



Examination of botanical gardens as urban green and open spaces in terms of ecosystem services: The case of Iasi Botanical Garden, Romania

Merve Kalaycı Kadak ^{1*}

¹Kastamonu University, Faculty of Engineering and Architecture, Department of Landscape Architecture, Kastamonu, Türkiye

ARTICLE INFO

Received: 27/04/2025

Accepted: 12/06/2025

<https://doi.org/10.53516/ajfr.1684808>

*Corresponding author:

mkalayci@kastamonu.edu.tr

ABSTRACT

Research Article

Background and Aims Modern cities are faced with rapidly increasing environmental-urban problems. This situation has further enhanced the need for public green spaces where urban residents can reconnect with nature. After the COVID-19 pandemic especially, urban residents' dependence on urban green and open spaces has become essential for both physical and psychological well-being. In this context, botanical gardens are some open spaces where urban recreation activities can be carried out. Botanical gardens allow for many cultural and social

activities. In this respect, botanical gardens also serve ecosystem services. Because cultural ecosystem services, which are a subclass of ecosystem services, are services that increase human well-being, contribute socially, and are not easily quantifiable economically. In addition to these benefits, they can also affect climate dynamics. Botanical gardens often represent crucial ecological elements of the urban structure. Provisioning habitats for some species in urban areas is one of the other benefits of botanical gardens for ecosystem services.

Methods The Anastasie Fătu Botanical Garden was analyzed. Through on-site observation and visual documentation, the services provided by ecosystem services and urban green and open space planning were examined.

Results The Botanical Garden, consistently contributes to nature protection and human well-being through ecosystem services. The contributions to education and recreation underline the significance of botanical gardens and this result coincides considerably with earlier studies.

Conclusion It was determined that the example area primarily provides cultural ecosystem services within the framework of green and open urban area. Activity-based suggestions were developed in terms of ecosystem services.

Key Words: Botanical garden, climate change adaptation, ecosystem services, southeast Europe, sustainability, urban planning

Kentsel açık ve yeşil alan olarak botanik bahçelerinin ekosistem servisleri açısından deneyimsel olarak incelemesi: Romanya Iasi Botanik Bahçesi örneği

ÖZ

Giriş ve Hedefler Günümüz şehirlerinde yaşanan kentsel-çevresel sorunlar, kent sakinlerinin doğayla bağ kurabilecekleri kamusal yeşil alanlara olan ihtiyacı daha da artırmıştır. Özellikle COVID-19 pandemisinden sonra kentli insanın kentsel açık yeşil alanlara olan bağlılığı hem fiziksel hem psikolojik iyilik hali açısından vazgeçilmez hale gelmiştir. Bu kapsamda botanik bahçeleri kentsel rekreasyon faaliyetlerinin gerçekleştirilebileceği dış mekanlardan bazılarıdır. Çok çeşitli bitkiye ve doğal oluşuma ev sahipliği yapan botanik bahçeleri, kültürel ve sosyal birçok faaliyete imkân tanımaktadır. Bu yönüyle botanik bahçeleri, ekosistem hizmetlerine de hizmet etmektedir. Çünkü ekosistem hizmetlerinin bir alt dalı olan kültürel ekosistem hizmetleri, insanların refahını artıran toplumsal olarak da katkı sunan ve direkt olarak ekonomik olarak ölçülemeyen hizmetlerdir. Bu faydalarının yanı sıra iklimsel süreçlere de katkı sağlayabilmektedir. Botanik bahçeleri, çoğu zaman şehrin yaşayan kısımlarını temsil eder. Ayrıca, botanik bahçeleri sadece insanlar için değil, birçok diğer canlıya da ev sahipliği yapabilmektedir. Bu yönüyle, kentsel alanlarda bazı türlere habitat oluşturması, botanik bahçelerinin ekosistem hizmetlerine olan diğer faydalarındandır.

Yöntemler Bu çalışmada, bakımlı yeşil alanları ile ünlü bir Avrupa kenti olan Iasi'de yer alan Anastasie Fătu Botanik Bahçesi incelenmiştir. Yerinde gözlem ve görsel dökümantasyon yöntemiyle ekosistem servislerinin sunduğu hizmetler ve kentsel açık yeşil alan planlaması bağlamında irdelenmiştir.

Bulgular Iasi Botanik Bahçesi, ekosistem hizmetleri bağlamında doğaya ve insan refahına olumlu yönde katkı yapmaktadır. Özellikle eğitim ve rekreasyonel açıdan sağladığı katkı düzeyi, botanik bahçelerinin önemini ortaya koymakta ve literatürdeki çalışmalarla örtüşmektedir.

Sonuçlar Çalışma alanının kentsel açık yeşil alan bağlamında özellikle kültürel ekosistem servislerine hizmet ettiği tespit edilmiştir. Etkinlikler ve ekosistem servisleri özelinde öneriler geliştirilmiştir.

Anahtar Kelimeler: Botanik bahçesi, ekosistem servisleri, güneydoğu Avrupa, iklim değişikliğine adaptasyon, kentsel planlama, sürdürülebilirlik

Citing this article:

Kalaycı Kadak, M., 2025. Examination of botanical gardens as urban green and open spaces in terms of ecosystem services: The case of Iasi Botanical Garden, Romania. *Anatolian Journal of Forest Research*, 11(1), 180-190.



Content of this journal is licensed under a Creative Commons Attribution NonCommercial 4.0 International Licence.

1. Introduction

Botanical gardens that are established as urban green and open spaces carry many various missions, such as preserving plant collections, carrying out educational and research activities, and providing recreational opportunities. Additionally, they contribute to the sustainable use of urban natural resources by collecting plant species, hosting scientific research, and supporting educational activities (Westwood et al., 2021). Indeed, the initial purpose of the botanical gardens was solely to cultivate medicinal plants. However, subsequent to the 17th century, a new mission was designated to the concept of botanical gardens, transforming them into spaces where economically advantageous plants would also be cultivated. Botanical gardens have taken on a greater mission, becoming not only ecosystems that make environmental contributions but also social responsibilities over time. For instance, some botanical gardens in China, via plant collecting, scientific research, and education activities, perform important studies on regional biodiversity and plant adaptation (Li et al., 2023). Furthermore, botanical gardens have a noticeable effect on increasing genetic diversity and preventing species extinction (Mounce et al., 2017). In addition, botanical gardens represent elements of green spaces that increase the sustainability of urban ecosystems. In terms of urban ecosystems, botanical gardens are not only important for the conservation of biodiversity but also increase social benefits through the recreational and aesthetic values they offer to visitors (Funsten et al., 2022). In terms of urban biodiversity conservation, providing ecological balance, and improving the quality of the urban environment are crucial in these areas (Aksu and Yilmaz, 2024). Botanical gardens and similar green and open spaces, especially in developed urban regions, fulfill the desire to gather with nature, which strengthens human well-being. Research on user satisfaction presented that the various activities and educational opportunities offered by botanical gardens are highly appreciated by city stakeholders and thus contribute directly to improving the urban life quality (Aksu and Yilmaz, 2024; Funsten et al., 2022). In examples such as Bogor Botanical Gardens, a well-planned environment strengthens visitors' feelings and cognitive connections with nature, thus remembering the visit experience positively (Danaparamita et al., 2021; Marlin et al., 2024). In this respect, it also supports cultural ecosystem services, which is a subclass of ecosystem services (Tulek, 2023). After the Covid-19 pandemic especially, urban residents' dependence on urban green and open spaces has become essential for both physical and psychological well-being. Even the standards of living in the cities have changed, and the idea of garden cities has come to the agenda more frequently. The urban residents, who spend most of their lives in indoor areas such as homes and workplaces, can most easily fulfill their longing for nature in urban green and open spaces. In this context, urban botanical gardens are commonly preferred. In addition, botanical gardens have critical roles in both performing ecological functions and increasing social well-being as the foundation of sustainable urban ecosystems.

On the other hand, urban botanical gardens, through their vast green areas and the presence of plants, can mitigate the effects of urban heat islands and help to create more climate-resilient cities. The disasters that occurred in cities due to the

effects of climate change have been frequently observed in recent decades. It is known that disasters caused by the effects of climate change in almost every location, independent of its surface area, population density, and geographical location, lead to many material and non-material damages (Gul and Esen, 2024; Kalaycı Kadak et al., 2024). It is essential to take action to contribute to climate resilience through urban green and open spaces in order to avoid these negativities (Basaran, 2024). In this context, the function of botanical gardens in reducing the urban heat island effect makes botanical gardens increasingly important. Because urban sustainability covers various ecosystem services, such as reducing the heat island effect, enhancing air quality, regulating the water cycle, and conserving biodiversity (Redweik et al., 2023).

Botanical gardens can be seen as a key component for sustainable and climate-resilient cities, as they can offer scientific, ecological, social, aesthetic, recreational, and cultural benefits simultaneously. With these features, botanical gardens are the essential factors of climate-sensitive urban planning. Botanical gardens are one of the green and open areas that contribute to the physical structure of the city as a whole within the urban landscape and are included in the most important components that bring together other land uses in a balance (Gul and Kucuk, 2001). Furthermore, they are considered as instruments for the development of scientific and social awareness in areas of interaction that bridge the gap between nature and human beings (Westwood et al., 2021). These areas serve environmental sustainability at both local and global scales by protecting dense plant diversity and natural habitats that are rarely found in urban environments (Cavender and Donnelly, 2019). In order to analyze botanical gardens in terms of the mentioned features, the botanical garden in Iasi (Romania), a city in Southeast Europe that impresses with its well-maintained green and open areas in the city, was determined as the examination area.

The aim of the study is to investigate the sections and functions of the Anastasie Fătu Botanical Garden through on-site observation and visual documentation under a nature-based approach. In addition, activity-based spatial recommendations for the botanical garden, which is evaluated in the context of ecosystem services, were also developed. Thus, the place and importance of botanical gardens in urban planning has been re-examined on both local and global scales.

2. Material and Method

This study focuses on the botanical garden located in Iasi, Romania. This study relies on the visual documentation obtained from the botanical garden by the author.

2.1 Material

2.1.1 Study area

The study area focuses on Iasi, Romania, which is located at latitude 41°11'12" N and longitude 27°33'38" E (Figure 1).



Figure 1. Location Map of Anastasie Fătu Botanical Garden, Iasi (Original, 2025)

Founded in 1856 on land owned by Romanian naturalist Anastasie Fătu, the Anastasie Fătu Botanical Garden (Grădina Botanică "Anastasie Fătu") is the largest and oldest botanical garden in Romania (URL-1, n.d.). The botanical garden has extended gradually until today, reaching the approximately 99-ha surface area (URL-2, n.d.). It has been a founding member of the Romanian Botanical Gardens Association since 2000 and has cooperations with 600 similar establishments, such as botanical gardens, arboretums, and research institutes (URL-3, n.d.).

2.2 Methodology

The Anastasie Fătu Botanical Garden, in the city of Iasi, which impresses with its well-maintained green and open areas of Romania in Southeast Europe, was determined as the examination area. It was addressed in terms of social-ecological functions of green and open areas in the urban. Moreover, the botanical garden was evaluated in terms of the ecosystem services (Table 1) and urban planning under the holistic and nature-based approach.

Table 1. Ecosystem services (Source: Millennium Ecosystem Assessment, 2005)

Provisioning Services (PS)	Supporting Services (SS)	Cultural Services (CS)	Regulating Services (RS)
Water	Nutrient Cycling	Educational	Climate Regulation
Food Production	Soil Formation	Recreational	Flood Regulation
Wood and Fiber	Primary Production	Aesthetic	Water Purification
Fuel	Habitat Provision	Spiritual	

The methodology of the article was designed in March 2022, and the on-site survey was completed in May 2022. Photographs were taken by the researcher for visual documentation during the field study. However, due to seasonal changes in plants, some visual documents obtained from the official web resources of the botanical garden were also used in the research. Thus, with the recommendations developed as a result of the study, it is focused on improving botanical gardens in terms of urban planning and ecosystem services and on supporting human well-being.

3. Results

The botanical garden was departmentalized into nine sections, which are as follows;

- Systematic Section
- Ornamental Section
- Greenhouse Complex
- Phytogeography Section
- Biology Section
- Useful Plants Section
- Rosarium Section
- Arboretum Section
- Section of Romanian Flora and Vegetation

In addition to these sections, the entrance to the botanical garden was examined first.

3.1 Entrance to the Botanical Garden

At the entrance to the botanical garden, there is a cycle stand for bicycles, which are frequently preferred as a means of transportation city-wide. In addition, the entrance to the site is bordered by wooden fences, and there is a kiosk for controlled access. The entrance is divided by a long seasonal flower bed and is double-sided (Figure 2).

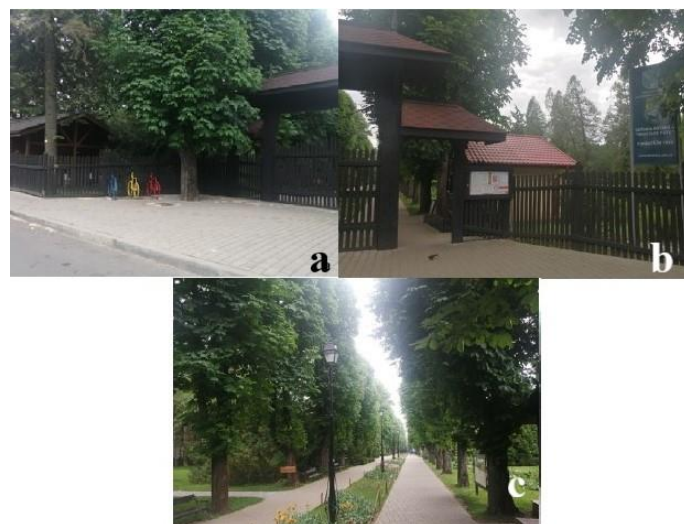


Figure 2. Bicycle rack (a), entrance area (b), main entrance (c) (Original, 2022)

3.2 Systematic section

This section is located by the main gate of the Botanical Garden, on the left side. The systematic section covers an area of around 5 hectares (Figure 3).



Figure 3. *Ginkgo biloba* (a,b), *Malus baccata* (c) (Original, 2022)

Plants had been classified according to their phylogenetic relationships. This section also has examples of topiary art (Figure 4).



Figure 4. Example of Topiary work (a, b) (Original, 2022)

3.3 Ornamental section

The ornamental section is located in relation to the greenhouse complex and the administrative places. This department is known to have a recreational and cultural role. In

this section are both indoor and outdoor parts as related to using types (Figure 5).



Figure 5. Examples of the Ornamental section (a,b,c) (source: URL-5)

In areas classified according to the ecological requirements of plants, the main purpose is not only to provide recreational benefits but also to carry out educational activities (URL-4, n.d.). In this section is the special subsection designed for the blind. Organized in 1991, it is located on the left side of the administrative building, where about 30 species are displayed with labels in both Latin and Braille (Figure 6).

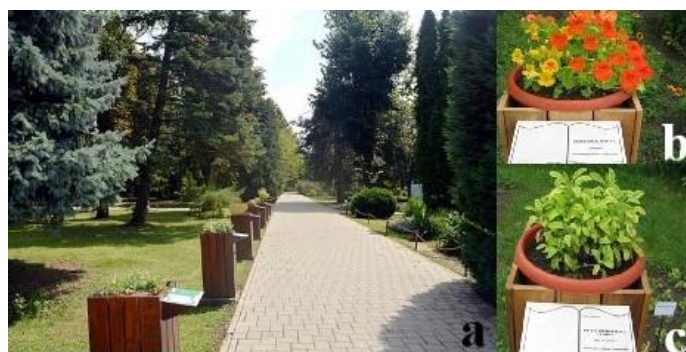


Figure 6. Subsection for the Blind; overview of the subsection(a), *Tropaeolum majus* (b), *Salvia officinalis* (c) (source: URL-5)

In this special part, the plants, such as *Tagetes patula*, *Tropaeolum majus*, and *Salvia officinalis*, release intense scents when touched, facilitating their identification.

3.4 Greenhouse complex

The greenhouse complex includes a total of 21 greenhouses (Figure 7, 8). The 11 of them can only be visited at times permitted by the botanical garden management. In particular, there are subtropical, tropical, and equatorial plant collections.



Figure 7. The overview of the section (a), *Geum coccineum* (b), *Lonicera nitida* (c), *Euphorbiaceae* (d), *Syngonium podophyllum*-*Pilea spruceana*-*Begonia bowerae* (e) (Original, 2022)



Figure 8. *Anemone blanda* (a), *Schefflera arboricola*-*Aucuba japonica* (Original, 2022)

3.5 Phytogeography section

This section, where plants from different geographical regions worldwide are classified according to their origin, has a surface area of approximately 16 hectares (Figure 9).



Figure 9. *Iris sibirica* (a), *Phlox divaricata* (b), *Sedum telephium* (c), *Paeonia x suffruticosa* 'Purple' (d), *Hemerocallis middendorffii* (e), *Allium* (f) (Original, 2022)

In addition, a short pedestrian walkway has been designed within the section (Figure 10).



Figure 10. The overview of the walking paths (a, b), the gazebo on the way (c) (Original, 2022)

3.6 Biology section

The biology section has a surface area of 5.5 hectares and covers various formations according to characteristics, such as the evolution, structures, and functions of plant species (Figure 11).

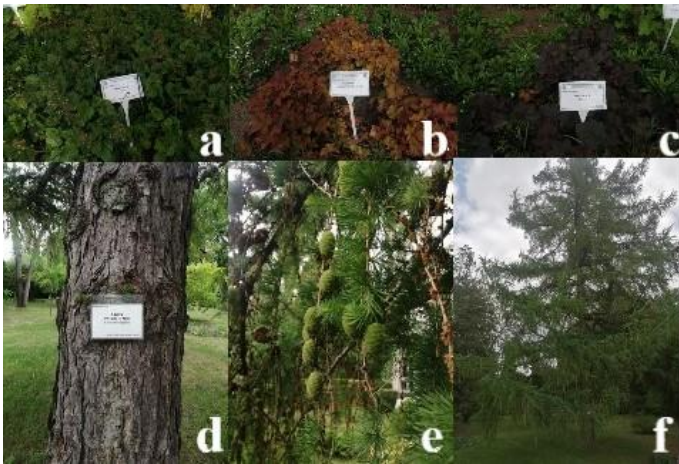


Figure 11. Heuchera (a, b, c), *Larix decidua* (d, e, f) (Original, 2022)

This section is located in the middle of the botanical garden. There is a rock garden that represents the evolution of living organisms (Figure 12). In this context, the different landscape elements, such as rock gardens, scent gardens, and water gardens, that are applied in the garden design have both aesthetic and ecological contributions (Aksoy et al., 2023).



Figure 12. The overview of the rock garden (a, b) (Original, 2022)

Furthermore, the flower beds and the ponds are organized in this section as recreational land use (Figure 13).



Figure 13. The flower arches (a), artificial pond (b) (Original, 2022)

3.7 Useful plants section

This section extends over 2 hectares on the central plain of the botanical garden (Figure 14). It is bounded to the northeast by the Systematic Section, to the west by the Biology Section, to the south by the Arboretum Section, and to the southeast by the Rosarium Section.



Figure 14. The overview of section (a), *Cydonia oblonga* (b), *Carpinus caroliniana* (c) (Original, 2022)

The section has subsections, which are as follows (URL-6, n.d.):

- Subdivision of plants used in the food industry
- Subsection of medicinal plants
- Subsection of aromatic and spice plants
- Subsection of fodder plants
- Subdivision of resin and rubber plants
- Subsection for plants utilized in the care of sensory organs (e.g., oral hygiene, eye health)

3.8 Rosarium section

The garden contains around 700 distinct species (URL-7, n.d.), differing in size, shape, color, and texture of flowers (Figure 15).



Figure 15. Various roses in the rosarium (a, b) (source: URL-7)

It is located near the Systematic, Useful Plants, and Arboretum areas, covering an area of approximately 1.5 hectares (Figure 16).



Figure 16. The overview of the section (Original, 2022)

3.9 Arboretum section

Located at the southern extremity of the Botanical Garden, it has an area of roughly 18 hectares (Figure 17).



Figure 17. The overview of the section (a), structure of the way (b) and stairs (c) in the section (Original, 2022)

Tree and shrub species are presented based on their ecological needs. Gymnospermae and Angiospermae have subdivisions (Figure 18).

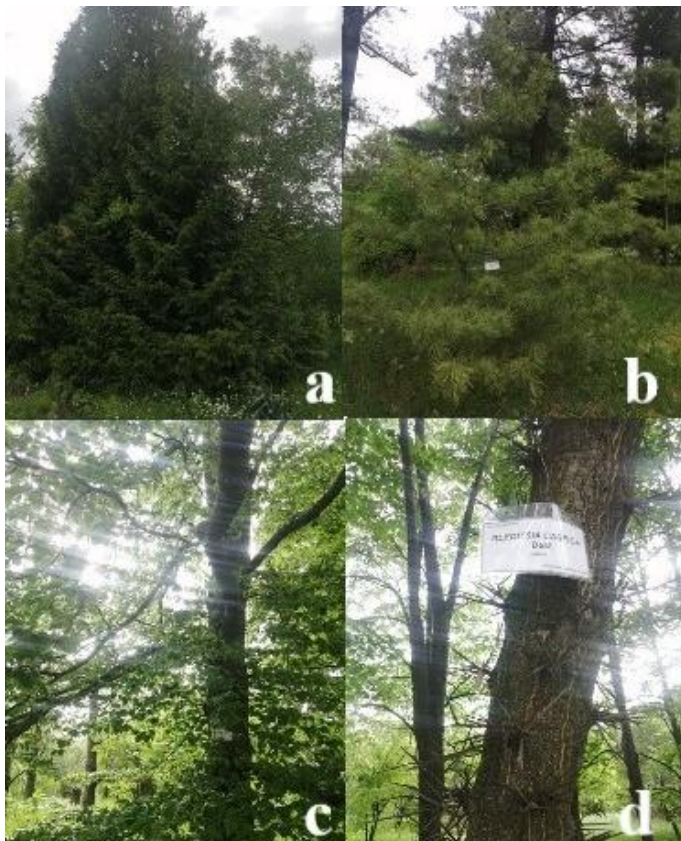


Figure 18. *Chamaecyparis lawsoniana* (a), *Pinus strobus* (b), *Fagus sylvatica* (c), *Gleditsia caspica* (d) (Original, 2022)

3.10 Section of Romanian flora and vegetation

The section exceeding 25 hectares constitutes the largest part of the botanical garden (Figure 19). It has been representing six sub-geographical regions, namely Moldova, Transylvania, Banat, Muntenia, Oltenia, and Dobrogea. The primary aim is to preserve genetic heritage under the cultural perspectives (URL-8).

4. Conclusions and Recommendations

Visited in 2022 in May, the Anastasie Fătu Botanical Garden is located in the Copou district in Iasi, Romania. Having the largest and oldest botanical garden in the whole country, it is definitely a must-see location. Placed in a region that stands out with its well-managed green and open urban spaces, this area supplies positive effects to the city in many categories, including educational, recreational, cultural, and other aspects associated with human well-being. Near the botanical garden, there is the Copou city park, which, despite being established at different times, is successfully connected. In this context, it is evident that the planning of connectivity among urban green and open areas in Iasi is not conducted in isolation.



Figure 19. The lake in the section (a), the overview of the section (b) (source: URL-8), the lake in the section (c) (Original, 2022)

Urban green and open spaces are sections of the city that contribute to the environmental, social, and sustainable functions of the urban framework. They consist of spaces for social interaction and relaxation, restoration of nature-based resources, and the conservation of natural and semi-natural elements (Wikantiyoso et al., 2020). Urban green and open spaces hold significant importance in landscape architecture. These spaces serve multiple functions regarding urban functionality and aesthetic purposes (Gul and Kucuk, 2001):

- They add dynamism to the monotonous structure of urban areas and provide balance with developed areas,
- They supply benefits in the safety of vehicle and pedestrian traffic,
- They permit people to attend recreational activities,
- They contribute positive effects on climatic factors, despite the urban heat island effect, notably in building regions,
- By supporting an environment for human and nature gathering, they benefit individuals and their human well-being.
- Through the plant communities they hosted, they conserved the direct contact of the top of the soil with climatic conditions as well as being green space.

In light of these findings, first the opportunities/benefits and potentials of the Iasi Botanical Garden as an urban green and open space were assessed (Table 2, Table 3). Afterwards, all of the values were examined in terms of ecosystem services (Table 4).

Table 2. Resources of the botanical garden according to the sections

Presently available resources	Section
Areas where genetic heritage or plants are under protected	All of the sections Arboretum Section
Areas allow some sports activities, such as walking and running	Phytogeography Section Ornamental Section Useful Plants Section
Areas permit the artistic exhibitions activities	Systematic Section Greenhouse complex Rosarium Section
Areas allow for the observation and viewing activities	Useful Plants Section Ornamental Section
Areas provide educational and scientific opportunities	Ornamental Section
Areas to supply to be alone within nature	Ornamental Section
Areas are provided to meet with plants from different phytogeographic regions	Phytogeography Section
Areas support to get information regarding to the evolution of plants	Biology Section
Areas allow to experiment plants for the disadvantaged peoples	Special place for the blind in the Ornamental Section
Areas enable the places for graduate educational research	Greenhouse complex Ornamental Section

Table 3. Benefits of the botanical garden according to the sections

Presently available benefits	Section
Can be used in all seasons	All of the sections except steeply-sloping parts of the Arboretum Section and Phytogeography Section
Can be informed about the plants	All of the sections
Getting away from urban chaos and stress	Phytogeography Section Useful Plants Section
Exploring nature, spending time in nature	All of the section
Getting the fresh air by getting away from developed areas	All of the section
Reducing the effects of greenhouse and heat island depends on climate change	All of the section
Utilizing from the therapeutic effects of water surfaces	Section of Romanian Flora and Vegetation Biology Section
Getting knowledge related to utilize the plants	Useful Plants Section

As seen in Table 2 and Table 3, the botanical garden holds many missions in the context of being an urban green and open area: The green and open areas can include parks, botanical gardens, streets landscape-designed, and even agricultural areas. These areas have crucial importance in supplying psychological advantages by decreasing stress levels of city residents. The studies show that these opportunities obtained from urban green and open areas can affect the well-being of city residents (Nababan and Ambarini, 2025). Additionally, strategic location of green areas, in respect of protection of natural resources, supporting local ecosystems, and supplying social well-being, are primary elements of the urban green areas concept (Wikantiyoso et al., 2020). These areas have essential importance in terms of providing psychological benefits, supporting social connections, and reducing the stress levels of city residents. In this perspective, the urban green and open areas generate ecological balance in the urban planning. Furthermore, they are crucial values that increase the life quality of resources (Nababan and Ambarini, 2025). Iasi Botanical Garden provides considerable benefits in the context of the ecosystem services, besides (Table 4).

For instance, botanical gardens have the function of providing habitat in the urban ecosystems. These areas support the habitats of pollinators, such as bees and butterflies. Thus, continuity of urban ecological networks and ecological services

has been supplied (Aksoy et al., 2023; Menezes et al., 2022; Prudic et al., 2022; Vilella-Arnizaut et al., 2022). In this context, all sections, which are provision habitats, of the botanical garden serve the ecosystem's supporting services, particularly the Phytogeography Section and Section of Romanian Flora and Vegetation.

According to this study, the botanical garden also serves cultural ecosystem services. These areas are important in terms of the awareness of the urban ecosystems by the educai and supplying social and cultural benefits. The botanical garden presents a direct connection with nature for residents through public attendance, environmental education, conservation of public health, and cultural heritage. Thus, being a bridge between urban planning and environmental consciousness for the urban citizens (Cowell et al., 2022; Zelenika et al., 2018). In this context, all sections of the botanical garden serve the ecosystem's services, particularly the Systematic Section, Ornamental Section, Arboretum Section, and Biology Section. The part that was designed for blind persons in the Ornamental Section is so crucial in the context of serving blind persons, who are disadvantaged. On the other hand, botanical gardens aim to provide ecosystem services, such as decreasing the effects of climate change, increasing links between nature and humans, improving the air quality, and managing the water cycle (Wikantiyoso et al., 2020).

Table 4. Classes of ecosystem services according to the resources and benefits

Presently available resources	ES
Areas where genetic heritage or plants are under protected	PS, SS, CS, RS
Areas allow some sports activities, such as walking and running	CS
Areas permit the artistic exhibitions activities	CS
Areas allow for the observation and viewing activities	CS
Areas provide educational and scientific opportunities	CS
Areas to supply to be alone within nature	CS
Areas are provided to meet with plants from different phytogeographic regions	SS, CS, RS
Areas support to get information regarding to the evolution of plants	SS, CS
Areas allow to experiment plants for the disadvantaged peoples	CS
Areas enable the places for graduate educational research	CS
Presently available benefits	
Can be used in all seasons	SS, CS, RS
Can be informed about the plants	SS, CS, RS
Getting away from urban chaos and stress	CS
Exploring nature, spending time in nature	CS
Getting the fresh air by getting away from developed areas	CS
Reducing the effects of greenhouse and heat island depends on climate change	RS
Utilizing from the therapeutic effects of water surfaces	PS, CS
Getting knowledge related to utilize the plants	CS

ES: Ecosystem services, PS: Provisioning services, SS: Supporting services, CS: Cultural services, RS: Regulating services

These evaluations evidence that Iasi Botanical Garden is placed at the good point with respect to services as an urban green and open area. In this context, some recommendations were developed in addition to services provided by botanical gardens under an ecological-based perspective:

- In the natural vegetation areas are large green surfaces. But it was monitored that entrance was prevented around the area. The area could be reused for light sport activities, such as walking, exercising, and orienteering. Benefits that are obtained from cultural ecosystem services can be increased with this approach. Moreover, the green structure can be affected to reduce the effects of urban heat island. In this respect, it will serve to regulating ecosystem services as well.
- In the Rosarium Section, places can be created, around the topiary part and edge of the ponds, for taking photos. Furthermore, places can be organized for painting by visitors. In this respect, the botanical garden can adjust to nowadays habits. Additionally, art-lovers can prefer to visit the botanical garden more.
- In the part of the Greenhouse Complex and Ornamental Section, the workshops, which visitors can attend, can be organized. For the purpose of awareness to conserve genetic heritage, seed-collecting events can be planned in the Section of Romanian Flora and Vegetation. In this respect, the botanical garden will contribute both educational and cultural ecosystem services.
- Resting and relaxing areas should be organized throughout the botanical garden, especially along the water surfaces. Additionally, the supporting can be planned using smart urban furniture. In this context, these areas will contribute to the provisioning ecosystem services and the regulating ecosystem services.
- A view terrace, which faces the lake, can be designed in the parts of the transition from the Arboretum section to the Section of Romanian Flora and Vegetation, utilizing

elevation differences. In this respect, aesthetic benefits can be obtained from cultural ecosystem services.

- The botanical garden expands over a large area, which is in the most favorite district, Copou, and there are settlements in its north and south. Additionally, the university faculties are located within walking distance of the botanical garden. Therefore, the concerts or theaters can be organized in the area for the young people, such as students. Besides, the organization can be organized for the children according to age ranges. So, the resource values of the botanical garden will be used not only in a time period of the year but also can be used all the time. Thus, recreational benefits will be obtained from cultural ecosystem services.

Briefly, these recommendations, which were developed under an ecological-based approach in the context of utilizing ecosystem services in urban planning, will contribute to human well-being.

In the following studies, examining of the green and open urban areas, which are especially located in Europe, under the human well-being and ecological-based perspectives via visitor survey support will fill a considerable gap in the literature regarding the assessment of users.

Acknowledgments

The data used in this research were published as an abstract at the 3rd International Mountain and Ecology Congress, which was organized on 20/10/2022 in Trabzon, Türkiye.

References

- Aksoy, N., Muderrisoğlu, H., Eroğlu, E., Gunes Ozkan, N., Birtürk, T., Kocer, N., Tunçkol, B., Yerli, O., Kulaç, Ş., Çetin, B., Sarginci, M., Kaya, S., Aslan, S., Kanoğlu, S.S., Başaran, N., Doğan, T.G., Ayteğin, A., 2023. Honey Plants of Düzce University Ornamental and Medicinal Plants

- Botanical Garden. *Düzce Üniversitesi Bilim ve Teknol. Derg.* 11, 2265–2282.
- Aksu, B., Yilmaz, H., 2024. Determination of User Satisfaction of Atatürk University Ata Botanical Garden. *Turkish J. Agric. Nat. Sci.* 11, 357–370.
- Basaran, N., 2024. The Relationship Between Climate Change and Regulation Ecosystem Services: The Case of Duzce City. *Düzce University*.
- Cavender, N., Donnelly, G., 2019. Intersecting urban forestry and botanical gardens to address big challenges for healthier trees, people, and cities. *Plants People Planet* 1, 315–322.
- Cowell, C.R., Bullough, L.A., Dhanda, S., Neves, V.H., Ikin, E., Moore, J., Purdon, R., Williams, C., Willison, J., Willoughby, S.J., 2022. Fortuitous Alignment: The Royal Botanic Gardens, Kew and the Sustainable Development Goals. *Sustain.* 14, 1–18.
- Danaparamita, E.D., Nadiroh, N., Safitri, D., Safarinanugraha, D., 2021. The Role of Environmental Management on Visitor Satisfaction of Bogor Botanical Gardens. *Int. J. Multicult. Multireligious Underst.* 8, 282.
- Funsten, C., Di Franco, C., Borsellino, V., Surano, N., Ascuto, A., Schimmenti, E., 2022. The recreational value of botanic garden events: A case study of the Zagara plant fair in Palermo, Italy. *J. Outdoor Recreat. Tour.* 39, 100565.
- Gul, A., Kucuk, V., 2001. The research of Isparta and the open-green areas in urban. *Turkish J. For.* 2, 27–48.
- Gul, E., Esen, S., 2024. High Desertification Susceptibility in Forest Ecosystems Revealed by the Environmental Sensitivity Area Index (ESAI). *Sustain.* 16, 1–21.
- Kalayci Kadak, M., Ozturk, S., Mert, A., 2024. Predicting climate-based changes of landscape structure for Türkiye via global climate change scenarios: a case study in Bartın river basin with time series analysis for 2050. *Nat. Hazards*.
- Li, Y., Li, S., Zhao, G., 2023. Spatiotemporal development of national botanic gardens worldwide and their contributions to plant diversity conservation from 1593 to 2023. *Front. For. Glob. Chang.* 6.
- Marlin, T., Manurung, S., Elizabeth, M., 2024. The Influence of Destination Image and Tourist Attraction on Visitor Satisfaction Case Study at Bogor Botanical Garden 12, 735–742.
- Menezes, M.R., Laviski, B.F.S., dos Santos, A.P.L., de França, E.C.B., Moreira, M.S., da Conceição-Neto, R., Queiroz, J.M., 2022. Flower Visitation by Bees, Wasps and Ants: Revealing How a Community of Flower-Visitors Establish Interaction Networks in a Botanical Garden. *Sociobiology* 69.
- Mounce, R., Smith, P., Brockington, S., 2017. Ex situ conservation of plant diversity in the world's botanic gardens. *Nat. Plants* 3, 795–802.
- Nababan, A.N.P., Ambarini, L.A.D., 2025. Sustainable strategy of green open space in reducing stress levels in urban areas. *J. Placemaking Streetscape Desing* 2, 134–154.
- Prudic, K.L., Cruz, T.M.P., Winzer, J.I.B., Oliver, J.C., Melkonoff, N.A., Verbais, H., Hogan, A., 2022. Botanical Gardens Are Local Hotspots for Urban Butterflies in Arid Environments. *Insects* 13, 1–9.
- Redweik, P., Reis, S., Duarte, M.C., 2023. A Digital Botanical Garden: Using Interactive 3D Models for Visitor Experience Enhancement and Collection Management. *Virtual Archaeol. Rev.* 14, 65–80.
- Tulek, B., 2023. Investigation of cultural ecosystem services supply in a river landscape: a case study in the Lower Rhine area using social media images. *One Ecosyst.* 8, e97259.
- URL-1, n.d. History [WWW Document]. Univ. Alexandru Ioan Cuza. URL <https://botanica.uaic.ro/history.htm> %0A (accessed 4.24.25).
- URL-2, n.d. About the Gradina Botanica a `Anastasiu Fatu`, Iasi [WWW Document]. Fatu`, Gradina Bot. a `Anastasiu. URL <https://tools.bgci.org/garden.php?id=110&ftrCountry=RO&ftrKeyword=&ftrBGCIId=&ftrIAReg> (accessed 4.24.25).
- URL-3, n.d. International Relations [WWW Document]. URL https://botanica.uaic.ro/rel_intl-en.htm (accessed 4.24.25).
- URL-4, n.d. The Ornamental Section [WWW Document]. Univ. Alexandru Ioan Cuza. URL https://botanica.uaic.ro/section_ornamental_details.htm (accessed 4.24.25).
- URL-6, n.d. Sectia Plante Utile [WWW Document]. URL https://botanica.uaic.ro/sector_planteutil_detalii.htm (accessed 4.24.25).
- URL-7, n.d. Sectia Rosarium [WWW Document]. Univ. Alexandru Ioan Cuza. URL botanica.uaic.ro/sector_rozariu_detalii.htm (accessed 4.24.25).
- Vilella-Arnizaut, I.B., Roeder, D. V., Fenster, C.B., 2022. Use of Botanical Gardens As Arks for Conserving Pollinators and Plant-Pollinator Interactions: a Case Study From the United States Northern Great Plains. *J. Pollinat. Ecol.* 31, 53–69.
- Westwood, M., Cavender, N., Meyer, A., Smith, P., 2021. Botanic garden solutions to the plant extinction crisis. *Plants People Planet* 3, 22–32.
- Wikantiyoso, R., Tutuko, P., Suhartono, T., Sulaksono, A.G., Safrilia, A., 2020. Green City MIS as a Sustainable Urban GOS Provision Control Implementation Model. *Int. Rev. Spat. Plan. Sustain. Dev.* 8, 160–172.
- Zelenika, I., Moreau, T., Lane, O., Zhao, J., 2018. Sustainability education in a botanical garden promotes environmental knowledge, attitudes and willingness to act. *Environ. Educ. Res.* 24, 1581–1596.