Integrating endemic flora into creative cities: A nature-based approach to the UNESCO Creative Cities Network

Meryem Akti, *Başak Aytatlı

Department of Landscape Architecture, Architecture and Design Faculty,
Atatürk Universıty, Türkiye

*Corresponding Author e-mail: basakaytatli@atauni.edu.tr

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Abstract. Cities are increasingly understood as socio-ecological systems in which long-term sustainability depends on the integration of cultural production and ecological integrity. Despite the growing influence of creative industries in urban policy, biodiversity and endemic flora remain largely absent from global creative city frameworks. This study introduces the EndeFlora criterion as a biocultural model that integrates endemic plant diversity into creative urban development strategies.

Focusing on Turkey's three primary phytogeographical regions Mediterranean, Euro-Siberian, and Irano-Turanian the research compiles species-level data from open-access biodiversity databases and evaluates their spatial distribution, ecological characteristics, and cultural associations. Rather than statistical modelling, a multidimensional assessment framework is developed linking endemism patterns with landscape planning, creative economy potential, and UNESCO Creative Cities Network (UCCN) principles.

The findings demonstrate that regions with high endemic richness overlap with cities engaged in or eligible for the UCCN, revealing an untapped ecological dimension within existing creative city policies. By positioning endemic flora as a structural component of urban identity, cultural landscape design, and nature-based creative economies, the EndeFlora framework proposes an integrative approach that bridges biodiversity conservation and creative development.

Keywords: biocultural heritage, creative cities, endemic flora, nature-based urban development, phytogeographical regions.

1. Introduction

As globalization intensifies, cultural homogenization increasingly threatens local identities and distinct urban expressions. In response, the creative city paradigm has emerged as a framework positioning culture and creativity at the center of urban development (Wahlbom, 2022). First articulated in the late twentieth century and widely discussed across North America, Europe, and Asia (Florida, 2002; Florida, 2005; Landry, 2008; Chang, 2000; Chang & Huang, 2008; Kong, 2012; Kong et al., 2015), the concept reframed creativity as a place-based process linking cultural industries, innovation, and sustainable growth. Over time, it has shaped urban policy through cultural branding and creative industry investments (Pratt, 2008;

Andersson et al., 2011; Rosi, 2014; Gathen et al., 2021). Building on functional, developmental, and competitive perspectives of creative cities (Matovic et al., 2018; Popescu & Corbo, 2012; Stevenson, 2020; Liu, 2024), UNESCO institutionalized this approach through the UNESCO Creative Cities Network (UCCN). Member cities commit to strengthening cultural industries, enhancing participation in cultural life, and integrating culture into socio-economic development strategies (Cooke & Lazzeretti, 2008; Kagan & Hahn, 2011; Dos Santos, 2021; Arcos-Pumarola et al., 2023; Kongmee & Kortana, 2023; Fairclough, 2003; Emmendoerfer & Mediotte, 2024; Gao et al., 2024). However, discourse within UCCN documentation predominantly emphasizes creativity, tourism, governance, and economic development. A word cloud analysis conducted by the authors illustrates the prominence of culture-led development themes and the marginal visibility of ecological and biodiversity-related concepts (Cochrane, 2011; Comunian, 2011; Yencken, 2013; Jurene & Jureniene, 2017; Bertazzon, 2020) (Fig. 1). This imbalance reveals a structural gap in the integration of culture–nature relationships within the creative city framework.



Figure 1. Word Cloud Analysis (generated by the authors)

The UCCN is organized around eight thematic fields literature, film, music, crafts and folk art, design, gastronomy, media arts, and architecture each reflecting local creative capacities and sectoral priorities (Fig. 2). While this structure supports cultural diversity and economic dynamism, it does not explicitly address biodiversity, natural heritage, or endemic species as components of urban identity.

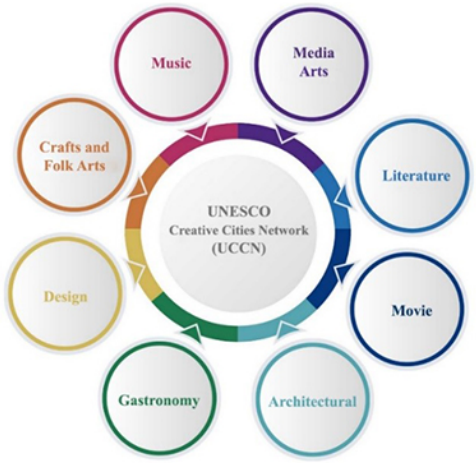


Figure 2. Creative Cities Network Themes (UNESCO, 2020)

Türkiye provides a particularly relevant context for addressing this gap. Located at the intersection of the Euro-Siberian, Mediterranean, and Irano-Turanian phytogeographical regions (Kaya & Aksakal, 2005), the country exhibits one of the highest endemism rates in Europe and the Near East. Approximately 3649 endemic taxa have been recorded, corresponding to nearly 33–35% of its total flora (Ekim et al., 2000; Güner et al., 2012; Noroozi et al., 2019). This high level of endemism is reinforced by climatic and geological diversity, altitudinal variation, and the ecological barrier known as the Anatolian Diagonal (Fig. 3).

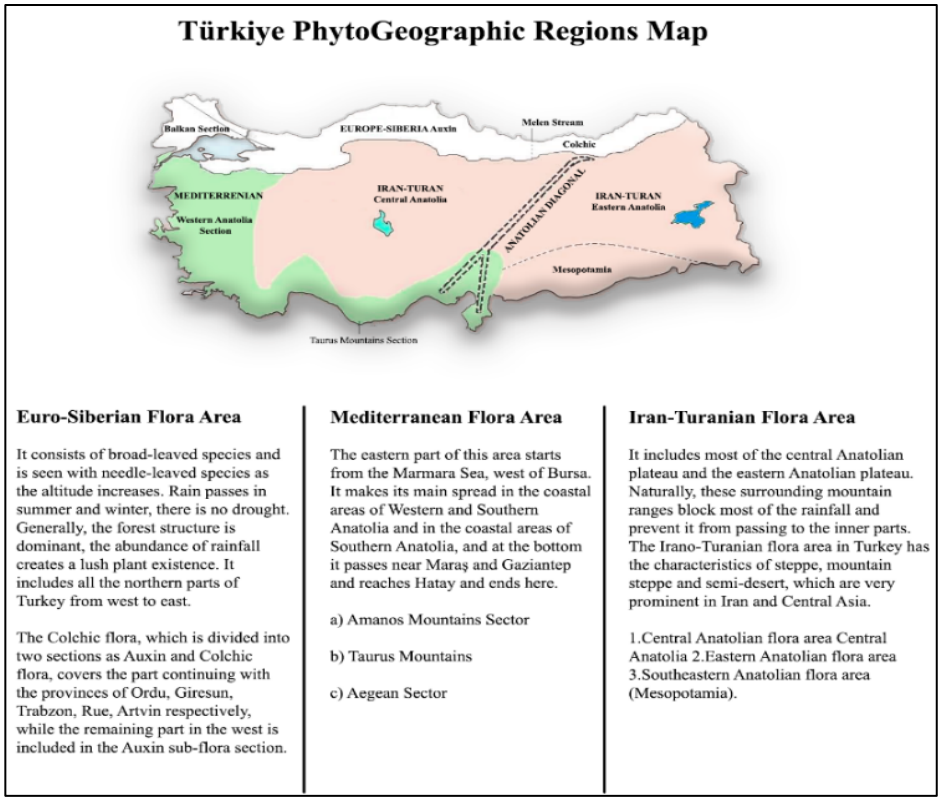


Figure 3. Phytogeographical Regions of Turkey (redrawn by the authors based on Güner et al., 2012).

Within the UCCN, Turkye is currently represented by eight cities across gastronomy, music, design, and crafts (O'Connor et al., 2020). Their distribution by creative field and year of designation is presented in Table 1.

Table 1. Turkish UCCN member cities by creative field and year of designation.

City – Creative Field – Year	Summary Information
Gaziantep Gastronomy – 2015	Designated as a City of Gastronomy through municipal initiatives, Gaziantep promotes its culinary heritage through festivals (e.g., Pistachio Festival), intercultural gastronomy projects, and sustainability-oriented food programs, including initiatives targeting disadvantaged groups (UNESCO, n.d.-a; UNESCO, 2020).
Hatay Gastronomy – 2017	Recognized for its multicultural culinary heritage, Hatay institutionalized its gastronomy strategy through the Hatay UCCN Gastronomy Council, formed via cooperation between local government, chambers of commerce, and academic institutions (UNESCO, 2017).
Kütahya Crafts and Folk Art 2017	Internationally known for tile and ceramic production, Kütahya strengthens its craft identity through festivals and research institutions such as the Tile and Ceramic Research and Application Center, reinforcing its traditional production infrastructure (Akalın et al., 2009).
İstanbul Design – 2017	Designated as a City of Design, İstanbul integrates creative industries into metropolitan development strategies through institutional platforms such as YEKON and extensive cultural infrastructure, including major design events and exhibition spaces (UNESCO, 2020).
Afyonkarahisar Gastronomy – 2019	Recognized for its long-standing culinary tradition, Afyonkarahisar emphasizes local food heritage and municipal-led branding initiatives under the UCCN framework (UNESCO, 2021).
Kırşehir Music – 2019	Designated for its strong folk music tradition, Kırşehir's musical identity is rooted in the legacy of prominent folk poets and the continuation of abdallık and bozlak traditions (UNESCO, 2021).

Bursa Crafts and Folk Art 2021	Bursa's designation reflects its diverse artisanal heritage, including silk production, shadow puppetry, tile-making, and traditional crafts shaped by historical migration and cultural diversity (UNESCO, 2025).
Şanlıurfa Music – 2023	With musical traditions dating back to ancient periods, Şanlıurfa promotes social cohesion and youth engagement through conservatories and cultural institutions supporting music-based community programs (UNESCO, 2025).

Source: UNESCO Creative Cities Network database; compiled by the authors.

Despite this cultural representation, ecological identity and endemic biodiversity have not been systematically incorporated into creative city strategies. The regional distribution of endemic species across Turkey demonstrates significant spatial variation. Based on Güner et al. (2012) and cross-checked with Noroozi et al. (2019), the proportional distribution of endemic taxa by region is presented in Table 2.

Table 2. Percentage Distribution of Endemic Plant Species in Turkey by Region.

Region	Percentage of Endemic Taxa (%)
Mediterranean	39–40
Eastern Anatolia	~20
Central Anatolia	~15
Black Sea	~12
Aegean	~8
Marmara	~4
Southeastern Anatolia	~2

Source: Based on Güner et al. (2012); Noroozi et al. (2019).

These marked regional disparities highlight the need for spatially sensitive biodiversity assessment frameworks. To address this conceptual and policy gap, this study proposes the "EndeFlora" criterion as a biocultural framework linking endemic flora with creative city strategies. EndeFlora operates as a qualitative and comparative assessment model integrating endemic species richness, spatial distribution, conservation priority, and cultural landscape relationships into urban development discourse. By positioning endemic flora as ecological indicators within creative city planning, the framework expands the cultural focus of the UCCN toward a holistic culture–nature paradigm.

This study therefore asks: How can endemic flora function as ecological indicators within creative city frameworks, and how might their integration strengthen ecological identity and sustainable urban development strategies? The EndeFlora criterion is introduced as a transferable conceptual model designed to operationalize the relationship between biological heritage and creative urban policy.

2. Study Area

This study focuses on Turkey, a biogeographically complex country situated at the intersection of three major phytogeographical regions: the Mediterranean, Euro-Siberian, and Irano-Turanian floristic zones (Ekim et al., 2000; Noroozi et al., 2019). This transitional position, combined with marked topographical variation and climatic heterogeneity, has generated exceptionally high levels of plant endemism.

Although Türkiye is administratively divided into seven geographical regions, the analytical framework of this study is structured around the three principal phytogeographical regions, as these units more accurately reflect floristic distribution patterns and endemic concentration. The Irano-Turanian Region covers the largest territorial extent, characterized by continental climate conditions and steppe ecosystems. The Mediterranean Region extends along the southern and western coasts, shaped by mountainous topography and Mediterranean climatic regimes. The Euro-Siberian Region occupies the northern part of the country, dominated by humid forest ecosystems. Climatic parameters, altitudinal gradients, and regional habitat diversity were considered in order to contextualize endemic species distribution patterns within these three floristic zones. The spatial configuration of these phytogeographical regions, which forms the ecological basis of the proposed EndeFlora framework, is presented in Figure 4.

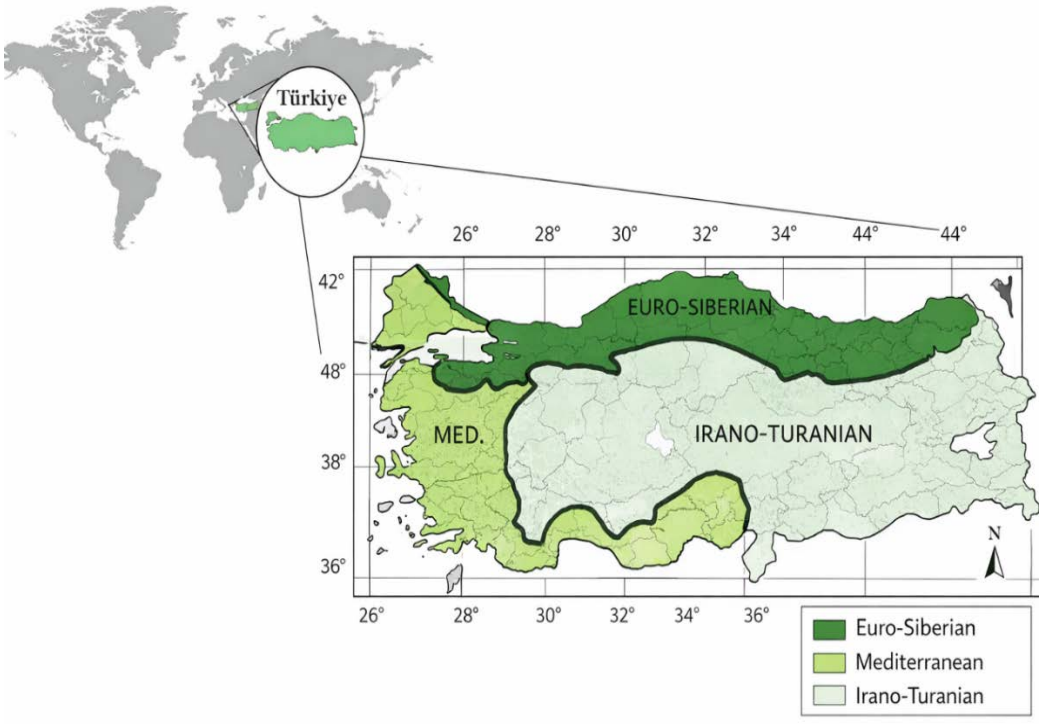


Figure 4. Phytogeographical regions of Turkey (Mediterranean, Euro-Siberian, and Irano-Turanian), compiled by the authors.

3. Materials and Methods

A three-stage methodological framework structured the study. In the first stage, the conceptual and thematic structure of the UNESCO Creative Cities Network (UCCN) was examined in relation to cultural diversity and sustainable development objectives, drawing on key scholarly sources (Boekholt et al., 2020; Duxbury et al., 2016). The creative sectors of Turkish member cities were analysed based on UNESCO official documents and evaluation reports (UNESCO, 2021) in order to identify thematic alignments and structural gaps within the existing eight creative fields. In the second stage, endemic plant diversity in Turkey was analysed within the country's three principal phytogeographical regions. Species distribution patterns, habitat characteristics, and conservation status were assessed using internationally and nationally recognized biodiversity databases. Taxonomic classifications and geographic data were compiled from Flora of Turkey and the East Aegean Islands (Davis, 1965), Global Biodiversity Information Facility (GBIF, n.d.), Plants of the World Online (POWO, n.d.; Royal Botanic Gardens, Kew, n.d.), Plants of Turkey Data Service (TÜBİVES, n.d.), and the Turley Plants Portal (Akalın et al., 2009). Conservation categories were evaluated according to IUCN criteria (IUCN, 2022).

To ensure methodological transparency, a qualitative weighting framework guided the selection of representative endemic species. Rather than applying statistical modelling, species were comparatively assessed using a structured qualitative framework aligned with the EndeFlora classification table. The evaluation considered: (i) endemic status and degree of geographical restriction within Turkey (Ekim et al., 2000); (ii) spatial distribution across phytogeographical regions and associated habitat characteristics (Davis, 1965); (iii) ecological functionality within local ecosystems, particularly contributions to soil stabilization, pollination, and water regulation (Millennium Ecosystem Assessment, 2005); (iv) documented cultural associations, including ethnobotanical use, traditional crafts, gastronomy, and symbolic representation (Özhatay et al., 2013); (v) aesthetic and landscape value in urban contexts (Kendal & Walker, 2008); and (vi) potential alignment with UNESCO Creative Cities Network (UCCN) thematic fields.This approach enabled the systematic comparison of endemic species while linking biological attributes with cultural creativity and sustainable urban development strategies.In the third stage, floristic findings were structured under the proposed "EndeFlora" criterion, and a nature-based thematic expansion for the

UCCN framework was developed. The EndeFlora approach reinterprets the creative city concept through an integrated ecological–cultural perspective, aligning biodiversity awareness with sustainable urban development (Evans et al., 2006; Baycan & Menderes, 2012). In parallel with this process, a logo was developed for the proposed EndeFlora criterion to maintain conceptual coherence with the visual framework of the UNESCO Creative Cities Network. The design follows the graphic language of the eight existing UCCN themes while incorporating references to plant morphology, regional diversity, and conservation symbolism. Conceived as a symbolic synthesis of botanical identity and cultural representation, the logo functions as a visual articulation of the biocultural framework advanced in this study rather than as a promotional device.

Overall, the EndeFlora criterion offers a multidisciplinary assessment framework encompassing ecological, cultural, and economic dimensions, and conceptually aligns with sustainable landscape planning literature (Selman, 2012; Ahern, 2013). Beyond proposing a new thematic direction for UCCN, this methodological approach contributes to nature-based urban strategy development and biodiversity-oriented local planning models.

4. Results and Discussion

Within the scope of the proposed "EndeFlora" criterion, a multidimensional evaluation framework was established to assess Turkey's endemic plant diversity in relation to cultural creativity, sustainable development, and nature-based urbanism. Rather than approaching endemic species solely as biological entities, the framework interprets them as biocultural assets that simultaneously function as ecological indicators, carriers of cultural identity, landscape components, and contributors to sustainable local economies.

The structure was designed in alignment with the culture-oriented sustainability logic of the UNESCO Creative Cities Network (UCCN) and conceptually integrated with the United Nations 2030 Agenda for Sustainable Development (UN General Assembly, 2015). Although UNESCO does not formulate the Sustainable Development Goals (SDGs), it embeds them within its strategic frameworks. Accordingly, the EndeFlora criterion establishes analytical intersections particularly with SDG 11 (Sustainable Cities and Communities), SDG 12 (Responsible Consumption and Production), and SDG 15 (Life on Land).

4.1. Categorical Structure of the EndeFlora Criterion

The evaluation framework consists of five principal dimensions: scientific–ecological characteristics; cultural–historical associations; aesthetic–landscape value; sustainability and economic potential, and compatibility with international cooperation mechanisms. The summarized structure is presented in Table 3.

Table 3. Multidimensional Structure of the EndeFlora Criterion.

Main Dimension	Sub-Criteria	Analytical Scope
Scientific–Ecological	Endemism Level	Narrow, national, and habitat-specific endemics (Ekim et al., 2000).
	Ecosystem Function	Pollination support, soil stabilization, water regulation (Millennium Ecosystem Assessment, 2005).
	Conservation Status	IUCN categories (CR, EN, VU, LC) indicating protection priority (IUCN, 2022).
	Climate Resilience	Adaptation to drought, salinity, and temperature variability.
Cultural–Historical	Ethnobotanical Use	Gastronomy, medicinal–aromatic use, traditional crafts (Özhatay et al., 2013).
	Symbolic Representation	Presence in mythology, folklore, literature, and art.
Aesthetic–Landscape	Visual and Seasonal Value	Flowering duration, morphology, seasonal dynamics (Kendal & Walker, 2008).
	Urban Integration	Compatibility with green infrastructure and urban microclimate regulation.
Sustainability–Economic	Local Economic Contribution	Ecotourism, sustainable harvesting, aromatic plant production.
	Climate Policy Contribution	Alignment with ecosystem-based planning (Selman, 2012; Ahern, 2013).
International–UNESCO Alignment	Intercultural Cooperation	Potential collaboration with UNESCO cities and research institutions.
	SDG Compatibility	Alignment with SDG 11, 12, and 15 (UN General Assembly, 2015).

This framework does not redefine botanical endemism; rather, it functions as a comparative indicator system linking ecological significance with cultural creativity capacity.

4.2. Regional Distribution Patterns

The spatial distribution of endemic plant diversity across Turkey's three principal phytogeographical regions reveals significant differentiation (Ekim et al., 2000; Noroozi et al., 2019). Mediterranean taxa show strong adaptation to coastal–mountain ecosystems, Irano-Turanian species dominate continental and steppe landscapes, and Euro-Siberian species are primarily associated with humid forest ecosystems. Representative endemic taxa from selected provinces illustrating this spatial specialization are presented (Table 4).

Table 4. Representative Endemic and Regional Species by Province.

Province	Floristic Region	Representative Endemic and Regional Species
Antalya	Mediterranean	*Crocus antalyensis* B. Mathew; *Phoenix theophrasti* Greuter
Mersin	Mediterranean	*Abies cilicica* (Antoine & Kotschy) Carrière; *Crocus mersinensis* Kernd. &Pasche
Konya	Irano-Turanian	*Astragalus setulosus* Boiss. & Balansa
Sivas	Irano-Turanian	*Crocus sivasensis* Kernd. & Pasche
Kayseri	Irano-Turanian	*Centaurea amaena* Boiss. & Balansa
Muğla	Mediterranean	*Liquidambar orientalis* Mill.
Van	Irano-Turanian	*Limonium vanense* Kit Tan & Sorger; *Fritillaria imperialis* L.
Bursa	Euro-Siberian	*Crocus thirkeanus* K. Koch
Erzurum	Irano-Turanian	*Prunus incana* (Pall.) Batsch
Samsun	Euro-Siberian	*Crocus ancyrensis* (Herb.) Maw

Sources: Şenkul & Kaya (2017); GBIF (2025); POWO (2025); TÜBİVES (2025).

4.3. Interpretation of Quantitative Patterns

Quantitative assessment reveals that the Irano-Turanian Region constitutes the largest spatial reservoir of endemic diversity, accounting for 61.4% of Turkey's endemic locations (Noroozi et al., 2019). The Mediterranean Region follows with 26.3%, while the Euro-Siberian Region represents 12.2% (Table 5).

Table 5. Distribution of Endemic Species Across Turkey's Floristic Regions.

Floristic Region	Area Share (%)	Endemic Locations	Endemic Species	Location Share (%)
Mediterranean	16.8	2557	1050	26.3
Euro-Siberian	18.5	1177	300	12.2
Irano-Turanian	64.7	5943	1220	61.4
Total	100	9677	2570	100

Sources: Bulut & Yılmaz (2019); Keskin et al. (2021); GBIF (2025); POWO (2025); TÜBİVES (2025). Compiled by the Authors.

Although the Mediterranean zone covers a comparatively smaller territorial share, its endemic density per unit area is notably high, reinforcing its classification as a biodiversity hotspot (Bulut & Yılmaz, 2019; Keskin et al., 2021). In contrast, the Irano-Turanian dominance reflects the ecological predominance of continental and semi-arid ecosystems within Turkey's overall endemism structure. Detailed regional datasets and species-level evaluations for the Mediterranean, Euro-Siberian, and Irano-Turanian regions are provided in Supplementary Tables S1-S2-S3, respectively.

4.4. Implications for the UNESCO Creative Cities Network

Although the UCCN effectively integrates creativity with sustainable development, its thematic structure remains largely focused on cultural production and economic innovation. Explicit ecological identity markers and biodiversity indicators are not formally embedded within its framework. The EndeFlora criterion addresses this structural gap by introducing a

biocultural dimension that integrates endemic plant diversity into creative city strategies. By aligning ecological richness with cultural narratives and sustainable urban policies, the framework expands the UCCN model from a culture-centered paradigm toward a nature-integrated creative ecology approach. Beyond Turkey, the model demonstrates transferability. Other UNESCO Creative Cities may adapt the EndeFlora framework by mobilizing their region-specific flora and cultural heritage systems, thereby embedding biodiversity awareness into global creative policy agendas.

Each of the three phytogeographical regions provides a distinct basis for the development of region-specific biocultural planning strategies under the EndeFlora framework. Rather than treating endemic species solely as conservation units, the model positions them as structural components of creative landscape development, local identity construction, and sustainable economic diversification.

In alignment with the sustainability, innovation, and cultural authenticity principles of the UNESCO Creative Cities Network (UNESCO, 2017), Turkey's floristic diversity offers an ecological infrastructure for creative development scenarios grounded in biocultural heritage (Pretty et al., 2009; Luerdi, 2023). Species such as *Sideritis lycia* Boiss. & Heldr. (Mediterranean Region) and *Lilium ponticum* K. Koch (Euro-Siberian Region) illustrate how endemic plants can simultaneously embody ecological value and narrative potential. Their integration into ecogastronomy, environmental education, creative storytelling, and thematic landscape design enables the construction of multidimensional sustainable tourism models (Duxbury et al., 2016; Kendal & Walker, 2008; Besser, 2022). Within the framework of Creative City Theory, the EndeFlora criterion thus functions not merely as a conservation-oriented tool, but as a strategic mechanism supporting nature-based creative economies (Landry, 2000; Evans, 2009).

Conceptually, the model is grounded in the notion of biocultural heritage, positioned at the intersection of ecological systems and cultural production. In this sense, it contributes not only to spatial planning but also to identity formation, collective memory, and participatory local development dynamics (Millennium Ecosystem Assessment, 2005; Gavin et al., 2015).
Cities participating in, or applying to, the UNESCO Creative Cities Network such as Gaziantep, Istanbul, and Kırklareli hold the potential to operationalize this model by making floristic heritage visible within creative policy frameworks. Community-based strategies rooted in traditional plant knowledge, medicinal plant use, and local production practices can simultaneously reinforce biodiversity conservation and creative economic development (Pretty et al., 2021; Buizer et al., 2016). The integration of endemic plants into public space

design, local branding processes, and thematic cultural routes strengthens the ecological dimension of urban identity while enhancing economic reproducibility (Ahern, 2013).

In order to systematize these implementation pathways, creative development strategies derived from the EndeFlora framework were categorized under thematic action areas. These strategies aim to operationalize endemic plant diversity within sustainable cultural landscape planning and nature-based creative economy models (Table 6). *lycia*

Table 6. Creative Development Strategies Based on EndeFlora Criteria.

Strategy Area	Application Proposal	Target Phytogeographic Region(s)	Purpose
Public Space Design	Integration of endemic plants into urban parks, pedestrian routes, and squares as identity-defining landscape elements	All regions	Strengthening natural identity and environmental awareness
Experiential Ecotourism	Development of endemic plant routes, guided observation trails, and thematic biodiversity walks	Mediterranean (*Stachys cretica* L.), Irano-Turanian (*Astragalus* L. spp.)	Alternative tourism models and local income generation
Arts and Education Programs	Photography workshops, botanical literacy programs, natural dye art activities	Euro-Siberian (*Lilium ponticum* K.Koch)	Botanical awareness and intergenerational knowledge transfer
Creative Gastronomy and Product Development	Medicinal and aromatic plant-based products (herbal teas, oils, spices) and innovative culinary applications	Mediterranean (*Sideritis lycia* Boiss. & Heldr.; *Origanum minutiflorum* O. Schwartz & P.H. Davis)	Local branding and value-added production
Digital and Creative Expression	AR/VR-supported plant identification experiences, digital storytelling platforms	All regions	Youth engagement and digital dissemination
Community Participation and Cultural Memory	Integration of traditional ecological knowledge and ethnobotanical narratives into planning processes	Especially Eastern and Southeastern Anatolia	Participatory governance and cultural heritage preservation
Local Product and Thematic Routes	Ethnobotanical marketing, gastronomic routes, regional promotion initiatives	Southeastern Anatolia, Marmara, Aegean	Rural diversification and tourism expansion

In conclusion, the EndeFlora strategy proposes a transitional model that extends beyond conventional ecotourism approaches by structurally linking endemic biodiversity with creative sector development. The framework supports the formation of sustainable urban identities, contributes to creative branding processes, and advances integrated development paradigms that transcend the traditional nature–culture dichotomy (Selman, 2012; Duxbury et al., 2023). By situating endemic plant diversity within biocultural planning and creative economy frameworks, the model offers both theoretical advancement and practical applicability for UNESCO-oriented urban strategies.

5. Future Research Directions

The EndeFlora criterion proposed in this study establishes a conceptual and strategic framework grounded in Turkey's endemic plant diversity and its integration into creative development paradigms. However, to enhance the operational applicability and empirical robustness of the model, several research directions should be pursued.

First, the qualitative structure of the EndeFlora framework could be transformed into a quantitative and index-based assessment system. The development of a measurable biocultural biodiversity index would enable comparative evaluation across phytogeographical regions and cities. Such a scoring system could integrate endemism intensity, habitat specificity, cultural embeddedness, and creative economy potential into a multi-criteria decision-making model.

Second, comparative interregional analyses should be conducted to test the adaptability of the framework across different ecological and socio-cultural contexts. This would allow the model to evolve from a nationally grounded framework into a transferable international planning instrument within the UNESCO Creative Cities Network.

Third, field-based pilot implementations in collaboration with local governments, conservation agencies, and UNESCO Creative Cities would provide empirical validation. Applied case studies examining the integration of endemic plants into public space design, creative tourism routes, and local product development could generate measurable socio-ecological outcomes.

Fourth, future research should incorporate updated floristic databases and high-resolution spatial data to improve species-level accuracy. The integration of GIS-based habitat modelling and climate change projections would further strengthen the predictive capacity of the framework. Finally, longitudinal studies examining the relationship between vegetation shifts, endemism patterns, and climate change scenarios would provide critical insights into the resilience dimension of the EndeFlora criterion.

6. Limitations of The Study

This study presents a conceptual and thematic evaluation of endemic plant diversity within Türkiye's three main phytogeographical regions. Several limitations should be noted.

First of all, endemic species data were derived from existing databases and literature, which may not fully capture all local taxa or microhabitats. Additionally, conservation status and habitat characteristics were not verified through field-based research for each species.

Another limtiation is the EndeFlora criterion remains a conceptual planning framework and has not yet been empirically tested through applied case studies. These limitations do not weaken the theoretical contribution of the study but indicate the need for further empirical validation and methodological refinement.

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