Features of urban greening for people with visual impairment in Vladivostok

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Abstract. The creation of an urban environment designed taking into account the needs of people with disabilities is currently one of the priority areas of state, social and urban planning policy, the practical results of which are aimed at ensuring equal opportunities with other citizens in various fields of work, life, and leisure. The objective is to identify the features of greening for blind and visually impaired people in the conditions of the city of Vladivostok. To achieve the goal, it is necessary to solve the following problems: to determine the assortment of ornamental plants and to identify compositional techniques of landscape design that ensure the possible use of non-visual receptors (auditory, olfactory, tactile, etc.) by blind people, and also, enhance the impact on the visual perception of the visually impaired when they orient in the environment. As a result of the study, the assortments of ornamental plants and compositional methods of greening for the conditions of the city of Vladivostok were identified, which facilitate the orientation of blind and visually impaired people in an urban environment and allow the formation of an accessible environment for people with visual impairments.

1. Introduction

At present, the importance of an environment accessible to various segments of the population, including people with different needs and opportunities, is growing. In this regard, issues of the formation of public urban spaces using the principles of universal design are becoming relevant. Most often, such approaches are considered from the perspective of architecture, however, greening also plays an important role in the formation of a favorable environment.

In Russian regulatory documents, the term “low-mobility groups of people” (close to English term “people with disabilities (PWD)”) is used — people who have difficulty in independently moving, getting a service, necessary information, or orienting in the environment (Set of Rules 59.13330.2016 Accessibility of buildings and structures for people with disabilities. The updated version of Building Norms and Rules 35-01-2001. Available online: https://tiflcentre.ru/download/SP59-2016.pdf, paragraph 3.21). This definition covers all people, including those with the motor, sensory and mental disorders, as well as people of different ages, height, weight, with structural features of the body, etc. (Lazovskaya N. [1]). Most often, the literature highlights the features of creating a universal
(accessible) environment for the category of people with mobility impairments, and much less often - for people with sensory impairments - with visual and hearing impairments.

The purpose of the study is to identify the features of greening for blind and visually impaired people using the example of Vladivostok. To achieve this goal, it is necessary to solve the following problems: to determine the assortment of ornamental plants and to identify compositional techniques of landscape design that ensure the possible use of non-visual receptors (auditory, olfactory, tactile, etc.) by blind people, and also enhance the impact on the visual perception of the visually impaired when they orient in the environment of Vladivostok.

The authors have collected, summarized and analyzed information from literary and online sources. The main information on theoretical developments was obtained from domestic and foreign scientific journals, including those presented on the electronic library portal and the ScienceDirect multidisciplinary platform from Elsevier. A review of information sources revealed the state of scientific development of the problem. In this work, the authors relied on studies that examined the issues: the impact of urban public greening on quality of life, health, social interaction and inclusion (Lindemann-Matthies P. and H Briege H. [2,3], Ward Thompson C. [4,5]); shaping the environment of urban public spaces based on the principles of universal design (Lazovskaya N. [1], Leontyeva E. [5], Kopeva A., Ivanova O. and Zaitseva T. [6]); creating an accessible environment for people with disabilities by landscape design of public urban spaces (Sholukh N. and Nadi’arna A. (eds) [7], Ivanova O. and Kopeva A. (eds) [8], Kopeva A., Ivanova O. and Malyschenko T. (eds) [9], Kopeva A., Ivanova O. and Maslovskaya O. (eds) [10]).

At the stage of posing the problem and determining its relationship with important scientific and social tasks related to the formation of public urban spaces for visually impaired groups of the population, an analysis of studies was conducted on the impact of the availability of urban green public spaces on sustainable planning and the well-being of various population groups (Norgate SH [11], Gupta K. and Roy A. [12], Fan P. and Xu L. [13], De la Barrera F. and Reyes-Paecke S. [14], Kabisch N. and Strohbach M. [15], Wüstemann H. and Kalisch D. [16]); the formation of sensory gardens and other recreational spaces for the visually impaired (Ivanova O., Kopeva A. and Khrapko O. [17], Kopeva A., Khrapko O. and Ivanova O. [18], Dovganyuk A. [19], Hussein H. [20], Panova N. [21], Maidanov A. [22]).

A review of contemporary literary sources showed that an integrated approach of creating an accessible environment for visually impaired people is used in some countries of the world (Hitter T. and Cantor M. (eds) [23]). Other researchers (Perry MA and Devan H. (eds) [24]; Hassan S. and Soltani K. (eds) (et al. [25]) note insufficient attention to this issue in their countries. Many studies show that living in green areas and caring for plants helps people with limited mobility, including the blind and visually impaired, develop various skills, regulate emotions and maintain self-confidence (Ruiz-Gallardo J. and Verde A. (eds) [26]; Skinner EA and Chi U. [27]; Passy R. [28]).

In order to determine the assortment of ornamental plants and to identify compositional techniques of landscape design that ensure the possible use of non-visual receptors (auditory, olfactory, tactile, etc.) by blind people, and also, enhance the impact on the visual perception of the visually impaired when they orient in the environment, a preliminary analysis was made for the assortment of ornamental plants and the results of the introduction of ornamental plants of the natural flora of the south of Primorsky Krai, as well as the principles of landscape design for the territories with limited use (Khrapko O. and Baranov V (eds) [29], Khrapko O. and Kopeva A. (eds) [30], Khrapko O., Kopeva A. and Ivanova O. [31,32], Khrapko O. and Kalinkina V. (eds) [33], Khrapko O. and Prelovsky V. (eds) [34]).

2. Methods
At the stage of determining the degree of knowledge on the problem, a method of systematization of theoretical sources (domestic and foreign scientific publications, including journals presented on the E-library portal and Elsevier’s multidisciplinary ScienceDirect platform) was used.
The main approaches to landscaping the territories based on the needs of the visually impaired were preceded by the study of ornamental plants in the collections of the Botanical Garden-Institute of the Far Eastern Branch of the Russian Academy of Sciences (Unique scientific setting (collection of living plants of the open ground). At the stage of collecting and studying the initial data, such methods as observation, photo-fixing, description of the functional and aesthetic characteristics of plants were used.

3. Results
As a result of the study, assortments of ornamental plants and compositional techniques of landscape design that ensure the possible use of non-visual receptors (auditory, olfactory, tactile, etc.) by blind people, as well as enhancing the impact on visual perception of visually impaired people were determined for the conditions of the city of Vladivostok.

4. Discussion
Of all the categories of people with disabilities, people with sensory disabilities — those with visual and hearing impairments — are closest to “standard” indicators by their anthropometric data. Creating an accessible environment for this category of PWD does not require making such significant changes in the main landscape elements, such as for people with a violation of the musculoskeletal system. Nevertheless, when developing compositional techniques of landscape design for the environment accessible for people with visual impairments, many features should be taken into account. Since visual impairments lead to significant disturbances in the perception of the world, the urban environment should maximize compensate for visual deprivation by the interaction of auditory, tactile, olfactory and other sensations, creating opportunities for the effective use of nonvisual receptors.

Disabled people with visual impairments belong to two types: blind and visually impaired. For blind people, tactile information is especially important, visually impaired people can navigate in space both with the help of tactile sensations and with the help of color and light contrasts (Leontyeva E. [5]). That is, an important aspect of the organization of landscape objects for people with visual impairments is the translation of visual images into images and a form that is accessible for tactile and/or sound perception (Dovganyuk A. [19]). It is noted in the literature (Sholukh N. and Nad’iarna A. (eds) [7]) that measures to facilitate the spatial orientation of the blind can be based on more active use of their unique compensatory abilities involving some effective natural landmarks from among certain breeds trees and other ornamental plants that are used in urban greening.

The use of plant material in the landscape design of an accessible environment should be based on the general principles of using plant material: taking into account the biological and environmental characteristics of plants, their decorative qualities, climatic and microclimatic conditions of sites for plant placement. Additionally, one should take into account the qualities of plants, which are of particular importance in creating a comfortable environment for people with visual impairments: the texture of branches, trunks, and leaves, the smell of plants, the color of the foliage and the color of flowers, etc. The use of planting types also has limitations. While the plant assortments used can be diverse, it is necessary to place decorative plants in homogeneous groups, dividing the compositions according to their decorative properties, not to mix their aromas, etc.

The basis of any landscape planting is trees and shrubs. When creating an accessible environment for visually impaired and blind people, the main selection criteria of the species will be the texture of the trunk and branches, a pleasant smell, and also the shape of the crown and the color of the leaves.

Primorsky Krai is characterized by mixed coniferous-deciduous forests, the leading species of which are coniferous. A number of them can be used in landscape planting, giving them a peculiar natural flavor. Conifers are distinguished by a variety of forms and architectonics of crowns, the color of needles, and the texture of the bark. In addition, many conifers secrete volatile, inhibiting the growth of pathogenic bacteria. One of the most decorative Far Eastern breeds is Abies holophylla, it is characterized by a dense conical or oval-cone-shaped crown. Fir can be used for row plantings, creating groups, and as individual trees. It goes well with flat-leaved birch, maples, from shrubs - with
Rhododendron, Philadelphus, Weigela. However, it should be remembered that in urban conditions, evergreen conifers often suffer from pollution, Dahurian larch (Larix gmelinii), the needle-like leaves of which change every year, can be used more widely. It is most suitable for creating compositional groups, it is especially good in autumn with bright yellow needle-like leaves. The brightly colored maple crowns will beautifully stand out against its background.

Of the variety of perspectives for creating green plantings from deciduous trees, when forming a favorable environment for the blind and visually impaired people with disabilities, beautifully flowering, with a characteristic color of foliage, with flowers with a pleasant smell, should be used. It can be Betula platyphylla, soft green foliage and a white-painted trunk of which will create a contrast against the dark crown of conifers. Brightly colored berries of the Sorbus amurensis (Sorbus aucuparia or Mountain-ash) help to complement the colorfulness of this composition and create a color accent.

Disabled people with visual impairments will get a variety of tactile sensations when they get acquainted with the characteristic bark of Phellodendron amurense (Amur cork tree), and from conifers - Abies holophylla and Pinus koraiensis (Korean pine).

Planting plants with a pronounced smell will help the blind and visually impaired people to navigate the space. So, groups of blooming Syringa vulgaris and Tilia amurensis will designate a specific area, however, it must be remembered that this sign will “work” only during the flowering of these plants.

The planting of shrubs will allow us to indicate the direction of movement and to highlight any territory. A hedge of flowering shrubs (Syringa amurensis, Forsythia, etc.) will mark the path, and the shrubs planted in a group with brightly colored foliage (Berberises, Spiraeas) will create an emphasis on the turn of the path.

One of the main factors affecting the orientation of the visually impaired in space is color; for them, brightness and color contrast are very important (Panova N. [21]). As a contrasting color, visually impaired people prefer bright yellow, bright orange and bright red, because they see this gamut of colors best. Yellow is the last color that people with minimal residual vision can see (Leontyeva E. [5]). Yellow color causes a feeling of light, the sun. As accents on a uniform green background of lawns, various compositions of annuals with yellow and orange-colored flowers (Eschscholzia, various species of Calendula and Tagetes) can be placed.

The red color is the brightest and most active color of the color gamut, plants with such a color of flowers can be used to create accents that attract attention. In the spring, you can create such an accent using bright red Tulips, in the summer - with Heucheras, Monards, in autumn the time comes for Salvia splendens. The pink color is softer; in summer, flower beds with the Astilbes, Phloxes, Paeonies against the background of the lawn will attract the attention. Expressive spots will be created by white flower beds; the Alyssum planted in such a flower bed will create not only white but also fragrant carpet.

When creating floral arrangements, it must be borne in mind that the colors of one gamut or alternating colors are viewed by visually impaired better than patterns and drawings. Therefore, choosing assortments for flower beds or flowers, preference should be given to plants with contrasting colors of flowers or foliage (Maidanov A. [22]). In one composition, plants with different leaf colors can be combined (Hostas with a white border of a leaf, yellow, bluish leaves, etc.).

In addition to color dominants, smells play a large role in perceiving the environment by people with visual impairments. There are many grassy ornamental plants for use in landscape planting, that possess not only decorative leaves, expressive flowers, but also their characteristic aroma. In the spring it will be Hyacinthuses and Narcissuses, which in the summer will be replaced by Tageteses and Petunias. The aromas of fragrant plants also have healing properties. So, the smell of Mentha (mint), for example, normalizes metabolic processes in humans.

5. Conclusions
A theoretical study allows us to conclude that when designing an accessible urban environment and, in particular, when choosing greening elements and compositional methods for combining them, it is
necessary to take into account not only the visual qualities of the plants but also their possible impact on hearing, smell, tactile and other sensations to ensure the orientation of the blind and visually impaired people in urban space. Our assessment revealed the assortment of ornamental plants and compositional methods of greening for the conditions of the city of Vladivostok, contributing to the orientation of blind and visually impaired people in urban space and allowing the formation of an accessible environment for people with visual impairments. The assumption is made that the use of the identified assortment of plants and compositional methods of combining them in urban landscape design practices can significantly improve the orientation of people with visual impairments in the city space and, thereby, significantly increase the degree of accessibility of the urban environment for blind and visually impaired peoples.

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