distribution patterns of the target species, (b) model their potential distributions by assessing the environmental fac-

tors that shape suitable habitats, and (c) identify the microhabitat variables that influence population densities.

2. Materials and Methods

2.1. Study Area and Target Species

The study extended over an area of 1467 km^2 in central Greece (Figure 1), encompassing seven mountains of the Pindos Mountain Range: Tymphrestos, Helidona, Kaliakouda, Oxia, Oiti, Vardousia and Giona. Most of the area (67%) lies above 1000 m and includes mountain peaks of 1923–2495 m (Table A1). The climate is Continental with some Mediterranean influence. The annual precipitation ranges from 833 to 1045 mm and the mean annual temperature ranges from 7 to 9.5 °C. It is a remote area of high naturalness, with large parts of roadless areas (260 km^2—18% of the study area) [33], and extended forests and semi-natural areas (48% of the study area), according to Corine Land Cover typology [34]

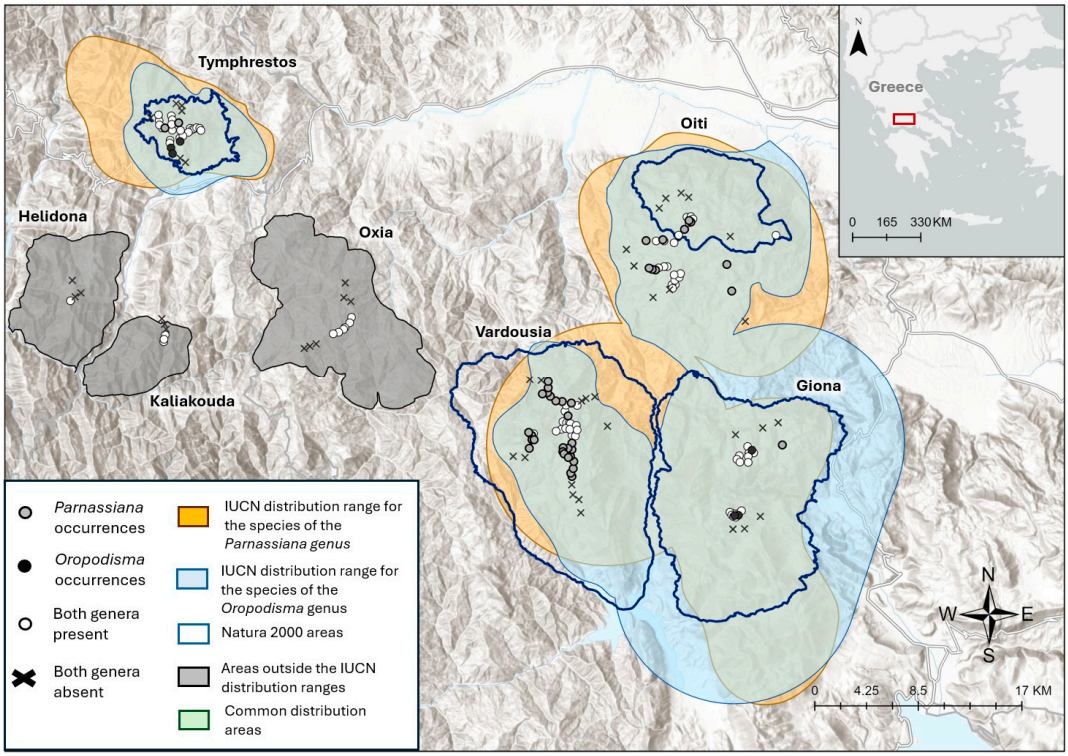

Figure 1. Study area across the distribution ranges of the two genera complexes (including seven mountains) and localities visited in the period of 2021–2024.

Four of the seven mountains studied are part of the Natura 2000 network, namely Mt. Tymphrestos (GR2430001), Mt. Vardousia (GR2450001), Mt. Giona (GR2450002), and Mt. Oiti (GR2440007), which has also been a national park since 1966 (Figure 1, Table A1). Three mountains lack any legal protection status, namely Mts. Oxia, Kaliakouda, and Helidona. Livestock farming represents the primary human activity above the tree line. Additional activities include a ski center located near the summit of Mt. Tymphrestos, and bauxite mining on the northern slopes of Mt. Giona, where karst-type deposits are extracted [35]. Wind power stations have been licensed for production at high altitudes in the mountains of Oiti and Oxia [36]

For the genus *Parnassiana*, we examined the global distributions of *P. coracis* [37], *P. tymphrestos* [38], and *P. gionica* [39], according to IUCN species status assessments. We also included populations from three mountains currently assigned to *P. coracis* and *P. tymphrestos* based on preliminary phylogenetic results provided before publication (Nefeli

Kotitsa, *pers. com*) (Table 1). For the genus *Oropodisma*, we evaluated the global distributions of *O. willemsei* [40] and *O. tymphrestosi* [41], according to IUCN species status assessments. We further considered new phylogenetic results made available to us for the purpose of our study before forthcoming publications (Joaquín Ortego, *pers.com)*, including three more mountains, and changing the taxonomy of the species considered as *O. tymphrestosi* in IUCN assessments [41] to *O. willemsei* in two mountains (Table 1).

Table 1. The distribution of the target species across the seven mountains of the study area. Mountains: T: Tymphrestos; H: Helidona; K: Kaliakouda; Ox: Oxia; Oi: Oiti; T: Tymphrestos; V: Vardousia; G: Giona. Source of data: ●: IUCN; ○: preliminary phylogenetic data [37–41]; x: IUCN data not considered.

Genus	Species	Mountains						
		T	H	K	Ox	Oi	V	G
Parnassiana	*P. coracis*				○		●	
	P. tymphrestos	●	○	○		●		
	P. gionica							●
Oropodisma	*O. willemsei*		○	○	○	○	○	●
	O. tymphrestosi	●				x	x	

2.2. Orthoptera Sampling

We sampled the five targeted species in August 2021–2024 at the peak of adult activity [17], by visiting 174 sites (Figure 1), representing the species microhabitats at different elevation zones, and focusing on mountain grasslands above the tree line and on forest clearings. By employing the time-constraint visit method, we conducted a 45 min active search for the target species in each site. When the species were encountered, we marked a quadrat with a standard area of 100 m^2 (10 m × 10 m) to count individuals. Considering the limited dispersal ability of these flightless species [42], we maintained a minimum spacing of 100 m among quadrats.

2.3. Microhabitat Parameters

We recorded 12 microhabitat parameters in each quadrat (see Table 5), following the methodological approach of a previous study on the same genera [18]. We recorded two topographic parameters, namely altitude (Al) and slope (Sl), and four ground cover parameters, namely soil (So), rock (R), stone (St), and vegetation (Vg) cover. We also recorded six vegetation-related variables, estimating the cover, mean, and maximum height of herbaceous plants (Hcover, Ghmean, and Ghmax, respectively) and robust herbaceous plants and shrubs (Rpcover, Rpmean, and Rpmax, respectively). We distinguished herbaceous plants without woody stems or roots, and robust herbaceous plants or shrubs with a woody stem, a woody base, or both [43]. Finally, we produced an inventory of the dominant plant species, defined as those with ground cover >70% in each quadrat. Plant species were primarily identified in the field, and where it was not possible, we collected some specimens for further examination in the laboratory using a stereoscope.

2.4. Environmental Data

We considered a dataset of 44 variables, including 37 bioclimatic-, 6 topographic-, and 1 vegetation-related variable, and rescaled all of them to a spatial resolution of 100 × 100 m cells (Table S1). We calculated the bioclimatic variables used in the SDMs with ClimateEU v4.63 [44] and the 'dismo' 1.1.4 [45] and 'envirem' 2.2 [46] R packages, adhering to methodologies described in [44,47,48]. We calculated topographical metrics using functions from

"raster" 2.6.7, "terra" 1.7.46 [49], and "spatialEco" 1.2-0 R packages [50]. We tested variables for collinearity, using Spearman rank correlation ($<|0.7|$) and variance inflation factors (VIFs < 5) [51] with the "collinear" 1.1.1 R package [52]. We used a set of 14 independent variables to feed the SDMs (8 variables for the *Oropodisma* complex, 9 for *O. willemsei*, 5 for *O. tymphrestosi*, 9 for the *Parnassiana* complex, 8 for *P. coracis*, 9 for *P. tymphrestos*, and 7 for *P. gionica*) (Table A3).

2.5. Data Analysis

2.5.1. Current Distribution Range

We delineated the potential distributional ranges of the target species in terms of alpha hulls, based on occurrence data. We calculated the alpha hulls using the 'EOO.computing' function from the "ConR" 1.3.3 package [53]. Alpha hulls provide more accurate distribution range estimates than convex hulls because they exclude discontinuities within the range and are more efficient when habitats exhibit irregular shapes or when sampling distributions are uneven [54]. This refinement is adequate for rare and threatened species, such as those in our study, where conventional methods tend to overestimate the true extent of distribution [55] (Figure S2).

2.5.2. Species Distribution Models

We conducted species distribution modeling (SDM) to predict suitable habitats for the target species. First, we cleaned the data utilizing the 'clean_coordinates' from the "CoordinateCleaner" 2.0.18 R package [56]. We then removed duplicate occurrences using the 'elimCellDups' function from the "enmSdm" 0.5.3.3 R package [57], followed by spatial thinning of the data with the 'thin' function from the "spThin" 0.1.0 R package [58], according to [58,59]. We managed raster data for environmental variables with the "terra" 1.7.29 package [49]. The final dataset comprised 122 records for the *Parnassiana* complex (49 for *P. coracis*, 57 for *P. tymphrestos*, and 16 for *P. gionica*) and 89 for the *Oropodisma* complex (66 for *O. willemsei* and 23 for *O. tymphrestosi*) at a scale of 100 × 100 m cells.

Next, we addressed spatial autocorrelation and sampling biases by implementing block cross-validation. We employed the 'cv_spatial' function from the "blockCV" 2.1.3 package [60] to partition our data into spatial blocks. For *P. gionica*, we randomly partitioned the data with the 'bm_CrossValidation' function from the "biomod2" 4.2.4 R package, as it had less than 20 occurrences [61,62]. To balance presences and absences, we generated pseudo-absence points using the 'sample_pseudoabs' function from the "flexsdm" 1.3.3 package [63], applying geographical and environmental constraints depending on the data density [64]. For *P. gionica*, we created random pseudo-absences, as is recommended for very rare species [61,62].

We then constructed an ensemble of small models (ESM), as the occurrence-to-predictor ratio for the target species was below 10:1, to accurately capture the realized climatic niches of these rare species [65]. Using the "ecospat" 3.1 package [66], we calibrated random forest models with the 'ecospat.ESM.Modeling' function and combined them into ensemble models with the 'ecospat.ESM.EnsembleModeling' function. To calculate the variable contribution of each variable, we used the 'ecospat.ESM.VarContrib' function. This function shows the proportional contribution of the variables in the final ensemble model, with a value higher than 1 indicating that the focal variable has a higher contribution than average. We used the random forest algorithm for species distribution modeling [67] and we evaluated model performance with several metrics following [68,69]. We optimized model thresholds with the 'ecospat.max.kappa' function from the "ecospat" 3.1 package [66] and only models with a value of True Skill Statistic (TSS) ≥ 0.4 [70], to generate binary maps (presence−absence).

Finally, we produced the species maps (habitat suitability and binary maps) by excluding the cells that had high extrapolation values. To address potential extrapolation errors, we quantified uncertainty in our predictions using the 'extra_eval' function from the "flexsdm" 1.3.3 package [63], and we investigated several distance thresholds for both species regarding their extrapolation values for model prediction truncation [71]. This strategy provides a safeguard against potential prediction errors [72]. We then truncated habitat suitability maps by excluding areas with high extrapolation uncertainty. Finally, we generated binary maps to distinguish suitable from unsuitable habitats.

2.5.3. Modeling Microhabitat Effects on Population Densities

We employed models to identify the microhabitat parameters (explanatory variables) potentially influencing the population densities of the target species (response variable). Fourteen explanatory variables were considered, including twelve continuous variables derived from quadrat sampling and two nominal variables representing sampling sites and sampling years (Table 1).

We created seven datasets, one for each genus complex and one for each species separately and then we took four steps before modeling for each dataset. To select the environmental variables, first, we tested for multi-collinearity using Spearman rank correlation ($r < |0.55|$) and variance inflation factors (VIFs < 5) [51]. Second, we checked for influential values (outliers), and every participant coefficient with a Cook's distance value over 1, was excluded from the models [73]. Third, we standardized all continuous numerical values, by subtracting their mean and dividing by their standard deviations. Finally, we selected the most influential variables to obtain a ratio closer to 10 events per variable [74], using the Least Absolute Shrinkage Operator (LASSO) regularization path [75]. For this process, we applied the function 'cv.glmnet' from the "glmnet" 4.1-8 R package [76]. We reduced the randomness of the function by performing 1000 iterations and choosing the lambda with the minimum average error.

We modeled the effects of microhabitat parameters on the population densities of the target species by applying generalized linear models (GLMs). We used negative binomial distribution for all datasets, accounting for overdispersion. Six variables were selected as fixed effects for the *Parnassiana* dataset, and eight variables were selected for the *Oropodisma* dataset. Subsequently, we fitted generalized linear mixed effects models (GLMMs) for each dataset, incorporating sites and years as random effects using the "lme4" 1.1-35.5 R package [77]. We assessed the necessity of including sites nested within years as a random effect via likelihood ratio tests (LRTs) comparing GLMs and GLMMs for each dataset [78]. The log-likelihood difference between the two models was calculated, and the test statistic was derived from the chi-squared distribution. For both genus complexes and *O. willemsei* datasets, a low p-value (<0.05) indicated that including random effects significantly improved model fit. Therefore, we proceeded with GLMMs for these three datasets and GLMs for the rest of the species. The exception was *P. gionica* where we used the Generalized Additive Model (GAM) with altitude as a smooth term, as it had reasonable effective degrees of freedom (edf = 5.55) and significantly improved model fit.

To identify confidence sets of best models, we used a multimodel inference approach [79] by comparing all the models for each dataset with all possible combinations of variables using the 'dredge' function from the "MuMIn" 1.47.5 R package [80]. We ranked models according to their Akaike Information Criterion value for a small sample size (AICc) to identify those with the best fit. We considered models with ΔAICc < 2 as good and as the "best" model (the one with the lowest AICc value) [81] and then we employed model averaging to reduce model selection uncertainty [79]. To evaluate the relative importance of each variable for each dataset, we summed the Akaike weights

across all models that included the covariate under consideration [79]. Finally, we assessed the model's goodness of fit in GLMMs using marginal and conditional R^2 values [82], calculated with the 'r.squaredGLMM' function in the "MuMIn" R package [80]. For GLMs and GAMs, we estimated the adjusted R^2 using the 'r2' function from the "performance" 0.12.4 R package [83]. We performed all statistical analyses in the R software environment, version 4.4.1 [84].

3. Results

3.1. Current Distribution Pattern and Population Densities

We recorded the presence of *Parnassiana* in 70% and of *Oropodisma* in 51% of the 174 sites visited, with an average population density of 8.9 and 8.5 individuals per m^2, respectively (Table 2). *Parnassiana tymphrestos* showed the highest population density and a large distribution range, followed by *O. willemsei*. *O tymphrestosi* showed the lowest population density and the most restricted distribution range, followed by *P. gionica* (Table 2, Figure S2).

Table 2. Number of sites with species presence (N), distribution range (see Figure S2), and mean population density in quadrats sampled (n).

Genus	Species	N (n)	Presence in Sites Sampled (%)	Distribution Range (km^2)	Population Density (ind/m^2)
Parnassiana	*P. coracis*	49 (47)	28	896	7.2 (±6.9)
	P. tymphrestos	57 (54)	33	2138	12.2 (±13.4)
	P. gionica	16 (16)	9	474	3.8 (±2.2)
	Subtotal	122 (117)	70	2802	8.9 (±10.6)
Oropodisma	*O. willemsei*	66 (63)	38	2114	8.5 (±9.6)
	O. tymphrestosi	23 (23)	13	410	2.5 (±8.1)
	Subtotal	89 (86)	51	2438	8.5 (±9.6)

We found that *P. tymphrestos* co-occurred at half of the sites with *O. willemsei* and less frequently with *O. tymphrestosi*; *O. willemsei* was also syntopic in about one-third of the quadrats with *P. coracis* and *P. gionica*. Species of the same genus were never syntopic, although their distribution ranges overlapped (Table 3).

Table 3. Frequency of co-occurrence (%) at sites sampled and percentage (%) of the species distribution range overlapping with other syntopic species in parenthesis (see Figure S2).

Species	*P. coracis*	*P. tymphrestos*	*P. gionica*	*O. willemsei*	*O. tymphrestosi*
P. coracis	-				
P. tymphrestos	0 (25.4)	-			
P. gionica	0 (13.8)	0 (23.8)	-		
O. willemsei	34.8 (41.3)	50.8 (68.8)	27.7 (21.1)	-	
O. tymphrestosi	0 (1.1)	36.8 (19.9)	0 (0)	0 (4.7)	-

3.2. Habitat Suitability

The total area of suitable habitat for the *Parnassiana* complex was 83 km^2, and for the *Oropodisma* complex, it was 169 km^2 (Figure 2). All models exhibited strong performance, achieving high pooled values for AUC (0.83 to 0.98), TSS (0.88 to 0.94), and Boyce (0.86 to 0.91) indices.

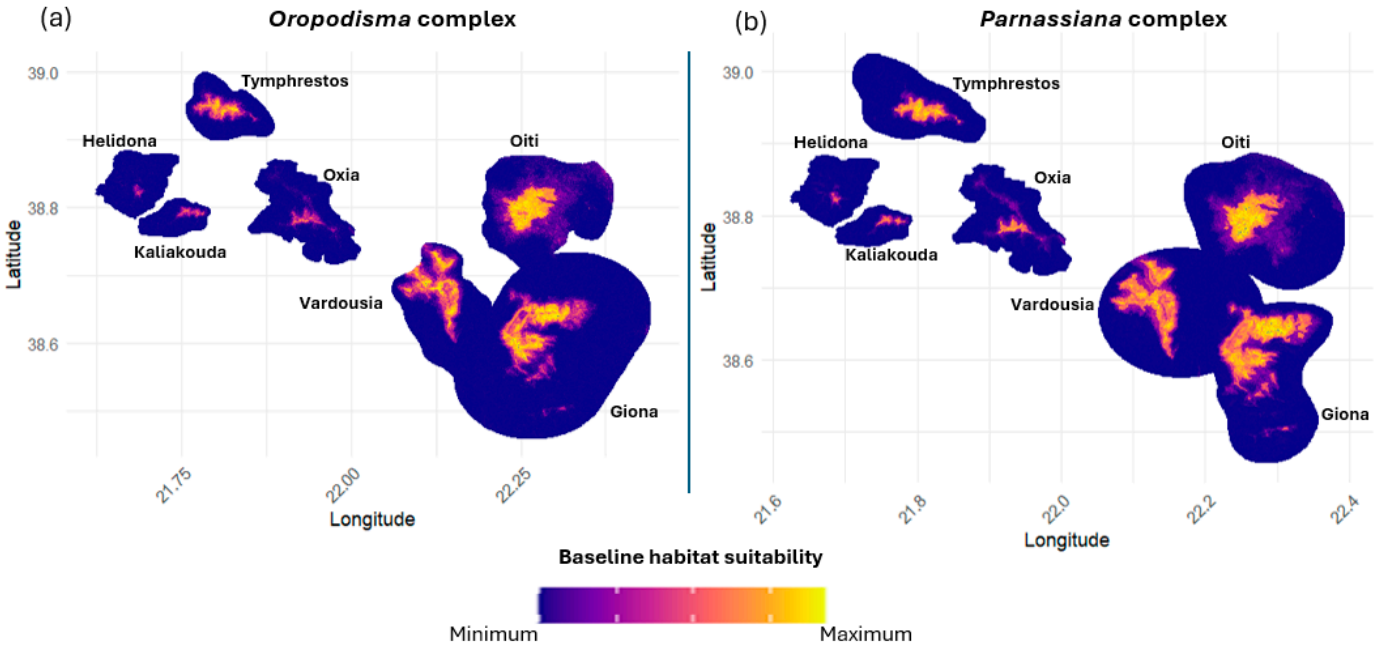

Figure 2. Habitat suitability maps for the target genera within their potential distribution areas. Panel (**a**) illustrates the habitat suitability for the *Oropodisma* genus and panel (**b**) shows the habitat suitability for the *Parnassiana* genus. The maps depict continuous habitat suitability values.

Among the predictors with an importance value (>1) shaping the suitable habitat for the genus complexes and the target species, the Normalized Difference Vegetation Index (NDVI) and Potential Evapotranspiration of the Driest Quarter (PETDQ) emerged as the primary determinants (Table 4). Precipitation of the Driest Quarter was a strong predictor for *Parnassiana*, and Potential Evapotranspiration of the Wettest Quarter (PETWQ) was a strong predictor for *Oropodisma*. In total, six predictors contributed above the average for *Parnassiana* (five for *P. coracis*, five for *P. tymphrestos*, three for *P. gionica*, four for *Oropodisma* complex, four for *O. willemsei*, and five for *O. tymphrestosi)* (Table A3).

Table 4. Key environmental predictors and their value ranges for suitable habitats of *Parnassiana* and *Oropodisma* complexes and their species. NDVI: Normalized Difference Vegetation Index; PETDQ: Potential Evapotranspiration of the Driest Quarter; PETWQ: Potential Evapotranspiration of the Wettest Quarter; and PDQ: Precipitation of the Driest Quarter.

Genus	Taxa	NDVI	PETDQ (mm/month)	PDQ (mm)	PETWQ (mm/month)
Parnassiana	*Parnassiana* complex	0.2–0.4	100–200	133–147	-
	P. coracis	0.2–0.4	100–200	133–136, 139–140	-
	P. tymphrestos	0.3–0.4	150–200	143–147	-
	P. gionica	0.3–0.4	150–200	143–147	-
Oropodisma	*Oropodisma* complex	0.2–0.4	100–220	-	100–120, 190–240
	O. willemsei	0.2–0.4	150–210	-	100–120, 190–240
	O. tymphrestosi	0.3–0.4	100–200	-	100–120, 190–240

3.3. Microhabitat

3.3.1. Microhabitat Description

All species occurred in mountainous grasslands at elevations ranging from 1527 to 2403 m (Table 3), assigned to four habitat types listed in Annex I of the Habitats Directive (92/43/EEC). We recorded the following habitats in the quadrats sampled: “Species-rich Nardus grasslands” (priority habitat 6230*), occurring on Mt. Helidona; “Endemic oro-

Mediterranean heaths with gorse" (4090), prevailing at the sites sampled on Mts. Vardousia, Kaliakouda, and Oxia; the "Alpine and Boreal heaths" (4060) prevailing at the sites sampled on Mt. Oiti; and "Alpine and subalpine calcareous grasslands" (6170), prevailing at the sites sampled on Mt. Tymphrestos. We recorded twenty-six dominant plant species (10 families), with five dominant species shaping the microhabitat of the target species in the quadrats sampled, namely *Festuca jeanpetrii*, *Eryngium amethystinum*, *Trisetum flavescens*, *Astragalus creticus rumelicus*, and *Thymus longicaulis* (Table S2).

Parnassiana species preferred general medium slopes (~20°) above the tree line, covered by extensive herbaceous vegetation (~60%), of medium height (~25 cm), with patches of stony substrates and less bare soil, and substantial cover of low thorny bushes (~35%), where they were hidden (Table 5). The species of the genus *Oropodisma* preferred habitats with a substantial cover of stony and rocky substrate (~40%), and they were usually found under loose stones.

Table 5. Environmental parameters and the main dominant plant species recorded in the quadrats of each target species. The total percentage of the dominant plant species in the plots is presented. Total vegetation cover is divided into herbaceous plant cover and robust herbaceous plant and shrub cover.

	Parnassiana						***Oropodisma***			
	P. coracis		***P. tymphrestos***		***P. gionica***		***O. willemsei***		***O. tymphrestosi***	
Variable	**Mean**	**Min–Max**	**Mean**	**Min–Max**	**Mean**	**Min–Max**	**Mean**	**Min–Max**	**Mean**	**Min–Max**
Elevation (m)	1782	1555–2403	1890	1542–2241	2037	1758–2135	1948	1567–2403	1970	1648–2241
Slope (°)	23.5	0–45	19.2	0–43	21	4–41	22.18	0–45	22.09	0–42
Soil cover (%)	7.1	0–35	6.4	0–25	3.4	0–10	22.18	0–45	4.57	0–12
Rock cover (%)	8.8	0–60	9.3	0–38	7.6	0–20	10.44	0–38	13.48	0–38
Stone cover (%)	11.8	0–60	15.48	0–65	29.8	5–55	20.63	0–60	23.09	0–45
Herb/grass cover (%)	66.4	30–97	66.5	20–100	56.8	35–90	63.36	30–98	67.52	30–98
Shrub/robust plant cover (%)	33.1	0–70	33.3	0–80	43	10–65	35.25	3–70	32.48	2–70
Grass/herb height (cm)	28.1	10–120	25.1	2.75–125	25.1	2.75–125	23.41	7–107	25.2	12.5–80
Shrub/robust plant height (cm)	33.1	10–140	16.4	0–90	16.4	0–90	14.66	6–120	11.33	5–65
Plant Species	**Percentage of Plots**									
Festuca jeanpertii	74.4%		69.6%		35.6%		68.7%		52.63%	
Eryngium amethystinum	51.8%		31.2%		54.6%		48.2%		7.37%	
Trisetum flavescens	50.0%		40.9%		18.3%		39.9%		31.58%	
Astragalus creticus subsp. *rumelicus*	52.8%		60.5%		67.8%		60.8%		28.42%	
Thymus longicaulis	65.6%		57.6%		28.3%		49.0%		53.68%	

3.3.2. Predictors of Population Density

The population density of the *Parnassiana* complex was positively affected by altitude (Alt) and negatively by stone cover (St). At the species level, altitude positively affected *P. coracis*, while stone cover (St) exerted a negative effect on *P. tymphrestos* and *P. gionica*. Slope exerted a strong positive influence on the populations of *O. willemsei*, while rock cover (R) negatively influenced *O. willemsei*, and soil cover (So) negatively influenced *O. tymphrestosi* (Table 6).

Models on the two complexes yielded low marginal R^2 (R2m) values of approximately 10–11% and 10–13% for *Parnassiana* (4 models) and *Oropodisma* (11 models), while conditional R^2 values (R2c) accounting for random effects succeeded in explaining 90% and 92% of the variation, respectively (Table A2).

Table 6. Model-averaged coefficients for all variables that were included in the set of best-ranked models (ΔAICc < 2), with the *p*-value and cumulative model weights (summed Akaike weights) indicating the relative importance of each variable. Alt: altitude; St: stone cover; Sl: slope; R: rock cover; So: soil cover; Rpmean: mean height of shrubby vegetation; Ghmean: mean height of herbaceous vegetation; Hcover: herbaceous plant cover.

Genus	Taxa	Variable	Coefficient	Pr (>|z|)	Cumulative Weight
Parnassiana	*Parnassiana* complex	Alt	0.0018	0.0028 *	0.796
		St	−0.0173	0.0037 *	0.228
		Rpmean	−0.0070	0.1684	0.154
		Ghmean	−0.0035	0.3143	0.120
	P. coracis	Alt	0.0035	0.00003 ***	0.911
		Sl	0.0131	0.0849	0.235
		St	−0.0144	0.1192	0.163
		Rpmean	−0.0074	0.2059	0.112
	P. tymphrestos	St	−0.0278	0.0012 **	0.916
		Ghmean	−0.0053	0.1407	0.187
		R	−0.0186	0.1960	0.185
		Slope	−0.0125	0.3440	0.125
	P. gionica	St	−0.1003	0.0275 *	1
		R	0.1808	0.0584	0.654
		Sl	0.0675	0.0822	0.086
Oropodisma	*Oropodisma* complex	Slope	0.0174	0.0208 *	0.969
		Ghmean	−0.0215	0.0550	0.197
		R	−0.0214	0.0892	0.149
		Hcover	−0.0085	0.2298	0.139
		So	0.0398	0.2448	0.120
		Rpmean	0.0398	0.3620	0.118
	O. willemsei	R	−0.3394	0.0059 **	0.625
		Sl	0.0169	0.0266 *	0.316
		Ghmean	−0.0246	0.0519	0.192
		Rpmean	−0.0179	0.0540	0.117
	O. tymphrestosi	So	−0.1502	0.0058 **	0.5960
		Hcover	0.0165	0.1391	0.2290

***: $p < 0.001$; **: $p < 0.01$; *: $p < 0.05$.

4. Discussion

4.1. Species Distribution and Population Densities

Although all species have small distribution ranges, aligning with their IUCN classifications as globally threatened [37–41], our findings showed variations in their distribution range and population densities. These disparities may reflect differences in species-specific traits that strongly affect species' abundance and distribution patterns, as has been observed in other insects [85].

We found that *P. tymphrestos* and *O. willemsei* were the two species with the largest distribution ranges and highest population densities at the quadrats sampled, followed by *P. coracis.* The two species seem to have a broader ecological niche as compared to the other species, as also indicated by the range of minimum and maximum values across the different microhabitat variables in the quadrats sampled (Table 5). They seem to possess greater ecological plasticity [86] and show greater ecological adaptability, which is reported to relate to wider distribution ranges and higher densities in Orthoptera [87,88]. On the contrary, *O. tymphrestosi* and then *P. gionica* had the most restricted distribution ranges and lowest population densities. The two species seem to have a greater specialization in

microhabitat selection or sensitivity to environmental disturbances [89], emphasizing the importance of conserving specialized habitats to maintain these insect populations [90].

Our results directly rely on the unpublished phylogenetic studies on the taxonomy of the species across the seven mountains studied. Any change in the taxonomy used in the current study would greatly change the results obtained. We stress the need for phylogenetic research, in particular for threatened species, clarifying the species taxonomy, in order to better inform conservation strategies [91,92]. We also underline the need for extensive field data collection combined with the use of quantitative analytical tools such as species distribution models and regression analyses, to improve our ecological understanding of poorly known insect species that are globally threatened.

4.2. Habitat Suitability

The most influential factor for the habitats of almost all target species was the Normalized Difference Vegetation Index (NDVI), reflecting the amount of healthy green vegetation in the habitats of the species. We found low to moderate NDVI values (0.2–0.4) in the suitable habitats of the target species (Table 4). This can be explained by the non-forest character of the habitats where the species were recorded, namely grasslands above the tree line without lush vegetation, as indicated by the dominant plant species recorded (Table 5). This index has been used to monitor Orthoptera habitats [93] and is deemed a useful tool to monitor insect diversity in remote and inaccessible regions, like montane ecosystems, influencing and predicting insect diversity [94,95]. The NDVI is also found to influence the suitable habitat of *Oropodisma parnassica*, an endangered grasshopper that inhabits Mts. Parnassos and Elikonas, to the southeast of our study area [18].

Our analysis demonstrated the significant influence of climatic variables on habitat suitability. Bioclimatic variables, including Potential Evapotranspiration of the Driest Quarter (PETDQ), Potential Evapotranspiration of the Wettest Quarter (PETWQ), and Precipitation of the Driest Quarter (PDQ, bio17), also shaped the suitable habitats of these taxa. PETDQ and PETWQ reflect the potential water loss through evaporation and plant transpiration during the driest and wettest three months, respectively. Specifically, PTDQ significantly influenced the habitat suitability of all taxa, with optimal values ranging from 100 to 200 mm. PETWQ, on the other hand, had a stronger effect on the genus *Oropodisma*, exhibiting peaks at 190–240 mm and a secondary peak at 100 mm, related probably to the xerothermophilic character of the species [18]. PDQ presented a peak at 136 mm and one at 139 mm, a high potential compared with the study area (128–138 mm). These findings underscore the importance of investigating the species' response to rising potential evapotranspiration rates, driven by increased water stress in Mediterranean mountain ecosystems under global warming [96,97]. We emphasize the need for further research to assess the climatic risks these species face, including modeling their potential distributions under various climate change scenarios.

Finally, topographical variables, such as slope, aspect, and the Topographical Position Index (TPI), further shaped habitat suitability for most taxa (Table A3). Slope and aspect affect local temperature and water balance by creating diverse microclimatic conditions in mountainous terrains [98,99]. Orthoptera species exploit these microhabitats for thermoregulation, positioning themselves in sunlight, shade, or off the ground [100,101]. Indeed, grasshoppers at higher elevations have been found to be more mobile and bask more than those at lower elevations [102]. Another indication is that both genera preferred localities with high TPIs that were slightly more elevated than adjacent areas, which are likely to enhance sunlight exposure [18].

4.3. Microhabitat Preferences

At finer spatial scales, we observed that the population density of the *Parnassiana* complex increased with elevation (Table 6), with the highest density recorded at 2200 m. While the elevation gradient is often associated with a decline in species richness and abundance [103,104], certain Orthoptera species exhibit genetic adaptations to cooler climates at higher elevations [105]. The genus *Parnassiana*, comprising montane species, is adapted to high-altitude environments, and *P. coracis* also shows a preference for these elevated habitats. Similar positive associations between altitude and insect populations have been observed in other montane insects, attributed to the availability of suitable microhabitats and the stability of local environmental conditions [106]. In contrast, the stone cover negatively impacted the population density of the *Parnassiana complex*, including *P. tymphrestos* and *P. gionica*. Although increased stone cover can enhance Orthoptera populations by promoting habitat heterogeneity [6], high levels of stone cover are generally associated with reduced vegetation, which limits food and shelter resources [107,108]. Consequently, *Parnassiana* species tend to avoid habitats with extensive stone cover, as they use thorny bushes for hiding.

We found a positive correlation between slope and population densities of the *Oropodisma* complex and *O. willemsei*, with these taxa showing a preference for slopes averaging 22 degrees. Slope steepness is crucial in the formation of microhabitats [98], and south-facing slopes provide basking opportunities and are preferred by grasshoppers due to their habitat preferences [109]. This effect is especially pronounced at higher elevations, where grasshoppers tend to be more mobile and exhibit greater basking behavior than those at lower elevations [102]. Previous research has demonstrated that other species in the same tribe as *Oropodisma* (Melanoplinae) are capable of dynamically adjusting their behavior to microclimatic changes, thereby maintaining optimal body temperatures [101]. Conversely, rock and soil cover negatively influenced the populations of *O. willemsei* and *O. tymphrestosi*, respectively. Studies have shown that most Orthoptera species avoid bare soil [13,110]. Although bare soil patches are favored by xerothermophilic species [19], habitats dominated by bare ground or rocky substrates generally offer less favorable conditions for species reliant on vegetation for cover and nourishment [111].

5. Conclusions

Our study provides conservation-relevant insights for five montane endemic Orthoptera species. We delivered the current distribution maps of the five globally threatened species along with their habitat suitability maps, delineating their potential distributions. These outputs, together with the insights into their ecological requirements, provide a guideline for montane grassland management by competent authorities. Our results underscored the vulnerability of these species to habitat loss and degradation, due to their limited distribution. Further research is recommended to elucidate the phylogeny of the species and to assess the impact of climate change on distribution shifts, in order to inform adaptive management plans.

Supplementary Materials: The following supporting information can be downloaded at https://www.mdpi.com/article/10.3390/ecologies6010005/s1: Figure S1: Photos of the five target species: (a) *Parnassiana coracis*, (b) *Parnassiana tymphrestos*, (c) *Parnassiana gionica*, (d) *Oropodisma willemsei*, and (e) *Oropodisma tymphrestosi*. Figure S2: Alpha hull distributions of *Parnassiana* and *Oropodisma* species across central Greece. The top map illustrates the alpha hulls for *Parnassiana* species, with *P. tymphrestos* (blue), *P. coracis* (orange), and *P. gionica* (green). The bottom map shows the alpha hulls for the Oropodisma species, with *O. tymphrestosi* (yellow) and *O. willemsei* (brown). Key mountain ranges are highlighted to indicate species' spatial distributions. Table S1: The full dataset of 28 variables considered for the species distribution modeling, indicating the 14 variables selected. Table S2. The

list of the dominant plant species (>70% cover) recorded in the quadrats for the genera *Parnassiana* and *Oropodisma* at each mountain.

Author Contributions: Conceptualization, V.K. and A.S.; methodology, V.K., A.S., and K.K.; formal analysis, A.S., K.K., and K.Z.; investigation, A.S., G.F., O.T., V.K., and L.W.; resources, V.K.; writing—original draft preparation, A.S., V.K., and G.F. writing—review and editing, A.S., K.K., K.Z., G.F., L.W., O.T., and V.K.; visualization, A.S. and V.K.; supervision, V.K.; funding acquisition, A.S. and V.K.; project administration, V.K. All authors have read and agreed to the published version of the manuscript.

Funding: The research was funded by the Management Agency of Oiti National Park (NECCA) under the EMEPERA scheme for the project 'Investigating the endemic and threatened entomofauna in Oiti and Tymphrestos (2021–2022: code 5032589)'. The research work of the first author was supported by the Hellenic Foundation for Research and Innovation (HFRI) under the 4th Call for HFRI PhD Fellowships (Fellowship Number: 11266: 2023–2026).

Institutional Review Board Statement: All research was conducted under the appropriate annual research permits issued by the Department of Forest Management of the Directorate General of Forests and Forest Environment of the Ministry of Environment and Energy of Greece (protocol code: 17898/705).

Informed Consent Statement: Not applicable.

Data Availability Statement: Data are contained within the article.

Acknowledgments: We are grateful to the Natural Environment and Climate Change Agency (NECCA) for providing us with a four-wheel-drive vehicle for carrying out part of the sampling. We are also deeply thankful to Vassia Margaritopoulou from the local Management Unit of Parnassos and Oiti National Parks and Protected Areas of Eastern Central Greece (NECCA) for her support in the fieldwork. We express our warmest appreciation to Joaquín Ortego and Nefeli Kotitsa for generously sharing their preliminary results regarding the phylogeny of the species. We thank Elvira Sakkoudi and Ilias Blanis for their valuable support and help in fieldwork and plant specimen identification. Finally, we warmly thank Konstantina Nasiou for her dedicated volunteer support during the fieldwork.

Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A

Table A1. Key characteristics of the mountains that constitute the study area and include the target species: peak altitudes, Natura 2000 site codes, and annual rainfall and temperatures (averages from the years 2021–2023 [112]).

Mountain	E (m)	N2000	R (mm)	T (°C)
Giona	2508	GR2450002	897	7.5
Helidona	1974	-	1024	9.5
Kaliakouda	2099	-	1027	7
Oiti	2151	GR2440007	835	9
Oxia	1923	-	1028	10
Tymphrestos	2313	GR2430001	1045	7
Vardousia	2495	GR2450001	833	9.5
Total (7)	-	4	833–1045	7–9.5

Appendix B

Table A2. Summary of top-ranked models for the two complexes and the five target species. k: number of parameters; AICc: AIC corrected for small sample size; ΔAICc: differences in the model from the best model AIC; wi: model's Akaike weight; R2m: R-squared values of fixed effects for all models; R2c: R-squared values of random effects for GLMs: Generalized Linear Models; GLMMs: Generalized Linear Mixed Models; and GAMs: Generalized Additive Models (only models with ΔAICc < 2 were considered in model averaging). Alt: altitude; St: stone cover; Sl: slope; R: rock cover; So: soil cover; Rpmean: mean height of shrubby vegetation; Ghmean: mean height of herbaceous vegetation; Hcover: herbaceous plant cover.

Genus	Taxa	Rank	Model	k	AICc	ΔAICc	wi	R2m	R2c
Parnassiana	*Parnassiana* Complex (GLMM)	1	Alt + St	2	731.6	0	0.294	0.1	0.9
		2	Alt + St + Rpmean	3	732.1	0.51	0.228	0.1	0.9
		3	Alt + St + Ghmean	3	732.9	1.30	0.154	0.11	0.9
		4	Alt + St + Rpmean + Ghmean	4	733.4	1.79	0.120	0.11	0.9
	P. coracis (GLM)	1	Alt + Slope	2	272.2	0	0.243	0.29	-
		2	Alt + Slope + St	3	272.3	0.07	0.235	0.33	-
		3	Alt + St	2	273	0.8	0.163	0.38	-
		4	Alt	1	273.1	0.86	0.158	0.31	-
		5	Alt + Rpmean + St	3	273.8	1.56	0.112	0.34	-
	P. tymphrestos (GLM)	1	St	1	374	0	0.257	0.15	-
		2	St + Ghmean	2	374.6	0.64	0.187	0.17	-
		3	St + R	2	374.6	0.65	0.185	0.17	-
		4	St + Ghmean + R	3	374.9	0.92	0.162	0.21	-
		5	St + Sl	2	375.4	1.44	0.125	0.16	-
	P. gionica (GAM)	1	St + Sl + R	3	596.7	0	1	0.990	-
Oropodisma	*Oropodisma* Complex (GLMM)	1	Sl + R + Ghmean	1	536	0	0.246	0.11	0.91
		2	Sl + Ghmean	2	536.5	0.45	0.197	0.09	0.91
		3	Sl + Ghmean + Hcover + R	2	537	1.01	0.149	0.13	0.92
		4	Sl + So	2	537	1.01	0.149	0.08	0.91
		5	Sl + R	2	537.2	1.14	0.139	0.07	0.91
		6	Sl + Ghmean + So	3	537.5	1.44	0.12	0.10	0.91
		7	Sl + Ghmean + Hcover	3	537.6	1.57	0.98	0.10	0.92
		8	Sl + Ghmean + R + Rpmean	4	537.7	1.64	0.043	0.12	0.91
		9	Sl	1	537.8	1.77	0.035	0.04	0.91
		10	Sl + R + So	3	537.9	1.91	0.026	0.09	0.91
		11	Sl + R + Rpmean	3	538	1.97	0.026	0.09	0.91
	O. willemsei (GLMM)	1	R + Sl + Rpmean + Ghmean	4	399.6	0	0.402	0.24	0.55
		2	R + Sl + Ghmean	3	401	1.43	0.197	0.21	0.52
	O. tymphrestosi (GLM)	1	So	1	137.3	0	0.367	0.19	-
		2	Hcover + So	2	138.3	0.94	0.229	0.28	-

Appendix C

Table A3. The proportional contribution of each variable in the final ensemble model for each taxon. A value higher than 1 indicates that the focal variable has a higher contribution than average bio2: Mean Diurnal Range; bio3: Isothermality; bio4: Temperature Seasonality; bio14: Precipitation of Driest Month; bio17: Precipitation of Driest Quarter; PETWQ: Potential Evapotranspiration of the Wettest Quarter; PETDQ: Potential Evapotranspiration of the Driest Quarter; AIT: Thornthwaite Aridity Index; Continentality: the difference in average temperature between the hottest and coldest months; TPI: Topographical Position Index; HLI: Heat Load Index; NDVI: Normalized Difference Vegetation Index].

Parnassiana			*Oropodisma*		
Taxon	**Variable**	**Importance**	**Taxon**	**Variable**	**Importance**
Parnassiana complex	HLI	1.15	*Oropodisma* complex	bio3	1.20
	bio17	1.09		PETWQ	1.18
	PETDQ	1.08		TPI	1.06
	NDVI	1.04		NDVI	1.02
	aspect	1.03		HLI	1.00
	slope	1.02		slope	0.97
	bio3	0.95		bio4	0.94
	TPI	0.88	*O. tymphrestosi*	AIT	1.33
	bio4	0.80		NDVI	1.02
P. coracis	bio17	1.72		TPI	0.86
	TPI	1.27		slope	0.79
	NDVI	1.23		HLI	0.69
	aspect	1.06	*O. willemsei*	PETDQ	1.16
	PETDQ	1.05		NDVI	1.11
	HLI	0.81		PETWQ	1.11
	slope	0.69		bio2	1.04
	bio3	1.43		bio17	0.97
P. tymphrestosi	HLI	1.26		TPI	0.97
	PETDQ	1.22		bio3	0.94
	PETWQ	1.20		HLI	0.93
	slope	1.12		aspect	0.86
	NDVI	1.01			
	bio2	0.90			
	bio3	0.80			
	aspect	0.80			
	TPI	0.76			
P. gionica	PETDQ	1.47			
	bio3	1.43			
	continentality	1.07			
	NDVI	0.965			
	TPI	0.912			
	HLI	0.741			
	aspect	0.629			

References

1. Mizsei, E.; Boros, Z.; Lovas-Kiss, Á.; Szepesváry, C.; Szabolcs, M.; Rák, G.; Ujszegi, J.; Gál, Z.; Lengyel, S.; Puskás, G. A trait-based framework for understanding predator–prey relationships: Trait matching between a specialist snake and its insect prey. *Funct. Ecol.* **2019**, *33*, 2354–2368. [CrossRef]
2. Sow, A.; Haran, J.; Benoit, L.; Galan, M.; Brévault, T. DNA Metabarcoding as a Tool for Disentangling Food Webs in Agroecosystems. *Insects* **2020**, *11*, 294. [CrossRef] [PubMed]

3. Li, W.-J.; Li, F.-F.; Bai, J.; Liang, K.; Li, K.; Qin, G.-Q.; Zhang, Y.-L.; Li, X.-J. Isolation and characterization of intestinal bacteria associated with cellulose degradation in grasshoppers (Orthoptera). *J. Insect Sci.* **2023**, *23*, 7. [CrossRef]
4. Stebaev, I.V.; Molodtsov, V.V. Typology of Landscape-Regional Distribution of the Acridoidea Species in Grass Biotopes of South-West Siberia Based on Isopleth Portraits of Their Quantitative Distribution. *Biol. Bull. Russ. Acad. Sci.* **2001**, *28*, 408–416. [CrossRef]
5. Weking, S.; Kämpf, I.; Mathar, W.; Hölzel, N. Effects of land use and landscape patterns on Orthoptera communities in the Western Siberian forest steppe. *Biodivers. Conserv.* **2016**, *25*, 2341–2359. [CrossRef]
6. Zografou, K.; Adamidis, G.C.; Komnenov, M.; Kati, V.; Sotirakopoulos, P.; Pitta, E.; Chatzaki, M. Diversity of spiders and orthopterans respond to intra-seasonal and spatial environmental changes. *J. Insect Conserv.* **2017**, *21*, 531–543. [CrossRef]
7. Helbing, F.; Blaeser, T.P.; Löffler, F.; Fartmann, T. Response of Orthoptera communities to succession in alluvial pine woodlands. *J. Insect Conserv.* **2014**, *18*, 215–224. [CrossRef]
8. Löffler, F.; Poniatowski, D.; Fartmann, T. Orthoptera community shifts in response to land-use and climate change—Lessons from a long-term study across different grassland habitats. *Biol. Conserv.* **2019**, *236*, 315–323. [CrossRef]
9. Tiede, Y.; Hemp, C.; Schmidt, A.; Nauss, T.; Farwig, N.; Brandl, R. Beyond body size: Consistent decrease of traits within orthopteran assemblages with elevation. *Ecology* **2018**, *99*, 2090–2102. [CrossRef] [PubMed]
10. Gardiner, T.; Casey, D. Topographic heterogeneity influences diversity and abundance of Orthoptera in a rewilding scheme. *J. Orthoptera Res.* **2024**, *33*, 255–266. [CrossRef]
11. Kenyeres, Z.; Takács, G.; Király, G. Challenges of Orthoptera conservation in grasslands with land use-determined sizes and structural heterogeneity. *Landsc. Ecol. Eng.* **2024**, *20*, 441–453. [CrossRef]
12. Hochkirch, A.; Nieto, A.; Criado, M. *European Red List of Grasshoppers, Crickets and Bush-Crickets*; Publications Office of the European Union: Luxembourg, 2016.
13. Stefanidis, A.; Zografou, K.; Tzortzakaki, O.; Kati, V. Orthoptera Community Dynamics and Conservation in a Natura 2000 Site (Greece): The Role of Beta Diversity. *Diversity* **2024**, *16*, 11. [CrossRef]
14. Spehn, E.; Rudmann-Maurer, K.; Korner, C.; Maselli, D. *Mountain Biodiversity and Global Change*; Global Mountain Biodiversity Assessment: Basel, Switzerland, 2010.
15. Barve, S.; Dhondt, A.A. Elevational replacement of two Himalayan titmice: Interspecific competition or habitat preference? *J. Avian Biol.* **2017**, *48*, 1189–1194. [CrossRef]
16. Graham, C.H.; Carnaval, A.C.; Cadena, C.D.; Zamudio, K.R.; Roberts, T.E.; Parra, J.L.; McCain, C.M.; Bowie, R.C.K.; Moritz, C.; Baines, S.B.; et al. The origin and maintenance of montane diversity: Integrating evolutionary and ecological processes. *Ecography* **2014**, *37*, 711–719. [CrossRef]
17. Willemse, L.; Kleukers, R.; Odé, B. *The Grasshoppers of Greece*; EIS Kenniscentrum Insecten en Andere Ongewervelden: Leiden, The Netherlands, 2018.
18. Stefanidis, A.; Kougioumoutzis, K.; Zografou, K.; Fotiadis, G.; Tzortzakaki, O.; Willemse, L.; Kati, V. Mitigating the extinction risk of globally threatened and endemic mountainous Orthoptera species: Parnassiana parnassica and Oropodisma parnassica. *Insect Conserv. Divers.* **2025**, *18*, 54–68. [CrossRef]
19. Kati, V.; Dufrêne, M.; Legakis, A.; Grill, A.; Lebrun, P. Conservation management for Orthoptera in the Dadia reserve, Greece. *Biol. Conserv.* **2004**, *115*, 33–44. [CrossRef]
20. Zografou, K.; Sfenthourakis, S.; Pullin, A.; Kati, V. On the surrogate value of red-listed butterflies for butterflies and grasshoppers: A case study in Grammos site of Natura 2000, Greece. *J. Insect Conserv.* **2009**, *13*, 505–514. [CrossRef]
21. Kati, V.; Mani, P.; von Helversen, O.; Willemse, F.; Elsner, N.; Dimopoulos, P. Human land use threatens endemic wetland species: The case of *Chorthippus lacustris* (La Greca and Messina 1975) (Orthoptera: Acrididae) in Epirus, Greece. *J. Insect Conserv.* **2006**, *10*, 65–74. [CrossRef]
22. Jackson, C.R.; Robertson, M.P. Predicting the potential distribution of an endangered cryptic subterranean mammal from few occurrence records. *J. Nat. Conserv.* **2011**, *19*, 87–94. [CrossRef]
23. Thomaes, A.; Kervyn, T.; Maes, D. Applying species distribution modelling for the conservation of the threatened saproxylic Stag Beetle (*Lucanus cervus*). *Biol. Conserv.* **2008**, *141*, 1400–1410. [CrossRef]
24. Grzywacz, B.; Heller, K.-G.; Chobanov, D.P.; Warchałowska-Śliwa, E. Conventional and molecular chromosome study in the European genus *Parnassiana* Zeuner, 1941 (Orthoptera, Tettigoniinae, Platycleidini). *Folia Biol.* **2017**, *65*, 1–8. [CrossRef]
25. Guisan, A.; Thuiller, W. Predicting species distribution: Offering more than simple habitat models. *Ecol. Lett.* **2005**, *8*, 993–1009. [CrossRef] [PubMed]
26. Elith, J.; Leathwick, J.R. Species Distribution Models: Ecological Explanation and Prediction Across Space and Time. *Annu. Rev. Ecol. Evol. Syst.* **2009**, *40*, 677–697. [CrossRef]
27. Peterson, A.T. Predicting Species' Geographic Distributions Based on Ecological Niche Modeling. *Condor* **2001**, *103*, 599–605. [CrossRef]

28. Poniatowski, D.; Fartmann, T. The classification of insect communities: Lessons from orthopteran assemblages of semi-dry calcareous grasslands in central Germany. *Eur. J. Entomol.* **2008**, *105*, 659–671. [CrossRef]
29. Zuur, A.F.; Ieno, E.N.; Walker, N.J.; Saveliev, A.A.; Smith, G.M. GLMM and GAMM. In *Mixed Effects Models and Extensions in Ecology with R*; Springer: New York, NY, USA, 2009; pp. 323–341.
30. Zuur, A.F.; Ieno, E.N.; Walker, N.J.; Saveliev, A.A.; Smith, G.M. GLM and GAM for Count Data. In *Mixed Effects Models and Extensions in Ecology with R*; Springer: New York, NY, USA, 2009; pp. 209–243.
31. Araújo, M.B.; New, M. Ensemble forecasting of species distributions. *Trends Ecol. Evol.* **2007**, *22*, 42–47. [CrossRef] [PubMed]
32. Marmion, M.; Parviainen, M.; Luoto, M.; Heikkinen, R.K.; Thuiller, W. Evaluation of consensus methods in predictive species distribution modelling. *Divers. Distrib.* **2009**, *15*, 59–69. [CrossRef]
33. Kati, V.; Petridou, M.; Tzortzakaki, O.; Papantoniou, E.; Galani, A.; Psaralexi, M.; Gotsis, D.; Papaioannou, H.; Kassara, C. How much wilderness is left? A roadless approach under the Global and the European Biodiversity Strategy focusing on Greece. *Biol. Conserv.* **2023**, *281*, 110015. [CrossRef]
34. Kosztra, B.; Büttner, G. *Updated CLC Illustrated Nomenclature Guidelines*; Environment Agency Austria: Wien, Austria, 2019.
35. Economou-Eliopoulos, M.; Kanellopoulos, C. Abundance and Genetic Significance of Lithium in Karst-Type Bauxite Deposits: A Comparative Review. *Minerals* **2023**, *13*, 962. [CrossRef]
36. RAE. Geospatial Map for Energy Units and Requests. Available online: https://geo.rae.gr/?lang=EN (accessed on 24 October 2024).
37. Willemse, L.; Hochkirch, A.; Heller, K.-G.; Kati, V.; Papapavlou, K.; Tzirkalli, E. *Parnassiana coracis*. The IUCN Red List of Threatened Species. 2016: e.T68450152A70624651. Available online: https://www.iucnredlist.org/species/68450152/70624651 (accessed on 22 October 2024). [CrossRef]
38. Willemse, L.; Hochkirch, A.; Heller, K.-G.; Kati, V.; Papapavlou, K.; Tzirkalli, E. Parnassiana tymphrestos. The IUCN Red List of Threatened Species. 2016: e.T68450372A70624904. Available online: https://www.iucnredlist.org/species/68450372/70624904 (accessed on 22 October 2024). [CrossRef]
39. Willemse, L.; Hochkirch, A.; Heller, K.-G.; Kati, V.; Papapavlou, K.; Tzirkalli, E. Parnassiana gionica. The IUCN Red List of Threatened Species. 2016: e.T68450237A70624696. Available online: https://www.iucnredlist.org/species/68450237/70624696 (accessed on 22 October 2024). [CrossRef]
40. Willemse, L.; Hochkirch, A.; Kati, V.; Tzirkalli, E.; Papapavlou, K.; Heller, K.-G. Oropodisma willemsei. The IUCN Red List of Threatened Species. 2016: e.T16084523A18053580. Available online: https://www.iucnredlist.org/species/16084523/18053580 (accessed on 23 October 2024). [CrossRef]
41. Willemse, L.; Hochkirch, A.; Kati, V.; Papapavlou, K.; Tzirkalli, E.; Heller, K.-G. Oropodisma tymphrestosi. The IUCN Red List of Threatened Species. 2016: E.T16084584A70566762. Available online: https://www.iucnredlist.org/species/16084584/70566762 (accessed on 22 October 2024). [CrossRef]
42. Reinhardt, K.; Köhler, G.; Maas, S.; Detzel, P. Low dispersal ability and habitat specificity promote extinctions in rare but not in widespread species: The Orthoptera of Germany. *Ecography* **2005**, *28*, 593–602. [CrossRef]
43. Strid, A. *Mountain Flora of Greece*; CUP Archive: Cambridge, UK, 1986; Volume 1.
44. Marchi, M.; Castellanos-Acuña, D.; Hamann, A.; Wang, T.; Ray, D.; Menzel, A. ClimateEU, scale-free climate normals, historical time series, and future projections for Europe. *Sci. Data* **2020**, *7*, 428. [CrossRef] [PubMed]
45. Hijmans, R.; Philipps, S.; Leathwick, J.; Elith, J. *dismo: Species Distribution Modeling*, R Package Version 1.1-4; R Core Team: Cary, CA, USA, 2017.
46. Title, P.O.; Bemmels, J.B. ENVIREM: An expanded set of bioclimatic and topographic variables increases flexibility and improves performance of ecological niche modeling. *Ecography* **2018**, *41*, 291–307. [CrossRef]
47. Hamann, A.; Wang, T.; Spittlehouse, D.L.; Murdock, T.Q. A Comprehensive, High-Resolution Database of Historical and Projected Climate Surfaces for Western North America. *Bull. Am. Meteorol. Soc.* **2013**, *94*, 1307–1309. [CrossRef]
48. Wang, T.; Hamann, A.; Spittlehouse, D.L.; Murdock, T.Q. ClimateWNA—High-Resolution Spatial Climate Data for Western North America. *J. Appl. Meteorol. Climatol.* **2012**, *51*, 16–29. [CrossRef]
49. Hijmans, R. *terra: Spatial Data Analysis*, R Package Version 1.7-46; R Core Team: Cary, CA, USA, 2023.
50. Evans, J.S. *spatialEco*, R Package Version 1.2-0; R Core Team: Cary, CA, USA, 2019.
51. Dormann, C.F.; Elith, J.; Bacher, S.; Buchmann, C.; Carl, G.; Carré, G.; Marquéz, J.R.G.; Gruber, B.; Lafourcade, B.; Leitão, P.J.; et al. Collinearity: A review of methods to deal with it and a simulation study evaluating their performance. *Ecography* **2013**, *36*, 27–46. [CrossRef]
52. Benito, B. *collinear: R Package for Seamless Multicollinearity Management*; Zonodo: Geneva, Switzerland, 2023. [CrossRef]
53. Dauby, G.; Lima, R.A.F.d. *ConR: Computation of Parameters Used in Preliminary Assessment of Species Conservation Status*, R package version 2.1; R Core Team: Cary, CA, USA, 2024. Available online: https://gdauby.github.io/ConR/ (accessed on 16 October 2024).
54. Burgman, M.A.; Fox, J.C. Bias in species range estimates from minimum convex polygons: Implications for conservation and options for improved planning. *Anim. Conserv.* **2003**, *6*, 19–28. [CrossRef]

55. Jetz, W.; Sekercioglu, C.H.; Watson, J.E.M. Ecological Correlates and Conservation Implications of Overestimating Species Geographic Ranges. *Conserv. Biol.* **2008**, *22*, 110–119. [CrossRef] [PubMed]
56. Zizka, A.; Silvestro, D.; Andermann, T.; Azevedo, J.; Duarte Ritter, C.; Edler, D.; Farooq, H.; Herdean, A.; Ariza, M.; Scharn, R. CoordinateCleaner: Standardized cleaning of occurrence records from biological collection databases. *Methods Ecol. Evol.* **2019**, *10*, 744–751. [CrossRef]
57. Smith, A.B. *enmSdm: Tools for Modeling Species Niches and Distributions*, R Package Version 0.5.1.5; R Core Team: Cary, CA, USA, 2020.
58. Aiello-Lammens, M.E.; Boria, R.A.; Radosavljevic, A.; Vilela, B.; Anderson, R.P. spThin: An R package for spatial thinning of species occurrence records for use in ecological niche models. *Ecography* **2015**, *38*, 541–545. [CrossRef]
59. Robertson, M.P.; Visser, V.; Hui, C. Biogeo: An R package for assessing and improving data quality of occurrence record datasets. *Ecography* **2016**, *39*, 394–401. [CrossRef]
60. Valavi, R.; Elith, J.; Lahoz-Monfort, J.J.; Guillera-Arroita, G. blockCV: An r package for generating spatially or environmentally separated folds for k-fold cross-validation of species distribution models. *Methods Ecol. Evol.* **2019**, *10*, 225–232. [CrossRef]
61. Dubos, N.; Préau, C.; Lenormand, M.; Papuga, G.; Monsarrat, S.; Denelle, P.; Louarn, M.L.; Heremans, S.; May, R.; Roche, P.; et al. Assessing the effect of sample bias correction in species distribution models. *Ecol. Indic.* **2022**, *145*, 109487. [CrossRef]
62. Inman, R.; Franklin, J.; Esque, T.; Nussear, K. Comparing sample bias correction methods for species distribution modeling using virtual species. *Ecosphere* **2021**, *12*, e03422. [CrossRef]
63. Velazco, S.J.E.; Rose, M.B.; de Andrade, A.F.A.; Minoli, I.; Franklin, J. flexsdm: An r package for supporting a comprehensive and flexible species distribution modelling workflow. *Methods Ecol. Evol.* **2022**, *13*, 1661–1669. [CrossRef]
64. Barbet-Massin, M.; Jiguet, F.; Albert, C.H.; Thuiller, W. Selecting pseudo-absences for species distribution models: How, where and how many? *Methods Ecol. Evol.* **2012**, *3*, 327–338. [CrossRef]
65. Breiner, F.T.; Guisan, A.; Bergamini, A.; Nobis, M.P. Overcoming limitations of modelling rare species by using ensembles of small models. *Methods Ecol. Evol.* **2015**, *6*, 1210–1218. [CrossRef]
66. Broennimann, O.; Di Cola, V.; Guisan, A. *ecospat: Spatial Ecology Miscellaneous Methods*, R package version 3.2; R Core Team: Cary, CA, USA, 2021.
67. Valavi, R.; Elith, J.; Lahoz-Monfort, J.J.; Guillera-Arroita, G. Modelling species presence-only data with random forests. *Ecography* **2021**, *44*, 1731–1742. [CrossRef]
68. Collart, F.; Hedenäs, L.; Broennimann, O.; Guisan, A.; Vanderpoorten, A. Intraspecific differentiation: Implications for niche and distribution modelling. *J. Biogeogr.* **2021**, *48*, 415–426. [CrossRef]
69. Konowalik, K.; Nosol, A. Evaluation metrics and validation of presence-only species distribution models based on distributional maps with varying coverage. *Sci. Rep.* **2021**, *11*, 1482. [CrossRef] [PubMed]
70. Liu, C.; Newell, G.; White, M. On the selection of thresholds for predicting species occurrence with presence-only data. *Ecol. Evol.* **2016**, *6*, 337–348. [CrossRef]
71. Velazco, S.J.E.; Rose, M.B.; De Marco, P., Jr.; Regan, H.M.; Franklin, J. How far can I extrapolate my species distribution model? Exploring shape, a novel method. *Ecography* **2024**, *2024*, e06992. [CrossRef]
72. Elith, J.; Kearney, M.; Phillips, S. The art of modelling range-shifting species. *Methods Ecol. Evol.* **2010**, *1*, 330–342. [CrossRef]
73. Cook, R.D. Cook's Distance. In *International Encyclopedia of Statistical Science*; Lovric, M., Ed.; Springer: Berlin/Heidelberg, Germany, 2011; pp. 301–302.
74. Peduzzi, P.; Concato, J.; Kemper, E.; Holford, T.R.; Feinstein, A.R. A simulation study of the number of events per variable in logistic regression analysis. *J. Clin. Epidemiol.* **1996**, *49*, 1373–1379. [CrossRef] [PubMed]
75. Tibshirani, R. Regression Shrinkage and Selection Via the Lasso. *J. R. Stat. Soc. Ser. B (Methodol.)* **1996**, *58*, 267–288. [CrossRef]
76. Friedman, J.H.; Hastie, T.; Tibshirani, R. Regularization Paths for Generalized Linear Models via Coordinate Descent. *J. Stat. Softw.* **2010**, *33*, 1–22. [CrossRef]
77. Bates, D.; Mächler, M.; Bolker, B.; Walker, S. Fitting Linear Mixed-Effects Models Using lme4. *J. Stat. Softw.* **2015**, *67*, 1–48. [CrossRef]
78. Bolker, B.M.; Brooks, M.E.; Clark, C.J.; Geange, S.W.; Poulsen, J.R.; Stevens, M.H.H.; White, J.-S.S. Generalized linear mixed models: A practical guide for ecology and evolution. *Trends Ecol. Evol.* **2009**, *24*, 127–135. [CrossRef] [PubMed]
79. Burnham, K.P.; Anderson, D.R. *Model Selection and Inference: A Practical Information-Theoretic Approach*, 2nd ed.; Springer: New York, NY, USA, 2002.
80. Barton, K. *MuMIn: Multi-Model Inference*, R package version 1.47.5; R Core Team: Cary, CA, USA, 2022. Available online: https://CRAN.R-project.org/package=MuMIn (accessed on 20 October 2024).
81. Richards, S.A. Testing ecological theory using the information-theoretic approach: Examples and cautionary results. *Ecology* **2005**, *86*, 2805–2814. [CrossRef]
82. Nakagawa, S.; Schielzeth, H. A general and simple method for obtaining R2 from generalized linear mixed-effects models. *Methods Ecol. Evol.* **2013**, *4*, 133–142. [CrossRef]

83. Lüdecke, D.; Ben-Shachar, M.S.; Patil, I.; Waggoner, P.; Makowski, D. performance: An R package for assessment, comparison and testing of statistical models. *J. Open Source Softw.* **2021**, *6*, 3139. [CrossRef]
84. R Core Team. *R: A Language and Environment for Statistical Computing*; R Foundation for Statistical Computing: Vienna, Austria, 2024; Available online: https://www.R-project.org/ (accessed on 15 October 2024).
85. Jones, D.G.; Kobelt, J.; Ross, J.M.; Powell, T.H.Q.; Prior, K.M. Latitudinal gradient in species diversity provides high niche opportunities for a range-expanding phytophagous insect. *J. Anim. Ecol.* **2022**, *91*, 2037–2049. [CrossRef] [PubMed]
86. Wellenreuther, M.; Dudaniec, R.Y.; Neu, A.; Lessard, J.-P.; Bridle, J.; Carbonell, J.A.; Diamond, S.E.; Marshall, K.E.; Parmesan, C.; Singer, M.C.; et al. The importance of eco-evolutionary dynamics for predicting and managing insect range shifts. *Curr. Opin. Insect Sci.* **2022**, *52*, 100939. [CrossRef]
87. Illich, I.; Zuna-Kratky, T. Population dynamics of an alpine grasshopper (Orthoptera) community over 30 years and the effects of climate warming and grazing. *J. Insect Conserv.* **2022**, *26*, 435–451. [CrossRef]
88. Samways, M.J.; Pryke, J.S. Large-scale ecological networks do work in an ecologically complex biodiversity hotspot. *Ambio* **2016**, *45*, 161–172. [CrossRef]
89. Nolte, D.; Boutaud, E.; Kotze, D.J.; Schuldt, A.; Assmann, T. Habitat specialization, distribution range size and body size drive extinction risk in carabid beetles. *Biodivers. Conserv.* **2019**, *28*, 1267–1283. [CrossRef]
90. Sánchez-Bayo, F.; Wyckhuys, K.A.G. Worldwide decline of the entomofauna: A review of its drivers. *Biol. Conserv.* **2019**, *232*, 8–27. [CrossRef]
91. Cadotte, M.W.; Tucker, C.M. Difficult decisions: Strategies for conservation prioritization when taxonomic, phylogenetic and functional diversity are not spatially congruent. *Biol. Conserv.* **2018**, *225*, 128–133. [CrossRef]
92. Kenyeres, Z.; Bauer, N. Conservation possibilities of *Isophya costata* (Orthoptera: Tettigoniidae: Phaneropterinae) based on frequency, population size, and habitats. *J. Orthoptera Res.* **2021**, *30*, 35–41. [CrossRef]
93. Deveson, E. Satellite normalized difference vegetation index data used in managing Australian plague locusts. *J. Appl. Remote Sens.* **2013**, *7*, 075096. [CrossRef]
94. Levanoni, O.; Levin, N.; Pe'er, G.; Turbé, A.; Kark, S. Can we predict butterfly diversity along an elevation gradient from space? *Ecography* **2011**, *34*, 372–383. [CrossRef]
95. Njovu, H.K.; Steffan-Dewenter, I.; Gebert, F.; Schellenberger Costa, D.; Kleyer, M.; Wagner, T.; Peters, M.K. Plant traits mediate the effects of climate on phytophagous beetle diversity on Mt. Kilimanjaro. *Ecology* **2021**, *102*, e03521. [CrossRef] [PubMed]
96. Dezsi, Ş.; Mîndrescu, M.; Petrea, D.; Rai, P.K.; Hamann, A.; Nistor, M.-M. High-resolution projections of evapotranspiration and water availability for Europe under climate change. *Int. J. Climatol.* **2018**, *38*, 3832–3841. [CrossRef]
97. Unnisa, Z.; Govind, A.; Lasserre, B.; Marchetti, M. Water Balance Trends along Climatic Variations in the Mediterranean Basin over the Past Decades. *Water* **2023**, *15*, 1889. [CrossRef]
98. Nadal-Romero, E.; Petrlic, K.; Verachtert, E.; Bochet, E.; Poesen, J. Effects of slope angle and aspect on plant cover and species richness in a humid Mediterranean badland. *Earth Surf. Process. Landf.* **2014**, *39*, 1705–1716. [CrossRef]
99. Scherrer, D.; Schmid, S.; Körner, C. Elevational species shifts in a warmer climate are overestimated when based on weather station data. *Int. J. Biometeorol.* **2011**, *55*, 645–654. [CrossRef]
100. Chappell, M.A. Metabolism and thermoregulation in desert and montane grasshoppers. *Oecologia* **1983**, *56*, 126–131. [CrossRef]
101. O'Neill, K.M.; Rolston, M.G. Short-term dynamics of behavioral thermoregulation by adults of the grasshopper *Melanoplus sanguinipes*. *J. Insect Sci.* **2007**, *7*, 27. [CrossRef]
102. Samietz, J.; Salser, M.A.; Dingle, H. Altitudinal variation in behavioural thermoregulation: Local adaptation vs. plasticity in California grasshoppers. *J. Evol. Biol.* **2005**, *18*, 1087–1096. [CrossRef]
103. König, S.; Krauss, J.; Classen, A.; Hof, C.; Prietzel, M.; Wagner, C.; Steffan-Dewenter, I. Micro- and macroclimate interactively shape diversity, niches and traits of Orthoptera communities along elevational gradients. *Divers. Distrib.* **2024**, *30*, e13810. [CrossRef]
104. Pitteloud, C.; Descombes, P.; Sànchez-Moreno, S.; Kergunteuil, A.; Ibanez, S.; Rasmann, S.; Pellissier, L. Contrasting responses of above- and below-ground herbivore communities along elevation. *Oecologia* **2020**, *194*, 515–528. [CrossRef] [PubMed]
105. Berner, D.; Körner, C.; Blanckenhorn, W.U. Grasshopper populations across 2000 m of altitude: Is there life history adaptation? *Ecography* **2004**, *27*, 733–740. [CrossRef]
106. Wilson, R.J.; Bennie, J.; Lawson, C.R.; Pearson, D.; Ortúzar-Ugarte, G.; Gutiérrez, D. Population turnover, habitat use and microclimate at the contracting range margin of a butterfly. *J. Insect Conserv.* **2015**, *19*, 205–216. [CrossRef]
107. Schaffers, A.P.; Raemakers, I.P.; Sýkora, K.V.; ter Braak, C.J.F. Arthropod assemblages are best predicted by plant species composition. *Ecology* **2008**, *89*, 782–794. [CrossRef]
108. Willemse, L.; Tilmans, J.; Kotitsa, N.; Trichas, A.; Heller, K.G.; Chobanov, D.; Odé, B. A review of *Eupholidoptera* (*Orthoptera*, *Tettigoniidae*) from Crete, Gavdos, Gavdopoula, and Andikithira. *ZooKeys* **2023**, *1151*, 67–158. [CrossRef]
109. Gardiner, T. Hillside lagomorph grazing and its influence on Orthoptera. *J. Orthoptera Res.* **2022**, *31*, 157–162. [CrossRef]

110. Neilly, H.; Jones, H.; Schwarzkopf, L. Ants drive invertebrate community response to cattle grazing. *Agric. Ecosyst. Environ.* **2020**, *290*, 106742. [CrossRef]
111. Spalinger, L.C.; Haynes, A.G.; Schütz, M.; Risch, A.C. Impact of wild ungulate grazing on Orthoptera abundance and diversity in subalpine grasslands. *Insect Conserv. Divers.* **2012**, *5*, 444–452. [CrossRef]
112. NOA. National Observatory of Athens. Available online: https://www.noa.gr (accessed on 23 October 2024).

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.