BIO-FRIENDLY EDUCATIONAL CAMPUSES – EXAMPLE OF ERZİNCAN CITY IN TURKIYE

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Abstract. This study emphasizes outcomes such as the identification of biodiversity in urban areas within Türkiye, the development of strategies to ensure its continuity, the enhancement of resilience against climate change by utilizing natural species in terms of plant material, the effective utilization of resource values, and the creation of awareness at local, national, and international scales. Totally, 10 different educational areas were surveyed, counting 13,323 plants comprising 80 different species, of which 35 are part of the natural flora. In particular, we promote biodiversity in cities by encouraging the planting of more native trees and the use of a greater variety of species that can attract wildlife. Among the identified plants, there are 1,043 edible tree species, 1,871 broadleaf species, 2,393 coniferous species, 828 other ornamental plants, shrubs, and bush types totaling 7,126, and 62 climbing plant species. In these areas, plant species diagnostics, naturalness status, and analyses of edible trees and fruit-bearing plants were conducted. Analyses were also performed according to the Shannon-Wiener diversity index, Simpson diversity index, and Biyodost Educational Campus Index for each area. We recommend considering a design concept that caters not only to humans but also appeals to all living beings for completed and planned educational areas. New concepts such as Bıo-Frıendly Educatıonal Area require collaboration across different disciplines in this field. Academic circles should begin to take the lead in developing and implementing this concept. The collaborative work of these disciplines will contribute to the development of innovative approaches in the design, management, and sustainability of bio-friendly areas.
Keywords: *biodiverse cities, drought-resistant landscaping, native species, urban biodiversity, natural edible plant species*

Introduction

Urbanization contributes significantly to environmental change and is closely linked to the future of biodiversity. The growth of cities worldwide and the increasing density of urban areas pose a threat not only to the species present within cities but also to the ecosystems that need to be preserved within and around them (Güneralp and Seto, 2013).

More than half of the world's population lives in cities. These cities also serve as habitats for a wide variety of plant and animal species. For instance, it is known that cities harbor at least 20% of all known bird species and 5% of plant species (Aronson et al., 2014).

In Australia, 30% of endangered species are found in cities (Ives et al., 2016). Urbanization represents a significant and long-term change in landscapes. Although cities occupy only a small portion of newly emerging land areas, they have been associated with the perforation of wild areas worldwide (Sanderson and Huron, 2011; Ramalho and Hobbs, 2012). As a result, urbanization is often linked to a significant loss of natural

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areas, affecting both the inhabitants of cities and biological diversity (McDonald et al., 2013).

Policies targeting sustainable, biodiversity-friendly urban development increasingly recognize the biological richness of cities at present and in the future (Aronson et al., 2017; Nilon et al., 2017). However, recent research questions the foundations of such approaches. Previous studies have focused on how species adapt to urban environments (Williams et al., 2009; McDonnell and Hahs, 2015).

Therefore, to mitigate the adverse effects of urban growth on biodiversity and to assist in the creation of more viable and effective conservation measures, it is imperative for conservation biologists, urban planners, and legislators to fully comprehend the consequences of urban expansion on species diversity (Güneralp and Seto, 2013).

Urban growth exacerbates the current biodiversity crisis. Hence, a significant challenge for sustainable urban development is to integrate the preservation of biodiversity into the design and management of green spaces (Shaffer, 2018).

Sustainable urban development and human well-being are closely linked to biodiversity-friendly cities. Urban nature provides a wide array of regulatory, provisioning, and cultural ecosystem services (Haase et al., 2014). It also supports physical and mental health (Hartig and Kahn, 2016) and helps in maintaining people’s connection with nature (Ives et al., 2017).

Regardless of their size, all life forms significantly contribute to species diversity, which naturally supports sustainability. Consequently, biological diversity enhances ecosystem productivity and protects against various environmental threats, offering a robust, recyclable, and healthy environment (Shah, 2019).

The loss of native species and the emergence of exotic species are causing rapid changes in the diversity and composition of most plant communities (Sala et al., 2000). Although exotic species may displace native species and reduce richness, their integration into existing native ecosystems can increase local species richness (Mack et al., 2000; Sax et al., 2002; Marks et al., 2008; Tilman, 2011).

Despite Türkiye’s richness in plant species diversity, it has been observed that exotic plants are preferred over native species in landscape works (Kaya Şahin et al., 2020). Moreover, the dominant character structures of some exotic species are causing the extinction of native species. Due to ecological reasons such as effects on wildlife and the inability to create habitats, urban landscape designs have given importance to the use of native species, considering approaches based on ecological principles (Hostetler and Holling, 2000).

Cities that value biodiversity should possess a wide variety of tree species that offer diverse environmental services. Urban tree species play a significant role in floristic diversity. Trees growing in parks, streets, private gardens, and university campuses are vital natural elements that connect people and the biosphere (Le Roux et al., 2014; Hartig and Kahn, 2016; Liu et al., 2021). For instance, birds are often used as fundamental environmental indicators and a proxy for other species due to their visibility and widespread distribution (Yong et al., 2016).

Fruit trees are productive plants that bear fruits safe for human consumption. They are cultivated for aesthetic and culinary uses in landscapes, as well as for commercial purposes. Fruit trees are utilized in cities to create landscapes that are both beautiful and functional. They are employed in public green spaces, residential areas, corporate settings, educational environments, street arrangements, community gardens, campuses, urban forests, and greenways (Bulut et al., 2007).

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Fruit trees are becoming increasingly popular in urban landscaping projects as they are both aesthetically pleasing and functional. Moreover, fruit trees have been effectively incorporated into initiatives aimed at enhancing community relations, rescuing animals, and improving food security (Colinas et al., 2018).

Edible plants do not only carry nutritional value but also hold a significant place in landscape design due to their aesthetic features, such as the beauty of their flowers and fruits, leaf texture, autumnal coloration, and habitus, among others. The other benefits provided by the use of edible plants include allowing urban dwellers to observe the growth processes of the food they consume, encouraging public participation in production, enhancing life quality by bringing people closer to nature and contributing to urban ecosystem services (Lovell, 2010; Güneroğlu and Pektaş, 2022).

The visual landscapes provided by edible fruit trees are more impactful than those of other ornamental plants. These plants represent a blend of beauty and utility. Edible fruit trees, with their aesthetic and functional features, are elements that create, balance, enhance, enrich, and invigorate their surroundings (Dikmen and Yılmaz, 2021).

Certain urban tree species play a significant role in floristic diversity. According to researches, as the number of tree species increases, so does the resilience of the ecosystem, and it is advised that no single species should constitute more than 10-20% of all tree species (Kendal et al., 2014). A study conducted in Europe suggests that open green spaces, woody vegetation, and impervious surfaces promote the diversity of bird species in urban areas (Tzortzakaki et al., 2018). The preservation of natural substrates and the renewal of trees in plantations are crucial as they provide food and shelter for many bird species (Geldenhuys, 1997; Duncan and Chapman, 2003; Lee et al., 2005). Identifying local factors that ensure population continuity in a settlement can assist landowners in providing additional resources for wildlife, thereby enhancing the natural biodiversity within these systems (Goddard et al., 2010). According to Vergnes et al. (2013), wildlife corridors are becoming a common element of urban design and appear to be a beneficial technique for increasing biological diversity in urban green spaces.

One of the biodiversity-friendly landscape designs that can provide these services is native plant gardens. Transforming lawn grasses into a native plant garden can reduce chemical, energy, and water usage (Nassauer et al., 2009). The fundamental approach to obtain more ecosystem services, improve the soil environment, and increase species diversity is to create multi-species mixed plantations (Lwila et al., 2021).

The Chinese government’s establishment of monoculture pine plantations for timber production has, over the long term, led to a decrease in soil fertility, nutrient loss, and a reduction in biodiversity (Yan et al., 2016).

One way to halt the loss of native species and the ecosystem services they provide is to encourage the planting of native plants in all environments (Burghardt et al., 2009). Moreover, a global synthesis has revealed that one of the key factors affecting the conservation of local wildlife in urban settings is still the amount of natural vegetation that remains (Hahs et al., 2009).

Numerous studies conducted over many years have demonstrated a significant correlation between ecosystem functioning and plant biodiversity, particularly highlighting the positive relationship between productivity and species richness (Hooper et al., 2005; Cardinale et al., 2011).

Previous research (Liu and Slik, 2022) suggests that reducing the dominance of the most common species and increasing the percentage of native trees would be goals of a

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biodiversity-friendly urban tree planting strategy that supports the long-term conservation of animals in urban areas (*Figure 1*).

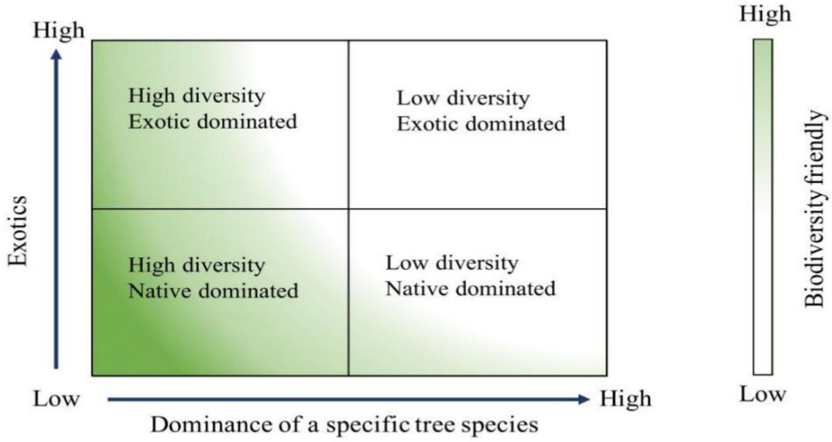

Figure 1. *Biodiversity-friendly habitats can be enhanced through the use of native plant species (Liu and Slik, 2022)*

Incorporating native and natural resources or species into the development process is anticipated to align with the nationally promoted green growth and development. It is articulated that supporting diverse tree species in cities is necessary. A significant portion of the world's population resides in urban areas, and 'biodiversity-friendly cities' are characterized as places with a high diversity of native trees, offering various ecosystem services and functions (Liu and Slik, 2022).

Hence, enhancing urban conservation efforts requires a deeper understanding of people's perceptions of biodiversity-friendly public green spaces (McDonnell and MacGregor-Fors, 2016). As the preservation of biodiversity becomes a global concern, international strategies and policies are increasingly becoming essential (Bonebrake et al., 2019). Consequently, determining the extent to which people approve of less manicured, almost natural green spaces is crucial for developing policies that promote urban biological diversity. To increase the acceptance of urban biodiversity conservation techniques, it is necessary to understand the fundamental factors that influence people's attitudes towards biodiversity-friendly green space management (Fischer et al., 2018a). The interaction of various social and cultural background characteristics may be the source of these views (Fischer et al., 2018b).

Urban afforestation is actively promoted as a planning tool for the adaptation and mitigation of climate change in urban areas, the enhancement of urban sustainability, and the improvement of human health and well-being (Salmond et al., 2016).

Biodiversity is a valuable accumulation that has formed since the emergence of life on Earth. The re-establishment of balances in the face of climate changes occurring on Earth can only be achieved thanks to this rich accumulation. In other words, biodiversity and ecosystems constitute the living foundation of 'Sustainable Development'. Considering that about half of the global economy is related to biological products and processes, this study also highlights the importance of biodiversity even more.

Activities that enable children to have positive interactions with nature, involving various plants, animals, water, air, and soil, can be instrumental in applying learned

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knowledge to life. To achieve this aim, natural life should be brought into the learning spaces within school gardens (Başal, 2005).

In today's developed countries, primary school gardens are regarded not just as places for children to spend their free time during recess but as educational spaces (Erdönmez, 2007).

Jackie Grobarek, an elementary school teacher, summarizes the function of school gardens in environmental education as follows: 'This summer, our students nurtured worms, plants, and caterpillars, and released the resulting butterflies back into nature. They learned that worms can consume waste and that plants can grow using the nutrients from worm castings' (Louv, 2010).

Recent studies indicate an increase in the use of fruit trees in private home gardens. This trend highlights the importance of gardens in open green spaces for recreational needs, despite urban populations drifting away from nature. The vegetation used in these gardens plays a critical role in providing a natural habitat and adding aesthetic value (Askan and Yılmaz, 2016).

Education and support programs are fundamental cornerstones in long-term conservation efforts. Urban green spaces offer opportunities for people to learn about environmental processes. Studies have determined that children who receive environmental education during primary school are more sensitive to nature conservation in their future life. For instance, in Austin, Texas, a bat conservation society has been established to protect and promote a rare Mexican bat species (*Tadarida brasiliensis*). This society aims to raise public awareness through informational meetings about bats (Selim et al., 2015).

Three zoological parks have been run in Mexico City: Los Coyotes Zoo, San Juan de Aragón Zoo, and Chapultepec Zoo. These parks have transformed into initiatives for the protection and conservation of their nationally and locally unique species in recent decades. As a crucial first step in preserving biodiversity in the parks, educational initiatives emphasize the preservation of habitat, water resources, and climate change (SCBD, 2012).

Urban areas require the development of landscape design practices that will create connectivity in bird migration corridors and the need for alternative green spaces is evident. Biodiversity and educational fields have been the focus of recent studies, highlighting their importance (Oğuztürk and Pulutkan, 2022).

Skelyy and Bradlay (2007) emphasized the necessity for teachers to utilize school gardens for effective environmental education and to foster positive attitudes towards the environment. Due to these functions, the Ford Elementary School in Georgia, USA, which is founded on the philosophy of environmental education, provides year-round environmental education to children in outdoor classrooms such as gardens, fields, and tree museums (Gülay and Önder, 2011).

An example of a project that creates new green infrastructure and supports biological diversity is the Overvecht Green Structure Plan in the Netherlands. In the Overvecht plan located in Utrecht, factors of the natural and built environment (such as building forms, habitat and microclimate features, ownership, security, and other social factors) have been considered. Landscape character zones have been delineated (public and commercial building green areas, neighborhood parks-canal sides, road systems, green paths-pedestrian and bicycle paths, private gardens, front yard greens) and their functions for recreation, landscape character, and biological diversity have been analyzed (Overvecht, 2003).

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Today, climate change is exacerbating many adverse effects faced by cities. Therefore, the development of sustainable urban ecosystems is crucial. Urban open green spaces play a critical role in the health, ecology, aesthetics, economy, and sociology of cities. These areas support the physical and mental health of people while preserving natural life.

This study aims to identify biodiversity in urban areas within Türkiye, develop strategies to ensure its continuity, enhance resilience against climate change by using natural species in terms of plant material, ensure the effective use of resource values, and create awareness at local, national, and international scales. The study is expected to contribute to the development of strategies that will increase the resilience of cities against the destructive effects of climate change.

World Leaders agreed in 2015 on 17 global goals to accomplish three significant tasks by 2030. These tasks are to end extreme poverty, fight inequality and injustice, and fix climate change. The global goals for sustainable development can fulfill these commitments. The project to be executed is related to at least seven of the sustainable development goals, including healthy and quality life, quality education, affordable and clean energy, sustainable cities and communities, climate action, life below water, and life on land, and will contribute to these objectives.

The primary objectives of this study are to explore the role and significance of urban green spaces, with their inherent natural and cultural landscape features, in mitigating climate change through the ecosystem services they provide. The concept of 'Biodiversity-Friendly Educational Areas' (Bio-Friendly Education areas), which will be introduced through this study, is a significant step for the world as it is set to be discussed within the scientific community and the public sphere as a brand value for Türkiye and the cities around us.

Distinct from other diversity indices, this study has established 'Biodiversity-Friendly Campus/City determination criteria'. This index, thanks to its applicability to all areas lacking in biodiversity assessments (such as districts, educational buildings, health facility areas, campuses, religious facility areas, municipal open-green spaces, roadside trees, central medians, gardens of official institutions, etc.), possesses a broad application scope. Following the evaluations, 'Bio-Friendly Educational Areas' will be classified at low-good-high levels, and 'Biodiversity-Friendly Campuses' that meet the criteria will be QR-coded. This will positively contribute to their selection for educational purposes and the awareness of the building's service to the environment.

Materials and Methods

Materials

The research area, Erzincan, is located in the Upper Euphrates Section of the Eastern Anatolia Region, between the latitudes of 39 02' - 40 05' North and longitudes of 38 16' - 40 45' East. The region experiences its highest average temperature in August (32°C), while the lowest is in January (-6.9°C) (MGM, 2022).

Located in the Upper Euphrates Section of the Eastern Anatolia region, Erzincan is characterized by a high level of plant diversity due to its geological diversity, topographical variation (ranging from 850 to 3550 meters), local climatic differences, phytogeographically lying within the Iran-Turan Region, proximity to the Euro-Siberian Flora Region, and its position on the Anatolian Diagonal (Diagonali), which is influential

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in the distribution and isolation of species. Approximately 60 local endemic species are found in Erzincan (Kandemir et al., 2022).

Plant diversity in Turkey is not homogeneously distributed across the country but is concentrated in certain areas. One such area is Erzincan and its surroundings. Erzincan also encompasses seven Significant Plant Areas (Şenkul and Kaya, 2017; Kandemir, 2019).

The study was carried out in a total of 10 different educational institutions, including a kindergarten, three primary schools, three high schools, two private colleges and the campus of the university in the city center of Erzincan between April and November 2022-2024 (*Figure 2, Figure 3*).

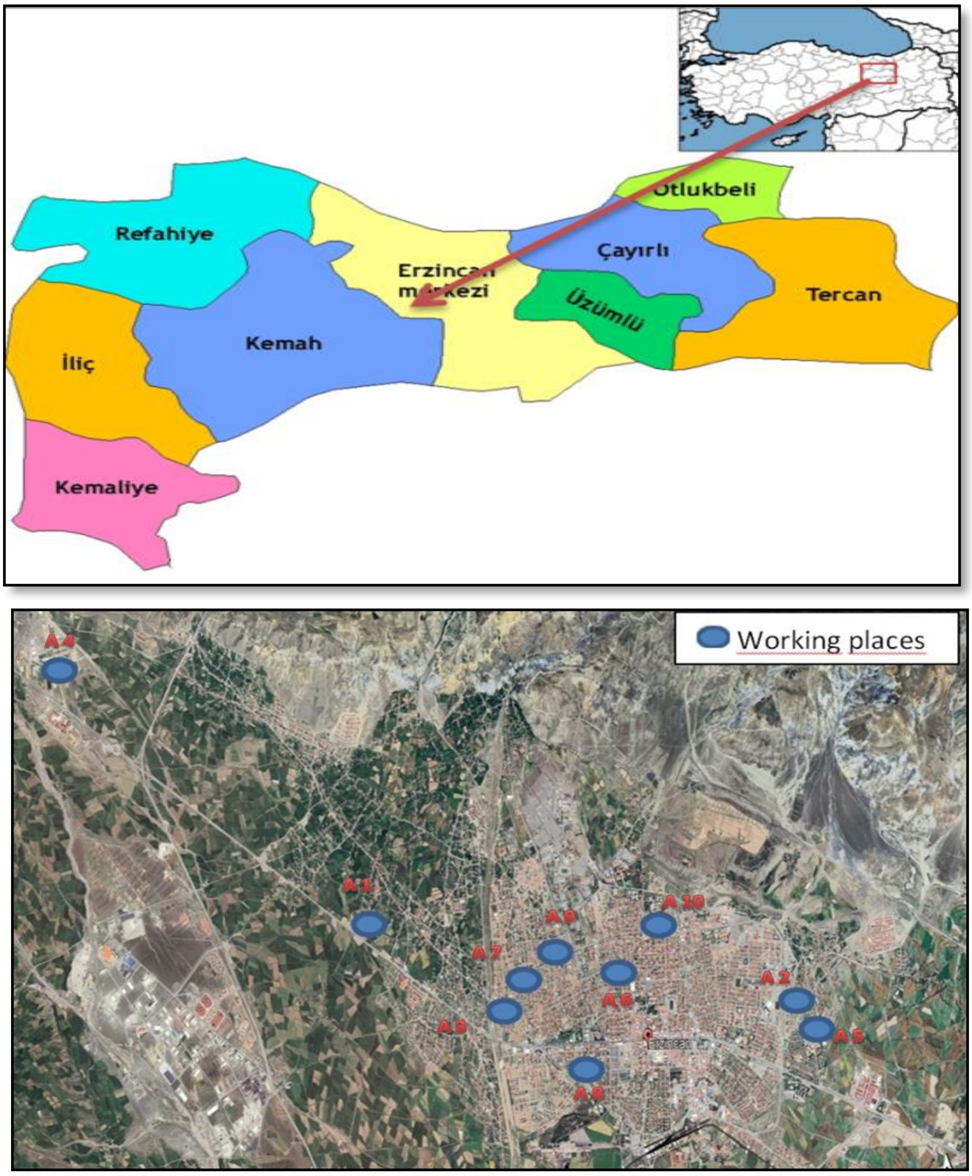

Figure 2. *The location of the research area and the gardens of the educational institutions under research (The numbering of the areas is based on the alphabetical order of the names of the educational fields)*

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Figure 3. *Visuals of the Study Areas*

The size of the work areas and the number of users were determined by interviewing the institution managers and are given in *Table 1*.

Table 1. *Number of areas studied, area sizes and number of users*

Study Areas	Area size(m²)	Number of users (Teacher-Student-Staff)
Kindergarten: Mimar Sinan Kindergarten (A8)	2750 m²	212
Primary School: Dr. Cahit Ziya Ulukök Primary School (A2)	9000 m²	92
Primary School: Melihşah Primary School (A7)	7000 m²	599
Primary School: Yavuz Selim Primary School (A9)	8450 m²	567
High School: Ertuğrulgazi Anatolian High School (A3)	10530 m²	577
High School: Science High School (A5)	10800 m²	421
High School: Social Sciences High School (A10)	35000 m²	447
Private College: Doğa College (A1)	11000 m²	700
Private College: Fidem College (A6)	3600 m²	400
University: Erzincan Binali Yıldırım University (A4)	1.225.000 m²	15000

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Method

The methodology of the study consists of the following stages:

- Literature review on the subject.
- Determination of study areas (Factors such as garden sizes, plant diversity and densities, and their recognizability in the city have been considered in the selection of these areas).
- Conducted research in the study areas
  - The images of these areas in spring and autumn were taken from the air with the help of a drone (DJI Mini 4 Pro, 48 MP, 4K).
  - Inventories have been conducted for the broad-leaved and coniferous trees, shrubs, dwarf coniferous bushes, and climbing plants found within these areas.
  - The construction years of the fields have been researched, and measurements have been taken of the ratio of impervious hard surfaces to open green spaces.
  - The number of fauna within these areas has been observed within one hour.
  - The positive and negative ecosystem components of the study areas have been identified.
  - Plant species and numbers within the areas, natural plant species ratios, construction year of the areas, ratio of open-green areas to hard impermeable surfaces, number of fauna observed in the area within 1 hour (Birds, butterflies, squirrels, etc.), positive ecosystem components, negative ecosystem components were measured.
  - The species identification of the plants and their naturalness status have been determined.
- Analyzes made in the Office
  - Plant species diagnostics, assessments of naturalness, and analyses of fleshy fruit-bearing plants suitable for consumption have been conducted (expert individuals in the field have assisted in identifying plant species, and resources from URL-1, Yücel (2005) have been utilized).
  - Biodiv, Past, EstimateS, Paup, and BİÇEB are among the most well-known and utilized software for biological diversity calculations globally. Indices based on the proportional or numerical values of area abundance data include the Shannon-Wiener diversity index, Brillouin index, Simpson index, McIntosh index, City Biodiversity Index (Singapore Index on Cities' Biodiversity), and Berger-Parker diversity indices.
  - All study areas were analyzed according to the Shannon-Wiener diversity index (H´), Simpson diversity index (1/D) and Bio-friendly Education Campus Indexes.

Shannon-Wiener diversity index (H´):

$$H' = -\sum \text{pi} \ln(\text{pi}) \quad \text{(Eq.1)}$$

where,

p_i: Ratio of the ith species relative to the others,

ln: It shows the base of the natural logarithm (Magurran, 1988, 2004).

Simpson diversity index (1/D):

$$1/_D = 1 - \sum n_i(n_i - 1)/\ \mathrm{N}(\mathrm{N} - 1) \quad \text{(Eq.2)}$$

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where,
i: Number of species,
n_i: Number of individuals of a species,
N: It shows the total number of individuals of species in a region (Magurran, 1988, 2004).

The effects of landscape features on campus bird species richness and diversity were investigated in 12 university campuses located in Xianlin University Town, Nanjing City, and in the study conducted on the effects of environmentally friendly urban planning, the bird species richness of the campuses was determined and the differences in biodiversity Shannon-Wiener and Simpson indices were compared. The effects of various land features on campus bird species richness were analyzed and it was concluded that species richness increased in parallel with water and green areas (Zhang et al., 2021).

Plants are the main components of urban forests, and rich plant diversity can improve the overall function of urban ecosystems (Liu et al., 2010). Moreover, diversity indices can be used to measure plant diversity, and plant diversity index values reveal the complex relationships among individual plants and are a unique way to reflect the use of environmental resources by plants (Condit et al., 2000; Rota et al., 2014). Among the diversity indices, the richness index is often used to describe the number of species in a community, and diversity indices are functions that combine species diversity and species abundance, such as the Simpson index and the Shannon index (Zhao et al., 2022).

To assess bird diversity in Minhang District located in the southwest of Shanghai city center, China, species richness, abundance, Shannon-Wiener index and Simpson Index were calculated based on bird observation dataset obtained from Citizen Science Data Sharing Platform. The habitat suitability of urban ecological corridors was positively correlated with bird diversity, and birds preferred to inhabit waters larger than 1 ha. The degree of urbanization was negatively correlated with bird diversity, and the distance to the center of the area had the strongest positive effect. The degree of slow traffic connection proved that low-intensity human activities in urban ecological corridors had a lower impact on bird diversity (Wang et al., 2024). The Biyodost Educational Campus Index has been developed according to criteria established by Yılmaz (2024). For each area, a total of 10 criteria have been determined, including the number of plant species, the naturalness of plants, the number of fruit-bearing plant species, the proportion of green spaces, the number of fauna, and the positive and negative components of the ecosystem. This new method is structured such that a settlement scoring 60 or above out of 100 points is considered Biyodost.

Results and Discussion

Plant species detected in school gardens in Erzincan City and plant species analysis

Plant species belonging to 10 education campuses located in the open green areas of Erzincan city were identified (*Table 2*). The plant species identified were classified as broad-leaved trees (edible trees and other ornamental trees), coniferous trees, shrublet and shrubs, dwarf coniferous shrubs and vine plants (*Table 3*).

Table 2. *Plant species and total plant numbers in educational buildings*

Results	A.1	A.2	A.3	A.4	A.5	A.6	A.7	A.8	A.9	A.10
Species Richness	24	9	28	52	20	20	19	15	25	26
Total Number of Plants	1643	307	248	7505	281	134	143	202	232	863

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Table 3. *Plant species detected in 10 education campuses located in the open green areas of Erzincan city*

		LATIN NAME	ENGLISH NAME	NATURAL TYPE	WORKING PLACES										TOTAL
					A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	
BROADLEAF TREES	TREES WITH FRUIT AND FRUIT	*Elaeagnus angustifolia* L.	Silverberry	+			2	5						2	9
		Juglans regia L.	Walnut	+			1	3				2	7	2	15
		Malus communis Laxm.	Apple	-				20	2		1		6	10	39
		Malus x purpurea 'Eleyi'	Ornamental apple	-	2		2	250	4	4			6	2	268
		Morus alba L.	Mulberry	+				60	2		2		2	20	86
		Morus pendula L.	Upside down mulberry	+			4	15	2	3	1		3	2	30
		Persica vulgaris Mill.	Peach	-		1									1
		Prunus amygdalus	Almond	+										1	1
		Prunus armeniaca L.	Apricot	-		5	4		4			2	11	26	52
		Prunus avium L.	Cherry	+			2						2	2	6
		Prunus cerasifera 'Atropurpurea'	Ornamental plum	+			28	70				3		2	103
		Prunus cerasus L.	Cherry	+									1		1
		Prunus Domestica	Plum	+		1	3		2				1	4	11
		Pyrus Calleryana	Ornamental pear	-				36							36
		Pyrus communis	Pear	+										4	4
		Pyrus eleagrifolia Pall.	Wild pear	+		1									1
		Tilia tomentosa Moench.	Linden	+	3	2	8	350	4	4	1	3	1	4	380
					TOTAL OF TREES WITH SUCCESSFUL FRUIT:										1043
		Acer negundo L.	Maple	+			4			3			3		10
		Acer platanoides 'Crimson king'	Red leaf maple	-				30	1						31
		LATIN NAME	ENGLISH NAME	NATURAL TYPE	WORKING PLACES										TOTAL
					A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	
BROADLEA	OTHER	*Acer platanoides globosum*	Ball maple	-				10							10

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		***Acer platanoides* L.**	**Sycamore maple**	+	**3**			**120**				**2**	**2**		**127**
		***Aesculus hippocastanum* L.**	**Horse chestnut with white flowers**	+	**5**		**2**	**70**	**3**			**2**	**2**		**84**
		***Ailanthus altissima* (Miller) Swingle**	**Stinky tree**	+			**1**			**5**	**3**				**9**
		***Betula verrucosa* Ehrh.**	**Birch**	+				**200**							**200**
		***Catalpa bignoniodies* Walt.**	**Catalpa**	-				**10**						**2**	**12**
		***Crataegus oriantalis* M.Bieb.**	**Hawthorn**	+									**2**		**2**
		***Fraxinus exelsior* L.**	**Tall tusk tree**	+			**3**		**4**	**5**				**8**	**20**
		Gleditsia triacanthos sunburst	**Yellow leaf gladicia**	-				**32**							**32**
		Koelreuteria paniculata	**Bridegroom lamp**	-										**2**	**2**
		***Platanus orientalis* L.**	**Eastern plane tree**	+			**6**	**5**	**5**		**30**	**16**	**8**	**24**	**94**
		***Populus alba* L.**	**White poplar**	+				**5**							**5**
		Robibia pseudoacacia ‘Umbraculifera’	**Ball locust**	-			**2**	**50**							**52**
		***Robinia hispida* L.**	**Acacia with pink flowers**	-			**3**	**5**							**8**
		***Salix babylonica* L.**	**White willow**	+				**5**			**1**		**4**	**58**	**68**
		LATIN NAME	**ENGLISH NAME**	**NATURAL TYPE**	**WORKING PLACES**										**TOTAL**
					A1	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**A9**	**A10**	
		***Salix matsudana* Koidz.**	**Spiral willow**	+				**10**							**10**
		***Sophora japonica* L.**	**Sophora**	-						**2**					**2**
		***Sophora pendula* L.**	**Saggy japanese sophora**	-						**2**					**2**

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	Ulmus globra Huds.	Mountain black tree	+			22	20		2			2	2	48
	OTHER ORNAMENTAL TREES (SPECIES WITHOUT SUCCESSFUL FRUIT) TOTAL:													828
	TOTAL OF BROAD-LEAVED TREES:													1871
CONIFEROUS TREES	*Cedrus libani* A.Rich.	Taurus cedar	+			2	10			10		2	8	32
CONIFEROUS TREES	*Picea orientalis* L.	Eastern spruce	+	7			80	2						89
CONIFEROUS TREES	*Picea pungens ‘Hoopsi’*	Grafted blue spruce	-	2										2
CONIFEROUS TREES	*Picea pungens ‘Glauca’*	Blue spruce	-	12	4	6	1000	84		2	10	2	14	1134
CONIFEROUS TREES	*Pinus halepensis* Mill.	Aleppo pine	+				20							20
CONIFEROUS TREES	*Pinus sylvestris* L.	Yellow pine	+		35	30	700	18		16	20	58	239	1116
CONIFEROUS TREES	**TOTAL OF CONIFEROUS TREES:**													2393
	TOTAL NUMBER OF TREES:													4266
	LATIN NAME	**ENGLISH NAME**	**NATURAL TYPE**	**WORKING PLACES**										**TOTAL**
				A1	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**A9**	**A10**	
TREES AND SHRUBS	*Buddleia davidii* Franch.	Butterfly bush	-				50							50
TREES AND SHRUBS	*Berberis thunbergii ‘Atropurpurea’*	Woman's salt shaker with red leaves	-	30			300							330
TREES AND SHRUBS	*Buxus sempervirens* L.	Box	-	150										150

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Category	LATIN NAME	ENGLISH NAME	NATURAL TYPE	WORKING PLACES A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	TOTAL
	Chaenomeles japonica	Japanese quince	-						6					6
	Cornus alba 'Sibirica'	Cranberry	-	30			400							430
	Cotinus coggygria Scop.	Dyer's sumac	+				15							15
	Cotoneaster horizontalis Decne.	Horizontal cotenaster	-	10			150		6					166
	Euonymus alatus	Burning bush	-				30							30
	Evonymus japonica L.	japanese taflan	-	280			5							285
	Forsythia x İntermedia	Golden bell	-			10	150			3				163
	Hibiscus syriacus L.	Marshmallow	-				5							5
	Ligustrum japonicum L.	Japanese privet	-	15										15
	Pyracantha coccinea M.Roem.	Red-fruited firethorn	+				400							400
	Rosa hybrida L.	Rose	+	160		18	2000	30	30	20	40	40	50	2388
	Spirea x wanhouttei	Goat beard	-	65			150							215
DWARF CONİFEROUS SHRUBS	*Syringa vulgaris* L.	Common lilac	+			2	100		2	1				105
DWARF CONİFEROUS SHRUBS	*Viburnum opulus* L.	Common snowball	+	30			200		4					234
DWARF CONİFEROUS SHRUBS	*Cupressocyparis leylandii* A.B.Jacks. & Dallim	Leyland	-	650		3		2						655

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		Cupressocyparis leylandii 'Gold Rider'	**Yellow leyland**	**-**				**30**							**30**
		Cupressus arizonica	**Blue arizon cypress**	**-**	**16**		**24**	**150**							**190**
		***Juniperus sabina* L.**	**Sabine juniper**	**+**	**20**		**12**	**100**		**12**		**6**			**150**
		***Juniperus virginiana* L.**	**Pencil juniper**	**-**	**3**			**50**							**53**
		Picea pungens glauca globosa nana	**Dwarf blue spruce**	**-**				**2**							**2**
		Pinus mugo 'mughus'	**Dwarf pine**	**-**				**2**							**2**
		Thuja orientalis 'Pyramidalis aurea'	**Golden arborvitae**	**-**	**110**		**42**	**10**	**2**	**6**	**6**	**4**	**2**	**1**	**183**
		***Thuja orientalis* L.**	**Eastern arborvitae**	**-**		**250**			**100**	**2**	**32**	**80**	**60**	**350**	**874**
TOTAL OF TREES AND SHRUBS:															**7126**

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		LATIN NAME	ENGLISH NAME	NATURAL TYPE	WORKING PLACES										TOTAL
					A1	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**A9**	**A10**	
HUGGING PLANTS		***Campsis radicans***	**Persian pipe**	**-**	**10**			**5**		**2**					**17**
		Lonicera sp.	**Honeysuckle**	**-**	**15**			**5**							**20**
		Rosa rampicanti	**ivy rose**	**+**	**2**				**4**	**6**		**4**			**16**
		***Vitis vinifera* L.**	**Grapes**	**+**					**6**		**3**				**9**
	TOTAL NUMBER OF CIRCULATOR PLANTS:														**62**
	TOTAL NUMBER OF PLANTS:														**13323**

In the study, a total of 13,323 plants were counted across 10 different educational fields, comprising 80 different species, of which 35 are natural flora. Among the identified plants, there are 1,043 edible trees-bearing species, 1,871 broadleaf species, 2,393 coniferous species, 828 other ornamental plants, shrubs, and bush types totaling 7,126, and 62 climbing plant species (*Figure 4*).

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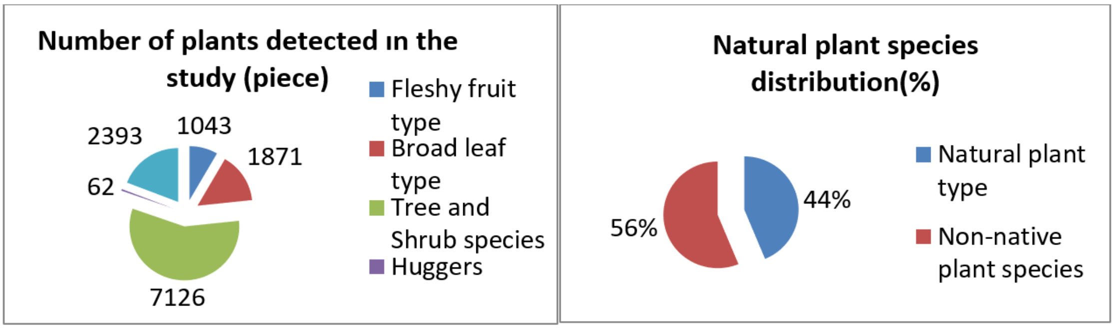

Figure 4. *Number of plants identified in the study area and distribution of natural plant species*

Urban planners must prioritize biodiversity conservation as a fundamental principle of urban design if they are to create a sustainable civilization where people and environment can coexist. To promote biodiversity in cities, we especially advocate planting more native trees and using a wider variety of species that can draw in wildlife. Additionally, impoverished countries and densely populated areas need to pay extra attention to raising knowledge of biodiversity-friendly tree planting systems. To find natural species that can be used as street trees and attract wildlife, further regional study should be carried out (Liu and Slik, 2022).

During the field studies, observations were conducted at regular intervals to determine the contribution of the identified plants to biodiversity. Observations were made for fauna species that prefer these plants, and photographic documentation was carried out at various times to identify materials from the area (*Figure 5*).

Figure 5. *Plant species identified in field studies*

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Species richness within the total number of plants in the areas was analyzed for each school garden and the results are given in *Table 2* and *Figure 6*.

Figure 6. *Plant species and total plant numbers in each school garden*

In the study, the order of plant species diversity in schools was determined as follows: A4 > A3 > A10 > A9 > A1 > A5 > A6 > A7 > A8 > A2. The educational field with the highest plant diversity was determined as Erzincan Binali Yıldırım University, and the educational field with the lowest plant diversity was determined as Dr. Cahit Ziya Ulukök Primary School. Of the identified plant species, 44% were natural plants and 56% were non-native species.

Askan and Yılmaz (2016) in their study titled 'Species Identified in the Open-Green Spaces of Erzincan City' observed that over the years, existing trees in educational areas have been carefully preserved, and plantings have been regularly conducted in suitable areas for plant cultivation. Interviews conducted during the study revealed that previous plantings did not give due importance to fruit-bearing plants, and it is particularly important to increase these plants in dormitory buildings, to enable students to consume fruits in their leisure time in green areas, to promote the city's cultivated plants, to ensure the continuity of these cultivated plants, and especially to maintain biodiversity.

Biodiversity index analyses

The differences in biodiversity statuses among the study areas have been examined in terms of the Simpson index, Shannon-Wiener diversity index, and Bio-Friendly City (BIOCITY) criteria.

Biological Diversity Components (BİÇEB) is designed as a web-based and desktop application aimed at enabling researchers working in the field of biodiversity to perform calculations related to their specific topics. The BİÇEB software addresses alpha-level species richness measurements, heterogeneity indices, and species abundance models. At the beta and gamma levels, diversity calculations for binary and continuous data are performed. These calculations are conducted between two communities and on a universal scale. Its user-friendly interface facilitates easy access for researchers, thereby making data analysis and calculations in biodiversity studies more effective and expedient (Özkan et al., 2020). The biodiversity measurement results according to the Simpson index conducted in the BİÇEB application for the areas are presented in *Table 4*.

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Table 4. *Biodiversity measurement results of the areas according to the Simpson index*

Results	A.1	A.2	A.3	A.4	A.5	A.6	A.7	A.8	A.9	A.10
1 - λ	0.78892	0.32268	0.91334	0.88772	0.76623	0.88238	0.86303	0.78134	0.83353	0.74727
Var D	0.0001164	0.0010794	0.00024548	0.00014158	0.00026911	0.00024319	0.00018744	0.00047692	0.00018659	0.00011471
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
		** t = 13.81581 sd = 341.55489 p = 0.0	** t = -12.01859 sd = 1013.41434 p = 0.0	** t = -12.27069 sd = 1950.32934 p = 0.0	t = 1.25178 sd = 415.39968 p = 0.21136	** t = -5.37233 sd = 206.51635 p = 0.0	** t = -4.71656 sd = 245.94194 p = 0.0	t = 0.32729 sd = 255.01185 p = 0.74371	** t = -2.844 sd = 397.68716 p = 0.00469	** t = 3.15603 sd = 1743.36318 p = 0.00163
			** t = -17.59351 sd = 333.93686 p = 0.0	** t = -17.1557 sd = 310.06764 p = 0.0	** t = -12.07857 sd = 448.69132 p = 0.0	** t = -15.39014 sd =412.90023 p = 0.0	** t = -15.18149 sd = 397.16792 p = 0.0	** t = -11.6263 sd = 492.19004 p = 0.0	** t = -14.35748 sd = 406.24864 p = 0.0	** t = -12.28705 sd = 374.21475 p = 0.0
				** t = 3.51586 sd = 306.94282 p = 0.0005	** t = 8.26474 sd = 376.09305 p = 0.0	t = 1.81519 sd = 187.83996 p = 0.07109	** t = 3.28075 sd = 216.97183 p = 0.00121	** t = 5.76293 sd = 242.46882 p = 0.0	** t = 5.21389 sd = 344.74733 p = 0.0	** t = 13.03041 sd = 1079.98502 p = 0.0
					** t = 7.33293 sd = 292.34334 p = 0.0	t = 0.3387 sd = 139.99322 p = 0.73534	t = 1.77805 sd = 151.32435 p = 0.0774	** t = 4.84397 sd = 206.58241 p = 0.0	** t = 3.91113 sd = 245.5652 p = 0.00012	** t = 12.81647 sd = 945.61007 p = 0.0
						** t = -5.13165 sd = 375.42562 p = 0.0	** t = -4.53034 sd = 414.04894 p = 0.23305	t = -0.55321 sd = 402.21876 p = 0.58043	** t = -3.15265 sd = 509.23714	t = 0.96778 sd = 539.6842 p = 0.33359

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									p = 0.00171	
							t = 0.93246 sd = 269.91308 p = 0.35193	** t = 3.76525 sd = 330.84896 p = 0.0002	* t = 2.35636 sd = 312.31662 p = 0.01907	** t = 7.14178 sd = 280.53478 p = 0.0
								** t = 3.16933 sd = 321.77309 p = 0.00167	t = 1.52535 sd = 353.49419 p = 0.12807	** t = 6.65959 sd = 349.87115 p = 0.0
									* t = - 2.02611 sd = 345.00064 p = 0.04352	t = 1.40071 sd = 306.70393 p = 0.16231
										** t = 4.96947 sd = 549.14209 p = 0.0

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Based on Simpson’s index (1-λ) values, the areas have been ranked in terms of biodiversity as follows: A3 > A4 > A6 > A7 > A9 > A1 > A8 > A5 > A10 > A2. The * symbol denotes statistical significance of the diversity difference between two communities at the 5% level, while the ** symbol indicates significance at the 1% level. The results of the measurements according to the Shannon-Wiener diversity index (H’) are presented in *Table 5*.

The value referred to as equality (E) represents the condition of balanced distribution among species. The E values indicate the state of balanced distribution among species within sample communities. According to the range ($0 < E < 1$), if it approaches 0, it denotes complete inequality, while approaching 1 indicates complete equality. For instance, area A6 exhibits a characteristic close to complete equality with an 84.8% rate. There is a difference in terms of biodiversity. After the calculations, readings were taken from the ‘t’ table according to the t values. In the reading conducted according to the degrees of freedom ‘Sd – df’, the t value was observed to be greater than 0.05, and it was statistically understood that there is a difference between the two areas. On the result screen, the * symbol signifies the statistical significance of the diversity difference between two communities at the 5% level, and the ** symbol indicates significance at the 1% level. The analysis results of Educational Institutions according to Eco-Friendly Campus Criteria are presented in *Table 6*.

The evaluation has been conducted in terms of Eco-Friendly Campus criteria. As a result of the assessment, the first three required criteria within the scope of eco-friendly standards are:

- Number of plant species in the area * (At least 25 plant taxa)
- Natural plant species usage rate* (Must be at least 10% of the total number of species)
- Rate of use of succulent fruit plant species* (Must be at least 10% of the total number of species)

Out of a total of 100 points from the main criteria given above;

- Green area with 50-60 points. LOW LEVEL BIOFRIENDLY CAMPUS
- Green area with 61-80 points, GOOD LEVEL BIO-FRIENDLY CAMPUS
- The green area that scores 81-100 points will be entitled to receive the title of HIGH LEVEL BIODOSTRIC CAMPUS (Yılmaz, 2024).

There is a significant deal of variance depending on the animal species, plant species, and biodiversity measure utilized, however it has been shown that increasing the richness, cover, or density of native plants in urban green spaces frequently leads to greater animal biodiversity. This backs up the assertions made by numerous policy papers and academic sources that recommend using native plant species to establish native animal habitat in urban green areas (Kendle and Rose, 2000; Sjöman et al., 2016; Alam et al., 2017).

Areas Doğa College (A1), Dr. Cahit Ziya Ulukök Primary School (A2), Science High School (A5), Fidem College (A6), Melihşah Primary School (A7), Mimar Sinan Kindergarten (A8) that do not meet the condition of having at least 10% of the total species count have been determined as NOT ECO-FRIENDLY CAMPUSES, while areas Yavuz Selim Primary School (A9) and Social Sciences High School (A10) are classified as GOOD LEVEL ECO-FRIENDLY CAMPUSES, and areas Ertuğrulgazi Anatolian High School (A3) and Erzincan Binali Yıldırım University (A4) are identified as HIGH LEVEL ECO-FRIENDLY CAMPUSES.

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Table 5. *Shannon-Wiener index biodiversity measurement results*

Results	A.1	A.2	A.3	A.4	A.5	A.6	A.7	A.8	A.9	A.10
H'	2.05904	0.72223	2.76942	2.78902	1.9149	2.54114	2.31508	1.96157	2.26995	1.88233
E	0.64789	0.3287	0.83111	0.70586	0.63921	0.84825	0.78625	0.72435	0.7052	0.57774
Var H'	0.00096	0.00462	0.00389	0.00023	0.00585	0.00759	0.00719	0.00639	0.0069	0.00211
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
		** t = 17.89586 sd = 444.25574 p = 0.0	** t = -10.20046 sd = 381.99856 p = 0.0	** t = -21.16106 sd = 2493.24893 p = 0.0	t = 1.74667 sd = 379.04708 p = 0.0815	** t = -5.2138 sd = 169.81936 p = 0.0	** t = -2.83615 sd = 183.45102 p = 0.00508	t= 1.13691 sd = 266.51451 p = 0.2566	* t = -2.37895 sd = 300.22679 p = 0.01799	** t = 3.18927 sd = 1647.77041 p = 0.00145
			** t = -22.19184 sd = 554.76362 p = 0.0	** t = -29.67737 sd = 338.29367 p = 0.0	** t = -11.65593 sd = 572.98946 p = 0.0	** t = -16.46089 sd = 298.50436 p = 0.0	** t = -14.65716 sd = 323.58272 p = 0.0	** t = -11.81128 sd =446.21195 p = 0.0	** t = -14.42003 sd = 483.03777 p = 0.0	** t = -14.14125 sd = 606.4557 p = 0.0
				t = -0.30536 sd = 278.16132 p = 0.76032	** t = 8.6585 sd = 518.95577 p = 0.0	* t = 2.13058 sd = 268.45174 p = 0.03403	** t = 4.31629 sd = 290.5523 p = 0.0	** t = 7.96772 sd =401.58136 p = 0.0	** t = 4.80838 sd = 437.3031 p = 0.0	** t = 11.45228 sd = 544.00883 p = 0.0
					** t = 11.21035 sd = 303.51252 p = 0.0	** t = 2.8031 sd = 142.24193 p = 0.00577	** t = 5.50201 sd = 152.29218 p = 0.0	** t = 10.16981 sd = 216.79561 p = 0.0	** t = 6.14725 sd = 247.71594 p = 0.0	** t = 18.74351 sd = 1059.94815 p = 0.0
						** t = -5.40183 sd = 327.41305 p = 0.0	** t = -3.50442 sd = 351.83488 p = 0.00052	t = -0.42184 sd = 462.50368 p = 0.67334	** t = -3.14438 sd = 497.12729 p = 0.00176	t = 0.36506 sd = 499.11806 p = 0.71522
								**	*	**

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							t = 1.85946 sd = 276.01999 p = 0.06403	t = 4.90176 sd = 309.21653 p = 0.0	t = 2.25289 sd = 330.57986 p = 0.02492	t = 6.6892 sd = 216.26402 p = 0.0
								** t = 3.03355 sd = 327.1823 p = 0.00261	t = 0.3802 sd = 350.30659 p = 0.70403	** t = 4.48741 sd = 235.87964 p = 1e-05
									** t = -2.675 sd = 433.58805 p = 0.00776	t = 0.85948 sd = 348.53211 p = 0.39067
										** t = 4.08361 sd = 385.88396 p = 5e-05

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Table 6. *Analysis of Educational Institutions According to Bio-friendly Education Campus Indexes (Yılmaz, 2023)*

Criterion no	Evaluation Criteria	Criterion Condition	Field features	Score received	Point total	A.1	A.2	A.3	A.4	A.5	A.6	A.7	A.8	A.9	A.10
1	**Number of plant species in the area***	Contains at least 25 plant taxa	25 type 26-30 type 31-35 type more than 35 species	7 8 9 10	10 points	**7**/10	0/10	**8**/10	**10**/10	**0**/10	**0**/10	**0**/10	**0**/10	**7**/10	**8**/10
2	**Natural plant species usage rate***	Must be at least 10% of the total number of species	%10 %10-15 %16-20 more than 20%	14 16 18 20	20 points	**20**/20	**20**/20	20/20	**20**/20	**20**/20	**20**/20	**20**/20	**20**/20	**20**/20	**20**/20
3	**Rate of use of edible trees plant species***	Must be at least 10% of the total number of species	%10 %10-15 %16-20 more than 20%	12 13 14 15	15 points	**0**/15	**15**/15	**15**/15	**14**/15	**15**/15	**13**/15	**15**/15	**15**/15	**15**/15	**15**/15
4	**Ratio of the number of plant species in the total number of plants**	At least 2 plant species are dominant in the total number of plants	Dominance of 2 plant species Dominance of 3 plant species Dominance of 4 plant species Dominance of 5 plant species More than 5 plant species are dominant	2 4 6 8 10	10 points	**8**/10	**2**/10	**8**/10	**10**/10	**4**/10	**4**/10	**2**/10	**4**/10	**4**/10	**4**/10
5	**Construction year of the green area**		less than 5 years Between 6 and 10 Between 11 and 15 Between 16 and 20	1 2 3 4	5 points	**2**/5	**3**/5	**4**/5	**3**/5	**5**/5	**5**/5	**4**/5	**3**/5	**5**/5	**5**/5

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			more than 20 years	5											
6	**Number of fauna observed in the area within 1 hour (Bird, butterfly, squirrel, etc.)**		< 5	1	5 points	**1**/5	**2**/5	**4**/5	**5**/5	**3**/5	**1**/5	**1**/5	**1**/5	**4**/5	**4**/5
			Between 6 and 10	2											
			Between 11 and 15	3											
			Between 16 and 20	4											
			>20	5											
7	**Area size**		less than 500 m2	1	5 points	**5**/5	**4**/5	**5**/5	**5**/5	**5**/5	**3**/5	**4**/5	**3**/5	**4**/5	**5**/5
			500 m2 - 1 acre	2											
			2-5 acres	3											
			6-10 acres	4											
			more than 10 acres	5											
8	**The ratio of open-green areas to hard impermeable surfaces**		less than 10%	1	5 points	**2**/5	**5**/5	**5**/5	**5**/5	**3**/5	**3**/5	**2**/5	**5**/5	**4**/5	**5**/5
			If 10-30%	2											
			If 31-50%	3											
			If 51-75%	4											
			If more than 75%	5											
9	**Positive ecosystem components**	More than 100 m from the main transportation axis		2	25 points	**17**/25	**10**/25	**19**/25	**25**/25	**17**/25	**14**/25	**10**/25	**10**/25	**14**/25	**15**/25
		Green corridor connection		2											
		Presence of natural habitat	Presence of endemic plant species in the area (number of each species x10 points)	10											

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			Existing tree grove of the area during construction	6											
			Wetland presence	5											
			Existing bush presence at the time of construction of the area	4											
			The presence of natural meadows and pastures in the area	3											
		No fertilizer or pesticide application in the area.		2											
		Natural stream or pond within the area		8											
		Artificial pond		6											
		Small pool		3											
		Fountain, water bowl		2											
		Coverage rate of tree and shrub cover in the entire garden	Fully closed (100%)	5											
			Half closed (50%)	4											
			Quarter closed (25%)	2											
		Naming the plants / Promotional cards		4											
		Having someone take care of the		2											

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		area/being under control													
		Keeping the area well-maintained		2											
		Avoid harsh pruning of plants		2											
		Clean air quality		3											
		Renewable energy presence		5											
		Rain harvest garden		5											
10	**Negative ecosystem components**	Air and soil pollution		-3	**-6 points**	**-6**/-6	**-6**/-6	**-6**/-6	**-6**/-6	**-3**/-6	**-6**/-6	**-6**/-6	**-3**/-6	**-3**/-6	**-3**/-6
		Loud noise		-3											
		Intensive use of pesticides and fertilizers		-5											
		Exposure to excessive night light		-3											
		No clean water source in or near it		-6											
		Being neglected and uncontrolled		-2											
		High voltage line passing through the area		-5											
	TOTAL SCORE				**100 points**	**56**	**55**	**82**	**91**	**69**	**57**	**52**	**58**	**74**	**78**

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The eco-friendly analysis of the campuses is provided in *Figure 7*.

Cities, while on one hand compressing biodiversity, on the other hand, possess a plethora of prospects to foster it through parks and public gardens of disparate scales, gardens of educational facilities, hobby gardens, sports areas, rooftop and terrace gardens, vertical gardens, cemeteries, natural and semi-natural zones, and aquatic surfaces. By sculpting these opportunities with apt planning and design methodologies and ensuring interconnectivity among them, biodiversity in urban landscapes will be preserved and propagated (Goddard, 2009; Pouya and Pouya, 2017; Basnou et al., 2020).

Figure 7. *Biofriendly analysis of educational campuses*

If they are planned and maintained using ecological principles, existing parks, greenways, natural areas, road trees, little house gardens, apartment and site gardens, walkways, and other open and green spaces on public and private lands can all support biodiversity in urban environments. Furthermore, roof and balcony terrace configurations, as well as facade greening, should incorporate design and maintenance strategies that enhance biodiversity (Uslu and Shakouri, 2013).

Research on the relationship between people, urban surroundings, and biodiversity is both fascinating and crucial. For the benefit of both urban nature and its inhabitants, it is also a potentially fruitful area for urban policies that seek to balance urbanization processes with biodiversity in urban areas. We contend that, despite the need to further our knowledge of the various stresses that urbanization places on urban environment, cities also present excellent chances to preserve biodiversity across all land-use types, from unique urban ecosystems to natural remains (Kowarik et al., 2020).

Conclusion

We underscore the necessity of augmenting investments in educational campuses at local or regional levels to safeguard an extensive array of indigenous tree species and the corresponding wildlife within urban territories. This is particularly pivotal for the enduring viability of biodiversity in nations that are less developed or in the process of development. It will also aid in alleviating the catastrophic repercussions of climate change. By endowing landscape design with a novel perspective that addresses not solely human needs but also those of all living entities, this endeavor will furnish a beneficial

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contribution to both forthcoming educational campuses and extant spaces. Owing to its capability to be applied to all domains where biodiversity determinations are found wanting (urban centers, districts, educational edifices, healthcare facility zones, campuses, ecclesiastical facility areas, municipal open-green spaces, roadside trees, median strips, gardens of official institutions, etc.), this index boasts a broad scope of application. After assessments alongside other biodiversity indices, ‘Eco-friendly Campuses’ will be categorized into low, medium, or high tiers, and edifices that fulfill these standards will be demarcated with QR codes, thereby facilitating judicious selections pertinent to both educational and environmental services. This study signifies a salient stride in broaching the notion of a ‘Biodiversity-Friendly City’ for the inaugural time, deliberating it as a hallmark of value for our cities within the scientific fraternity and public discourse, and also as a crucial step in formulating global strategies.

In our analysis of ten different educational campuses in Erzincan, we observed that most campuses are dominated by only a few tree species, and a significant portion of these trees are non-native species. The likelihood of these areas being biodiversity-friendly is low. Based on this evidence, a conceptual framework has been proposed, and two critical criteria have been identified for implementing biodiversity-friendly measures for urban trees. Decision-makers in these areas should encourage the planting of more native and fruit-bearing trees in designs and identify and utilize more species that can attract wildlife. Thus, it will be possible to promote biodiversity in cities, especially in regions with high population density and those that are developing.

Planning for biodiversity-friendly cities must be done based on global information, employing diverse criteria and incorporating additional explanatory factors at different geographical scales to preserve biodiversity and generate sustainable habitats in cities. The immediate goals of this effort are to protect natural areas, boost biodiversity, and preserve the delicate balance between nature and humankind (Liu and Slik, 2022).

New concepts like BIO-FRIENDLY EDUCATIONAL AREA require collaboration across different disciplines in this field. Academic circles should begin to take the lead in developing and implementing this concept. This necessitates the convergence of experts from architecture, landscape architecture, urban planning, environmental science, health sciences, and other related fields. The collaborative work of these disciplines will contribute to the development of innovative approaches in the design, management, and sustainability of bio-friendly spaces.

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