

INFLUENCE OF GREEN ARCHITECTURE OBJECTS ON THE ECOLOGICAL AND TOURIST ATTRACTIVENESS OF THE URBAN ENVIRONMENT

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Abstract

The development of large cities is associated with the deterioration of the environment, which pushes humanity to become aware of environmental priorities. As a result, cities have an urgent need to maximize the natural component of the urban environment. The article proposes that the design of green landscaping and architecture objects seeks to minimize the negative impact of construction on nature. The objective of this article is to evaluate the design characteristics of landscape design objects and green architecture as a means of ecological and tourist attractiveness of the urban environment. The literature review supports that there is a trend in the development of the modern urban environment thanks to the combination of urban and natural elements, which generates a new type of emotional and aesthetic impact on human beings and increases the environmental attractiveness of the urban environment for both city residents and tourists. Based on the case study method, the authors create a basic scheme for the probable implementation of the design of landscaping elements in an urban environment and the use of green architecture objects. The study of the experience of landscaping and design of green architecture objects allows us to conclude that the design of landscaping and green architecture objects is a new stage in the development of modern urban planning, based on the principles of attraction of natural components to the urban environment.

Keywords: Green Architecture Objects; Urban Environment; Landscape Design; Ecology; Tourist Attractiveness.

INFLUÊNCIA DOS OBJETOS DE ARQUITETURA VERDE NA ATRATIVIDADE ECOLÓGICA E TURÍSTICA DO AMBIENTE URBANO

Resumo

O desenvolvimento das grandes cidades está associado à deterioração do meio ambiente, o que impede a humanidade a tomar consciência das prioridades ambientais. Como resultado, as cidades têm uma necessidade urgente de maximizar o componente natural do ambiente urbano. O artigo propõe que o projeto de objetos de paisagismo e arquitetura verde busca minimizar o impacto negativo da construção na natureza. O objetivo deste artigo é avaliar as características de projeto de objetos de paisagismo e arquitetura verde como meio de atratividade ecológica e turística do ambiente urbano. A revisão de literatura sustenta que há uma tendência no desenvolvimento do ambiente urbano moderno, graças à combinação de elementos urbanos e naturais, que gera um novo tipo de impacto emocional e estético no ser humano e aumenta a atratividade ambiental do ambiente urbano tanto para os moradores da cidade quanto para os turistas. Baseando-se no método de estudo de caso, os autores criam um esquema básico para a provável implementação do projeto de elementos de paisagismo em um ambiente urbano e o uso de objetos de arquitetura verde. O estudo da experiência de paisagismo e design de objetos de arquitetura verde permite concluir que o design de objetos de paisagismo e arquitetura verde é uma nova etapa no desenvolvimento do planejamento urbano moderno, baseado nos princípios de atração de componentes naturais para o ambiente urbano.

Palavras-chave: Objetos de Arquitetura Verde; Ambiente Urbano; Desenho Paisagístico; Ecologia; Atrativo Turístico.

INFLUENCIA DE LOS OBJETOS DE ARQUITECTURA VERDE EN EL ATRACTIVO ECOLÓGICO Y TURÍSTICO DEL ENTORNO URBANO

Resumen

El desarrollo de las grandes ciudades va asociado al deterioro del medio ambiente, lo que empuja a la humanidad a tomar conciencia de las prioridades medioambientales. Como consecuencia, las ciudades tienen la urgente necesidad de maximizar el componente natural del entorno urbano. El artículo propone que el diseño de objetos de paisajismo y arquitectura verde busque minimizar el impacto negativo de la construcción sobre la naturaleza. El objetivo de este artículo es evaluar las características de diseño de los objetos de diseño paisajístico y la arquitectura verde como medio de atractivo ecológico y turístico del entorno urbano. La revisión de la literatura apoya que existe una tendencia en el desarrollo del entorno urbano moderno gracias a la combinación de elementos urbanos y naturales, lo que genera un nuevo tipo de impacto emocional y estético en los seres humanos y aumenta el atractivo medioambiental del entorno urbano tanto para los habitantes de las ciudades como para los turistas. Basándose en el método del estudio de casos, los autores crean un esquema básico para la probable aplicación del diseño de elementos paisajísticos en un entorno urbano y el uso de objetos de arquitectura verde. El estudio de la experiencia de paisajismo y diseño de objetos de arquitectura verde permite concluir que el diseño de objetos de paisajismo y arquitectura verde es una nueva etapa en el desarrollo del urbanismo moderno, basada en los principios de atracción de componentes naturales al entorno urbano.

Palabras clave: Objetos de Arquitectura Verde; Entorno Urbano; Diseño Paisajístico; Ecología; Atractivo Turístico.

1 INTRODUCTION

The process of city formation is characterized by large dimensions, globality, and high rates of territorial development, as well as a high concentration of anthropomorphic activity. While creating some unconditional advantages, this has led to a violation of the optimal balance

between natural and artificial components of the landscape. Therefore, as confirmed by the conducted studies (Aksenova and Belousova 2020; Stryabkova et al. 2021), the ecological aspect becomes decisive in the organization of urban space.

Green spaces play a huge role in neutralizing and weakening the negative impact of the artificial environment of the city. They mitigate the inconveniences of urban life,



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form a special microclimate of urban systems, participate in the organization of space, creating an individual and unique character of the city (Belousova et al. 2021; Yerkinbayeva et al. 2021).

For the improvement of modern urban spaces, green spaces should fill as much as possible the territory of streets and squares, embankments and arrays of residential quarters, territories of playgrounds and industrial enterprises, and, undoubtedly, parks and public gardens (Huseynov 2011). However, landscaping alone is insufficient for this, and it is important to develop architecture using modern trends in green architecture design (Aksenova & Belousova 2020).

In this situation, the analysis of world urban planning concepts is of particular importance, highlighting modern, progressive trends and the implementation of the results of this experience, the best solutions, and software landscape planning in Russian cities to increase environmental and tourist attractiveness (Stryabkova et al. 2021).

Regarding the use of vegetation in the formation of the urban environment, researchers (Grahn & Stigsdotter 2010) note that during a long stay of a person in an artificial environment, they need to be surrounded by plants that have not only aesthetic influence but also act with volatile phytogenic substances and incense (aromas).

However, there are no publications where landscape gardening, together with green architecture objects, is considered an element of urban space that can provide functional comfort and environmental and tourist attractiveness at present (see search in the big publishing houses, such as Scopus, Web of Science, Elsevier, etc.), which suggests a hot topic to be studied as well as it demands the openness to make a broader literature review, considering the grey literature, for example.

Considering this context, the purpose of the paper is to evaluate the design features of landscape gardening and green architecture objects as a means of ecological and tourist attractiveness of the urban environment. In a more specific way, the objective of papers is twofold: in one hand, to determine the functional purpose of landscape gardening in modern urban space from the perspective of increasing its environmental and tourist attractiveness; and in another hand, to consider the use of green architecture objects as a factor in increasing the ecological and tourist attractiveness of the urban environment.

The study assumes the premises that the design of landscape gardening and green architecture objects seeks to minimize the negative impact of construction on nature. This trend in the development of the modern urban environment, thanks to the combination of urban and natural elements, generates a new kind of emotional and aesthetic impact on humans and increases the environmental attractiveness of the urban environment for both city residents and tourists.

2 LITERATURE REVIEW

One of the most relevant study areas in the modern city is the landscape-related and ecological studies, which attract the attention of architects and designers both to green infrastructure and plants (Atiqul Haq 2011; Choumert and Salanié 2008; Maas et al. 2006), and to possible approaches to understanding the problems of this industry and the

mechanisms of their potential solutions (Choumert and Salanié 2008; Kamal et al. 2017; Peschardt et al. 2012).

Especially valuable are the studies that suggest ways to use new means of landscape design in urban spaces for their aesthetic harmonization (Ellis 2012; Jansson, 2014; Laforteza et al. 2013), as well as optimization in terms of functionality and ecology (Balova et al. 2021; Gill et al. 2007; Tratalos et al. 2007), techniques for attracting natural elements into architecture using various methods of landscape gardening (Bowler et al. 2010; Florida et al. 2011) and green architecture objects (Huseynov 2011; Ragheb et al. 2016).

Scientists define landscape gardening as the design and practical application of plants in an artificial object environment, which solves aesthetic, biomedical, psychological problems associated with the isolation of a person from the natural plant environment (Westphal 2003). It is a purposeful scientifically based introduction of plants into the design of architectural space, considering their biological compatibility, environmental characteristics, and the ability to improve air quality (Joye et al. 2010).

According to researchers (Aliamin, 2021), green architecture is the art of forming space through a natural landscape, and the vegetation itself serves as the main building material in its creation. With the right layout, most of the structural elements that a person builds from metal and concrete can be created from plants.

Green architecture integrates the natural landscape in architecture, attracting natural components of form-making and merging architecture with nature. Thus, the nature that is being displaced from the territories of cities can be returned to the internal or external space of buildings and structures or created from plant materials (Mohammadjavad et al. 2014).

Researchers (Mercer et al. 2007) note that the main feature of green architecture is the use of plants as a living material, so it is constantly in motion, showing growth and development, constantly changing with the seasons, temperature, illumination. Plant architecture is also a good vector of biodiversity. Plant walls, terraces, green roofs contribute to the positive effect of biological corridors that should be created in the city.

Green architecture has been used for different purposes. For instance, analyzing the green architecture in rural areas related to the tourism sector, Gutkevych & Haba (2020) argue that "one of the newest forms of tourism is rural green tourism [...] which opens opportunities for solving a number of problems of rural development. Rural green tourism is a specific form of recreation in the countryside, which has ample opportunity to use the natural, material and cultural potential of certain regions. [...] The analysis of the activity of rural green tourism objects will make it possible to increase the attractiveness of rural green tourism."

Additionally, Polyakova (2019) suggests that the application of Architectural Environment Design (AED) methods can help to improve the development of territories, by attracting domestic and inbound tourism, also economic investments, generating diversification of services, attracting people, residents, workers as well as generating the improvement of the number of services and the quality of life. Yet according to the author, this has been used as a governmental strategy in Russia to foster the development of induced areas – called Territories of Priority Social Economic

Development (TAD) - whose main objective is to generate attractiveness for these areas.

3 METHODS

The study was conducted as a qualitative research focusing on the design features of landscape gardening and green architecture objects as a means of ecological and tourist attractiveness of the urban environment was carried out. In the study, along with theoretical methods of analyzing scientific sources on the problem of using different types of landscape gardening, depending on their functional purpose, we used the case study method (Yin, 2018), by selecting and analyzing some of the most representative cases of various green architecture types.

The source base of the study consisted of research publications devoted to various aspects of landscape gardening and the design of green architecture objects (papers from scientific peer-reviewed journals listed in Scopus and Web of Science).

The search scientific bibliography related to the problem of the study was done in 2 moments. The first one was related to the topic of green architecture, in general. This phase was carried out using the Boolean method using the "green architecture objects" and "tourist attractiveness". Due to the fact that no papers were found, the parameters were changed to be more inclusive, being used "green architecture" and "tourism". Again, no results were found making this intersection, which led us to look for this specific sort of papers in a broad basis, for example, using grey literature.

The second phase was to adopt an even broader search

and then the following keywords were used: "landscape gardening", "urban greening", "green infrastructure", and "green architecture" to get a link to the corresponding paper. The source base has been updated by the time of publication, from 2003 to the present, and is also limited by the requirement of free access to the necessary materials. The search results showed the presence of more than 300 scientific papers and monographs. However, based on the limited volume of the published paper, only 25 sources (regarding the green architecture in general) were considered as the most informative and relevant to the study goal.

For the case analysis, the following cases were considered as objects of research of various types of green architecture: the Circus Trees, California, USA; the Bio-park on Okinawa Island, Japan; the Bergamo Live Cathedral in Bergamo, Italy; the Patient Gardener garden structure located on the campus of the Polytechnic University of Milan, Italy; the Eco-Boulevard in Madrid, Spain.

Structurally, the study consisted of an analysis of the functional purpose of landscape gardening in modern urban space, as well as examples of the use of green architecture objects to increase the environmental attractiveness of the city, including for tourists.

4 RESULTS

The analysis of scientific literature has shown that when designing landscape gardening in modern urban space to increase its environmental attractiveness, it is necessary to consider not only the aesthetic but also the functional purpose of landscape gardening, including various components (Table 1).

Table 1. The functional purpose of landscape gardening in modern urban space.


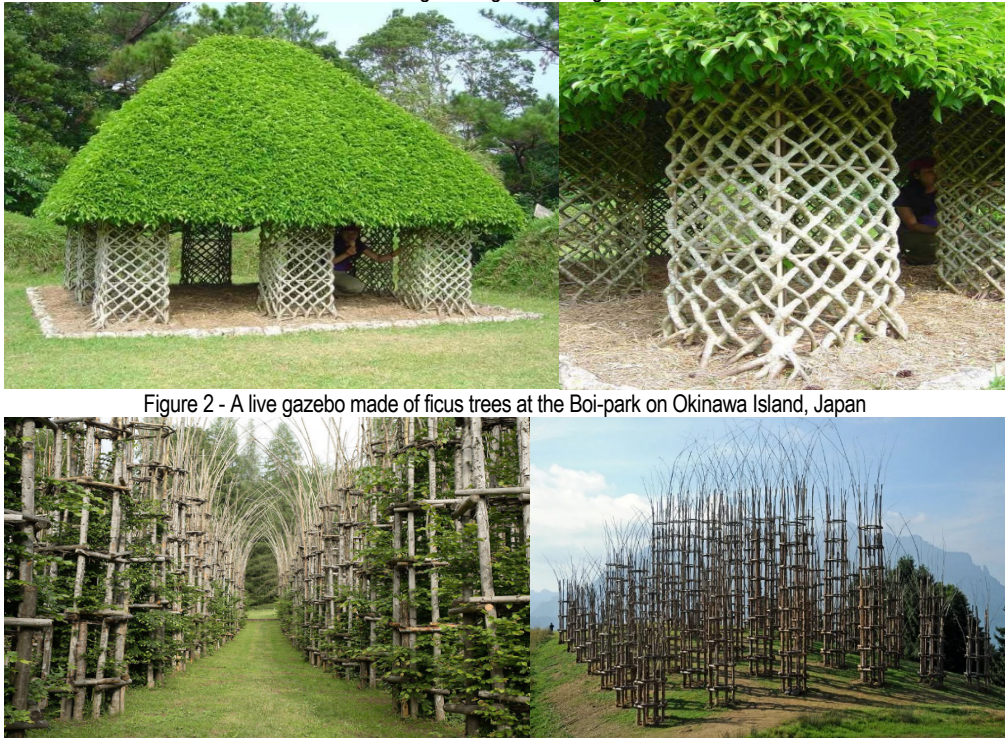

No	Components of the purpose of landscape gardening	Types
1	Decorative purpose	Horizontal landscape gardening
		Vertical landscape gardening
	Characteristic: It consists in giving aesthetic appeal or originality to the environment. The means are space-planning forms and design objects that create an initial emotional and artistic impression of the space. Decorativeness is achieved through the aesthetic and psychological impact of plants on humans through the beauty of shape and colour and the use of features of dynamic seasonal changes	
2	Symbolic purpose	Landscape gardening in the interior spaces
		Landscape gardening at sacred places
	Characteristic: It boils down to the archetype of a place, a kind of identifier of personal space, especially clearly the boundaries of one's territory and its landscaping are manifested in the formation of the inner space of the courtyard compared to the outer space of the street. In addition, landscape gardening is used to identify certain sacred places, for example, landscaping at the territory of a church, chapel, cemetery, using certain types of plants, their combinations, and landscape features	
3	Restrictive purpose	Pedestrian zoning
		Recreational zoning
	Characteristic: Such technologies are selected for the project implementation of landscape components in the urban environment, which subordinate the spatial parameters and characteristics of the natural components of almost any spatial situation. Zoning and visual partitioning of the space occurs through the introduction of horizontal or vertical landscape gardening planes, the shapes, and dimensions of which are diverse. Plants enhance the expressiveness of elements: indicate the directions of circulation of passages, exits, service areas, parking lots; plantings separate existing architectural elements from each other	
4	Informative purpose	Utilitarian landscape gardening
		Interstitial advertising
	Characteristic: elements of landscape design provide the information necessary for social coordination, and also become the object of integrated advertising	
5	Psychological purpose	
	Characteristic: the environment is aesthetically attractive if it is associated with relaxation, meditation, communication and causes many positive emotions. Psychological comfort is achieved by regulating the openness-closeness of urban spaces with green spaces	

Source: own elaboration based on the analysis of scientific literature.

One of the ways to design landscape gardening to increase the environmental attractiveness of the urban

environment is the use of green architecture objects (Table 2).

Table 2. Green architecture objects.

No	Green architecture objects
1	<p data-bbox="683 331 991 360">Creating different shapes from trees</p>  <p data-bbox="644 779 1027 808">Figure 1 - The Circus Trees, California, USA</p>
3	<p data-bbox="687 801 986 831">Growing buildings from living trees</p>  <p data-bbox="469 1218 1203 1247">Figure 2 - A live gazebo made of ficus trees at the Boi-park on Okinawa Island, Japan</p> <p data-bbox="592 1563 1082 1592">Figure 3 - The Bergamo Live Cathedral in Bergamo, Italy</p>
4 and 5	 <p data-bbox="277 1968 826 2024">Figure 4 - The Patient Gardener structure on the campus of the Polytechnic University of Milan, Italy</p> <p data-bbox="858 1968 1257 1998">Figure 5 - The Eco-Boulevard in Madrid, Spain</p>

Source: own elaboration, based on a compilation of different proposals of green architecture according to the case study method.

5 DISCUSSION

As the results of the study showed when designing landscape gardening to increase the ecological and tourist attractiveness of the urban environment, it is necessary to consider the functional purpose of landscape gardening in the space of a modern city, which includes the following components: decorative, symbolic, restrictive, informative (including for advertising purposes), and psychological ones.

The results of the study demonstrate that today landscape gardening has become one of the newest areas of design and landscape architecture, which is gaining intensive momentum in various spheres of human activity. It is actively used not only in the interiors of residential and public buildings but also in the interior environment of the city (Gill et al. 2007, 115).

We agree with researchers who believe that landscape gardening in an urban environment can be the main determining factor in the compositional solution of space, a natural background for works of monumental or decorative art; an addition or accent of the architectural and spatial environment (Bowler et al. 2010).

The use of landscape gardening elements as additional ones involves filling an existing space among houses (then this addition, primarily with woody plants, can reach about 50% of the space) or additions to existing vegetation (natural or artificial) and is carried out through the use of shapes, colors and textures of plants (Tratalos et al. 2007).

We believe that the ecological significance of landscape gardening is that one of the main criteria for the sensory perception of the environment is the ability to effectively use urban space, fully feeling colors, smells, and sounds. Therefore, the main task of landscape gardening is to reduce the degree of irritation caused by intense noise, contrasting light, redundancy, traffic, and human flows. In particular, through landscape gardening, it is possible to improve the human air environment (tonic or soothing smells), improve the environment, mainly due to volatile phytoncides, purify the air from gases, dust, and smoke.

With the help of bioindication, that is, the use of plants as living indicators of air, soil, and water pollution, it is possible to assess the degree of environmental pollution, constantly monitoring its quality. For this purpose, various types of mosses and lichens are most widely used, which is especially important due to the active development of vertical landscape gardening design in the urban environment.

For these purposes, modern technologies and inventions are used, for example, first a metal frame is attached to the facade of the building, then a layer of polyvinyl chloride (PVC) to ensure water resistance, and then a layer of polyamide material in which plants are planted (Laforteza et al. 2013, 102).

As it was shown earlier, one of the ways of landscape gardening design is the use of green architecture objects.

Researchers note that today various techniques allow creating individual objects and structures or small architectural forms from living plants, such as various arches, gazebos, summer living quarters, furniture, objects of any shape. These methods and techniques of creating various figures from trees are aimed at giving a special shape to the

trunk and branches. They do not need expensive inventory and complex technologies, to create them one only needs imagination, patience, and time (Table 2, Figure 1).

Another area of use of green architecture is the cultivation of buildings from living trees. One of the pioneers of this direction was the German architect Arthur Vihula, who in 1926 described the technique of creating multi-story houses, bridges, towers, and other architectural objects from living trees (Ragheb et al. 2016, 778).

Judging by the results of various studies (Huseynov 2011, 534; Joye et al. 2010, 57), a tree can adapt to various external loads and easily perform the functions of a load-bearing structural element, one example of which can be a living gazebo made of ficus trees at the Bio-park on Okinawa Island, Japan (Table 2, Figure 2) (Joye et al. 2010, 57).

Another interesting example is the Bergamo Living Temple project, which was created by Giuliano Mauri, the famous Italian ecological architect. This temple is growing, that is, it is still "building itself". The building is located on the outskirts of the Italian city of Bergamo at the foot of Mount Arera, in northern Italy. The essence of the project is that hornbeam seedlings were planted inside 42 columns made of wood. According to Giuliano's plan, in about fifteen years, the column-frames will become "cramped" for trees and will collapse naturally, and the hornbeams themselves form a vegetable structure of the cathedral from a living tree. The project occupies a significant area of 650 m². In total, 80 hornbeam seedlings, 600 chestnut bars, and 1,800 spruce trunks were needed for the construction. About 6 kilometers of the walnut vine were used to connect the elements (Ragheb et al. 2016, 778) (Table 2, Figure 3).

Swedish architects from the Visiondivision art association, together with a group of students, designed a two-level structure that is now growing on the campus of the Polytechnic of Milan. The garden structure, called the Patient Gardener, will be formed from a circle of ten Japanese cherries, which will subsequently be bent, trimmed, and docked. The trees will be tied to the central wooden dome-shaped frame of the first floor, while the upper branches will grow outward like the walls of the first floor. Two of the trees will be woven together like seedlings (Westphal 2003, 137) (Table 2, Figure 4).

However, in modern green construction, there are examples of the implementation of multi-level structures. An example is the Eco-boulevard in Madrid, created by the architects of Ecosistema Urbano in 2000 (Table 2, Figure 5).

Thus, the study of the experience of landscape gardening design and the use of modern trends in green architecture is relevant and timely all over the world, as well as in Russia. Historical urban planning and architecture should be characterized by harmonious coexistence with nature, as evidenced by the large area of green areas. However, in modern conditions of intensive urban development when new buildings appear in former parks and green areas, nature is gradually disappearing from our cities.

Therefore, when planning landscape gardening and creating green architecture objects, first of all, the goal is to solve the issue of psychological comfort and harmony of all components with the help of plant objects, as well as to preserve and improve the ecology of the environment.




The objective of the development of landscape gardening and green architecture in design and construction is to find among the buildings a suitable place for plants (as living material) that will benefit and beautify the environment, creating a successful combination with architectural structures. Plants not only produce oxygen but also create a pleasant atmosphere in large spaces, relieving stress and increasing the loyalty of visitors, creating a comfortable and attractive environment for their stay and residence.


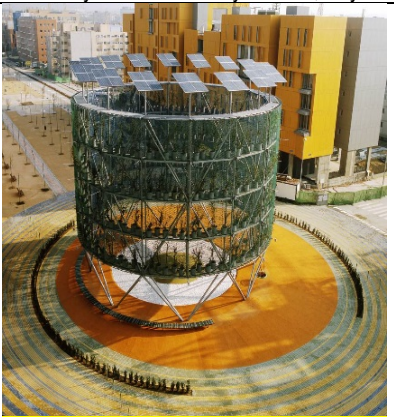
Thus, the involvement of natural components in architectural shaping can be different depending on the spatial, functional, and constructive use. All these ways of

using natural elements not only improve the environmental qualities of buildings and their territories but also increase the tourist attractiveness of urban space for tourists.

Thus, the modern object and spatial environment should be characterized by a harmonious relationship of the internal environment with the external one, which is achieved through the use of non-standard planning solutions, organic, natural smoothly transitional forms, and materials. Such an environment is designed considering innovations in technology, which allows reasonable use of environmental resources with minimal impact on it, encourages tourists and visitors to visit green attractions (Table 3).

Table 3. The characteristics and purpose of green architecture objects.

Characteristics	Decorative and Symbolic Purpose	Objects
<p>The Circus Trees in California, USA, are an example of creating different shapes from trees using various techniques. The trees are shaped into different forms such as baskets, chairs, and even an entire house. This method and technique of creating various figures from trees are aimed at giving a special shape to the trunk and branches</p>	<p>The Circus Trees are a collection of unique tree sculptures created by horticulturist Axel Erlandson. They serve a decorative purpose by showcasing the potential of shaping trees into interesting and beautiful forms.</p>	<p>These trees represent one of the most visible demonstrations of the love of nature by man—first to create and nourish, then to maintain, and finally to preserve and cherish these stunning creatures.</p>  <p>The circus trees</p>
<p>A live gazebo made of ficus trees is located at the Bio-park on Okinawa Island, Japan. It is an example of growing buildings from living trees. The ficus trees are trained and shaped into a gazebo, creating a natural and unique structure.</p>	<p>The live gazebo made of ficus trees serves a decorative purpose by creating a unique and visually appealing structure that blends in with the natural environment.</p>	<p>The gazebo can be seen as a symbol of the importance of preserving natural habitats and the potential for architecture to work in harmony with the natural world.</p>  <p>A live gazebo made of ficus trees at the Bio-park on Okinawa Island, Japan</p>
<p>The Italian architect Giuliano Mauri worked in the style of Land Art (a direction in art in which the work is inextricably linked with the natural landscape). The design of the cathedral consists of spruce trunks, chestnut and hazel branches and 42 beech seedlings, which, after 15 years, should complete the work begun by Mauri, turning the Green Cathedral into a unique work of landscape art. The project occupies a significant area of 650 m².</p>	<p>The Bergamo Live Cathedral serves a decorative purpose by creating a unique and visually stunning structure that showcases the potential for living trees to be used in architecture</p>	<p>The Cathedral can be seen as a symbol of the importance of sustainability and harmony with the nature</p>  <p>The Bergamo Live Cathedral in Bergamo, Italy</p>

<p>The Patient Gardener structure is located on the campus of the Polytechnic University of Milan, Italy. It is formed from a circle of ten Japanese cherries, which are bent, trimmed, and docked. The trees are tied to the central wooden dome-shaped frame of the first floor, while the upper branches grow outward like the walls of the first floor.</p>	<p>The Patient Gardener structure serves a decorative purpose by creating a visually unique and interesting structure that showcases the potential for trees to be shaped into different forms.</p>	<p>The structure can be seen as a symbol of the importance of patience and care in cultivating the natural world.</p>	 <p>The Patient Gardener structure on the campus of the Polytechnic University of Milan, Italy</p>
<p>The Eco-Boulevard in Madrid, Spain, is an example of green architecture that involves creating multi-level structures. The boulevard was created by the architects of Ecosistema Urbano in 2000. The structure is formed by a series of platforms and ramps that are covered with plants, creating a natural and green space in the heart of the city.</p>	<p>The Eco-Boulevard serves a decorative purpose by creating a visually stunning green space that provides a welcome break from the concrete and steel of the urban environment.</p>	<p>The Eco-Boulevard can be seen as a symbol of the importance of incorporating green spaces into urban planning. There are two main objectives: one of a social nature aimed to generate activity, and one of an environmental nature, the bioclimatic adaptation of outdoor space, achieved with a system of passive air conditioning based on chilling by evapotranspiration.</p>	 <p>The Eco-Boulevard in Madrid, Spain</p>

Source: own elaboration.

5 CONCLUSIONS

The study has considered landscape gardening as an important element in the organization of urban space, which brings functional, ecological, and aesthetic comfort. The functions of landscape gardening in modern urban space have also been identified and analyzed, namely: the decorative function (the need for beauty); the symbolic function (a substitute for the natural environment); the restrictive function (the functional necessity, such as the differentiation of pedestrian and traffic flows); the informative function for advertising purposes (increasing attention or popularization of an object or product); the ecological function (drawing attention to the problems of conservation of natural resources and biodiversity in modern conditions).

Landscape gardening nowadays has ceased to be a local phenomenon. The scope of its application has spread from the interiors of buildings to urban space and has become one of the means of its expression. Therefore, the study of aspects of landscape gardening is extremely important in the context of the organization of urban space. Describing examples, outlining the purpose and main tasks, the paper creates a basic scheme of the probable project implementation of landscape gardening elements in an urban environment. The definition of the main directions of possible development of the ecosystem of the city provides flexible inclusion of landscape gardening objects in the new integrity of the environment.

The results of the study have confirmed the hypothesis that the design of landscape gardening and green architecture objects seeks to minimize the negative impact of construction on nature. This trend in the development of the modern urban environment, thanks to the combination of urban and natural elements, generates a new kind of emotional and aesthetic impact on humans and increases the environmental attractiveness of the urban environment for both city residents and tourists.

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Table 1. CRediT author statement

Term	Definition	Author 1	A.2	A.3	A.4	A.5	A.6
Conceptualization	Ideas; formulation or evolution of overarching research goals and aims	+	+	+	+	+	+
Methodology	Development or design of methodology; creation of models	+	+	+	+	+	+
Software	Programming, software development; designing computer programs; implementation of the computer code and supporting algorithms; testing of existing code components	+	+	+	+	+	+
Validation	Verification, whether as a part of the activity or separate, of the overall replication/ reproducibility of results/experiments and other research outputs	+	+	+	+	+	+
Formal analysis	Application of statistical, mathematical, computational, or other formal techniques to analyze or synthesize study data	+	+	+	+	+	+
Investigation	Conducting a research and investigation process, specifically performing the experiments, or data/evidence collection	+	+	+	+	+	+
Resources	Provision of study materials, reagents, materials, patients, laboratory samples, animals, instrumentation, computing resources, or other analysis tools	+	+	+	+	+	+
Data Curation	Management activities to annotate (produce metadata), scrub data and maintain research data (including software code, where it is necessary for interpreting the data itself) for initial use and later reuse	+	+	+	+	+	+

Term	Definition	Author 1	A.2	A.3	A.4	A.5	A.6
Writing - Original Draft	Preparation, creation and/or presentation of the published work, specifically writing the initial draft (including substantive translation)	+	+	+	+	+	+
Writing - Review & Editing	Preparation, creation and/or presentation of the published work by those from the original research group, specifically critical review, commentary or revision – including pre-or post-publication stages	+	+	+	+	+	+
Visualization	Preparation, creation and/or presentation of the published work, specifically visualization/ data presentation	+	+	+	+	+	+
Supervision	Oversight and leadership responsibility for the research activity planning and execution, including mentorship external to the core team	+	+	+	+	+	+
Project administration	Management and coordination responsibility for the research activity planning and execution	+	+	+	+	+	+
Funding acquisition	Acquisition of the financial support for the project leading to this publication	+	+	+	+	+	+

Source: adapted from Elsevier (2022, s/p), based upon Brand et al. (2015).

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