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Plants as a Special Material of Landscape Architecture

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Abstract. The features of creating a favorable urban environment using plant material are considered. The object of the study is open green spaces characteristic of Vladivostok's landscape. Most of them require reconstruction and formation of new solutions for landscape organization of territories. The task of this publication is to show the possibilities of using plants to create a special image of the city and comfortable living conditions for its residents by the example of using plant material in the landscape design of Vladivostok's. The study is based on the analysis of literature sources on the state of green spaces and plant assortments promising for use in landscape plantings in Vladivostok, as well as on projects carried out by students and teachers of Vladivostok State University and Far Eastern Federal University. A wide range of using a variety of plant material in the formation of green spaces is defined, which gives the opportunity to bring dynamics to the landscape architecture of the city, to create an favorable urban environment. Examples of recommended plants for the formation of landscape plantings are given, taking into account their decorative, soil-protective qualities and ability to create favorable external conditions.

Keywords: urban environment, green spaces, plants.

1 INTRODUCTION

When human beings create settlements and especially cities, a special environment is formed within them, which differs significantly from the natural environment. It is characterized by a significant change in the main environmental factors: deterioration of urban soils, air pollution, surface and groundwater, the formation of special climatic conditions, which leads to significant transformation of the environment [1]. The increasing pace of urban development, reconstruction of old and creation of new settlements increasingly acute issues of creating a favorable for their inhabitants of the external environment, improving its quality. It was noted that the quality of life is largely determined by the state of the living environment and significantly depends on the objective living conditions of people. Today in the Russian Federation ecologization of living environment is one of the most important tasks of the modern stage of urban planning and architecture development [2]. Ecologization of urban space, as one of the goals of the implementation of the concept of sustainable development, is becoming more and more relevant and demanded trend of urban development. It involves the creation of a safe and comfortable ecological environment for human habitation, improving the quality of environmental conditions of human life [3].

Landscape architecture plays a significant role in solving this problem, and a variety of methods and materials are available in its arsenal. One of the materials - plants, which due to its peculiarities is specific. Plant material, unlike inert artificial and natural materials, is dynamic, changing throughout the seasons of the year and plant life. As numerous studies have shown, plants improve the microclimate [4, 5], have a significant impact on the aesthetics of the city. Their use makes it possible to create a unique urban landscape, to break the monotony of streets and

buildings, to create visual accents. The use of plant material makes it possible to bring elements of natural landscape into the urban environment. Green spaces are an important factor in improving human health and well-being, smooth and reduce the tension and conflict of the urbanized environment [6]. Significant green space has been shown to be strongly associated with improved human mental well-being [7].

Plant material is specific and a special approach to its use is required. A number of factors of the urban environment distinguishes it from the natural and has a negative impact on the plants used for planting. In this regard, when using plants in the landscape architecture of the city to maximize the decorative and health-improving effect and save material costs, it is necessary to take into account their properties and features, rationally select the assortment.

There are a number of examples of the use of plant material in the urban environment in the literature. These are the creation of parks and public gardens [8, 9], which have a significant impact on the creation of a favorable environment in the city. Much attention is paid to increasing green areas by placing green plantings on roofs of houses and underground structures that can significantly improve the ecology of the environment [10, 11]. Planting trees and shrubs along highways not only reduces the negative impact of emissions from motor vehicles, but also makes pedestrian movement along highways safer. The above examples demonstrate only a few aspects of the use of plant material in urban spaces. In addition, the use of plants characteristic of a given area gives settlements their originality, brings them closer to the surrounding natural landscape [12].

The task of this publication is to show the possibilities of using plants to create a special image of the city and comfortable living conditions for its residents by the example of using plant material in the landscape design in Vladivostok.

2 MATERIALS AND METHODS

Since 2010, the Department of Design and Technology of Vladivostok State University (VVSU) and the Department of Architecture and Urban Planning of the Far Eastern Federal University (FEFU) have been developing project proposals for landscaping and reconstruction of landscaped areas of the city of Vladivostok with the selection of plant assortments and taking into account the main approaches to the formation of the urban environment [13, 14]. When creating projects, it is taken into account that the concept of forming the green spaces of the city should take into account two sides - functional and aesthetic. Plants placed on green areas of general, limited and special purpose should, firstly, be functional, i.e. perform noise-, wind- and soil-protective functions, weakening unfavorable natural and city-forming factors. Secondly, they should be aesthetically attractive, creating a look characteristic of the south of Primorsky Krai. The authors analyzed literature sources on the state of green spaces in Vladivostok and assortments of plants promising for use in landscape plantings [14, 15].

To exemplify the use of plant material in the landscape architecture of the city, areas of great importance in the structure of the city and reflecting its specificity were selected: street, parks and squares, embankments, slope areas.

3 RESULTS

State of urban flora. The city of Vladivostok is located in the zone with monsoon climate, which is formed under the influence of two main factors: the immediate proximity of the ocean and mountainous type of relief. This imposes its own requirements on the selection of assortment and placement of green plantings.

According to research [14], Vladivostok's urban plantations have 58 species of tree. In the plantations of the city there are rare for the Far East species of woody plants: ussuri pear, manchurian apricot et al. The largest landscaping assortment (53 species) was found in intra-block plantings. To a lesser extent it is represented in street landscaping - 49, squares - 47 species. A small number of species (41) form the most significant urban landscaping objects - parks. Tree stands in all types of plantations are usually characterized by low species diversity. This is especially characteristic of courtyard and especially street plantings, which are formed most often by 1-2 and much less often by 3-5 species.

According to scientists-practitioners, the weak points of landscaping in Vladivostok are the monotony of mass assortment, lack of special landscape solutions for landscaping of entrance capes, coastal cliffs, highways; lack of a powerful system of functional plantings that protect the environment and optimize microclimate; lack of interesting compositional solutions of landscaping; insignificant participation of conifers in landscaping. Taking this into account, the design landscape solution of Vladivostok's main green spaces was proposed.

Street landscaping. In order to isolate sidewalks from excessive sun, dust and exhaust gases, broad-leaved trees with free crown development, resistant to gas pollution, are planted. In Vladivostok conditions these are maples, Manchurian apricot, Manchurian ash. In the gaps between trees to increase decorativeness and reduce the monotony of plantings plant beautifully flowering shrubs (philadelphus, spirea et al.).

On city streets, where it is impossible to plant plants in open ground, container planting is included in landscaping projects. In addition, in the conditions of Vladivostok, the use of vertical gardening is promising for landscaping retaining walls. This technique has also proven itself positively on the southern facades of a number of buildings.

Many green plantings along the roadways of Vladivostok streets require reconstruction after the “ice storm”, which damaged up to 30% of the vegetation in 2022. An example of the reconstruction of a pedestrian zone along one of the streets is shown in Fig. 1. This project uses a combination of a lawn, group plantings of trees and shrubs with the creation of retaining walls.

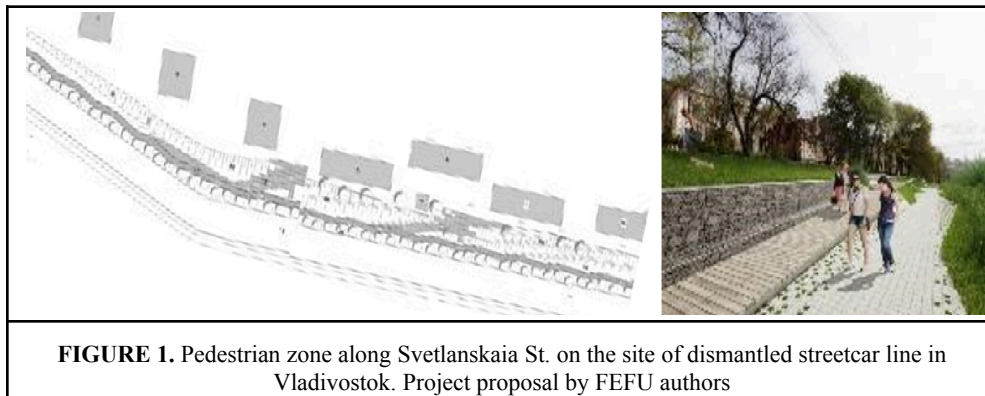
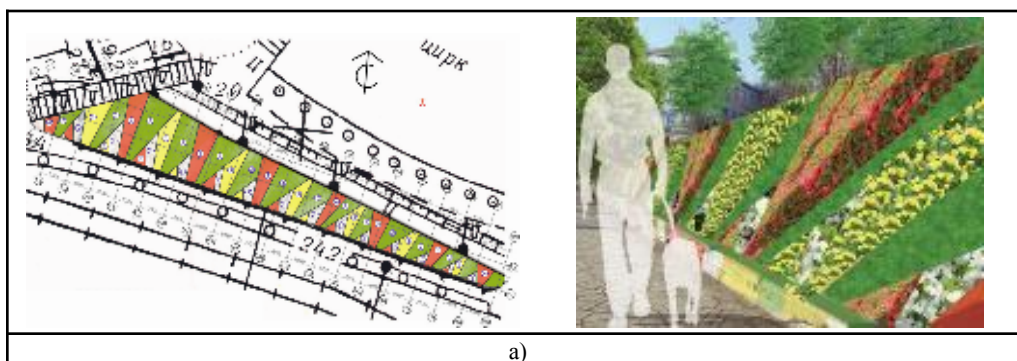
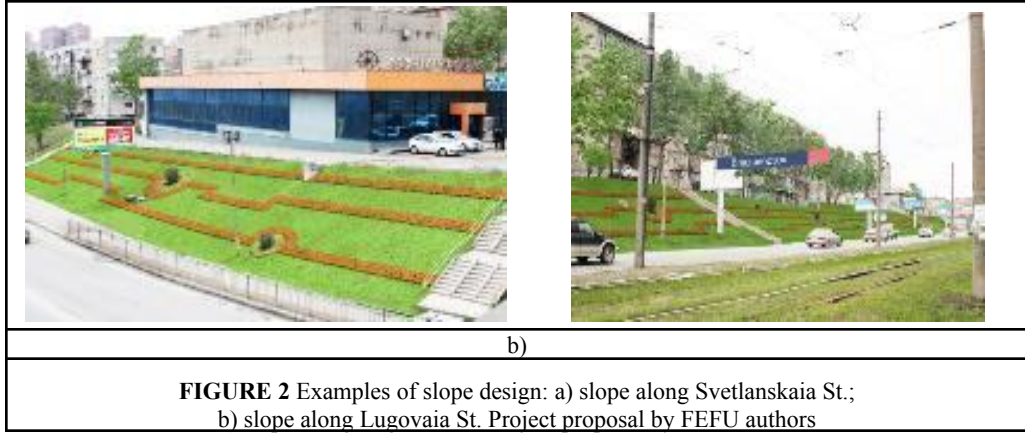


FIGURE 1. Pedestrian zone along Svetlanskaia St. on the site of dismantled streetcar line in Vladivostok. Project proposal by FEFU authors

Formation of slopes and slope areas. The whole territory of Vladivostok is characterized by a complex relief with a variety of stony placers and rocks. Ornamental plants of natural flora, adapted to life in such conditions, can serve as a basis for creating decorative groups on slope areas. When designing landscape design of sloping areas, it is suggested to create lawns, rocky slides and gardens with the use of plants adapted to special conditions, capable of fixing the soil, preventing the formation of erosion. First of all, these are species of Far Eastern flora - junipers, shrubby et al. Ornamental tree (ussuri pear, sakhalin cherry) and shrub (weigela, rhododendron et al.) species are included in the compositions as slope stabilizing species.

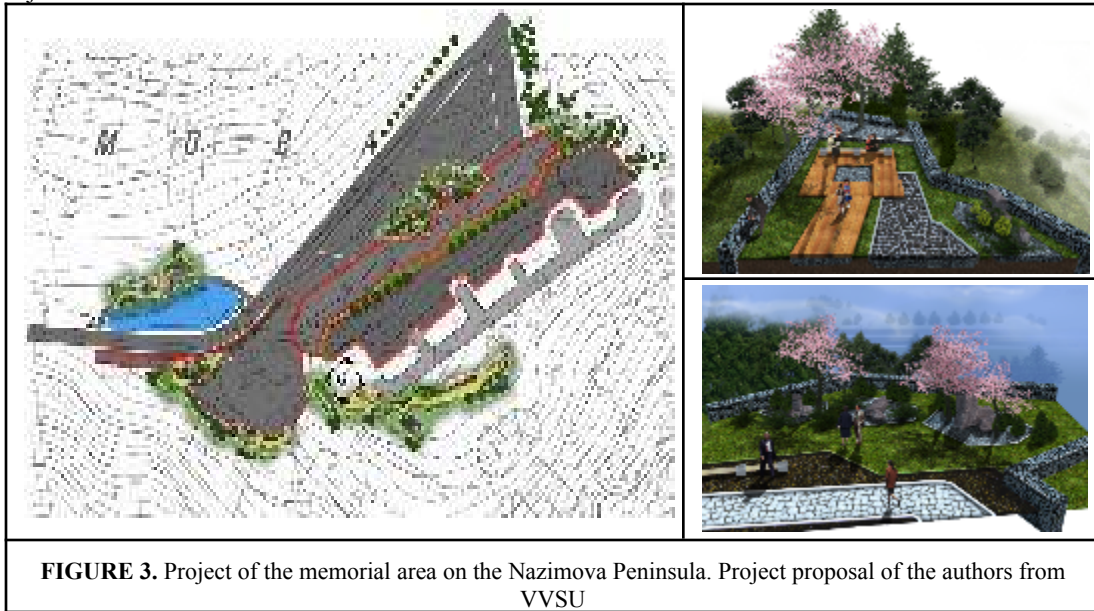
In conditions of complex relief, heavy rainfall and strong winds in Vladivostok to obtain a strong anti-erosion and beautiful lawn cover of slopes forming terraces in urban development, it is necessary to apply only one type of cereal perennial grasses with the inclusion of soilprotective shrubs in the form of groups and row plantings, flower beds and rocky slides. It is recommended to include beautifully flowering unpretentious annuals in compositions and floral design of slopes (Fig. 2).



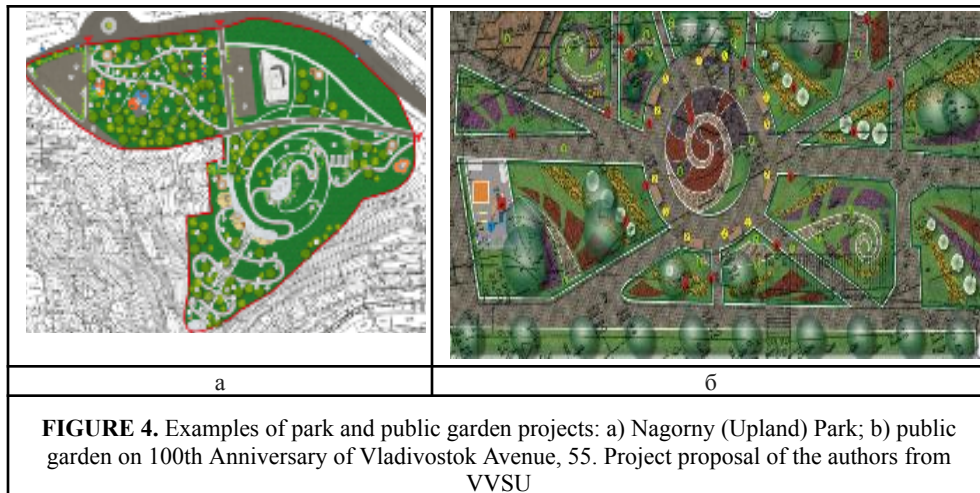


One of the peculiarities of Vladivostok is the presence of embankments both along the river banks and along the sea. When designing embankments along the rivers flowing through Vladivostok's territory, the task of their reconstruction was set to create green walking areas along them [16, 17]. The landscape groups included willows, riverine maple, as well as hairy alder and common bird cherry as shore-strengthening species.

A special microclimate is formed on sea coasts, which should be taken into account when using plant material on sea embankments [18]. It is proposed to include wind-resistant tree species (manchurian apricot, maackia et al.) in the assortments for seafront landscaping. Emotional impact of plantings on people is significantly enhanced by the inclusion of beautifully flowering trees (sakhalin cherry, manchurian apricot) and shrubs (rhododendron, rugose rose) in landscape compositions (Fig. 3). Far eastern lianas used as ground cover plants, anchor steep precipitous slopes adjacent to embankments.



Parks and public gardens, which are the main recreational areas of the city, are of special importance in the structure of the city; therefore, they are subject to special requirements. They should be accessible to all categories of residents, have high aesthetic qualities and create a favorable comfortable environment for recreation. Most of Vladivostok's public gardens and parks require reconstruction as they do not meet modern requirements. When creating projects for the reconstruction of Vladivostok's parks and squares, the assortment of plants characterized by both decorative and health-improving properties (linden, larch) was included in the first place. The aesthetic appeal of urban landscaping is enhanced by the use of floral design [19, 20]. In this regard, the projects used perennial and annual plants that bloom at different times (Fig. 4).



4 DISCUSSION

The theoretical basis for this study was the research reflecting the importance of plants in creating a favorable urban environment by the landscape design techniques. In Vladivostok, some experience in solving such problems has already been accumulated, but the authors touched upon only some issues of landscaping public spaces and territories of limited use [21], areas of high-rise residential development on steep slopes in Vladivostok [22], etc. When creating projects of landscape organization of Vladivostok's green areas, teachers and students of VVSU and FEPU comprehensively approach the tasks. The development of green areas projects required taking into account the purpose of each territory, taking into account the peculiarities of the relief. In this regard, zoning techniques were selected, types of landscape compositions were determined, and plant assortments were chosen. In the projects of pedestrian zones along the highways, linear plantings of tree and shrub species resistant to pollution and able to retain dust and harmful substances are presented. To overcome the monotony of compositions of such linear row plantings, it was proposed to include beautifully flowering shrubs and perennials.

A special approach was required when designing the landscaping of slopes and embankments. Decorative effect and the ability of vegetation to fix slope areas, preventing soil washing away, were the main requirements taken into account in the projects of these territories. For slopes it was proposed to use lawns of grasses with a developed root system, creating on their background compositions of annuals and perennials with decorative foliage and bright flowers. Plants resistant to sea winds were selected and compositions of them were proposed for embankments. Landscape organization of such territories included decorative tree and shrub groups, arrangement of various flower beds, border plantings of shrubs for functional division of the territory.

The most complex compositional solutions were proposed in the projects for parks. The projects propose to divide the main functional zones - walking zone, quiet recreation zone, amusement zone, etc. - by linear plantings of trees and shrubs. Various floral groupings (flowerbeds, rambleries, flower panel) are used in the promenade zone in order to enhance the decorative nature of the landscape. Nuanced compositions (tree and shrub plants with decorative foliage and original crown shape) are used in the zone of quiet rest.

5 CONCLUSION

Examples of Vladivostok's green spaces projects demonstrate the diverse use of plant material, which brings dynamics to the city's landscape architecture and creates a favorable, harmonious urban environment. Plants make the appearance of the city more attractive, solve the problems of functional division of the territory, give the landscape of the city a special character. Inclusion of natural flora plants adapted to the local climate in plant assortments makes greening more sustainable and brings the features of the surrounding natural landscape into the urban environment.

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