








## Article

# Assessing the Vulnerability of Medicinal and Aromatic Plants to Climate and Land-Use Changes in a Mediterranean Biodiversity Hotspot

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**Abstract:** Medicinal and Aromatic Plants (MAPs) play a critical role in providing ecosystem services through their provision of herbal remedies, food and natural skin care products, their integration into local economies, and maintaining pollinators' diversity and populations and ecosystem functioning. Mountainous regions, such as Chelmos-Vouraikos National Park (CVNP), represent unique reservoirs of endemic MAP diversity that require conservation prioritisation. This study aims to provide insights into the sustainable management of MAPs, contributing to efforts to protect Mediterranean biodiversity amid the dual challenges of climate and land-use change, using a suite of macroecological modelling techniques. Following a Species Distribution Modelling framework, we investigated the vulnerability of endemic and non-endemic MAPs to climate and land-use changes. We examined the potential shifts in MAP diversity, distribution, and conservation hotspots within the CVNP. Our results revealed species-specific responses, with endemic taxa facing severe range contractions and non-endemic taxa initially expanding but eventually declining, particularly under land-use change scenarios. Local biodiversity hotspots are projected to shift altitudinally, with considerable area losses in the coming decades and elevated species turnover predicted throughout the CVNP, leading to biotic homogenization. Climate and land-use changes jointly threaten MAP diversity, calling for adaptive conservation strategies, thus highlighting the importance of proactive measures, such as awareness raising, establishing plant micro-reserves, assisted translocation, and promoting sustainable harvesting to protect these species within the CVNP. Our study offers vital insights for managing biodiversity hotspots amid global change pressures, stressing the need to integrate ecological and socioeconomic factors.

**Keywords:** biodiversity conservation; conservation prioritization; ecosystem services; extinction risk; Greece; Species Distribution Modelling

## 1. Introduction

Biodiversity is essential to ecosystem resilience and human well-being, yet its distribution across the globe is markedly uneven, influenced by a complex interplay of evolutionary processes [1–5]. Human impacts, particularly climate and land-use change (CC-LUC), pose significant threats to biodiversity, disproportionately affecting biodiversity

hotspots [6–8]. While accounting for many unique species, such hotspots are also areas where habitat loss occurs at alarming rates [9–13].

The Mediterranean region, one of the largest biodiversity hotspots, harbours approximately 25,000 plant taxa, with half being endemic [14–18]. This high level of both overall and endemic taxa is due to the region's intricate network of ecosystems [17]. Within the Mediterranean Basin, Greece is considered a regional plant diversity hotspot [15,19–21] due to its diverse topography and climatic conditions [18,22–29].

Mountains, in particular, are museums and cradles of plant diversity [30–39] and serve as nature's last strongholds against the march of human impact [40–49]. Within Greece, several mountains and mountain ranges constitute local (*sensu* [50]) biodiversity hotspots and endemism centres [18], as well as threatened plant diversity hotspots [22]. Most of these mountains occur in the phytogeographical area of the Peloponnese, the most endemic species-rich phytogeographical area of Greece [51,52], with Mt. Chelmos and the corresponding Chelmos-Vouraikos National Park (CVNP) standing out as an endemic plant diversity hotspot and a centre of palaeoendemism, hosting several Critically Endangered Greek endemics [18,22,53–55].

Apart from the intrinsic value of plant diversity, certain plant species, such as crop wild relatives and Medicinal and Aromatic Plants (MAPs), are significant plant genetic resources. Crop wild relatives contribute to agricultural resilience through genetic diversity [56]. Medicinal and Aromatic Plants provide pivotal ecosystem services in developed and developing countries through their rich chemodiversity, their beneficial biological properties [57–70] and use in traditional Mediterranean medicine and diet (mainly as herbal teas, but also as spices and ingredients of local dishes) [63,71–73] while playing an essential role in local trade, traditional and primary health care, as well as the food, cosmetic and pharmaceutical industries [73,74]. More specifically, there is a growing demand for natural health products and herbal medicine [75–79]. In recent years, there has been a significant increase in demand for raw MAP material, oils, extracts and essential oils for use as drugs, food supplements, preservatives, ingredients in functional foods and natural cosmetics, leading to a corresponding rise in their market value [80], with approximately 80,000 plant species currently used for medicinal purposes globally [57,81]. Thus, in a sense, medicinal plants can serve as flagship species to preserve and monitor biodiversity while also promoting public awareness of conservation efforts [82]. On the other hand, climate change threatens the diversity and sustainable use of medicinal plants globally [83]. Increased environmental extremes and economic losses resulting from climate change are anticipated to adversely affect public health, affecting the related ecosystem services concerning medicinal and aromatic plants [84]. This is due to the expected decline in access to beneficial medicinal plants, which will contribute to increased human suffering and preventable deaths [84]. Moreover, climate and land-use change are predicted to reduce the environmentally suitable areas of MAPs across the globe [85–91]. Climate and land-use change thus are expected to alter the phytochemical content (secondary metabolites) of MAPs and compromise their quality and effectiveness [85–90]. An intangible side effect is the reduced discovery rate of innovative drugs (and drug targets) and health products. These impacts will probably be exacerbated by uncontrolled overharvesting [84]. In doing so, climate and land-use change will potentially impact the livelihoods of people who depend on MAP collection and trade. Thus, as the global demand for effective innovative drugs and herbal products grows, driven by population growth and ageing, increased health awareness, and the spread of diseases, it becomes imperative to understand the future trajectory of these MAP-rich areas and to adapt management practices to sustain the ecosystem services provided by MAPs. The main problems for MAP populations are:

1. the uncontrolled and unsustainable harvesting for personal use and also trade. This underlies the need for conservation and local cultivation of valued plants and sustainability training for harvesters and certification of commercial material [84],
2. the land use changes and habitat fragmentation, and
3. climate change [63,92].

Within this context, regional biodiversity hotspots (*sensu* [50]), such as Greece, serve as reservoirs of these precious resources, with their unique climatic and edaphic conditions fostering a rich diversity of MAPs, an essential natural resource [61,92–98]. More specifically, the Peloponnesian mountains and Mt. Chelmos, in particular, are hotspots of endemic plants with novel chemical metabolites and beneficial biological properties and of taxa with recorded traditional uses and environmental properties [93,94,98]. Nevertheless, relatively few studies have been conducted in the eastern Mediterranean (e.g., [86]) and Greece, in particular, dealing with the impacts of climate and land-use change on economically important plants [54,86,92,99,100]. Our study thus addresses this gap by focusing on the Chelmos-Vouraikos National Park as a case study. We will investigate the potential impacts of climate change and land use change on the biodiversity in one of the protected areas in Greece, laying the foundation for more comprehensive future studies in Greece and the Mediterranean Basin. This understanding is vital at a time when biodiversity is under unprecedented threat, and conservation strategies need urgent recalibration [12,22,101–103]. More specifically, we aim to address the following questions, which are organised under three thematic areas:

**A. Species-specific responses to drivers of global change**

1. How will climate and land-use change affect the MAP taxa in Chelmos-Vouraikos National Park?
2. Will climate change or land-use change pose a more significant threat to MAP taxa, and will the effects be species-specific?
3. How will the spatial distribution of MAP taxa within the Chelmos-Vouraikos National Park evolve in response to these changes?

**B. Biodiversity hotspots over time**

4. Which areas within the Chelmos-Vouraikos National Park serve as taxonomically and phylogenetically geographically weighted hotspots?
5. How will these areas shift in altitude and size over time?
6. Which areas within the Chelmos-Vouraikos National Park will experience high taxonomic and phylogenetic temporal turnover?

**C. Conservation strategies**

7. What is the vulnerability of the Medicinal and Aromatic Plant taxa in Chelmos-Vouraikos National Park?

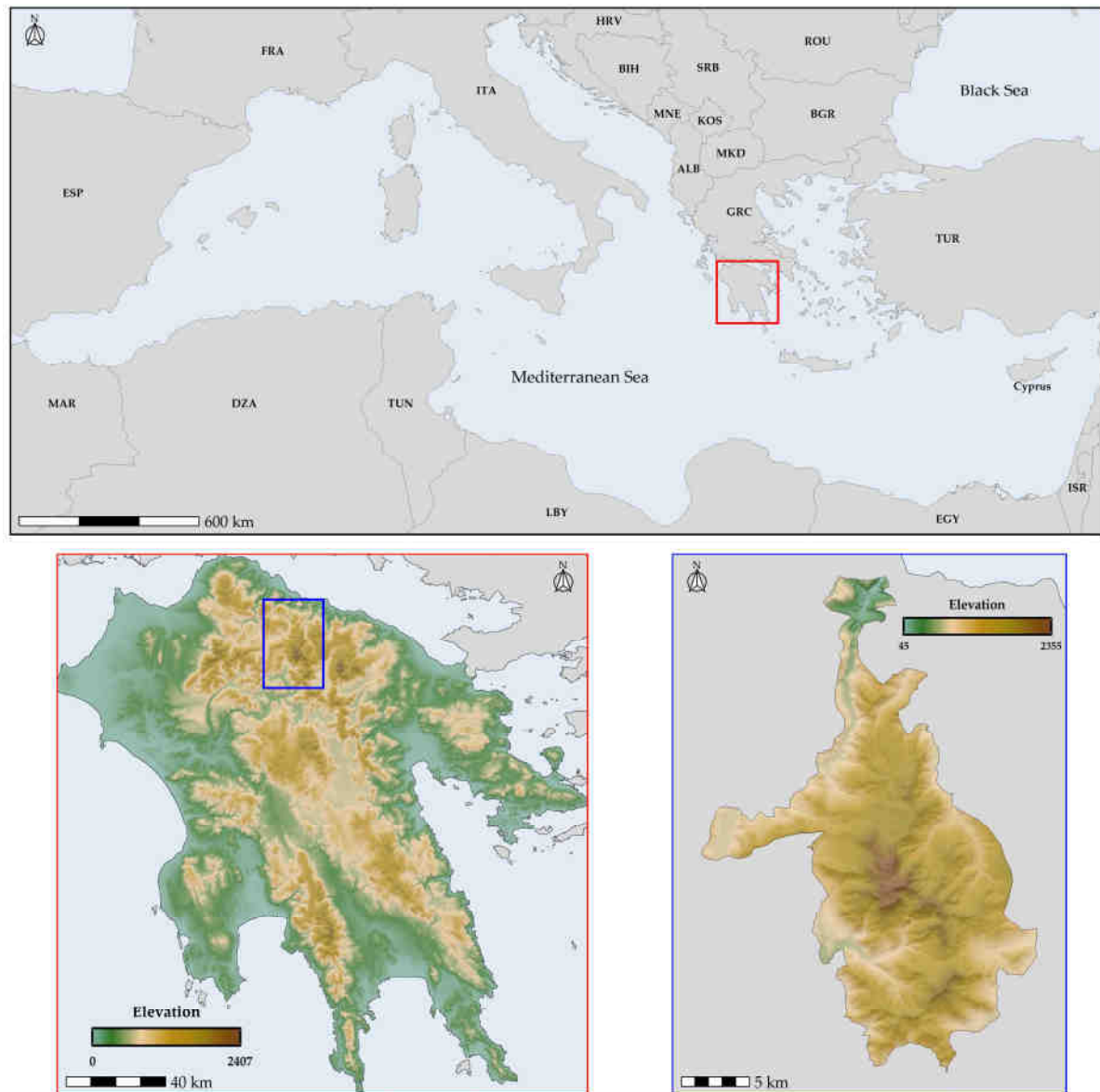
Through these questions, our study aims to provide insights into the conservation and sustainable management of MAPs, contributing to broader efforts to protect Mediterranean biodiversity amid the dual challenges of climate and land-use change. Moreover, it aims to complement the national efforts for the Mapping and Assessment of Ecosystem Services (MAES) implementation in Greece [104] and support scientifically informed decision and policy making, especially for protected areas.

## 2. Materials and Methods

### 2.1. Species Occurrence Data

Two-hundred and sixty-one (261) Greek endemic and non-endemic medicinal and aromatic plant taxa (Table S1) occur in the Chelmos-Vouraikos National Park (Figure 1) with 1671 records (authors' field observations, specimens deposited in the Herbarium of the University of Patras, Flora Hellenica Database, Strid (ongoing); [55,103,105]). Following the criteria of [51,52], these taxa are categorised into subspecies and species without subspecies. All taxa were verified for synonyms based on [51,52] for accuracy. We excluded data points with over 100 m of coordinate uncertainty and refined our data using the 'clean\_coordinates' function from the 'CoordinateCleaner' 2.0.18 R package [106]. Duplicate entries were removed using the 'elimCellDups' function from the 'enmSdm' 0.5.3.3 R package [107]. We further thinned the remaining data spatially using the 'thin' function from the 'spThin' 0.1.0 R package [108]. Finally, we estimated the Aver-

age Nearest Neighbour Index for the cleaned, spatially thinned occurrence data to ensure they were not geographically clustered [109], with the function ‘nni’ from the ‘spatialEco’ 1.3.7 R package [110]. Our cleaning and spatial thinning procedure followed [108,111]. Our final dataset comprised 573 records for 70 taxa (seven endemic and 63 non-endemic taxa; Table S2) since we included in our analyses only those taxa that had five or more occurrences, following [112].



**Figure 1.** Top panel: The Mediterranean Basin with the Peloponnese highlighted by a red polygon and including ISO-3 country codes. Bottom panel (left to right): The Peloponnese zoomed in, outlined with a blue polygon indicating the wider study area. The study area, Mt. Chelmos, is shown in detail.

## 2.2. Environmental Data

For our research, we constructed a comprehensive monthly climate dataset covering the years 1981 to 2009. This dataset includes the 19 standard bioclimatic variables as defined by WorldClim [113–115], complemented by an additional 16 environmental variables specified in [116], as most occurrence data were collected over the past three decades. The spatial resolution of this dataset was set to 100 m. For its development, altitude information were provided by the CGIAR Consortium for Spatial Information [117]. Our analytical process involved the use of the ClimateEU v4.63, the “dismo” 1.1.4 [118], and

the “envirem” 2.2 [116] R packages, following the protocols in [119–121]. In addition, we incorporated soil metrics from SoilGrids [122] and dynamic land use/land cover (LULC) data from [123], ensuring uniformity in resolution with other environmental metrics. The soil and LULC data were downscaled using the ‘terra’ 1.7.46 R package [124]. We also quantified five critical topographical metrics: aspect, heat load index, slope, topographic position index, and terrain ruggedness index. This quantification utilized the altitude data previously mentioned and was conducted through functions from the “raster” 2.6.7 [125], the ‘terra’ 1.7.46 R package [124] and the “spatialEco” 1.2-0 R packages [110].

Future climate projections encompassed:

1. three different periods, i.e., the 2020s (2011–2040), 2050s (2041–2070) and 2080s (2071–2100) [119],
2. three global circulation models (GCMs) (i.e., other (CCSM4, HadGEM2, and an ensemble of 15 global circulation models), and
3. Two IPCC representative concentration pathways: the less severe RCP4.5 and the more extreme RCP8.5, in addition to future LULC projections from Chen et al. [123] under SSP1-RCP26, SSP3-RCP70, and SSP5-RCP85 scenarios [126].

In our analysis, the topographical and soil variables were considered static over time, in contrast to the bioclimatic and LULC variables, which were dynamic. Our analysis was conducted with a select set of 22 environmental variables, carefully chosen to avoid collinearity as verified by Spearman rank correlation ( $<0.7$ ) and variance inflation factors ( $<5$ ) [127]. These collinearity checks were performed using the “usdm” 1.1.18 R package [128].

### 2.3. Species Distribution Models

All taxa included in our analyses maintained an occurrence-to-predictor ratio below 10:1. Adhering to guidelines set forth in [129–131], we utilized the Random Forest algorithm along with the “ecospat” 3.1 [132] R to accurately model the realized climatic niches of these taxa, as outlined in [133–135]. We split our occurrence data into two categories: (i) those taxa with ten or more occurrences and (ii) those with less than ten occurrences (5–9 occurrences) [136]. We then created species-specific pseudo-absences for both categories. For the first category (taxa with  $\geq 10$  occurrences), pseudo-absences were generated using the ‘sample\_pseudoabs’ function from the ‘flexsdm’ 1.3.0 R package [137]. This approach involves a three-tiered process, creating pseudo-absences within a geographical buffer, environmentally constraining them, and distributing them in environmental space via k-means clustering [137–139]. Regarding the second category (taxa with  $<10$  occurrences), we created random pseudo-absences, as is recommended for very rare and specialised taxa [140,141]. For taxa with 20 or more occurrences, we conducted an optimized spatial cross-validation of occurrences and pseudo-absences prior to model fitting, as recommended in [142,143]. This was done using the ‘part\_sblock’ function from the ‘flexsdm’ 1.3.0 R package [137]. The model’s performance was then evaluated against null models [144], using various metrics [145–149] through functions available in the ‘CalibratR’ 0.1.2, ‘DescTools’ 0.99.40, ‘ecospat’ 3.2, ‘enmSdm’ 0.5.3.2, ‘Metrics’ 0.1.4, ‘MLmetrics’ 1.1.1 and ‘modEvA’ 2.0 R packages [107,132,150–153]. As for the taxa with 5–19 occurrences, we partitioned the occurrences and pseudo-absences with the ‘BIOMOD\_CrossValidation’ function from the ‘biomod’ 4.2.4 R package [154].

We employed well-calibrated (TSS  $\geq 0.4$ ) models to pinpoint potentially suitable habitats for all taxa during each analysis period.

Binary maps for every GCM, RCP, SSP, and period combination were produced using the metric that optimizes sensitivity and specificity [139,155,156]. To address prediction issues, all non-zero cells in the clamping mask for each taxon were set to NA as a precautionary measure [157].

The potential range shifts of all taxa, in terms of directionality and extent, were assessed using the “biomod2” 4.2.4 R package [154]. We assumed full dispersal capability for non-endemic taxa across the study area, while endemic taxa were presumed to have minimal



dispersal ability. We also estimated two fragmentation metrics, namely the number of patches and the effective mesh size [158], for every GCM, RCP, SSP and period combination for each taxon included in our analyses using functions from the ‘landscapemetrics’ 2.0.0 R package [159]. Finally, two additional metrics were employed to address environmental extrapolation concerns (ExDet and the proportion of data nearby) using the ‘dsmextra’ 1.1.4 R package [160,161]. We repeated the analyses mentioned above for all three model categories, namely, climate change (CC), land-use/land cover change (LULCC), and the combination of climate change and land-use/land cover change (CC-LULCC).

#### 2.4. Biodiversity Hotspots Detection

We adopted the methodology outlined in [18], for all spatial analyses related to species richness (SR), corrected-weighted endemism (CWE; [162,163]), Phylogenetic Diversity (PD) and Phylogenetic Endemism (PE; [164]). This was accomplished using the time-calibrated phylogenetic tree from [18], applying it specifically to the plant taxa in our dataset with the help of the ‘phyloregion’ 1.0.4 [165–167] and the ‘PhyloMeasures’ 2.1 [168] R packages. Following the approach in [18,169], we pinpointed biodiversity hotspots for various taxonomic and phylogenetic biodiversity metrics, focusing on areas that represent the top 1%, 5%, and 10% values (denoted as L1, L2, and L3 hotspots, respectively) of each metric. The identification of these biodiversity hotspots was conducted using functions available in the ‘phyloregion’ 1.0.4 R package [165–167]. We also identified the Priority Hotspots as described in [18], emphasizing the intersection of CWE and PE metrics. In this context, biodiversity hotspots are defined and referred to as local biodiversity hotspots, which are situated within broader regional biodiversity hotspots [50]. We repeated the above analyses for all GCMs, RCPs, SSPs and periods for both the endemic and the non-endemic taxa.

We also identified the Anthropocene refugia (cells constituting current and future L1–3 CWE-PE hotspots) in our study area by applying a strict consensus rule on the current and future Priority Hotspots, i.e., we only considered those cells that are currently serving and will continue to serve as Priority Hotspots for every GCM, RCP, SSP and period combination. We estimated these Anthropocene refugia’ respective area and altitude for all three models included in our analyses (i.e., CC, LULCC and CC-LULCC).

#### 2.5. Temporal Beta Diversity

We estimated the temporal taxonomic and phylogenetic beta diversity and its components (replacement and richness differences; [170–172]) between the current and all respective future projections, using the ‘divraster’ 1.0.3 R package [173,174]. We also identified the temporal taxonomic and phylogenetic beta diversity L1–L3 hotspots under the framework described above and then estimated their overlap.

#### 2.6. Sensitivity, Exposure and Vulnerability to Climate and Land-Use Change

Adopting the climate niche factor analysis from [175], we assessed species’ sensitivity, exposure, and vulnerability to climate and land-use changes, focusing on the temporally dynamic variables. This assessment was done using the CENFA 1.1.2 R package [176]. Sensitivity represents a species’ dependence on current climate conditions, with high sensitivity indicating a greater influence by future climate shifts [175,177]. Exposure quantifies expected climatic changes within a species’ habitat. Using ‘cnfa’ and ‘departure’ functions from the CENFA R package, we calculated species sensitivity and exposure. We calculated the vulnerability to climate change by taking the geometric mean of sensitivity and exposure, employing the “vulnerability” function in the CENFA R package. Due to computational constraints, we performed these analyses for every period, but for the Ensemble GCM RCP 8.5 regarding the CC model, the Ensemble GCM RCP 8.5 SSP5 for the CC-LULCC model and for SSP5 under the LULCC model. We estimated the median and standard deviation for the spatial sensitivity, exposure and vulnerability for each

period. Finally, we identified the L1-L3 hotspots for these metrics under the framework described above.

### 3. Results

#### 3.1. Species Distribution Models

Each of the models demonstrated a robust predictive ability (Table S2; Figure S1) and exhibited performance that significantly surpassed random expectations ( $p < 0.01$ ) for all three model categories (i.e., CC, LULCC and CC-LULCC). Depending on the model category, different environmental factors were identified as the most important predictors for the majority of the taxa analysed (Table S3):

1. The LULC category ‘Needle-leaf evergreen temperate trees’ for the LULCC model
2. The precipitation of the wettest month for the CC model and
3. Aspect for the CC-LULCC model

We focus on the Ensemble GCM RCP 8.5 SSP5 scenario for the 2080s, as it represents the worst-case scenario regarding the anticipated range changes for both taxon categories, i.e., endemic and non-endemic taxa (Table S4). The extent of extrapolation novelty was notably low across different GCMs, RCPs, SSPs and period combinations. Analogous climate conditions were found to constitute a high proportion, varying between 95.12% and 99.98%.

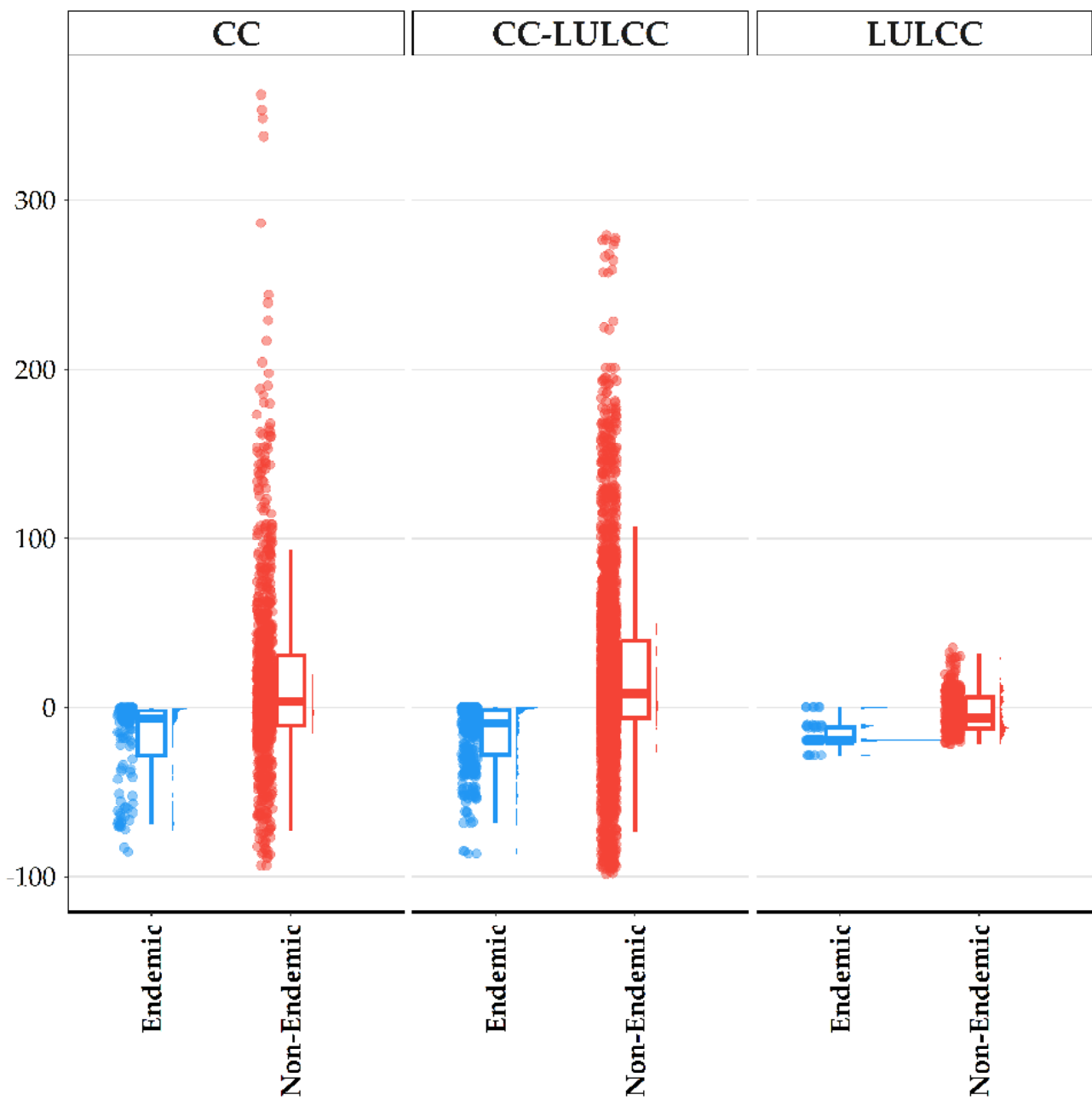
#### 3.2. Habitat Suitability Range Change

Significant interspecific differences were observed in relation to all sources of uncertainty, both in terms of the direction and the extent of the anticipated range shifts (Table S4; Figures 2, S2 and S3). All endemic taxa are expected to experience range contractions, with these contractions gradually becoming more prominent in the long term, with these negative impacts being more severe in the LULCC model compared to the CC-LULCC and CC models (median range contraction is  $-19.90\%$ ,  $-9.48\%$  and  $-6.79\%$ , respectively; Table S4; Figures 2, S2 and S3). On the other hand, most of the non-endemic taxa are projected to experience range expansions (the considerable interspecific variation notwithstanding) under the CC-LULCC and the CC model, while the opposite is valid under the LULCC model (median range change being  $7.87\%$ ,  $3.55\%$  and  $-6.30\%$  for each model, respectively; Table S4; Figures 2, S2 and S3). Twenty-one non-endemic taxa are projected to experience substantial range expansions ( $>100\%$ ; Table S5), which are waning over time (Table S4). All the above-mentioned negative trends get progressively higher over time. All taxa had lower values for both fragmentation metrics in the future compared to the present (Figure 3).

#### 3.3. Biodiversity Hotspots

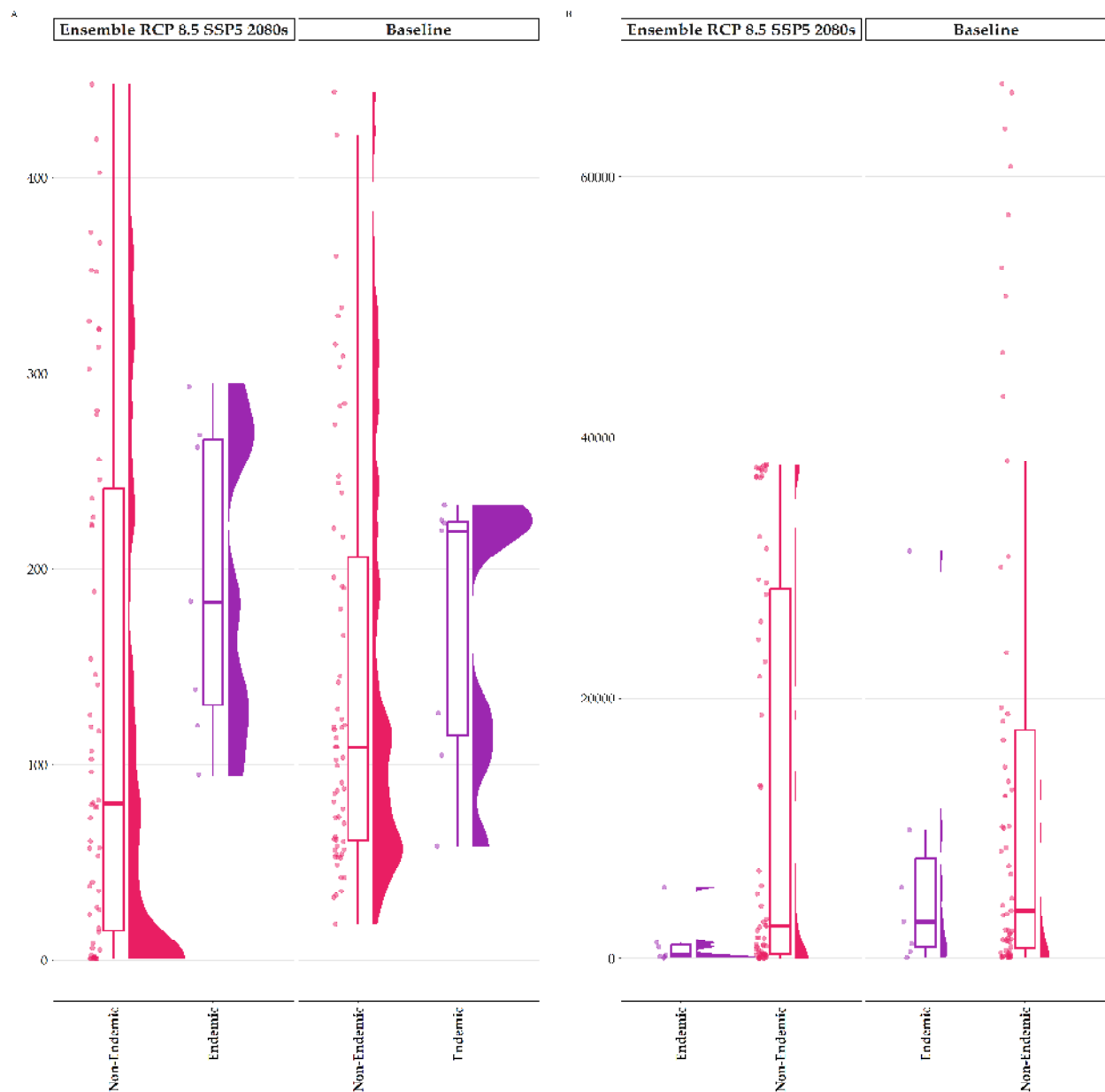
The highest values for all the biodiversity metrics are currently located in the central areas of Chelmos-Vouraikos National Park (Figures S4A–S7A). According to the non-weighted biodiversity metrics, i.e., SR and PD, even though the areas currently displaying the largest such values will essentially continue to do so in the coming decades (Figures S4 and S6), several taxa are projected to become locally extirpated or shift their altitudinal range (Figures 4 and S8). On the other hand, the geographically weighted metrics paint an entirely different picture despite their agreement regarding the areas currently displaying the highest values (Figures S5A and S7A). As time progresses, according to the CWE and PE metrics, the areas exhibiting high such values will be at the fringes of Chelmos-Vouraikos National Park (Figures S6B,C and S7B,C), and by the 2080s, only a small area located in the central part of Chelmos-Vouraikos National Park will present high CWE and PE values (Figures S6D and S7D). Current L1 hotspots for all metrics are located in the same central area of Chelmos-Vouraikos National Park (Figures 5, S9 and S10), but based on the combined CWE-PE metric, no currently identified Priority Hotspot is projected to exist in the future, at least under the CC-LULCC model (Figure 5). The L1 CWE-PE hotspots currently occupy  $58.7\text{--}2508.7\text{ km}^2$ , occurring at  $1254\text{--}1685\text{ m a.s.l.}$ , depending on the model category (Table S6), with the LULCC model presenting the largest extent and

the lowest altitude. In all cases, the L1 CWE-PE hotspots will experience range contraction (−4.0% to −86.4%; Table S6) and altitudinal shifts (Table S6).

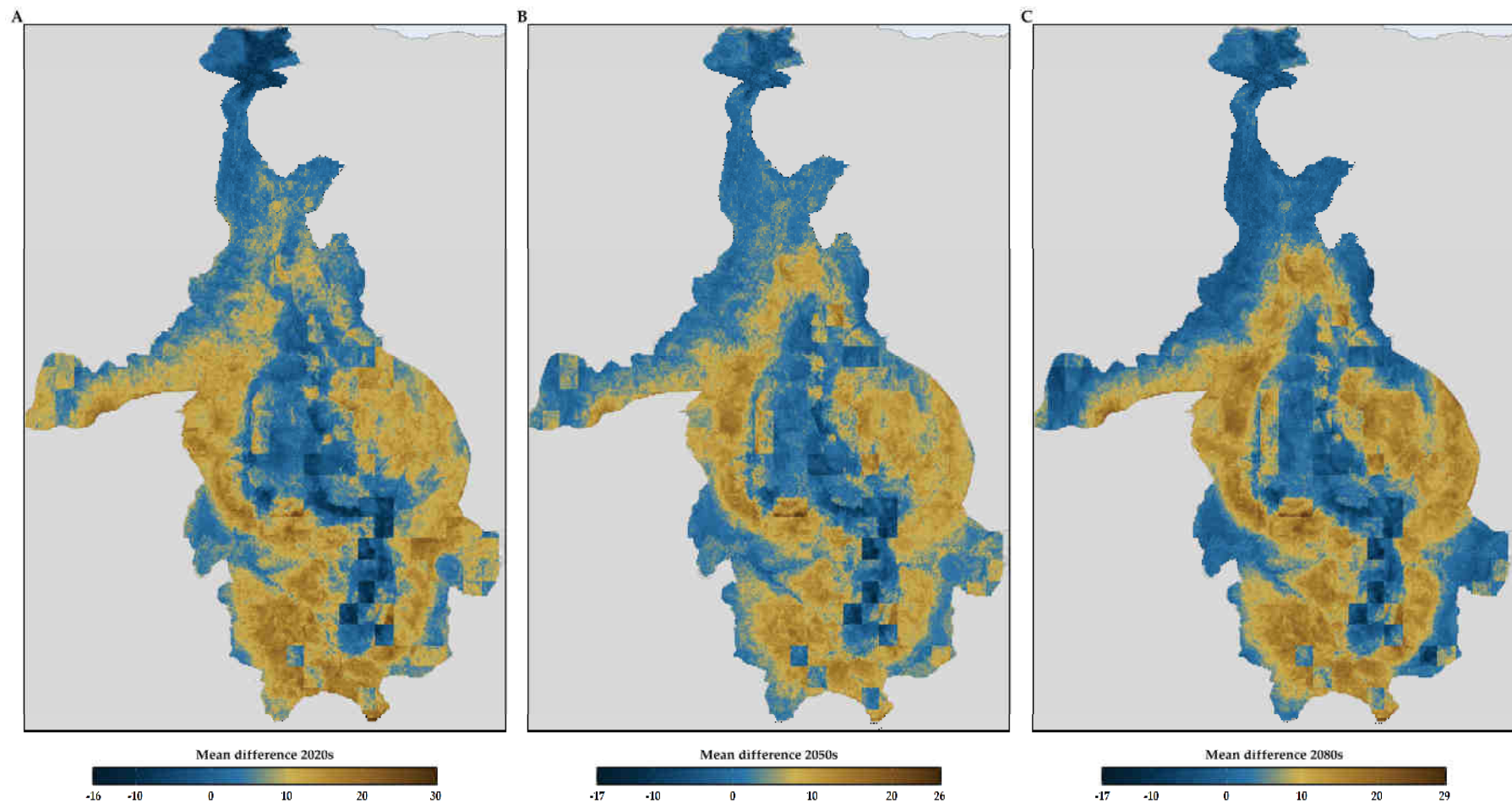


**Figure 2.** Raincloud plot depicting the median area range change (in percentage) for all medicinal and aromatic plant taxa analysed. This data is presented under three model categories: Climate Change (CC), Land Use Land Cover Change (LULCC), and their interaction (CC-LULCC). The plot aggregates results from selected scenarios and climate models: three Global Circulation Models (GCMs), two Representative Concentration Pathways (RCPs), and three Shared Socioeconomic Pathways (SSPs) across three time periods (2020s, 2050s, and 2080s).

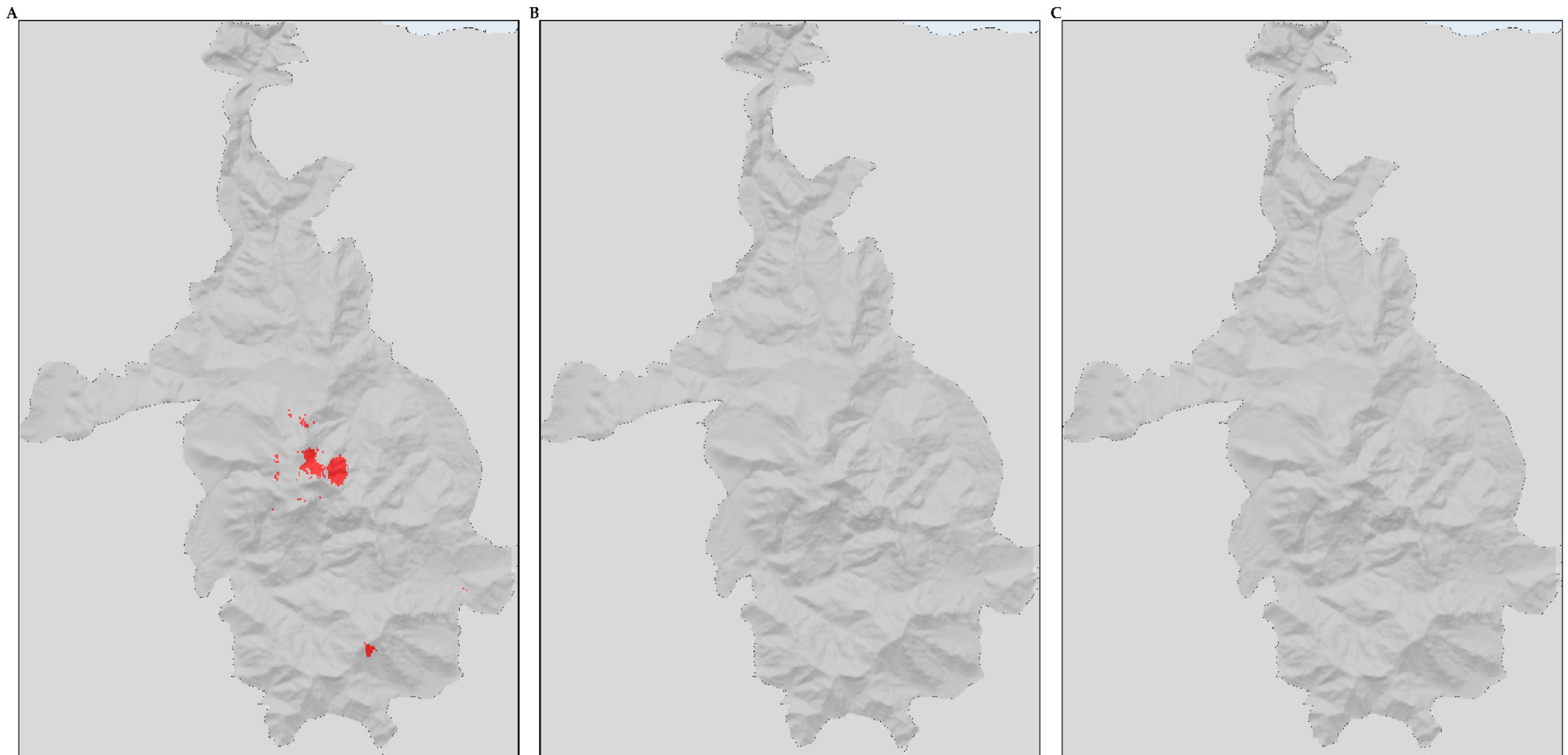




**Figure 3.** Raincloud plot of the (A) number of patches and (B) effective mesh size for all the medicinal and aromatic plant taxa we included in our analyses under the baseline period and the Ensemble RCP 8.5 SSP5 combination in the 2080s.



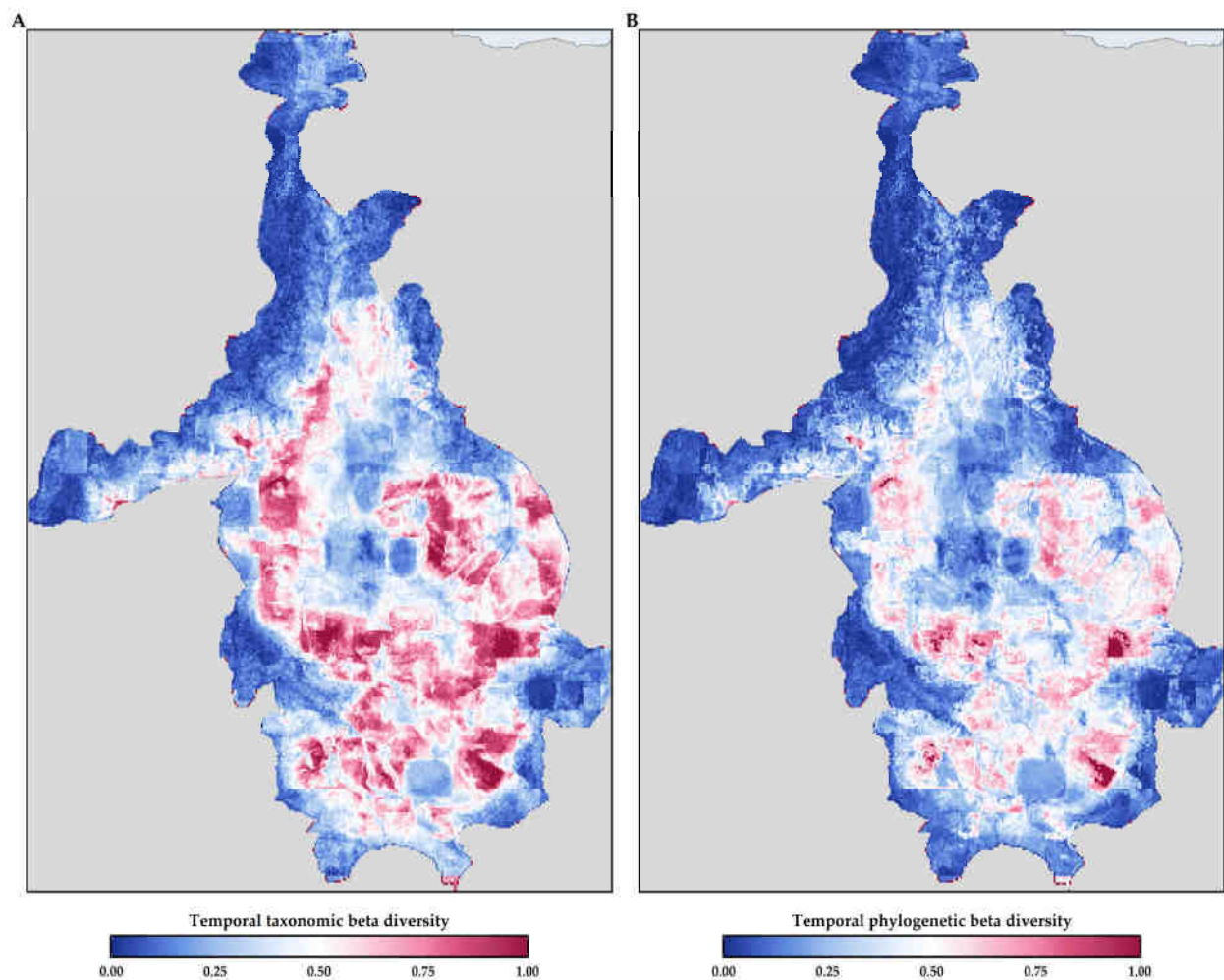
**Figure 4.** Mean difference in species richness: This figure displays the average change in future species richness compared to the species richness for the baseline period for all medicinal and aromatic plant (MAP) taxa occurring in Chelmos Vouraikos National Park. The analysis involves subtracting the current species richness from each Global Circulation Model (GCM)/Representative Concentration Pathway (RCP) species richness raster under the Shared Socioeconomic Pathway 5 (SSP5). This process is repeated for three future time periods: (A) the 2020s, (B) the 2050s, and (C) the 2080s. The resulting differences are then averaged to represent the mean change in species richness across all included taxa under the CC-LULCC model.



**Figure 5.** From left to right: L1 (top 1%) corrected-weighted—phylogenetic endemism (CWE-PE) hotspots, also known as Priority Hotspots (marked with red cells), for both (A) the baseline period and (B) the future (the Ensemble RCP 8.5 SSP5 combination in the 2080s). Panel (C) depicts the Anthropocene refugia under the strict consensus rule, meaning we only considered cells currently serving and projected to continue serving as Priority Hotspots across every combination of GCM, RCP, SSP, and period for the CC-LULCC model.

### 3.4. Temporal Beta Diversity

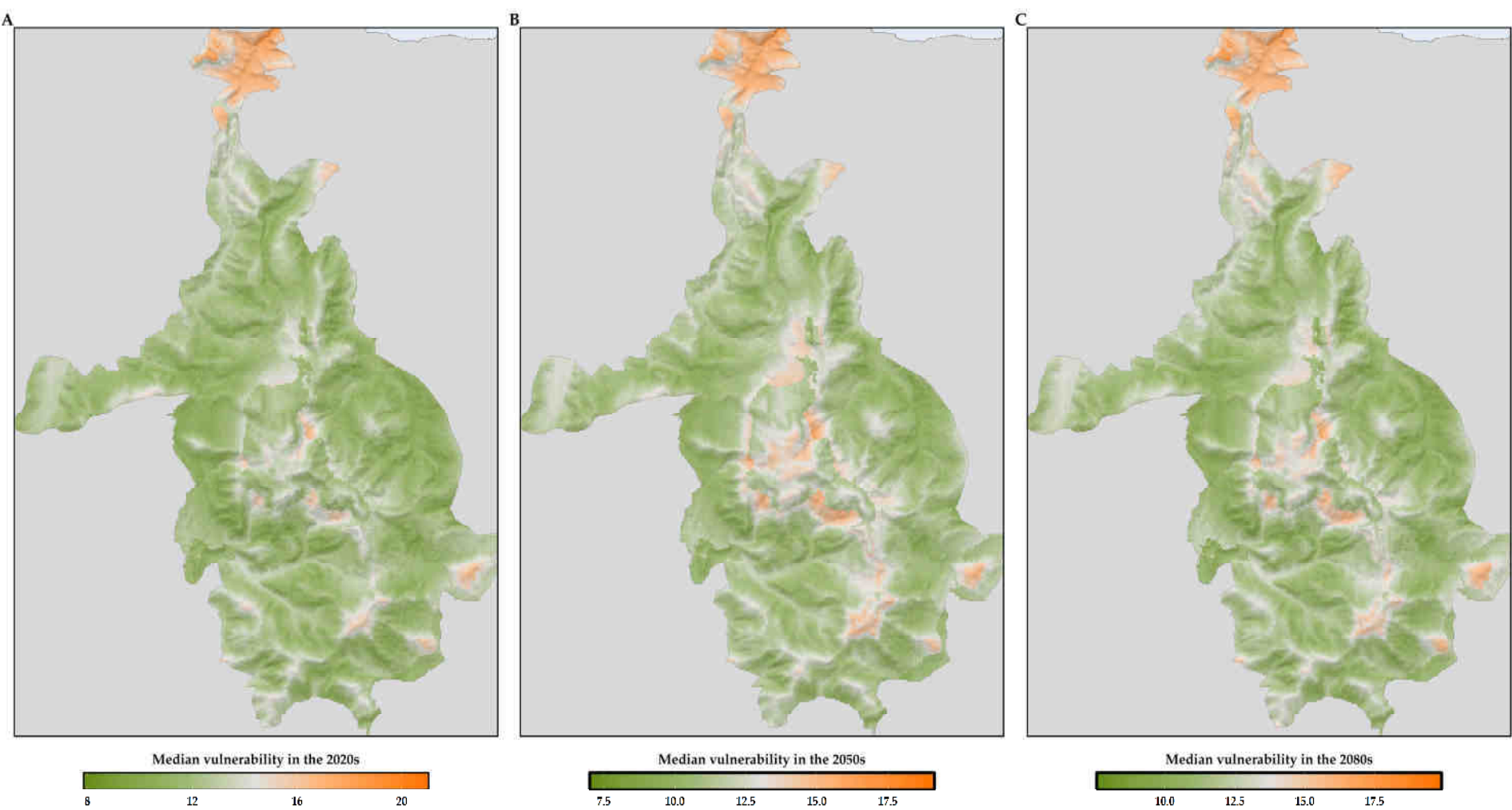
Temporal taxonomic and phylogenetic beta diversity was primarily influenced by species replacement, a fact underscored by the ratio of the replacement component to the total beta diversity (Figure S11). These dynamics were particularly prominent in the central regions of CVNP (Figure 6). Additionally, we noted that the areas exhibiting the highest values (i.e., the respective L1 hotspots) for both facets of beta diversity were predominantly situated in the south-central zones of the CVNP, showing significant congruence (Figure S12). Notably, these areas do not coincide with the L1-L3 CWE-PE hotspots.



**Figure 6.** Temporal (A) taxonomic and (B) phylogenetic beta diversity between the baseline period and the Ensemble RCP 8.5 SSP5 combination in the 2080s.

### 3.5. Sensitivity, Exposure and Vulnerability to Climate and Land-Use Change

Non-endemic taxa displayed statistically significantly lower sensitivity and vulnerability than endemic taxa on CVNP (Kruskal-Wallis ANOVA  $H = 402.18$ ,  $df = 2$ ,  $p < 0.001$ ; Table S7; Figure S13). *Rubus sanctus* and *Nepeta argolica* subsp. *argolica* had the highest vulnerability values among non-endemic and endemic taxa, respectively (Table S7; Figure S13). The northern (i.e., the Vouraikos gorge and its surrounding area), central, and southwestern areas of the CVNP are more vulnerable to climate change (Figure 7), with the central areas showing lower standard deviation across all periods (Figure S14).



**Figure 7.** Spatial median vulnerability for the medicinal and aromatic plant taxa included in our analyses for the (A) 2020s, (B) 2050s, and (C) 2080s.



## 4. Discussion

### 4.1. Species-Specific Responses to Drivers of Global Change

In the Anthropocene, understanding the nuanced responses of diverse species to anthropogenic disturbances like climate change and land use change remains paramount. Climate change may block the ability of species to deal with land-use change, and in turn, land-use change could limit resilience to climate change [13,178]. Climate change and land use change have significant impacts on medicinal and aromatic plants, including a reduction in their diversity, abundance and growth forms, changes in their geographical distribution and habitat ranges, a decrease in the climatically suitable areas for them and detrimental effects on their secondary metabolome as a source of innovative drugs and probes for novel biochemical mechanisms and targets [13,87,179–181]. Our study provides novel insights into the potential impacts of climate and land-use change on the diversity and distribution of MAPs in the Chelmos-Vouraikos National Park, a protected area and biodiversity hotspot in Greece. Our results indicate that climate and land-use change significantly threaten MAP diversity in the study area in the coming decades (Figures 2, S2 and S3). However, land-use change appears to be a more detrimental factor than climate change alone. Furthermore, the impacts of climate and land-use change are distinctly species-specific (Tables S4, S5 and S7; Figures 2, S2, S3 and S13; [54]). This species-specific response to climate change aligns with findings from previous studies that conducted climate change vulnerability assessments—without taking into consideration the land-use change though—for MAPs in other parts of the world [182–187]. This idiosyncrasy, in response, significantly impacts conservation strategies, particularly within protected areas such as the Chelmos-Vouraikos National Park.

Endemic taxa face an elevated risk of range contractions and potential local extirpations, likely due to their restricted geographic ranges and specialised niches [188]. Endemic MAPs within the Chelmos-Vouraikos National Park appear particularly vulnerable, being more negatively affected by land-use change (Tables S4, S5 and S7; Figures 2, S2, S3 and S13). These findings align with recent meta-analyses showing that climate change disproportionately threatens endemic species [189] and with the fact that climate and land-use change affect more the limited ability of endemic taxa to disperse and adapt to new conditions [190–192]. This also concerns Greece’s unique biodiversity and the ecological challenges several of the Greek endemics and the range-restricted taxa occurring there face [22,36,92,193,194]. In contrast, at least initially, most non-endemic MAP taxa are projected to undergo range expansions within the Chelmos-Vouraikos National Park (Tables S4, S5 and S8; Figures 2, S2 and S3). This corroborates previous observations that species with widespread distributions tend to be “winners” under climate change as they can track suitable conditions across landscapes [195–197]. However, non-endemic MAPs also face substantial range declines in the long term, especially under the land-use change model (Table S4; Figures 2, S2 and S3). Overall, our results highlight the synergistic threats posed by both drivers of global change [13]. While endemic taxa are more sensitive to climate shifts due to narrow environmental tolerances [198], land-use change poses a relatively more significant hazard [7,199–201]. This aligns with the finding that land-use change has been the primary driver of plant extinctions [6]. The severe range contractions for MAP taxa projected under extensive habitat conversion highlight the critical role of protected areas like the Chelmos-Vouraikos National Park in safeguarding these valuable plant resources. Such differential responses among endemics and non-endemics underscore the intricate interplay of ecological, evolutionary, and anthropogenic forces in shaping species distributions [202,203]. Predicting climate and land-use change interactions requires understanding the underlying ecological mechanisms, and interdisciplinary cooperation is needed to advance understanding [204].

### 4.2. Biodiversity Hotspots

Our study predicts significant shifts in the location of biodiversity hotspots within the Chelmos-Vouraikos National Park (Figures 4, 5 and S4–S7). Species richness hotspots are

expected to remain relatively stable (Figures 4 and S4), likely because widespread generalist species can persist under altered conditions [188]. However, hotspots of phylogenetic endemism and corrected weighted endemism will substantially shift from central to peripheral park zones (Figures 5, S6 and S7). These metrics better capture vulnerability, giving greater weight to range-restricted and evolutionarily distinct taxa [18,22,164,167,205–207]. More specifically, areas currently designated as biodiversity hotspots within the Chelmos-Vouraikos National Park might face a staggering loss, with predictions of up to 86.4% of their area vanishing (Table S6; Figures 5, S6 and S7). This drastic shrinkage threatens the safe havens of plant genetic resources, necessitating immediate and strategic intervention [43,46,208–211].

Furthermore, the displacement of these hotspots over time highlights that the areas currently harbouring the greatest phylogenetic endemism and corrected-weighted endemism will not remain constant (Figure 5). This contrasts with the prevailing paradigm that the locations of biodiversity hotspots are relatively static [212], especially in the Anthropocene, an era of rapid environmental change. Our findings demonstrate that climate and land-use change can radically reshape biogeographic patterns, at least at local scales, a pattern observed in other biodiversity hotspots and taxa [12,36,37,169,213–216]. This underscores the need for flexible conservation strategies that track shifting areas of endemism and evolutionary distinctiveness [195] and even more so for economically important taxa, such as the MAPs occurring in mountainous protected areas, such as the Chelmos-Vouraikos National Park, where the local population may use them for their therapeutical properties. We must prioritise thus these vulnerable areas to safeguard the genetic diversity harboured by MAPs in the Chelmos-Vouraikos National Park.

Bearing in mind that conservation funds and human resources are scarce in post-memorandum and post-COVID Greece [217–219], we also identified the CWE-PE Anthropocene refugia that are expected to maintain high biodiversity despite global change based on the intersection of current and future hotspots [220]. These refugia represent top conservation priorities, as they constitute zones of long-term resilience [221]. However, even these refugia face significant range size reductions and upward elevation shifts (Table S6; Figures 5 and S8), a phenomenon observed elsewhere [36,222–224]. This reflects the overall trends of range contractions and mountaintop extinctions predicted in our models and in other mountainous areas of Greece [36,46]. These results corroborate a recent analysis showing that protected areas within the EU may provide less effective refuge than non-protected areas for biodiversity under climate change, especially in the Alpine, Boreal and Continental biogeographical regions in Europe and in high-altitude protected areas [103], which are more exposed to global change drivers [225].

Another complication regarding the MAP conservation prioritisation in the Chelmos-Vouraikos National Park arises from the fact that the areas projected to experience the highest temporal taxonomic and phylogenetic turnover (Figures 6, S11 and S12) do not overlap with either the L1 CWE-PE hotspots or the Anthropocene refugia (Figure 5) or the areas facing the greatest vulnerability to climate and land-use change (Figure 7). Nevertheless, these areas of extensive reshuffling of community composition (Figures 6, S11 and S12) warrant specialised conservation consideration, as species turnover might lead to biotic homogenisation (Figure S11). This in turn can culminate in the decline in the unique MAP assemblages that define the Chelmos-Vouraikos National Park, replaced by a more homogenised, less diverse MAP community with a poorer phytochemical diversity and altered quality, safety and health-promoting efficacy [85–90].

#### 4.3. Conservation Strategies

It thus seems that a network of interconnected and intensified conservation measures will likely be needed to prevent MAP extinctions and safeguard ecosystem services in the Chelmos-Vouraikos National Park and highlight the need for a multifaceted conservation strategy incorporating assisted migration, landscape connectivity, and climate adaptation planning to safeguard MAP diversity in the Chelmos-Vouraikos National Park. One

potential approach that has gained traction in recent years is the establishment of plant micro-reserves [226]. These smaller conservation areas, strategically located, can provide a haven for species facing the most significant threats, ensuring their survival in the face of looming challenges [227–230]. However, other management measures become equally critical [179]. Over-harvesting of MAPs, driven by their commercial demand and their medicinal and aromatic value, is a persistent concern, and sustainable harvesting emerges as a key conservation approach for numerous wild-harvested species, considering their significant role in local economies and their enduring value to harvesters over an extended period [231–236]. Rigorous monitoring, regulation and awareness campaigns can curb this threat, preserving these plants for future generations.

It is crucial to inform and educate the collectors and the general public about the potential impacts of over-harvesting, such as the loss of genetic resources and essential compounds (responsible for biological actions), and the significance of these species in maintaining ecological balance and resilience. By bridging the knowledge gap and fostering a culture of conservation, we can galvanise collective action towards preserving these invaluable resources.

Translocation of the most sensitive MAPs is another common proactive adaptation strategy increasingly recognised as a necessary option for managing threatened plant species and worth exploring [237–239]. We can ensure their survival by moving these species to more favourable habitats, especially in suitable remote areas with low harvesting pressure, and high genetic diversity increases the early establishment of translocated populations [240,241]. However, this approach is fraught with challenges [238,242–244], from selecting suitable relocation sites to ensuring the relocated species can thrive in their new homes without outcompeting native species [245–247]. Long-term monitoring is required for proper evaluation to improve in situ conservation [243,248,249] and could enhance insights into climate change vulnerability [250,251].

Regarding the Anthropocene refugia and the areas of high temporal taxonomic and phylogenetic turnover, carefully laid out adaptive management plans can target these high-risk zones by fostering landscape connectivity and heterogeneity to promote resilience. Establishing micro-reserves for the endemic MAPs and securing crucial public support for these initiatives, potentially through a popular method like offering educational opportunities within a park setting [231,252], may be necessary.

#### 4.4. Policy Implications

The study findings also support the ongoing efforts for MAES implementation in the EU and Greece, providing a concrete methodological procedure for mapping and assessing the national MAES indicators IB2 (Floristic diversity) and IB3 (Micro-refugia of floristic and endemic diversity) and providing robust input for developing a new indicator for the “Food, material and energy” group, with the name “MAPs”, following [104]. Our results are also spatially explicit and ready to use and can be directly integrated into the open access, participatory, and web GIS (ppGIS/webGIS) platform of the LIFE-IP 4 NATURA project (this project is the recipient of the largest nature-focused funding scheme for Greece ever sanctioned by the European Commission), led by the Ministry of Environment and Energy [253]. Thus, our findings can be directly applied to the decision-making process, especially for the management and policymaking of Natura 2000 protected areas. In the Chelmos-Vouraikos National Park, our findings on the vulnerability of Medicinal and Aromatic Plants (MAPs) to climate and land-use changes align with the projected land cover shifts detailed in [54]. These shifts predominantly involve increases in broad-leaf deciduous trees, needleleaf evergreen trees, and broad-leaf evergreen shrubs. Additionally, the Chelmos-Vouraikos National Park is experiencing severe crop abandonment and a rapid transition of C3 grasslands, primarily concentrated in its central and south-eastern areas (as shown in Figure 3 of [54]). Our analysis has identified a substantial overlap of 22.7% between the current L1 CWE-PE hotspots under the CC-LULCC model in the Chelmos-Vouraikos National Park and the land-use and land-cover change (LULC) hotspots

previously reported by [54] (Figure S15). This significant overlap emphasizes the areas within the park most affected by these changes, highlighting the necessity for targeted conservation efforts. These land cover changes, especially the afforestation and the loss of mountainous grasslands, are pivotal in shaping the CVNP's conservation strategies. They underscore the urgency of implementing targeted actions to ensure the survival and sustainable use of both endemic and non-endemic MAPs in the CVNP, given the rapid pace of anticipated land-use change in the coming decades [54]. Our results offer vital insights for developing effective management plans for the Chelmos-Vouraikos National Park, enabling the adaptation of conservation strategies in response to the evolving landscape. Moreover, our findings should be considered for drafting future protected areas' management plans, since our spatially explicit findings may alter Natura 2000 areas' zonation boundaries and/or allowed land use. In the EU context, our results provide a baseline for future assessments following EU and Member States' obligations to develop natural capital accounts for ecosystem condition and ecosystem services (see, e.g., [254,255]). At the same time, it simultaneously supports scientifically informed decisions under the framework of the recently adopted EU Nature Restoration Law, EU Biodiversity Strategy, and European Green Deal.

## 5. Conclusions

The Chelmos-Vouraikos National Park represents an exemplary template that can inform protected area management globally, especially in other biodiversity hotspots facing comparable threats. Mountainous regions, in particular, represent unique reservoirs of endemic MAP diversity that need conservation prioritisation. As climate and land use changes accelerate, proactive adaptation efforts grounded in quantitative vulnerability assessments will grow increasingly vital. Our findings, while regionally focused, contribute to the understanding of global biodiversity trends, highlighting the need for comparing these results with other similar studies for broader applicability.

Our study also underscores the tight interconnectedness of local and global conservation priorities and contributes to a deeper understanding of global biodiversity trends by examining how localised ecological systems respond to global environmental pressures. While we focused on a protected area of regional and EU significance, the insights from our research have implications for safeguarding Mediterranean and global MAP biodiversity. Local biodiversity hotspots like the Chelmos-Vouraikos National Park provide anchors for maintaining regional and global biodiversity amid intensifying threats, highlighting the reciprocal linkages between local and global conservation goals. While our study offers insights into the resilience and adaptability of endemic MAPs in the Chelmos-Vouraikos National Park, their broader applicability needs to be established through comparative studies in different ecological and geographical settings. The results of our study will also be instrumental in comparing the resilience and adaptability of endemic versus non-endemic MAPs in different ecological and geographical settings. They will enhance our comprehension of how regional plant diversity hotspots are intrinsically linked to the broader mosaic of global biodiversity, which is crucial for formulating cohesive and effective conservation policies on an international scale. This comparison enriches the global understanding of ecological responses to climate and land-use change and helps formulate region-specific and globally applicable conservation strategies. Our detailed examination of local ecological systems under global environmental pressures enriches the global understanding of ecological responses and underscores the importance of integrating local findings into the broader conservation narrative.

In conclusion, our study predicts significant disruptions to the protected MAP flora of the Chelmos-Vouraikos National Park under forecasted climate and land-use changes. However, we also identify potential conservation strategies to promote resilience in this unique Mediterranean hotspot. The evidence from our analysis exemplify how quantitative assessments can inform evidence-based adaptation planning to safeguard biodiversity hotspots in the face of global change. Understanding the specific responses of MAPs to envi-



ronmental changes will inform adaptive management practices, ensuring that conservation strategies remain effective under changing abiotic conditions. Moving forward, expanded monitoring and modelling efforts will help refine projections and enable adaptive responses to emerging threats. With proactive policies in place and collaborative efforts rooted in rigorous research and complemented by public engagement, the Chelmos-Vouraikos National Park can continue to serve as a hotspot for Greece's MAP diversity long into the future. These findings, while region-specific, can inform broader conservation strategies by serving as a case study for other Mediterranean and global biodiversity hotspots. Our research, therefore, while primarily focused on a specific region, lays the groundwork for further research on MAPs and their conservation, highlighting the dynamic interplay between local actions and global biodiversity conservation goals.

The conclusions we draw and potential enhancements to our study, could be extended beyond the scope of Chelmos-Vouraikos National Park, and serve as the basis for future research for MAPs, as an important component of a national natural capital, and the combined effect of climate and land use changes on their populations; and for conservation management plans of protected areas and policy-making processes following national and European laws.

**Supplementary Materials:** The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/land13020133/s1>, Figure S1: Raincloud plot of the model performance evaluation metrics for (A) the CC model, (B) the LULCC model and (C) the CC-LULCC model. AUC: Area under the curve. AUC-PR: Area under the precision-recall curve. TSS: True skill statistic; Figure S2: Raincloud plot of the median projected proportion of area range loss for all the medicinal and aromatic plant taxa we analysed under (A) all global circulation models (GCM) and (B) all shared socioeconomic pathways (SSP); Figure S3: Raincloud plot of the projected proportion of area range change for all the medicinal and aromatic plant taxa we analysed under all global circulation models (GCM), representative pathway concentrations (RCP) and shared socioeconomic pathways combination for every period under the CC-LULCC model; Figure S4: From left to right: Current medicinal and aromatic plant species richness (SR) and future SR for the 2020s, 2050s and 2080s based on the Ensemble RCP 8.5 SSP5 combination; Figure S5: From left to right: Current medicinal and aromatic plant phylogenetic diversity (PD) and future PD for the 2020s, 2050s and 2080s based on the Ensemble RCP 8.5 SSP5 combination; Figure S6: From left to right: Current medicinal and aromatic plant corrected-weighted endemism (CWE) and future CWE for the 2020s, 2050s and 2080s based on the Ensemble RCP 8.5 SSP5 combination; Figure S7: From left to right: Current medicinal and aromatic plant phylogenetic endemism (PE) and future PE for the 2020s, 2050s and 2080s based on the Ensemble RCP 8.5 SSP5 combination; Figure S8: Anticipated overall median altitudinal range difference (in meters) per taxon, calculated across the 2020s, 2050s, and 2080s compared to the baseline period, under the CC-LULCC model. Taxon abbreviations appear in Table S7; Figure S9: From left to right: L1 (top 1%) corrected-weighted—phylogenetic endemism (CWE-PE) hotspots, also known as Priority Hotspots (marked with red cells), for both the baseline period and the future. This is under the strict consensus rule, meaning we only considered cells currently serving and projected to continue serving as Priority Hotspots across every combination of GCM, RCP, SSP, and period for the CC model; Figure S10: From left to right: L1 (top 1%) corrected-weighted—phylogenetic endemism (CWE-PE) hotspots, also known as Priority Hotspots (marked with red cells), for both the baseline period and the future. This is under the strict consensus rule, meaning we only considered cells currently serving and projected to continue serving as Priority Hotspots across every combination of GCM, RCP, SSP, and period for the LULCC model; Figure S11: The ratio of the replacement component to the total beta diversity for the temporal (A) taxonomic and (B) phylogenetic beta diversity between the baseline period and the Ensemble RCP 8.5 SSP5 combination in the 2080s; Figure S12: L1 (top 1%) hotspots for (A) the temporal taxonomic and (B) the temporal phylogenetic beta diversity of the medicinal and aromatic plant taxa included in our analyses for the Ensemble RCP 8.5 SSP5 combination in the 2080s, with (C) illustrating the overlap of these L1 temporal taxonomic and phylogenetic beta diversity hotspots; Figure S13: Raincloud plot showing the overall median vulnerability, calculated across the 2020s, 2050s, and 2080s, for each medicinal and aromatic plant taxon included in our analyses under the CC, CC-LULCC, and LULCC models; Figure S14: Spatial standard deviation of vulnerability for the medicinal and aromatic plant



taxa included in our analyses for the (A) 2020s, (B) 2050s and (C) 2080s; Figure S15: L1 (top 1%) corrected-weighted—phylogenetic endemism (CWE-PE) hotspots, also known as Priority Hotspots (marked with red cells), for the baseline period. These are overlaid with the hotspots of LULC change in Chelmos-Vouraikos National Park. Data for the latter were retrieved from [54].”; Table S1: The medicinal and aromatic plant taxa occurring on Mt. Chelmos; Table S2: Evaluation of models’ predictive performance via several discrimination (AUC, AUC-PR, TSS) and calibration [Brier score, Cohen’s kappa, Continuous Boyce Index (CBI), Somer’s D] metrics for all the taxa included in the analyses. PTNI: Potential Niche Truncation Index. LULCC: the land-use/land-cover change model. CC: the climate change model. CC-LULCC: the climate change and land-cover/land-use change model; Table S3: Variable importance for each of the taxa included in our analyses. LULCC: the land-use/land-cover change model. CC: the climate change model. CC-LULCC: the climate change and land-cover/land-use change model. RCP: Representative Concentration Pathway. SSP: Shared Socioeconomic Pathway. AIT: Thornthwaite’s aridity index. BDOD: Bulk density of the fine earth fraction. BDDT: Broadleaf deciduous temperate trees. BEST: Broadleaf evergreen temperate trees. C3: C3 grasses. CEC: Cation exchange capacity of the soil. CFVO: Volumetric fraction of coarse fragments. Clay: Proportion of clay particles in the fine earth fraction. HLI: Heat load index. NETT: Needleleaf evergreen temperate trees. OCS: Organic carbon stocks. PWM: Precipitation of the wettest month. Sand: Proportion of sand particles in the fine earth fraction. Silt: Proportion of silt particles in the fine earth fraction. SOC: Soil organic carbon content in the fine earth fraction. TAR: Temperature annual range. TPI: Topographic position index; Table S4: Proportion of potential area change for each of the taxa included in our analyses for every time-period and climate change model/scenario. GCM: Global Circulation Model. RCP: Representative Concentration Pathway. SSP: Shared Socioeconomic Pathway. LULCC: the land-use/land-cover change model. CC: the climate change model. CC-LULCC: the climate change and land-cover/land-use change model.; Table S5: the non-endemic taxa expected to substantially expand their range.; Table S6: The present and the future area and altitude for the areas identified as Priority Hotspots in the present and in the future, as well as their absolute and proportional areal and altitudinal difference. The area and altitude for the Anthropocene refugia are also presented. LULCC: the land-use/land-cover change model. CC: the climate change model. CC-LULCC: the climate change and land-use/land-cover change model; Table S7: The sensitivity, marginality and vulnerability values for each taxon included in our analyses for the periods 2020s, 2050s and 2080s. GCM: Global Circulation Model. RCP: Representative Concentration Pathway. SSP: Shared Socioeconomic Pathway. CC: the climate change model. CC-LULCC: the climate change and land-use/land-cover change model. LULCC: the land-use/land-cover change model; Table S8: The abbreviations appearing in Figure S8 for all the taxa included in our analyses.

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## References

1. Cai, L.; Kreft, H.; Taylor, A.; Denelle, P.; Schrader, J.; Essl, F.; van Kleunen, M.; Pergl, J.; Pyšek, P.; Stein, A.; et al. Global models and predictions of plant diversity based on advanced machine learning techniques. *New Phytol.* **2023**, *237*, 1432–1445. [\[CrossRef\]](#) [\[PubMed\]](#)
2. Cai, L.; Kreft, H.; Taylor, A.; Schrader, J.; Dawson, W.; Essl, F.; van Kleunen, M.; Pergl, J.; Pyšek, P.; Winter, M.; et al. Climatic stability and geological history shape global centers of neo- and paleoendemism in seed plants. *Proc. Natl. Acad. Sci. USA* **2023**, *120*, e2300981120. [\[CrossRef\]](#)
3. Tietje, M.; Antonelli, A.; Forest, F.; Govaerts, R.; Smith, S.A.; Sun, M.; Baker, W.J.; Eiserhardt, W.L. Global hotspots of plant phylogenetic diversity. *New Phytol.* **2023**, *240*, 1636–1646. [\[CrossRef\]](#) [\[PubMed\]](#)
4. Sabatini, F.M.; Jiménez-Alfaro, B.; Jandt, U.; Chytrý, M.; Field, R.; Kessler, M.; Lenoir, J.; Schrod, F.; Wiser, S.K.; Arfin Khan, M.A.S.; et al. Global patterns of vascular plant alpha diversity. *Nat. Commun.* **2022**, *13*, 4683. [\[CrossRef\]](#) [\[PubMed\]](#)
5. Qian, H.; Zhang, J.; Jiang, M. Global patterns of taxonomic and phylogenetic diversity of flowering plants: Biodiversity hotspots and coldspots. *Plant Divers.* **2023**, *45*, 265–271. [\[CrossRef\]](#)
6. Le Roux, J.J.; Hui, C.; Castillo, M.L.; Iriando, J.M.; Keet, J.H.; Khapugin, A.A.; Médail, F.; Rejmánek, M.; Theron, G.; Yannelli, F.A.; et al. Recent Anthropogenic Plant Extinctions Differ in Biodiversity Hotspots and Coldspots. *Curr. Biol.* **2019**, *29*, 2912–2918.e2. [\[CrossRef\]](#) [\[PubMed\]](#)
7. Moreira, H.; Kuipers, K.J.J.; Posthuma, L.; Zijp, M.C.; Hauck, M.; Huijbregts, M.A.J.; Schipper, A.M. Threats of land use to the global diversity of vascular plants. *Divers. Distrib.* **2023**, *29*, 688–697. [\[CrossRef\]](#)
8. Asamoah, E.F.; Beaumont, L.J.; Maina, J.M. Climate and land-use changes reduce the benefits of terrestrial protected areas. *Nat. Clim. Chang.* **2021**, *11*, 1105–1110. [\[CrossRef\]](#)
9. Robiansyah, I.; Primananda, E.; Zulkarnaen, R.N.; Helmanto, H.; Kusuma, Y.W.C.; Yudaputra, A. Climate Change Impact on Medicinal Plants: An Insight from the IUCN Red List of Threatened Species. In *Medicinal Plants: Biodiversity, Biotechnology and Conservation*; Springer: Singapore, 2023; pp. 115–131.
10. Ekka, P.; Patra, S.; Upreti, M.; Kumar, G.; Kumar, A.; Saikia, P. Land Degradation and Its Impacts on Biodiversity and Ecosystem Services. In *Land and Environmental Management through Forestry*; Wiley: Hoboken, NJ, USA, 2023; pp. 77–101.
11. Minachilis, K.; Kougioumoutzis, K.; Petanidou, T. Climate change effects on multi-taxa pollinator diversity and distribution along the elevation gradient of Mount Olympus, Greece. *Ecol. Indic.* **2021**, *132*, 108335. [\[CrossRef\]](#)
12. Kougioumoutzis, K.; Kaloveloni, A.; Petanidou, T. Assessing Climate Change Impacts on Island Bees: The Aegean Archipelago. *Biology* **2022**, *11*, 552. [\[CrossRef\]](#)
13. He, X.; Liang, J.; Zeng, G.; Yuan, Y.; Li, X. The effects of interaction between climate change and land-use/cover change on biodiversity-related ecosystem services. *Glob. Chall.* **2019**, *3*, 1800095. [\[CrossRef\]](#) [\[PubMed\]](#)
14. Cuttelod, A.; García, N.; Malak, D.A.; Temple, H. The mediterranean: A biodiversity hotspot under threat. In *Wildlife in a Changing World—An Analysis of the 2008 IUCN Red List of Threatened Species*; Vié, J.-C., Hilton-Taylor, C., Stuart, S.N., Eds.; IUCN: Gland, Switzerland, 2008; p. 16.
15. Médail, F.; Quezel, P. Hot-spots analysis for conservation of plant biodiversity in the Mediterranean Basin. *Ann. Mo. Bot. Gard.* **1997**, *84*, 112–127. [\[CrossRef\]](#)
16. Médail, F.; Myers, N. *Mediterranean Basin*; Mittermeier, C.G., Lamoreux, J., Fonseca, G.A.B., Eds.; Sierra: Cheyenne, WY, USA, 2004.
17. Médail, F. The specific vulnerability of plant biodiversity and vegetation on Mediterranean islands in the face of global change. *Reg. Environ. Chang.* **2017**, *17*, 1775–1790. [\[CrossRef\]](#)
18. Kougioumoutzis, K.; Kokkoris, I.P.; Panitsa, M.; Kallimanis, A.; Strid, A.; Dimopoulos, P. Plant Endemism Centres and Biodiversity Hotspots in Greece. *Biology* **2021**, *10*, 72. [\[CrossRef\]](#) [\[PubMed\]](#)
19. Médail, F.; Diadema, K. Glacial refugia influence plant diversity patterns in the Mediterranean Basin. *J. Biogeogr.* **2009**, *36*, 1333–1345. [\[CrossRef\]](#)
20. Monnet, A.-C.; Cilleros, K.; Médail, F.; Albassatneh, M.C.; Arroyo, J.; Bacchetta, G.; Bagnoli, F.; Barina, Z.; Cartereau, M.; Casajus, N.; et al. WOODIV, a database of occurrences, functional traits, and phylogenetic data for all Euro-Mediterranean trees. *Sci. Data* **2021**, *8*, 89. [\[CrossRef\]](#) [\[PubMed\]](#)
21. Cheikh Albassatneh, M.; Escudero, M.; Monnet, A.; Arroyo, J.; Bacchetta, G.; Bagnoli, F.; Dimopoulos, P.; Hampe, A.; Leriche, A.; Médail, F.; et al. Spatial patterns of genus-level phylogenetic endemism in the tree flora of Mediterranean Europe. *Divers. Distrib.* **2021**, *27*, 913–928. [\[CrossRef\]](#)
22. Kougioumoutzis, K.; Kokkoris, I.P.; Panitsa, M.; Strid, A.; Dimopoulos, P. Extinction Risk Assessment of the Greek Endemic Flora. *Biology* **2021**, *10*, 195. [\[CrossRef\]](#)
23. Hammoud, C.; Kougioumoutzis, K.; Rijdsdijk, K.F.; Simaiakis, S.M.; Norder, S.J.; Foufopoulos, J.; Georgopoulou, E.; Van Loon, E.E. Past connections with the mainland structure patterns of insular species richness in a continental-shelf archipelago (Aegean Sea, Greece). *Ecol. Evol.* **2021**, *11*, 5441–5458. [\[CrossRef\]](#)
24. Kougioumoutzis, K.; Simaiakis, S.M.; Tiniakou, A. Network biogeographical analysis of the central Aegean archipelago. *J. Biogeogr.* **2014**, *41*, 1848–1858. [\[CrossRef\]](#)
25. Kougioumoutzis, K.; Valli, A.T.; Georgopoulou, E.; Simaiakis, S.M.; Triantis, K.A.; Trigas, P. Network biogeography of a complex island system: The Aegean Archipelago revisited. *J. Biogeogr.* **2017**, *44*, 651–660. [\[CrossRef\]](#)

26. Matthews, T.J.; Rigal, F.; Kougioumoutzis, K.; Trigas, P.; Triantis, K.A. Unravelling the small-island effect through phylogenetic community ecology. *J. Biogeogr.* **2020**, *47*, 2341–2352. [\[CrossRef\]](#)
27. Valli, A.T.; Kougioumoutzis, K.; Iliadou, E.; Panitsa, M.; Trigas, P. Determinants of alpha and beta vascular plant diversity in Mediterranean island systems: The Ionian islands, Greece. *Nord. J. Bot.* **2019**, *37*, e02156. [\[CrossRef\]](#)
28. Panitsa, M.; Kagiampaki, A.; Kougioumoutzis, K. Plant diversity and biogeography of the Aegean Archipelago: A New Synthesis. In *Biogeography and Biodiversity of the Aegean. In Honour of Prof. Moysis Mylonas*; Sfenthourakis, S., Pafilis, P., Parmakelis, A., Poulakakis, N., Triantis, K., Eds.; Broken Hill Publishers Ltd.: Nicosia, Cyprus, 2018; pp. 223–244. ISBN 9789925563784.
29. Simaiakis, S.M.; Rijsdijk, K.F.; Koene, E.F.M.; Norder, S.J.; Van Boxel, J.H.; Stocchi, P.; Hammoud, C.; Kougioumoutzis, K.; Georgopoulou, E.; Van Loon, E.; et al. Geographic changes in the Aegean Sea since the Last Glacial Maximum: Postulating biogeographic effects of sea-level rise on islands. *Palaeogeogr. Palaeoclimatol. Palaeoecol.* **2017**, *471*, 108–119. [\[CrossRef\]](#)
30. Dagallier, L.P.M.J.; Janssens, S.B.; Dauby, G.; Blach-Overgaard, A.; Mackinder, B.A.; Droissart, V.; Svenning, J.C.; Sosef, M.S.M.; Stévant, T.; Harris, D.J.; et al. Cradles and museums of generic plant diversity across tropical Africa. *New Phytol.* **2020**, *225*, 2196–2213. [\[CrossRef\]](#) [\[PubMed\]](#)
31. López-Pujol, J.; Zhang, F.-M.; Sun, H.-Q.; Ying, T.-S.; Ge, S. Mountains of Southern China as “Plant Museums” and “Plant Cradles”: Evolutionary and Conservation Insights. *Mt. Res. Dev.* **2011**, *31*, 261–269. [\[CrossRef\]](#)
32. Körner, C.; Paulsen, J.; Spehn, E.M. A definition of mountains and their bioclimatic belts for global comparisons of biodiversity data. *Alp. Bot.* **2011**, *121*, 73–78. [\[CrossRef\]](#)
33. Perrigo, A.; Hoorn, C.; Antonelli, A. Why mountains matter for biodiversity. *J. Biogeogr.* **2020**, *47*, 315–325. [\[CrossRef\]](#)
34. Rahbek, C.; Borregaard, M.K.; Antonelli, A.; Colwell, R.K.; Holt, B.G.; Nogues-Bravo, D.; Rasmussen, C.M.Ø.; Richardson, K.; Rosing, M.T.; Whittaker, R.J.; et al. Building mountain biodiversity: Geological and evolutionary processes. *Science* **2019**, *365*, 1114–1119. [\[CrossRef\]](#)
35. Rahbek, C.; Borregaard, M.K.; Colwell, R.K.; Dalsgaard, B.; Holt, B.G.; Morueta-Holme, N.; Nogues-Bravo, D.; Whittaker, R.J.; Fjeldsø, J. Humboldt’s enigma: What causes global patterns of mountain biodiversity? *Science* **2019**, *365*, 1108–1113. [\[CrossRef\]](#)
36. Kougioumoutzis, K.; Kokkoris, I.P.; Panitsa, M.; Trigas, P.; Strid, A.; Dimopoulos, P. Plant Diversity Patterns and Conservation Implications under Climate-Change Scenarios in the Mediterranean: The Case of Crete (Aegean, Greece). *Diversity* **2020**, *12*, 270. [\[CrossRef\]](#)
37. Kougioumoutzis, K.; Kokkoris, I.P.; Panitsa, M.; Trigas, P.; Strid, A.; Dimopoulos, P. Spatial Phylogenetics, Biogeographical Patterns and Conservation Implications of the Endemic Flora of Crete (Aegean, Greece) under Climate Change Scenarios. *Biology* **2020**, *9*, 199. [\[CrossRef\]](#) [\[PubMed\]](#)
38. Guardiola, M.; Sáez, L. Are Mediterranean Island Mountains Hotspots of Taxonomic and Phylogenetic Biodiversity? The Case of the Endemic Flora of the Balearic Islands. *Plants* **2023**, *12*, 2640. [\[CrossRef\]](#) [\[PubMed\]](#)
39. González-Orozco, C.E. Unveiling evolutionary cradles and museums of flowering plants in a neotropical biodiversity hotspot. *R. Soc. Open Sci.* **2023**, *10*, 230917. [\[CrossRef\]](#) [\[PubMed\]](#)
40. Pauli, H.; Gottfried, M.; Dullinger, S.; Abdaladze, O.; Akhalkatsi, M.; Alonso, J.L.B.; Coldea, G.; Dick, J.; Erschbamer, B.; Calzado, R.F.; et al. Recent plant diversity changes on Europe’s mountain summits. *Science* **2012**, *336*, 353–355. [\[CrossRef\]](#) [\[PubMed\]](#)
41. Alexander, J.M.; Chalmandrier, L.; Lenoir, J.; Burgess, T.I.; Essl, F.; Haider, S.; Kueffer, C.; McDougall, K.; Milbau, A.; Nuñez, M.A.; et al. Lags in the response of mountain plant communities to climate change. *Glob. Change Biol.* **2018**, *24*, 563–579. [\[CrossRef\]](#) [\[PubMed\]](#)
42. Rumpf, S.B.; Hülber, K.; Klöner, G.; Moser, D.; Schütz, M.; Wessely, J.; Willner, W.; Zimmermann, N.E.; Dullinger, S. Range dynamics of mountain plants decrease with elevation. *Proc. Natl. Acad. Sci. USA* **2018**, *115*, 1848–1853. [\[CrossRef\]](#) [\[PubMed\]](#)
43. Steinbauer, M.J.; Grytnes, J.A.; Jurasinski, G.; Kulonen, A.; Lenoir, J.; Pauli, H.; Rixen, C.; Winkler, M.; Bardy-Durchhalter, M.; Barni, E.; et al. Accelerated increase in plant species richness on mountain summits is linked to warming. *Nature* **2018**, *556*, 231–234. [\[CrossRef\]](#)
44. Ernakovich, J.G.; Hopping, K.A.; Berdanier, A.B.; Simpson, R.T.; Kachergis, E.J.; Steltzer, H.; Wallenstein, M.D. Predicted responses of arctic and alpine ecosystems to altered seasonality under climate change. *Glob. Change Biol.* **2014**, *20*, 3256–3269. [\[CrossRef\]](#)
45. Noroozi, J.; Talebi, A.; Doostmohammadi, M.; Rumpf, S.B.; Linder, H.P.; Schneeweiss, G.M. Hotspots within a global biodiversity hotspot-areas of endemism are associated with high mountain ranges. *Sci. Rep.* **2018**, *8*, 10345. [\[CrossRef\]](#)
46. Kougioumoutzis, K.; Kokkoris, I.P.; Strid, A.; Raus, T.; Dimopoulos, P. Climate-Change Impacts on the Southernmost Mediterranean Arctic-Alpine Plant Populations. *Sustainability* **2021**, *13*, 13778. [\[CrossRef\]](#)
47. Kaltsas, D.; Trichas, A.; Kougioumoutzis, K.; Chatzaki, M. Ground beetles respond to grazing at assemblage level, rather than species-specifically: The case of Cretan shrublands. *J. Insect Conserv.* **2013**, *17*, 681–697. [\[CrossRef\]](#)
48. Kokkoris, I.P.; Kougioumoutzis, K.; Charalampopoulos, I.; Apostolidis, E.; Apostolidis, I.; Strid, A.; Dimopoulos, P. Conservation Responsibility for Priority Habitats under Future Climate Conditions: A Case Study on *Juniperus drupacea* Forests in Greece. *Land* **2023**, *12*, 1976. [\[CrossRef\]](#)
49. Geppert, C.; Bertolli, A.; Prosser, F.; Marini, L. Red-listed plants are contracting their elevational range faster than common plants in the European Alps. *Proc. Natl. Acad. Sci. USA* **2023**, *120*, e2211531120. [\[CrossRef\]](#) [\[PubMed\]](#)
50. Cañadas, E.M.; Fenu, G.; Peñas, J.; Lorite, J.; Mattana, E.; Bacchetta, G. Hotspots within hotspots: Endemic plant richness, environmental drivers, and implications for conservation. *Biol. Conserv.* **2014**, *170*, 282–291. [\[CrossRef\]](#)

51. Dimopoulos, P.; Raus, T.; Bergmeier, E.; Constantinidis, T.; Iatrou, G.; Kokkini, S.; Strid, A.; Tzanoudakis, D. Englera. In *Vascular Plants of Greece: An Annotated Checklist*; Botanic Garden and Botanical Museum Berlin-Dahlem: Berlin, Germany, 2013; pp. 1–372.
52. Dimopoulos, P.; Raus, T.; Bergmeier, E.; Constantinidis, T.; Iatrou, G.; Kokkini, S.; Strid, A.; Tzanoudakis, D. Vascular plants of Greece: An annotated checklist. Supplement. *Willdenowia* **2016**, *46*, 301–348. [\[CrossRef\]](#)
53. Tsakiri, M.; Koumoutsou, E.; Kokkoris, I.P.; Trigas, P.; Iliadou, E.; Tzanoudakis, D.; Dimopoulos, P.; Iatrou, G. National park and unesco global geopark of chelmos-vouraikos (Greece): Floristic diversity, ecosystem services and management implications. *Land* **2022**, *11*, 33. [\[CrossRef\]](#)
54. Kougioumoutzis, K.; Trigas, P.; Tsakiri, M.; Kokkoris, I.P.; Koumoutsou, E.; Dimopoulos, P.; Tzanoudakis, D.; Iatrou, G.; Panitsa, M. Climate and Land-Cover Change Impacts and Extinction Risk Assessment of Rare and Threatened Endemic Taxa of Chelmos-Vouraikos National Park (Peloponnese, Greece). *Plants* **2022**, *11*, 3548. [\[CrossRef\]](#) [\[PubMed\]](#)
55. Tsakiri, M.; Kokkoris, I.P.; Trigas, P.; Tzanoudakis, D.; Iatrou, G. Contribution to the vascular flora of Chelmos-Vouraikos National Park (N Peloponnese, Greece). *Phytol. Balc.* **2020**, *26*, 523.
56. Castañeda-Álvarez, N.P.; Khoury, C.K.; Achicanoy, H.A.; Bernau, V.; Dempewolf, H.; Eastwood, R.J.; Guarino, L.; Harker, R.H.; Jarvis, A.; Maxted, N.; et al. Global conservation priorities for crop wild relatives. *Nat. Plants* **2016**, *2*, 16022. [\[CrossRef\]](#)
57. Chen, S.L.; Yu, H.; Luo, H.M.; Wu, Q.; Li, C.F.; Steinmetz, A. Conservation and sustainable use of medicinal plants: Problems, progress, and prospects. *Chin. Med.* **2016**, *121*, 37. [\[CrossRef\]](#) [\[PubMed\]](#)
58. Hamilton, A.C. Medicinal plants, conservation and livelihoods. *Biodivers. Conserv.* **2004**, *13*, 1477–1517. [\[CrossRef\]](#)
59. Sklirou, A.D.; Angelopoulou, M.T.; Argyropoulou, A.; Chaita, E.; Boka, V.I.; Cheimonidi, C.; Niforou, K.; Mavrogonatou, E.; Pratsinis, H.; Kalpoutzakis, E.; et al. Phytochemical study and in vitro screening focusing on the anti-aging features of various plants of the greek flora. *Antioxidants* **2021**, *10*, 1206. [\[CrossRef\]](#) [\[PubMed\]](#)
60. Stavropoulou, M.I.; Angelis, A.; Aligiannis, N.; Kalpoutzakis, E.; Mitakou, S.; Duke, S.O.; Fokialakis, N. Phytotoxic triterpene saponins from *Bellis longifolia*, an endemic plant of Crete. *Phytochemistry* **2017**, *144*, 71–77. [\[CrossRef\]](#) [\[PubMed\]](#)
61. Solomou, A.D.; Martinos, K.; Skoufogianni, E.; Danalatos, N.G. Medicinal and Aromatic Plants Diversity in Greece and Their Future Prospects: A Review. *Agric. Sci.* **2016**, *4*, 9–20. [\[CrossRef\]](#)
62. Charitonidou, M.; Stara, K.; Kougioumoutzis, K.; Halley, J.M. Implications of salep collection for the conservation of the Elder-flowered orchid (*Dactylorhiza sambucina*) in Epirus, Greece. *J. Biol. Res.* **2019**, *26*, 1–13. [\[CrossRef\]](#) [\[PubMed\]](#)
63. Tomou, E.-M.; Skaltsa, H.; Economou, G.; Trichopoulou, A. Sustainable diets & medicinal aromatic plants in Greece: Perspectives towards climate change. *Food Chem.* **2022**, *374*, 131767. [\[CrossRef\]](#)
64. Hanlidou, E.; Karousou, R.; Lazari, D. Essential oils of three taxa of the nepeta argolica aggregate from Greece. *Chem. Biodivers.* **2012**, *9*, 1559–1566. [\[CrossRef\]](#)
65. Karousou, R.; Hanlidou, E.; Lazari, D. Essential-oil diversity of three *Calamintha* species from Greece. *Chem. Biodivers.* **2012**, *9*, 1364–1372. [\[CrossRef\]](#)
66. Dardioti, A.; Hanlidou, E.; Lanaras, T.; Kokkini, S. The essential oils of the greek endemic *Satureja horvatii* ssp. *macrophylla* in relation to bioclimate. *Chem. Biodivers.* **2010**, *7*, 1968–1977. [\[CrossRef\]](#)
67. Aligiannis, N.; Kalpoutzakis, E.; Mitaku, S.; Chinou, I.B. Composition and Antimicrobial Activity of the Essential Oils of Two *Origanum* Species. *J. Agric. Food Chem.* **2001**, *49*, 4168–4170. [\[CrossRef\]](#) [\[PubMed\]](#)
68. Kalpoutzakis, E.; Chatzimitakos, T.; Athanasiadis, V.; Mitakou, S.; Aligiannis, N.; Bozinou, E.; Gortzi, O.; Skaltsounis, L.A.; Lalas, S.I. Determination of the Total Phenolics Content and Antioxidant Activity of Extracts from Parts of Plants from the Greek Island of Crete. *Plants* **2023**, *12*, 1092. [\[CrossRef\]](#) [\[PubMed\]](#)
69. Argyropoulou, A.; Lemus Ringele, G.B.; Fotopoulou, A.; Nastos, C.; Papachristodoulou, A.; Stavropoulos, G.; Pratsinis, H.; Kletsas, D.; Kalpoutzakis, E.; Halabalaki, M. Chemical and biological evaluation of plants from the Greek flora towards their use as cosmetics. In Proceedings of the GA—70th Annual Meeting, Thessaloniki, Greece, 28–31 August 2022.
70. Grabarska, A.; Wróblewska-Łuczka, P.; Kukula-Koch, W.; Łuszczki, J.J.; Kalpoutzakis, E.; Adamczuk, G.; Skaltsounis, A.L.; Stepulak, A. Palmatine, a bioactive protoberberine alkaloid isolated from *berberis cretica*, inhibits the growth of human estrogen receptor-positive breast cancer cells and acts synergistically and additively with doxorubicin. *Molecules* **2021**, *26*, 6253. [\[CrossRef\]](#) [\[PubMed\]](#)
71. Androutopoulou, C.; Christopoulou, S.D.; Hahalis, P.; Kotsalou, C.; Lamari, F.N.; Vantarakis, A. Evaluation of essential oils and extracts of rose geranium and rose petals as natural preservatives in terms of toxicity, antimicrobial, and antiviral activity. *Pathogens* **2021**, *10*, 494. [\[CrossRef\]](#) [\[PubMed\]](#)
72. Gkioni, M.D.; Zeliou, K.; Dimaki, V.D.; Trigas, P.; Lamari, F.N. GC-MS and LC-DAD-MS Phytochemical Profiling for Characterization of Three Native *Salvia* Taxa from Eastern Mediterranean with Antiglycation Properties. *Molecules* **2022**, *28*, 93. [\[CrossRef\]](#) [\[PubMed\]](#)
73. World Health Organization. *WHO Global Report on Traditional and Complementary Medicine 2019*; World Health Organization: Geneva, Switzerland, 2019; ISBN 9241515430.
74. Upreti, Y.; Asselin, H.; Dhakal, A.; Julien, N. Traditional use of medicinal plants in the boreal forest of Canada: Review and perspectives. *J. Ethnobiol. Ethnomed.* **2012**, *8*, 7. [\[CrossRef\]](#) [\[PubMed\]](#)
75. Jimoh, M.A.; Jimoh, M.O.; Saheed, S.A.; Bamigboye, S.O.; Laubscher, C.P.; Kambizi, L. Commercialization of Medicinal Plants: Opportunities for Trade and Concerns for Biodiversity Conservation. In *Sustainable Uses and Prospects of Medicinal Plants*; Taylor and Francis: Abingdon, UK, 2023; pp. 309–332.



76. Barata, A.M.; Rocha, F.; Lopes, V.; Carvalho, A.M. Conservation and sustainable uses of medicinal and aromatic plants genetic resources on the worldwide for human welfare. *Ind. Crops Prod.* **2016**, *88*, 8–11. [\[CrossRef\]](#)
77. Lange, D. The role of east and southeast Europe in the medicinal and aromatic plants' trade. *Med. Plant Conserv.* **2002**, *8*, 14–18.
78. Qazi, M.A.; Molvi, K.I. Herbal medicine: A comprehensive review. *Int. J. Pharm. Res.* **2016**, *8*, 1–5.
79. Vasisht, K.; Sharma, N.; Karan, M. Current perspective in the international trade of medicinal plants material: An update. *Curr. Pharm. Des.* **2016**, *22*, 4288–4336. [\[CrossRef\]](#)
80. Ten Kate, K.; Laird, S.A. *The Commercial Use of Biodiversity: Access to Genetic Resources and Benefit-Sharing*; Routledge: London, UK, 2019; ISBN 1000699366.
81. Saeed, S.T.; Samad, A. Emerging threats of begomoviruses to the cultivation of medicinal and aromatic crops and their management strategies. *Virus Dis.* **2017**, *28*, 1–17. [\[CrossRef\]](#)
82. Qian, J.; Zhuang, H.; Yang, W.; Chen, Y.; Chen, S.; Qu, Y.; Zhang, Y.; Yang, Y.; Wang, Y. Selecting flagship species to solve a biodiversity conservation conundrum. *Plant Divers.* **2020**, *42*, 488–491. [\[CrossRef\]](#) [\[PubMed\]](#)
83. Rajasekharan, P.E.; Wani, S.H. Distribution, diversity, conservation and utilization of threatened medicinal plants. In *Conservation and Utilization of Threatened Medicinal Plants*; Springer: Cham, Switzerland, 2020; pp. 3–30.
84. Applequist, W.L.; Brinckmann, J.A.; Cunningham, A.B.; Hart, R.E.; Heinrich, M.; Katerere, D.R.; Van Andel, T. Scientists' warning on climate change and medicinal plants. *Planta Med.* **2020**, *86*, 10–18. [\[PubMed\]](#)
85. Gairola, S.; Shariff, N.M.; Bhatt, A.; Kala, C.P. Influence of climate change on production of secondary chemicals in high altitude medicinal plants: Issues needs immediate attention. *J. Med. Plants Res.* **2010**, *4*, 1825–1829.
86. Kaky, E.; Gilbert, F. Assessment of the extinction risks of medicinal plants in Egypt under climate change by integrating species distribution models and IUCN Red List criteria. *J. Arid Environ.* **2019**, *170*, 103988. [\[CrossRef\]](#)
87. Patni, B.; Bhattacharyya, M.; Kumari, A.; Purohit, V.K. Alarming influence of climate change and compromising quality of medicinal plants. *Plant Physiol. Rep.* **2022**, *27*, 1–10. [\[CrossRef\]](#)
88. Gupta, A.; Singh, P.P.; Singh, P.; Singh, K.; Singh, A.V.; Singh, S.K.; Kumar, A. Medicinal plants under climate change: Impacts on pharmaceutical properties of plants. In *Climate Change and Agricultural Ecosystems*; Elsevier: Amsterdam, The Netherlands, 2019; pp. 181–209.
89. Munt, D.D.; Muñoz-Rodríguez, P.; Marques, I.; Saiz, J.C.M. Effects of climate change on threatened Spanish medicinal and aromatic species: Predicting future trends and defining conservation guidelines. *Isr. J. Plant Sci.* **2016**, *63*, 309–319. [\[CrossRef\]](#)
90. Mishra, T. Climate change and production of secondary metabolites in medicinal plants: A review. *Int. J. Herb. Med.* **2016**, *4*, 27–30.
91. Sun, Y.; Alseekh, S.; Fernie, A.R. Plant secondary metabolic responses to global climate change: A meta-analysis in medicinal and aromatic plants. *Glob. Change Biol.* **2023**, *29*, 477–504. [\[CrossRef\]](#)
92. Kougioumoutzis, K.; Papanikolaou, A.; Kokkoris, I.P.; Strid, A.; Dimopoulos, P.; Panitsa, M. Climate Change Impacts and Extinction Risk Assessment of *Nepeta* Representatives (Lamiaceae) in Greece. *Sustainability* **2022**, *14*, 4269. [\[CrossRef\]](#)
93. Cheminal, A.; Kokkoris, I.P.; Strid, A.; Dimopoulos, P. Medicinal and Aromatic Lamiaceae Plants in Greece: Linking Diversity and Distribution Patterns with Ecosystem Services. *Forests* **2020**, *11*, 661. [\[CrossRef\]](#)
94. Cheminal, A.; Kokkoris, I.P.; Zotos, A.; Strid, A.; Dimopoulos, P. Assessing the Ecosystem Services Potential of Endemic Floras: A Systematic Review on the Greek Endemics of Peloponnese. *Sustainability* **2022**, *14*, 5926. [\[CrossRef\]](#)
95. Karousou, R.; Deirmentzoglou, S. The herbal market of Cyprus: Traditional links and cultural exchanges. *J. Ethnopharmacol.* **2011**, *133*, 191–203. [\[CrossRef\]](#) [\[PubMed\]](#)
96. Karousou, R.; Balta, M.; Hanlidou, E.; Kokkini, S. "Mints", smells and traditional uses in Thessaloniki (Greece) and other Mediterranean countries. *J. Ethnopharmacol.* **2007**, *109*, 248–257. [\[CrossRef\]](#) [\[PubMed\]](#)
97. Hanlidou, E.; Karousou, R.; Kleftoyanni, V.; Kokkini, S. The herbal market of Thessaloniki (N Greece) and its relation to the ethnobotanical tradition. *J. Ethnopharmacol.* **2004**, *91*, 281–299. [\[CrossRef\]](#)
98. Petrakou, K.; Iatrou, G.; Lamari, F.N. Ethnopharmacological survey of medicinal plants traded in herbal markets in the Peloponnisos, Greece. *J. Herb. Med.* **2020**, *19*, 100305. [\[CrossRef\]](#)
99. Bariotakis, M.; Georgescu, L.; Laina, D.; Koufaki, M.; Souma, M.; Douklias, S.; Giannakakis, K.A.; Chouli, K.N.; Paoli, L.; Loppi, S. Climate Change Dependence in Ex Situ Conservation of Wild Medicinal Plants in Crete, Greece. *Biology* **2023**, *12*, 1327. [\[CrossRef\]](#) [\[PubMed\]](#)
100. Fassou, G.; Kougioumoutzis, K.; Iatrou, G.; Trigas, P.; Papasotiropoulos, V. Genetic diversity and range dynamics of *Helleborus odorus* subsp. *cyclophyllus* under different climate change scenarios. *Forests* **2020**, *11*, 620. [\[CrossRef\]](#)
101. Spiliopoulou, K.; Dimitrakopoulos, P.G.; Brooks, T.M.; Kelaidi, G.; Paragamian, K.; Kati, V.; Oikonomou, A.; Vavylis, D.; Trigas, P.; Lymberakis, P. The Natura 2000 network and the ranges of threatened species in Greece. *Biodivers. Conserv.* **2021**, *30*, 945–961. [\[CrossRef\]](#)
102. Spiliopoulou, K.; Brooks, T.M.; Dimitrakopoulos, P.G.; Oikonomou, A.; Karavatsou, F.; Stoumboudi, M.T.; Triantis, K.A. Protected areas and the ranges of threatened species: Towards the EU Biodiversity Strategy 2030. *Biol. Conserv.* **2023**, *284*, 110166. [\[CrossRef\]](#)
103. Lai, Q.; Hoffmann, S.; Jaeschke, A.; Beierkuhnlein, C. Emerging spatial prioritization for biodiversity conservation indicated by climate change velocity. *Ecol. Indic.* **2022**, *138*, 108829. [\[CrossRef\]](#)
104. Kokkoris, I.P.; Mallinis, G.; Bekri, E.S.; Vlami, V.; Zogaris, S.; Chrysafis, I.; Mitsopoulos, I.; Dimopoulos, P. National Set of MAES Indicators in Greece: Ecosystem Services and Management Implications. *Forests* **2020**, *11*, 595. [\[CrossRef\]](#)



105. Maroulis, G.; Artelari, R. A floristic report from Mount Erimanthos (NW-Peloponnisos, Greece). *Fl. Medit.* **2005**, *15*, 109–120.
106. 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. [\[CrossRef\]](#)
107. Smith, A.B. *enmSdm: Tools for Modeling Species Niches and Distributions*; R Package Version 0.5.1.5 2020; R Core Team: Cary, CA, USA, 2020.
108. 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. [\[CrossRef\]](#)
109. Clark, P.J.; Evans, F.C. Distance to Nearest Neighbor as a Measure of Spatial Relationships in Populations. *Ecology* **1954**, *35*, 445–453. [\[CrossRef\]](#)
110. Evans, J.S. *spatialEco*; R Package Version 1.2-0 2019; R Core Team: Cary, CA, USA, 2019.
111. 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. [\[CrossRef\]](#)
112. van Proosdij, A.S.J.; Sosef, M.S.M.; Wieringa, J.J.; Raes, N. Minimum required number of specimen records to develop accurate species distribution models. *Ecography* **2016**, *39*, 542–552. [\[CrossRef\]](#)
113. Fick, S.E.; Hijmans, R.J. WorldClim 2: New 1-km spatial resolution climate surfaces for global land areas. *Int. J. Climatol.* **2017**, *37*, 4302–4315. [\[CrossRef\]](#)
114. Booth, T.H. The Need for a Global Tree Trial Database. *New For.* **2023**, *54*, 1–7. [\[CrossRef\]](#)
115. Booth, T.H.; Nix, H.A.; Busby, J.R.; Hutchinson, M.F. Bioclim: The first species distribution modelling package, its early applications and relevance to most current MaxEnt studies. *Divers. Distrib.* **2014**, *20*, 1–9. [\[CrossRef\]](#)
116. 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. [\[CrossRef\]](#)
117. Jarvis, A.; Reuter, H.I.; Nelson, A.; Guevara, E. Hole-Filled SRTM for the Globe Version 4. 2008. Available online: <http://srtm.csi.cgiar.org> (accessed on 25 July 2023).
118. Hijmans, R.; Philipps, S.; Leathwick, J.; Elith, J. *dismo: Species Distribution Modeling*; R Package Version 1.1-4 2017; R Core Team: Cary, CA, USA, 2017.
119. 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. [\[CrossRef\]](#)
120. 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. [\[CrossRef\]](#)
121. 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. [\[CrossRef\]](#)
122. Hengl, T.; de Jesus, J.M.; Heuvelink, G.B.M.; Gonzalez, M.R.; Kilibarda, M.; Blagotić, A.; Shangguan, W.; Wright, M.N.; Geng, X.; Bauer-Marschallinger, B.; et al. SoilGrids250m: Global gridded soil information based on machine learning. *PLoS ONE* **2017**, *12*, e0169748. [\[CrossRef\]](#) [\[PubMed\]](#)
123. Chen, G.; Li, X.; Liu, X. Global land projection based on plant functional types with a 1-km resolution under socio-climatic scenarios. *Sci. Data* **2022**, *9*, 125. [\[CrossRef\]](#) [\[PubMed\]](#)
124. Hijmans, R. *Terra: Spatial Data Analysis*; R Package Version 1.7-46 2023; R Core Team: Cary, CA, USA, 2023.
125. Hijmans, R.J. Package ‘raster’—Geographic Data Analysis and Modeling. *CRAN Repos.* **2019**. Available online: <https://cran.r-project.org/web/packages/raster/index.html> (accessed on 15 November 2023).
126. Cao, Y.; Wang, F.; Tseng, T.-H.; Carver, S.; Chen, X.; Zhao, J.; Yu, L.; Li, F.; Zhao, Z.; Yang, R. Identifying ecosystem service value and potential loss of wilderness areas in China to support post-2020 global biodiversity conservation. *Sci. Total Environ.* **2022**, *846*, 157348. [\[CrossRef\]](#)
127. 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. [\[CrossRef\]](#)
128. Naimi, B.; Hamm, N.A.S.; Groen, T.A.; Skidmore, A.K.; Toxopeus, A.G. Where is positional uncertainty a problem for species distribution modelling? *Ecography* **2014**, *37*, 191–203. [\[CrossRef\]](#)
129. Breiner, F.T.; Nobis, M.P.; Bergamini, A.; Guisan, A. Optimizing ensembles of small models for predicting the distribution of species with few occurrences. *Methods Ecol. Evol.* **2018**, *9*, 802–808. [\[CrossRef\]](#)
130. Breiner, F.T.; Guisan, A.; Nobis, M.P.; Bergamini, A. Including environmental niche information to improve IUCN Red List assessments. *Divers. Distrib.* **2017**, *23*, 484–495. [\[CrossRef\]](#)
131. 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. [\[CrossRef\]](#)
132. Broennimann, O.; Di Cola, V.; Guisan, A. *ecospat: Spatial Ecology Miscellaneous Methods*; R Package Version 3.2 2021; R Core Team: Cary, CA, USA, 2021.
133. Valavi, R.; Elith, J.; Lahoz-Monfort, J.J.; Guillera-Arroita, G. Modelling species presence-only data with random forests. *Ecography* **2021**, *44*, 1731–1742. [\[CrossRef\]](#)

134. Valavi, R.; Guillera-Arroita, G.; Lahoz-Monfort, J.J.; Elith, J. Predictive performance of presence-only species distribution models: A benchmark study with reproducible code. *Ecol. Monogr.* **2022**, *92*, e01486. [\[CrossRef\]](#)
135. Valavi, R.; Elith, J.; Lahoz-Monfort, J.J.; Guillera-Arroita, G. Flexible species distribution modelling methods perform well on spatially separated testing data. *Glob. Ecol. Biogeogr.* **2023**, *32*, 369–383. [\[CrossRef\]](#)
136. Jimenez-Valverde, A. Prevalence affects the evaluation of discrimination capacity in presence-absence species distribution models. *Biodivers. Conserv.* **2021**, *30*, 1331–1340. [\[CrossRef\]](#)
137. 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. [\[CrossRef\]](#)
138. 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. [\[CrossRef\]](#)
139. Liu, C.; White, M.; Newell, G. Selecting thresholds for the prediction of species occurrence with presence-only data. *J. Biogeogr.* **2013**, *40*, 778–789. [\[CrossRef\]](#)
140. Inman, R.; Franklin, J.; Esque, T.; Nussear, K. Comparing sample bias correction methods for species distribution modeling using virtual species. *Ecosphere* **2021**, *12*, e03422. [\[CrossRef\]](#)
141. Dubos, N.; Préau, C.; Lenormand, M.; Papuga, G.; Monsarrat, S.; Denelle, P.; Le Louarn, M.; Heremans, S.; May, R.; Roche, P. Assessing the effect of sample bias correction in species distribution models. *Ecol. Indic.* **2022**, *145*, 109487. [\[CrossRef\]](#)
142. Roberts, D.R.; Bahn, V.; Ciuti, S.; Boyce, M.S.; Elith, J.; Guillera-Arroita, G.; Hauenstein, S.; Lahoz-Monfort, J.J.; Schröder, B.; Thuiller, W.; et al. Cross-validation strategies for data with temporal, spatial, hierarchical, or phylogenetic structure. *Ecography* **2017**, *40*, 913–929. [\[CrossRef\]](#)
143. Santini, L.; Benítez-López, A.; Maiorano, L.; Čengić, M.; Huijbregts, M.A.J. Assessing the reliability of species distribution projections in climate change research. *Divers. Distrib.* **2021**, *27*, 1035–1050. [\[CrossRef\]](#)
144. Raes, N.; ter Steege, H. A null-model for significance testing of presence-only species distribution models. *Ecography* **2007**, *30*, 727–736. [\[CrossRef\]](#)
145. Allouche, O.; Tsoar, A.; Kadmon, R. Assessing the accuracy of species distribution models: Prevalence, kappa and the true skill statistic (TSS). *J. Appl. Ecol.* **2006**, *43*, 1223–1232. [\[CrossRef\]](#)
146. Hirzel, A.H.; Le Lay, G.; Helfer, V.; Randin, C.; Guisan, A. Evaluating the ability of habitat suitability models to predict species presences. *Ecol. Modell.* **2006**, *199*, 142–152. [\[CrossRef\]](#)
147. Fielding, A.H.; Bell, J.F. A review of methods for the assessment of prediction errors in conservation presence/absence models. *Environ. Conserv.* **1997**, *24*, 38–49. [\[CrossRef\]](#)
148. Sofaer, H.R.; Hoeting, J.A.; Jarnevich, C.S. The area under the precision-recall curve as a performance metric for rare binary events. *Methods Ecol. Evol.* **2019**, *10*, 565–577. [\[CrossRef\]](#)
149. Liu, C.; White, M.; Newell, G. Measuring and comparing the accuracy of species distribution models with presence-absence data. *Ecography* **2011**, *34*, 232–243. [\[CrossRef\]](#)
150. Hammer, B.; Frasco, M. *Metrics: Evaluation Metrics for Machine Learning*; R Package Version 0.1.4 2018; R Core Team: Cary, CA, USA, 2018.
151. Márcia Barbosa, A.; Real, R.; Muñoz, A.R.; Brown, J.A. New measures for assessing model equilibrium and prediction mismatch in species distribution models. *Divers. Distrib.* **2013**, *19*, 1333–1338. [\[CrossRef\]](#)
152. Schwarz, J.; Heider, D. GUESS: Projecting machine learning scores to well-calibrated probability estimates for clinical decision-making. *Bioinformatics* **2019**, *35*, 2458–2465. [\[CrossRef\]](#) [\[PubMed\]](#)
153. Signorell, A.; Aho, K.; Anderegg, N.; Aragon, T.; Arppe, A.; Baddeley, A.; Bolker, B.; Caeiro, F.; Champely, S.; Chessel, D. *DescTools: Tools for descriptive statistics*; R Package Version 0.99-40 2021; R Core Team: Cary, CA, USA, 2021.
154. Thuiller, W.; Georges, D.; Engler, R.; Breiner, F. biomod2: Ensemble Platform for Species Distribution Modeling. CRAN Repository. 2016. Available online: <https://cran.r-project.org/web/packages/biomod2/index.html> (accessed on 15 November 2023).
155. Liu, C.; Berry, P.M.; Dawson, T.P.; Pearson, R.G. Selecting thresholds of occurrence in the prediction of species distributions. *Ecography* **2005**, *28*, 385–393. [\[CrossRef\]](#)
156. 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. [\[CrossRef\]](#) [\[PubMed\]](#)
157. Elith, J.; Kearney, M.; Phillips, S. The art of modelling range-shifting species. *Methods Ecol. Evol.* **2010**, *1*, 330–342. [\[CrossRef\]](#)
158. McGarigal, K. FRAGSTATS: Spatial Pattern Analysis Program for Categorical Maps. Computer Software Program Produced by the Authors at the University of Massachusetts, Amherst. 2002. Available online: [www.umass.edu/landeco/research/fragstats/fragstats.html](http://www.umass.edu/landeco/research/fragstats/fragstats.html) (accessed on 25 July 2023).
159. Hesselbarth, M.H.K.; Sciaini, M.; With, K.A.; Wiegand, K.; Nowosad, J. landscapemetrics: An open-source R tool to calculate landscape metrics. *Ecography* **2019**, *42*, 1648–1657. [\[CrossRef\]](#)
160. Bouchet, P.J.; Miller, D.L.; Roberts, J.J.; Mannocci, L.; Harris, C.M.; Thomas, L. dsmextra: Extrapolation assessment tools for density surface models. *Methods Ecol. Evol.* **2020**, *11*, 1464–1469. [\[CrossRef\]](#)
161. Mannocci, L.; Roberts, J.J.; Halpin, P.N.; Authier, M.; Boisseau, O.; Bradai, M.N.; Cañadas, A.; Chicote, C.; David, L.; Di-Méglio, N.; et al. Assessing cetacean surveys throughout the Mediterranean Sea: A gap analysis in environmental space. *Sci. Rep.* **2018**, *8*, 3126. [\[CrossRef\]](#)
162. Linder, H.P. Plant diversity and endemism in sub-Saharan tropical Africa. *J. Biogeogr.* **2001**, *28*, 169–182. [\[CrossRef\]](#)

163. Linder, H.P. On areas of endemism, with an example from the African restionaceae. *Syst. Biol.* **2001**, *50*, 892–912. [\[CrossRef\]](#)
164. Rosauer, D.; Laffan, S.W.; Crisp, M.D.; Donnellan, S.C.; Cook, L.G. Phylogenetic endemism: A new approach for identifying geographical concentrations of evolutionary history. *Mol. Ecol.* **2009**, *18*, 4061–4072. [\[CrossRef\]](#)
165. Daru, B.H.; Karunarathne, P.; Schliep, K. Phyloregion: R package for biogeographical regionalization and macroecology. *Methods Ecol. Evol.* **2020**, *11*, 1483–1491. [\[CrossRef\]](#)
166. Daru, B.H.; Elliott, T.L.; Park, D.S.; Davies, T.J. Understanding the Processes Underpinning Patterns of Phylogenetic Regionalization. *Trends Ecol. Evol.* **2017**, *32*, 845–860. [\[CrossRef\]](#) [\[PubMed\]](#)
167. Daru, B.H.; Farooq, H.; Antonelli, A.; Faurby, S. Endemism patterns are scale dependent. *Nat. Commun.* **2020**, *11*, 2115. [\[CrossRef\]](#) [\[PubMed\]](#)
168. Tsirogianis, C.; Sandel, B. PhyloMeasures: A package for computing phylogenetic biodiversity measures and their statistical moments. *Ecography* **2016**, *39*, 709–714. [\[CrossRef\]](#)
169. González-Orozco, C.E.; Pollock, L.J.; Thornhill, A.H.; Mishler, B.D.; Knerr, N.; Laffan, S.W.; Miller, J.T.; Rosauer, D.F.; Faith, D.P.; Nipperess, D.A.; et al. Phylogenetic approaches reveal biodiversity threats under climate change. *Nat. Clim. Chang.* **2016**, *6*, 1110–1114. [\[CrossRef\]](#)
170. Magurran, A.E. Measuring biological diversity. *Curr. Biol.* **2021**, *31*, R1174–R1177. [\[CrossRef\]](#) [\[PubMed\]](#)
171. Carvalho, J.C.; Cardoso, P.; Gomes, P. Determining the relative roles of species replacement and species richness differences in generating beta-diversity patterns. *Glob. Ecol. Biogeogr.* **2012**, *21*, 760–771. [\[CrossRef\]](#)
172. Baselga, A. Partitioning the turnover and nestedness components of beta diversity. *Glob. Ecol. Biogeogr.* **2010**, *19*, 134–143. [\[CrossRef\]](#)
173. Cardoso, P.; Rigal, F.; Carvalho, J.C. BAT—Biodiversity Assessment Tools, an R package for the measurement and estimation of alpha and beta taxon, phylogenetic and functional diversity. *Methods Ecol. Evol.* **2015**, *6*, 232–236. [\[CrossRef\]](#)
174. Mota, F.M.M.; Alves-Ferreira, G.; Talora, D.C.; Heming, N.M. Divraster: An R package to calculate taxonomic, functional and phylogenetic diversity from rasters. *Ecography* **2023**, *2023*, e06905. [\[CrossRef\]](#)
175. Rinnan, D.S.; Lawler, J. Climate-niche factor analysis: A spatial approach to quantifying species vulnerability to climate change. *Ecography* **2019**, *42*, 1494–1503. [\[CrossRef\]](#)
176. Rinnan, D.S. *CENFA: Climate and Ecological Niche Factor Analysis*; R Core Team: Cary, CA, USA, 2018.
177. Hirzel, A.H.; Hausser, J.; Chessel, D.; Perrin, N. Ecological-niche factor analysis: How to compute habitat-suitability maps without absence data? *Ecology* **2002**, *83*, 2027–2036. [\[CrossRef\]](#)
178. Nunez, S.; Alkemade, R. Exploring interaction effects from mechanisms between climate and land-use changes and the projected consequences on biodiversity. *Biodivers. Conserv.* **2021**, *30*, 3685–3696. [\[CrossRef\]](#)
179. Groner, V.P.; Nicholas, O.; Mabhaudhi, T.; Slotow, R.; Akçakaya, H.R.; Mace, G.M.; Pearson, R.G. Climate change, land cover change, and overharvesting threaten a widely used medicinal plant in South Africa. *Ecol. Appl.* **2022**, *32*, e2545. [\[CrossRef\]](#) [\[PubMed\]](#)
180. Karami, S.; Ejtehadi, H.; Moazzeni, H.; Vaezi, J.; Behroozian, M. Minimal climate change impacts on the geographic distribution of *Nepeta glomerulosa*, medicinal species endemic to southwestern and central Asia. *Sci. Rep.* **2022**, *12*, 19893. [\[CrossRef\]](#) [\[PubMed\]](#)
181. Cramer, W.; Guiot, J.; Fader, M.; Garrabou, J.; Gattuso, J.P.; Iglesias, A.; Lange, M.A.; Lionello, P.; Llasat, M.C.; Paz, S.; et al. Climate change and interconnected risks to sustainable development in the Mediterranean. *Nat. Clim. Change* **2018**, *8*, 972–980. [\[CrossRef\]](#)
182. Cahyaningsih, R.; Phillips, J.; Magos Brehm, J.; Gaisberger, H.; Maxted, N. Climate change impact on medicinal plants in Indonesia. *Glob. Ecol. Conserv.* **2021**, *30*, e01752. [\[CrossRef\]](#)
183. Kunwar, R.M.; Thapa-Magar, K.B.; Subedi, S.C.; Kutal, D.H.; Baral, B.; Joshi, N.R.; Adhikari, B.; Upadhyaya, K.S.; Thapa-Magar, S.; Ansari, A.S.; et al. Distribution of important medicinal plant species in Nepal under past, present, and future climatic conditions. *Ecol. Indic.* **2023**, *146*, 109879. [\[CrossRef\]](#)
184. Shaban, M.; Ghehsareh Ardestani, E.; Ebrahimi, A.; Borhani, M. Climate change impacts on optimal habitat of *Stachys inflata* medicinal plant in central Iran. *Sci. Rep.* **2023**, *13*, 6580. [\[CrossRef\]](#)
185. Gafna, D.J.; Obando, J.A.; Kalwij, J.M.; Dolos, K.; Schmidlein, S. Climate Change Impacts on the Availability of Anti-malarial Plants in Kenya. *Clim. Change Ecol.* **2023**, *5*, 100070. [\[CrossRef\]](#)
186. Tshabalala, T.; Mutanga, O.; Abdel-Rahman, E.M. Predicting the Geographical Distribution Shift of Medicinal Plants in South Africa Due to Climate Change. *Conservation* **2022**, *2*, 694–708. [\[CrossRef\]](#)
187. Guo, Y.; Wei, H.; Lu, C.; Gao, B.; Gu, W. Predictions of potential geographical distribution and quality of *Schisandra sphenanthera* under climate change. *PeerJ* **2016**, *4*, e2554. [\[CrossRef\]](#) [\[PubMed\]](#)
188. Boyd, J.N.; Anderson, J.T.; Brzyski, J.; Baskauf, C.; Cruse-Sanders, J. Eco-evolutionary causes and consequences of rarity in plants: A meta-analysis. *New Phytol.* **2022**, *235*, 1272–1286. [\[CrossRef\]](#) [\[PubMed\]](#)
189. Manes, S.; Costello, M.J.; Beckett, H.; Debnath, A.; Devenish-Nelson, E.; Grey, K.-A.; Jenkins, R.; Khan, T.M.; Kiessling, W.; Krause, C. Endemism increases species' climate change risk in areas of global biodiversity importance. *Biol. Conserv.* **2021**, *257*, 109070. [\[CrossRef\]](#)
190. Zhang, J.; Nielsen, S.E.; Chen, Y.; Georges, D.; Qin, Y.; Wang, S.S.; Svenning, J.C.; Thuiller, W. Extinction risk of North American seed plants elevated by climate and land-use change. *J. Appl. Ecol.* **2017**, *54*, 303–312. [\[CrossRef\]](#)



191. Peng, S.; Zhang, J.; Zhang, X.; Li, Y.; Liu, Y.; Wang, Z. Conservation of woody species in China under future climate and land-cover changes. *J. Appl. Ecol.* **2022**, *59*, 141–152. [\[CrossRef\]](#)
192. da Silva, J.M.C.; Rapini, A.; Barbosa, L.C.F.; Torres, R.R. Extinction risk of narrowly distributed species of seed plants in Brazil due to habitat loss and climate change. *PeerJ* **2019**, *7*, e7333. [\[CrossRef\]](#)
193. Kougioumoutzis, K.; Kotsakiozi, P.; Stathi, E.; Trigas, P.; Parmakelis, A. Conservation genetics of four critically endangered greek endemic plants: A preliminary assessment. *Diversity* **2021**, *13*, 152. [\[CrossRef\]](#)
194. Charitonidou, M.; Kougioumoutzis, K.; Halley, J.M. An orchid in retrograde: Climate-driven range shift patterns of *Ophrys helenae* in Greece. *Plants* **2021**, *10*, 470. [\[CrossRef\]](#) [\[PubMed\]](#)
195. Sandel, B.; Arge, L.; Dalsgaard, B.; Davies, R.G.; Gaston, K.J.; Sutherland, W.J.; Svenning, J.C. The influence of late quaternary climate-change velocity on species endemism. *Science* **2011**, *334*, 660–664. [\[CrossRef\]](#) [\[PubMed\]](#)
196. Dornelas, M.; Gotelli, N.J.; Shimadzu, H.; Moyes, F.; Magurran, A.E.; McGill, B.J. A balance of winners and losers in the Anthropocene. *Ecol. Lett.* **2019**, *22*, 847–854. [\[CrossRef\]](#) [\[PubMed\]](#)
197. Kress, W.J.; Krupnick, G.A. Lords of the biosphere: Plant winners and losers in the Anthropocene. *Plants People Planet* **2022**, *4*, 350–366. [\[CrossRef\]](#)
198. Thuiller, W.; Lavorel, S.; Araújo, M.B.; Sykes, M.T.; Prentice, I.C. Climate change threats to plant diversity in Europe. *Proc. Natl. Acad. Sci. USA* **2005**, *102*, 8245–8250. [\[CrossRef\]](#) [\[PubMed\]](#)
199. Newbold, T.; Hudson, L.N.; Contu, S.; Hill, S.L.L.; Beck, J.; Liu, Y.; Meyer, C.; Phillips, H.R.P.; Scharlemann, J.P.W.; Purvis, A. Widespread winners and narrow-ranged losers: Land use homogenizes biodiversity in local assemblages worldwide. *PLoS Biol.* **2018**, *16*, e2006841. [\[CrossRef\]](#) [\[PubMed\]](#)
200. Newbold, T.; Oppenheimer, P.; Etard, A.; Williams, J.J. Tropical and Mediterranean biodiversity is disproportionately sensitive to land-use and climate change. *Nat. Ecol. Evol.* **2020**, *4*, 1630–1638. [\[CrossRef\]](#) [\[PubMed\]](#)
201. Newbold, T. Future effects of climate and land-use change on terrestrial vertebrate community diversity under different scenarios. *Proc. R. Soc. B Biol. Sci.* **2018**, *285*, 20180792. [\[CrossRef\]](#)
202. Orsenigo, S.; Mondoni, A.; Rossi, G.; Abeli, T. Some like it hot and some like it cold, but not too much: Plant responses to climate extremes. *Plant Ecol.* **2014**, *215*, 677–688. [\[CrossRef\]](#)
203. Sweeney, C.P.; Jarzyna, M.A. Assessing the Synergistic Effects of Land Use and Climate Change on Terrestrial Biodiversity: Are Generalists Always the Winners? *Curr. Landsc. Ecol. Rep.* **2022**, *7*, 41–48. [\[CrossRef\]](#)
204. Schulte to Bühne, H.; Tobias, J.A.; Durant, S.M.; Pettorelli, N. Improving Predictions of Climate Change–Land Use Change Interactions. *Trends Ecol. Evol.* **2021**, *36*, 29–38. [\[CrossRef\]](#)
205. Crisp, M.D.; Laffan, S.; Linder, H.P.; Monro, A. Monro Endemism in the Australian flora. *J. Biogeogr.* **2001**, *28*, 183–198. [\[CrossRef\]](#)
206. Laffan, S.W.; Rosauer, D.F.; Di Virgilio, G.; Miller, J.T.; González-Orozco, C.E.; Knerr, N.; Thornhill, A.H.; Mishler, B.D. Range-weighted metrics of species and phylogenetic turnover can better resolve biogeographic transition zones. *Methods Ecol. Evol.* **2016**, *7*, 580–588. [\[CrossRef\]](#)
207. Meineke, E.K.; Davies, T.J.; Daru, B.H.; Davis, C.C. Biological collections for understanding biodiversity in the Anthropocene. *Philos. Trans. R. Soc. B Biol. Sci.* **2019**, *374*, 20170386. [\[CrossRef\]](#) [\[PubMed\]](#)
208. Médail, F.; Baumel, A. Using phylogeography to define conservation priorities: The case of narrow endemic plants in the Mediterranean Basin hotspot. *Biol. Conserv.* **2018**, *224*, 258–266. [\[CrossRef\]](#)
209. Cotto, O.; Wessely, J.; Georges, D.; Klonner, G.; Schmid, M.; Dullinger, S.; Thuiller, W.; Guillaume, F. A dynamic eco-evolutionary model predicts slow response of alpine plants to climate warming. *Nat. Commun.* **2017**, *8*, 15399. [\[CrossRef\]](#) [\[PubMed\]](#)
210. Kokkoris, I.P.; Skuras, D.; Maniatis, Y.; Dimopoulos, P. Natura 2000 public awareness in EU: A prerequisite for successful conservation policy. *Land Use Policy* **2023**, *125*, 106482. [\[CrossRef\]](#)
211. Charitonidou, M.; Kougioumoutzis, K.; Karypidou, M.C.; Halley, J.M. ‘Fly to a Safer North’: Distributional Shifts of the Orchid *Ophrys insectifera* L. Due to Climate Change. *Biology* **2022**, *11*, 497. [\[CrossRef\]](#)
212. Myers, N.; Mittermeier, R.A.; Mittermeier, C.G.; Da Fonseca, G.A.B.; Kent, J. Biodiversity hotspots for conservation priorities. *Nature* **2000**, *403*, 853–858. [\[CrossRef\]](#)
213. Cancellario, T.; Miranda, R.; Baquero, E.; Fontaneto, D.; Martínez, A.; Mammola, S. Climate change will redefine taxonomic, functional, and phylogenetic diversity of Odonata in space and time. *npj Biodivers.* **2022**, *1*, 1. [\[CrossRef\]](#)
214. Saladin, B.; Pellissier, L.; Graham, C.H.; Nobis, M.P.; Salamin, N.; Zimmermann, N.E. Rapid climate change results in long-lasting spatial homogenization of phylogenetic diversity. *Nat. Commun.* **2020**, *11*, 4663. [\[CrossRef\]](#) [\[PubMed\]](#)
215. Spalink, D.; Kriebel, R.; Li, P.; Pace, M.C.; Drew, B.T.; Zaborsky, J.G.; Rose, J.; Drummond, C.P.; Feist, M.A.; Alverson, W.S.; et al. Spatial phylogenetics reveals evolutionary constraints on the assembly of a large regional flora. *Am. J. Bot.* **2018**, *105*, 1938–1950. [\[CrossRef\]](#)
216. Guo, W.-Y.; Serra-Diaz, J.M.; Eiserhardt, W.L.; Maitner, B.S.; Merow, C.; Violle, C.; Pound, M.J.; Sun, M.; Slik, F.; Blach-Overgaard, A. Climate change and land use threaten global hotspots of phylogenetic endemism for trees. *Nat. Commun.* **2023**, *14*, 6950. [\[CrossRef\]](#)
217. Paliogiannis, C.; Koedam, N.; Cliquet, A. The impact of the economic crisis on the implementation of the EU Nature Directives in Greece: An expert-based view. *J. Nat. Conserv.* **2019**, *48*, 36–46. [\[CrossRef\]](#)
218. Chodorow-Reich, G.; Karabarbounis, L.; Kekre, R. The macroeconomics of the Greek depression. *Am. Econ. Rev.* **2023**, *113*, 2411–2457. [\[CrossRef\]](#)

219. Antoniadou, A.; Antonarakis, A.S. Financial crises, environment and transition. In *Financial Crises, Poverty and Environmental Sustainability: Challenges in the Context of the SDGs and Covid-19 Recovery*; Springer: Cham, Switzerland, 2022; pp. 25–43.
220. Monsarrat, S.; Jarvie, S.; Svenning, J.C. Anthropocene refugia: Integrating history and predictive modelling to assess the space available for biodiversity in a human-dominated world. *Philos. Trans. R. Soc. B Biol. Sci.* **2019**, *374*, 20190219. [\[CrossRef\]](#) [\[PubMed\]](#)
221. Brown, S.C.; Wigley, T.M.L.; Otto-Bliesner, B.L.; Rahbek, C.; Fordham, D.A. Persistent Quaternary climate refugia are hospices for biodiversity in the Anthropocene. *Nat. Clim. Chang.* **2020**, *10*, 244–248. [\[CrossRef\]](#)
222. Sales, L.P.; Pires, M.M. Identifying climate change refugia for South American biodiversity. *Conserv. Biol.* **2023**, *37*, e14087. [\[CrossRef\]](#)
223. Baranzelli, M.C.; Cosacov, A.; Sede, S.M.; Nicola, M.V.; Sérsic, A.N. Anthropocene refugia in Patagonia: A macrogenetic approach to safeguarding the biodiversity of flowering plants. *Biol. Conserv.* **2022**, *268*, 109492. [\[CrossRef\]](#)
224. Domic, A.I.; Capriles, J.M. Distribution shifts in habitat suitability and hotspot refugia of Andean tree species from the last glacial maximum to the Anthropocene. *Neotrop. Biodivers.* **2021**, *7*, 297–309. [\[CrossRef\]](#)
225. Di Marco, M.; Daskalova, G.; Dragonetti, C. The exposure of the world's mountains to global change drivers. *Preprint* **2023**. [\[CrossRef\]](#)
226. Kadis, C.; Thanos, C.A.; Laguna Lumbreras, E. *Plant Micro-Reserves: From Theory to Practice*; Experiences Gained from EU LIFE and Other Related Projects; Utopia: Athens, Greece, 2013; ISBN 9786188064720.
227. Laguna, E.; Deltoro, V.I.; Pérez-Botella, J.; Pérez-Rovira, P.; Serra, L.; Olivares, A.; Fabregat, C. The role of small reserves in plant conservation in a region of high diversity in eastern Spain. *Biol. Conserv.* **2004**, *119*, 421–426. [\[CrossRef\]](#)
228. Meineri, E.; Hylander, K. Fine-grain, large-domain climate models based on climate station and comprehensive topographic information improve microrefugia detection. *Ecography* **2017**, *40*, 1003–1013. [\[CrossRef\]](#)
229. Lannuzel, G.; Balmot, J.; Dubos, N.; Thibault, M.; Fogliani, B. High-resolution topographic variables accurately predict the distribution of rare plant species for conservation area selection in a narrow-endemism hotspot in New Caledonia. *Biodivers. Conserv.* **2021**, *30*, 963–990. [\[CrossRef\]](#)
230. Cogoni, D.; Fenu, G.; Dessi, C.; Deidda, A.; Giotta, C.; Piccitto, M.; Bacchetta, G. Importance of Plants with Extremely Small Populations (PSESPs) in Endemic-Rich Areas, Elements Often Forgotten in Conservation Strategies. *Plants* **2021**, *10*, 1504. [\[CrossRef\]](#) [\[PubMed\]](#)
231. Xia, C.; Huang, Y.; Qi, Y.; Yang, X.; Xue, T.; Hu, R.; Deng, H.; Bussmann, R.W.; Yu, S. Developing long-term conservation priority planning for medicinal plants in China by combining conservation status with diversity hotspot analyses and climate change prediction. *BMC Biol.* **2022**, *20*, 89. [\[CrossRef\]](#) [\[PubMed\]](#)
232. Pore, A.; Bais, S.; Bhausaheb Sathe, A. Commercial Cultivation and Collection Aspects of Medicinal and Aromatic Plants. *Asian J. Res. Chem.* **2023**, *16*, 184–191. [\[CrossRef\]](#)
233. Brinckmann, J.A.; Kathe, W.; Berkhoudt, K.; Harter, D.E.V.; Schippmann, U. A New Global Estimation of Medicinal and Aromatic Plant Species in Commercial Cultivation and Their Conservation Status. *Econ. Bot.* **2022**, *76*, 319–333. [\[CrossRef\]](#)
234. Schippmann, U.; Leaman, D.; Cunningham, A.B. A Comparison of Cultivation and Wild Collection of Medicinal and Aromatic Plants Under Sustainability Aspects. In *Medicinal and Aromatic Plants*; Springer: Dordrecht, The Netherlands, 2007.
235. Sharma, N.; Kala, C.P. Harvesting and management of medicinal and aromatic plants in the Himalaya. *J. Appl. Res. Med. Aromat. Plants* **2018**, *8*, 1–9. [\[CrossRef\]](#)
236. Labokas, J.; Karpavičienė, B. On the Prospects of In Situ Conservation of Medicinal- and Aromatic-Plant Genetic Resources at Ancient-Hillfort Sites: A Case Study from Lithuania. *Plants* **2023**, *12*, 861. [\[CrossRef\]](#)
237. Zimmer, H.C.; Auld, T.D.; Cuneo, P.; Offord, C.A.; Commander, L.E. Conservation translocation—An increasingly viable option for managing threatened plant species. *Aust. J. Bot.* **2019**, *67*, 501–509. [\[CrossRef\]](#)
238. Silcock, J.L.; Simmons, C.L.; Monks, L.; Dillon, R.; Reiter, N.; Jusaitis, M.; Veski, P.A.; Byrne, M.; Coates, D.J. Threatened plant translocation in Australia: A review. *Biol. Conserv.* **2019**, *236*, 211–222. [\[CrossRef\]](#)
239. Sourabh, P.; Sourabh, P.; Thakur, J.; Sharma, P.; Uniyal, P.L.; Pandey, A.K. Habitat Distribution Modelling for Reintroduction of Endangered Medicinal Plants—*Ephedra gerardiana*, *Lilium polyphyllum*, *Crepidium acuminatum*, *Pittosporum eriocarpum* and *Skimmia anquetilia* in India. *Int. J. Ecol. Environ. Sci.* **2018**, *44*, 207–216.
240. Schäfer, D.; Vincent, H.; Fischer, M.; Kempel, A. The importance of genetic diversity for the translocation of eight threatened plant species into the wild. *Glob. Ecol. Conserv.* **2020**, *24*, e01240. [\[CrossRef\]](#)
241. Rossetto, M.; Bragg, J.; Brown, D.; van der Merwe, M.; Wilson, T.C.; Yap, J.Y.S. Applying simple genomic workflows to optimise practical plant translocation outcomes. *Plant Ecol.* **2023**, *224*, 803–816. [\[CrossRef\]](#)
242. Abeli, T.; Dalrymple, S.E. Advances in plant conservation translocation. *Plant Ecol.* **2023**, *224*, 741–744. [\[CrossRef\]](#)
243. Fenu, G.; Calderisi, G.; Boršić, I.; Bou Dagher Kharrat, M.; García Fernández, A.; Kahale, R.; Panitsa, M.; Cogoni, D. Translocations of threatened plants in the Mediterranean Basin: Current status and future directions. *Plant Ecol.* **2023**, *224*, 765–775. [\[CrossRef\]](#)
244. Monks, L.; Yen, J.; Dillon, R.; Standish, R.; Coates, D.; Byrne, M.; Veski, P. Herbivore exclusion and water availability improve success across 76 translocations of 50 threatened plant species in a biodiversity hotspot with a Mediterranean climate. *Plant Ecol.* **2023**, *224*, 817–830. [\[CrossRef\]](#)
245. Maschinski, J.; Albrecht, M.A. Center for Plant Conservation's Best Practice Guidelines for the reintroduction of rare plants. *Plant Divers.* **2017**, *39*, 390–395. [\[CrossRef\]](#)



246. Tariq, M.; Nandi, S.K.; Bhatt, I.D.; Bhavsar, D.; Roy, A.; Pande, V. Phytosociological and niche distribution study of *Paris polyphylla smith*, an important medicinal herb of Indian Himalayan region. *Trop. Ecol.* **2021**, *62*, 163–173. [[CrossRef](#)]
247. Sarma, B.; Baruah, P.S.; Tanti, B. Habitat distribution modeling for reintroduction and conservation of *Aristolochia indica* L.—A threatened medicinal plant in Assam, India. *J. Threat. Taxa* **2018**, *10*, 12531–12537. [[CrossRef](#)]
248. Fenu, G.; Bacchetta, G.; Charalambos, S.C.; Fournaraki, C.; Giusso del Galdo, G.P.; Gotsiou, P.; Kyratzis, A.; Piazza, C.; Vicens, M.; Pinna, M.S.; et al. An early evaluation of translocation actions for endangered plant species on Mediterranean islands. *Plant Divers.* **2019**, *41*, 94–104. [[CrossRef](#)] [[PubMed](#)]
249. Julien, M.; Schatz, B.; Robert, A.; Colas, B. Monitoring time of conservation-driven and mitigation-driven plant translocations in Europe. *Plant Ecol.* **2023**, *224*, 791–802. [[CrossRef](#)]
250. Gauthier, P.; Pons, V.; Letourneau, A.; Kleszczewski, M.; Papuga, G.; Thompson, J.D. Combining population monitoring with habitat vulnerability to assess conservation status in populations of rare and endangered plants. *J. Nat. Conserv.* **2017**, *37*, 83–95. [[CrossRef](#)]
251. Gauthier, P.; Pons, V.; Fisogni, A.; Murru, V.; Berjano, R.; Dessena, S.; Maccioni, A.; Chelo, C.; de Manincor, N.; Doncieux, A.; et al. Assessing vulnerability of listed Mediterranean plants based on population monitoring. *J. Nat. Conserv.* **2019**, *52*, 125758. [[CrossRef](#)]
252. Ferretti-Gallon, K.; Griggs, E.; Shrestha, A.; Wang, G. National parks best practices: Lessons from a century's worth of national parks management. *Int. J. Geoh Heritage Parks* **2021**, *9*, 335–346. [[CrossRef](#)]
253. Mallinis, G.; Chalkidou, S.; Roustanis, T.; Kokkoris, I.P.; Chrysafis, I.; Karolos, I.-A.; Vagiona, D.; Kavvadia, A.; Dimopoulos, P.; Mitsopoulos, I. A national scale web mapping platform for mainstreaming ecosystem services in Greece. *Ecol. Inform.* **2023**, *78*, 102349. [[CrossRef](#)]
254. United Nations; System of Environmental Economic Accounting. *System of Environmental-Economic Accounting—Ecosystem Accounting (SEEA EA)*; White Cover Publication, Pre-Edited Text Subject to Official Editing; United Nations: New York, NY, USA, 2021.
255. Vallecillo, S.; Maes, J.; Teller, A.; Babí Almenar, J.; Barredo, J.; Trombetti, M.; Abdul Malak, D.; Paracchini, M.L.; Carré, A.; Addamo, A.; et al. *EU-Wide Methodology to Map and Assess Ecosystem Condition Towards a Common Approach Consistent with a Global Statistical Standard*; EU: Luxembourg, 2022.

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