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Problems and Perspective of Vertical Gardening in the Vladivostok Design

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Abstract. The article considers the phenomenon of vertical gardening. The authors analyse the problems, potential and possibilities of using this type of gardening in the Vladivostok, that has a harsh climate. The vertical gardening in urban environments and in the interiors of private and public spaces are considered. It has been established that the main problems of vertical gardening in Vladivostok are: a difficult climate, designers must adapt the existing methods in the world to local climatic conditions; the using of non-acclimatized plants; expensive local planting material; lack of interest in the problem of improving the city's government structures. For the Vladivostok, the development of certain types of vertical gardening is promising: the use of local, endemic flora (lianas, ivy, ferns, mosses, etc.); the using of vertical gardening elements for the creation of topiary; the decorating of building facades and retaining walls with annual plants; the using of vertical gardening in interiors. It has been established that for the development of this direction, comprehensive studies of biologists, theoretical designers and practical designers are needed, that will be aimed at developing a general concept of landscaping and improvement in the Vladivostok.

1. Introduction

Vertical gardening is one of the relevant ways of decorating buildings, constructions and their interiors with living plants. Particular attention is given to this type of landscaping in urban spaces due to the optimal combination of functional (small area and low water consumption), ecological (the ability of structures to create noise, wind protection, improve air quality) and aesthetic properties. Technical devices for vertical landscaping systems are constantly replenished. Scientific research and practical activities of landscape designers are underway in the world to select plants, improve forms and technologies. This tendency is manifested in the Vladivostok and Primorsky Territory. Theorists and practitioners of architectural and landscape design are interested in vertical gardening. Some the possibility of its application is reflected in the Improvement Rules of Vladivostok.

Vertical gardening issues are more often covered in Russian and foreign publications for designers-practice.

Modern researchers reveal various features of this phenomenon, not striving for its comprehensive study. So, the researchers are trying to classify the types of vertical landscaping according to their



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functions [1; 2; 3], they study vertical gardening systems from the point of view of the principles of their arrangement, maintenance, the cost of the materials and elements [4]. In the works also discusses the possibility of using vertical gardening in architectural design and urban development [5; 6], for the decoration of facades and roofs of buildings [7; 8], for the aesthetization of artificial vertical and inclined walls (gabions, retaining walls, etc.) [9]. There are works that contain methods for creating and caring for objects of vertical gardening [10], for the selection of assortment and recommendations for vertical gardening with annual flower crops of urban spaces [11]. A special place is occupied by studies that devoted to describing the properties of plants that can be used for vertical gardening, studying the necessary conditions to maintain their viability [12, 13], and also studying the possibilities of growing plants in a vertical plane [14].

One of the recognized world leaders in vertical gardening is a French researcher and designer - Patrick Blanc. He proposed an original concepts and technology for creating vertical gardens, which almost all modern designers are guided [15]. Another no less famous specialist is Malaysian architect Ken Yeang, the author of more than 200 building projects that use the principles of vertical terrace gardening. His concepts are considered also [16]. Researchers are considering the principles of vertical gardening in the interiors of apartments and public spaces, including the creation of phyto-pictures (herbal pictures) [17-19].

However, there are not enough articles devoted to vertical gardening in the far East of Russia and, in particular, in Primorsky Territory. The work of G. A. Adamchik notes the absence of new trends and any development in the landscaping of Primorsky Territory, as well as some possibilities for changing the current situation by introducing this type of landscaping [20]. S. E. Tlustaya, S. I. Frolova and O. A. Shkurko presented a number of projects related to the design of one of the buildings of the historical center and landscaping of transport areas in the Vladivostok [21; 22]. A. S. Serebryakov, along with colleagues O. G. Obertas, V. V. Petukhov, L. A. Cherniavina wrote about the possibility of decorating with plants supporting walls that are important part of the urban landscape, to enhance aesthetic perception of space [23;24].

This article assesses the need for vertical gardening in the Vladivostok and discusses the problems that accompany the development of this type of gardening in the Primorsky Territory.

2. Discussion and results

Currently, there are a number of types of vertical gardening associated with methods of gardening beyond the horizontal type of planting.

The first historically recorded type, which was called the Gardens of Babylon (Amitis) (about 605 BC). That type had a visual vertical effect, which is associated with terracing landings on four tiers. In the future, such buildings were found in Ancient Rome, Medieval Nuremberg, known Riding gardens of the Kremlin (XVII century).

Another type- the roof gardens – also has a long historical tradition. In the world architecture is widespread project "Green roof" (Greenroofs), which includes not only technology, but also teaching methods of creating gardens on the roof. This type can be attributed to the projects of Ken Yeang, who designs high-rise buildings with eco-design style.

One of the most common and simple types of vertical gardening is the formation of a vertical plant composition with the help of creeping and climbing plants (liana, ivy etc.) on a structure of supports and guides. We also refer to the same type as gardening of arbors and pergolas using MAF as supports and guide frames. The height of the structures can reach a height of 25 meters.

The next type of vertical gardening was the placement of balcony boxes and planters of the same structure with the same flower culture (or several capable of coexistence). This type is one of the methods of vertical gardening used for decoration of building facades.

Elements of vertical gardening are used in topiary. The development of topiary art has led to the formation of voluminous compositions that are read in space and vertically and are composed of several plants of one or more species. Gardening of volumetric figures (flower sculpture) with annuals is also applied using vertical structures.

One of the most promising areas in environmental design is the Vertical Gardens concept of the botanist and French designer Patrick Blanc. Vertical gardens mean the principle of transferring the composition of horizontal landscape techniques to the vertical in connection with the ability of some low-growing herbaceous and woody plants to develop without finding the root system in the soil. Such plants are able to grow on any surface, not exclusively horizontal.

The technical system of Patrick Blanc is patented and is called the Vertical Garden System. Patrick Blanc also formulated the basic principles and approaches to the construction and design of vertical gardens, which are relevant for most types of vertical gardening:

1. The composition is formed on the basis of a technical system patented by Patrick Blanc. Its characteristic features are a multilayer structure based on lightweight materials (plastic, polymer felt) and a hydroponic plant nutrition system, which allows you to abandon the nutrient medium (soil or substrates). As a result, the installed system with plants has a small weight that does not exceed 30 kg per 1 sq.m. This avoids excessive load on the walls of buildings and eliminates their destruction.

2. A study of the sources, as well as personal observations of the authors this article showed that for the successful formation of the composition in the Vertical Garden System designs, it is necessary to perform a rigorous selection of plant material:

- Use mainly local plants and in rare cases - acclimatized plants;
- Use long-lived plants - annuals are not recommended.
- Plants should be selected based on the characteristics of coexistence. So, sun-loving plants are placed above the shade-tolerant. It is necessary to take into account the aggressiveness of the plant in relation to other botanical species.
- Plants without a central stem (bush forms) are preferred, which, due to the close relative position in the composition, are independent of gravity.



Figure 1. Patrick Blanc Vertical Garden “Halles Avignon”, Provence, French Riviera, 2005. Available from: <https://www.verticalgardenpatrickblanc.com/node/1307> [Accessed 9th august 2019].



Figure 2. Patrick Blanc Vertical Garden “Caixa Forum”, Architects: Herzog & de Meuron, Madrid, 2007. Available from: <https://www.verticalgardenpatrickblanc.com/node/1414> [Accessed 9th august 2019].

1. Plants create a stable composition, which is formed on the basis of their colorful and decorative properties. Patrick Blanc compares some of the results of his work with graffiti. The decor chosen by the designer either complements the architectural style, or is in conflict with it (see Figures 1-2).

Thus, the concept of Patrick Blanc testifies to a qualitatively new attitude to the artistic features of the vertical surface, which is decorated with flora.

The understanding of the term "vertical gardening" remains traditional and indicates the placement of living plants on the vertical surfaces. The term "vertical gardens" is used as an indicator of the figurative and artistic content of the composition, which is created using flora.

Modern interior designers are transferring the Patrick Blanc method from landscape and urban space to interior. A panel of living plants (the simplest types are from a living or stabilized sphagnum), phytowalls, or living walls, or screens for zoning and decorating the space are used.

Thus, there are many types of vertical landscaping. Most of them are applicable, or already to some extent used in urban spaces and interiors of Vladivostok.

Problems

Let's consider a series of examples showing the specifics and problems that arise when creating vertical landscaping in the Vladivostok.

The Vladivostok city has specific features of relief and climate. The city is built on a complex, mountainous terrain, it's located in a climatic zone with a monsoon climate and has very low temperatures in the winter. Patrick Blanc, whose recommendations designers use, notes that the coldest cities in which he carried out his projects were New York, Seoul and Berlin. Vladivostok has a more severe climate. Therefore, the methods proposed by Patrick Blanc form require adaptation.

At present, the creation of voluminous long-lived facade compositions in the Vladivostok to using the existing methods is not possible, since the composition's lifetime is limited by the onset of the cold season or interrupted by a strong typhoon. The vertical garden system and planting material are expensive and do not allow them to be constantly restored due to weather conditions that destroyed the vertical garden.

Another problem is the choice by customers and designers for any types of landscaping of imported non-climatized planting materials, which is cheaper than plants from the natural flora of the Primorsky Territory. The use of imported, non-climatized planting material shortens the life of compositions and often profane many promising for the development of the concept of landscaping in the Vladivostok. Native plants are accustomed to changes in humidity and temperature and survive in the local climate. However, they are not used in famous projects already done earlier, for example, Patrick Blanc. Using native plants require the designer to make independent decisions in terms of selection plants, care, landing, etc.

Next problem is the lack of attention to promising projects and concepts of landscaping of the Vladivostok from the side of government structures that formulate policies in the field of improvement.

Perspectives

Despite the fact, that the use of vertical gardening in the external environment causes obvious difficulties, we will consider some promising solutions in this area. The Vladivostok is a city with a developed historical part. In the historical center of the city, new buildings according to the point principle are being built.

As a result, recreational areas, squares and parks are destroyed, which negatively affects the ecology of the city. We believe that the development in the city of various forms of vertical gardening, which does not occupy a significant area, can become a compensation for urbanization of the environment, can significantly improve the ecology and appearance of urban facilities.

At the same time, Primorsky Territory has a unique originality of botanical species that allow introducing endemic, natural flora to urban objects. For example, there are developments by O. V. Khrapko, A. V., Kop'yeva, O. G. Ivanova [25]. In the Vladivostok there is the regulation for vertical and roof gardening. It is established that the possibility of vertical gardening in these climatic conditions is limited to three floors. In addition, there are prerequisite "these buildings and structures have facades or wide (at least 5 m wide) planes of external walls without openings" [26].

Currently, for the implementation of projects for vertical gardens in the city of Vladivostok, it is necessary to conduct research studies and practical experiments in several directions. Among them:

1. Study and selection of plants for future vertical gardens that are resistant to excessive insolation and salinization, to strong gusty winds and sudden changes in temperature. A study of promising introducers such as mosses and ferns is required.

It is necessary to carry out projects of partial landscaping of facades based on a vertical garden system with monitoring of the condition and reception of the object by residents and tourists. Search for opportunities to improve the vertical garden system, including in the direction of heating the system, that aimed at nourishing and maintaining the temperature necessary for plant life in the cold season. The search for the possibilities of forming compositions based on removable modules that are cleaned in the cold season is relevant. In particular, writes about this G.A. Adamchik [20].

2. In the climatic conditions of the city of the Vladivostok, research and experiment on the inclusion of already tested and new forms in the visual image of the city becomes relevant. For example, the creation of large topiary figures, flower sculptures, that decorated with annuals. These structures can be installed permanently and covered with shields or decorative covers for the cold period. Such objects have repeatedly appeared in the city of Vladivostok and in other cities of the Primorsky Territory (Figures 3-4). However, there is no systematic work in this direction.

One of the stages for developing low-cost technology of vertical gardening in the Vladivostok can be simple figures (balls, cubes, pyramids) from annuals. It is recommended to use begonias, viola, coleus for these purposes. These plants are saturated in light and are well adapted to the climate.



Figures 5-6. Lianas on the main building facade of the Botanical Garden-Institute of the Far Eastern Branch of the Russian Academy of Sciences (Vladivostok) Available from: <https://www.maam.ru/detskijasad/botanicheskii-sad-vo-vladivostoke-oktjabr-2015-g-fotoyekskursija.html> [Accessed 9th august 2019].

1. Partial design of building facades and retaining walls by native vines seems promising. We can see lianas on the main building facade of the Botanical Garden-Institute of the Far Eastern Branch of the Russian Academy of Sciences (Vladivostok) (Figures 5-6).

2. It also looks perspective to decorate the retaining walls of the city with annual and perennial plants for inclusion its in the architectural ensemble of the city and enrichment of the environment.

3. A positive role in stimulating the scientific search and creation of urban and interior vertical gardening projects is played by the training of this type of design in higher educational institutions of the Primorsky Territory (Far Eastern Federal University, Vladivostok State University of Economics and Service) within "Design", "Design of the Architectural Environment", "Landscape architecture" training directions.

4. It seems promising to use elements of vertical gardening in the interiors of public and residential premises. In the city of Vladivostok, the representatives of the Russian manufacturer of rare watering modules for vertical gardening have been working for several years. For example, the company "Vertical healing gardens"; modules for eco-walls from Alivotec are also available.

5. This makes it possible to develop vertical gardens as direction. For example, let's see project "BIBILOK" company (BB Lock), that is dealer of the company "Vertical healing gardens" (Figure 7). Note that, planting material in the Vladivostok is significantly more expensive than in other regions. Perhaps the high price determines the low prevalence living plants walls in both private and public spaces of the city.

At the same time, there are few objects in the city based on federal funding. For example, part of the exposition "Tropical Rain Forest" in the Primorsky Oceanarium (Figure 8). This is one of the most striking and large-scale examples of vertical gardening in the Vladivostok at the moment. We can see the stylistic homogeneity and compositional integrity of this design.



Figure 7. The project "BIBILOK" company (BB Lock). Available from: <http://vin-st.com/> [Accessed 9th august 2019].



Figure 8. "Tropical Rain Forest" in the Primorsky Oceanarium. Available from: <http://primocean.ru/news/anons.html> [Accessed 9th august 2019].

3. Conclusion

Thus, the new approaches to vertical gardening in the world are aimed at increasing attention to the aesthetic function of such projects. The vertical composition should have expressive and artistic qualities, it should play a special role in the architectural ensemble.

In this aspect, the city of Vladivostok has considerable prospects. It has a distinctive style and is located in a region in which unique endemic plants grow. This allows you to search for new forms and practical implementations for adapted to local climatic conditions. The improvement of Vladivostok should be enriched with various objects of vertical gardening, that use different types, shapes and decorative properties of plants. For this, comprehensive studies of biologists, theoretical designers and practical designers are needed. It's will be aimed at developing a general concept of landscaping in the Vladivostok.

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