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Landscape Planning of Schoolyards

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Abstract. The optimal landscape architecture planning of schoolyards allows for creation of favorable conditions for children personal development and physical fitness. The key principles of schoolyard landscape planning, same as for other areas intended for children, are as follows: establishment of a favorable microclimate, safety, aesthetic and educational environment. Green spaces play an essential role in this respect as they are essential to sanitary, hygienic, structural, and spatial planning performing decorative, artistic, cognitive, and educational functions in these areas. Various types of landscape plantings are used in school areas: borders, lawns, beds, vines, ornamental arrangements, and various potted plants. Children's safety is the key principle when selecting a landscape design type and the plants' range. Any allergenic, poisonous, thorny, strong-smelling or life-threatening plants are excluded. Plants on school grounds can serve as visual aids for studies. Drought-resistant, attractive, colorful, abundantly blooming plants with variable leaf texture are preferred. Ornamental trees and shrubs as well as perennials and annuals provide a broad plant range for school grounds.

Keywords: schoolyard, landscape design, green spaces, planting, assortments of ornamental plants.

1. Introduction

The urban environment has been noticeably changing due to on-going urbanization processes. These changes necessitate development of new approaches to urban environment optimization and solution of tasks mitigating adverse effects on human health. When considering approaches to these tasks, the key focus is usually placed on areas intended for public recreation, as such areas are major green spaces in the city and play a leading role in creation of favorable environment. However, areas intended for restricted use, such as pre-school, daycare, and school yards and grounds near residential buildings are equally important. These areas generally reflect the diversity as well as contradictions characteristic to a larger-scale urban landscape. Landscape planning of school yards is of much importance. A beautifully arranged school yard brings up a feeling of beauty in children, raises their spirit, positively influences health of children and adults, contributes to aesthetic education of schoolchildren, and develops their taste and creative thinking. Environment encouraging harmonic development of children, stimulating their personal attitude to the surroundings may, in turn, become a



basis for welfare and prosperity of the city in the future. In this article, we address key planning principles for restricted-use areas, considering school yards as an example. These principles were earlier discussed by a number of authors (Khrapko, Kopeva et al. [1,2]). These principles may be applied to landscape architecture planning of any areas intended for children, such as grounds of pre-schools or children's parks. This issue needs attention, as it is during the childhood that a person's world view, aesthetic culture, and physical health are formed. Optimal landscape architecture planning of areas intended for children will ensure favorable conditions for their personal development and physical fitness. This study is based on research materials and documents on the integration of nature into urban design and planning [3,4]; the benefits of nature-based solutions for health and well-being [5-8]; the importance of landscape design in the formation of a stable habitat [9,10]; the solution of the problem of ecologization and humanization of the environment [11]; the experience of using green roofs and green walls [12-15].

2. Problem statement

Major tasks faced by planners of any urban area nowadays are conservation and rehabilitation of existing natural landscapes along with creation of new artificial landscapes. This is certainly true for school yards, though, since in most cases the majority of schoolyards have been in use for many years, the need for rehabilitation of already existing landscapes currently comes to the foreground. In case of new construction, the foremost task is conservation of previously existing landscapes and creation of new ones. The key principles underlying landscape planning of school yards should be safety along with the establishment of a favorable microclimate, aesthetic and educational environment.

2.1. Key functions of green plants in school yards

Landscape and functional planning of school yards can be performed using a wide spectrum of state-of-the-art materials and means, with green plants playing an important and special role, as their key functions are as follows (Golovan [16]).

- Sanitary and hygienic (protection against anthropogenic pollution, noise reduction, climate control, and beneficial effect of phytoncides);
- Structural and space-planning (creation of a spatial structure, segregation of functional zones);
- Ornamental and artistic (creation of compositional accents and background for buildings and site facilities, decoration of non-aesthetic facilities);
- Learning/educational function (natural landscape imitation and stylization aimed at learning of the surrounding flora and fauna and development in harmony with the environment).

2.1.1. Sanitary and hygienic function of green plants. The sanitary and hygienic function of green plants is closely connected with the safety principle – one of principles that should underline the landscape planning of school yards. Safety is understood as creation of an environment protecting children against adverse external factors, such as atmospheric dust, exhaust gases, and high noise level as well as against monotonous and featureless urban areas provoking aggressiveness. One of the purposes of such an environment should be establishing of a favorable microclimate, so that children can spend a significant portion of their free time in the open, playing outdoor games.

An important aspect in optimization of microclimatic conditions in school yards is diminishing the exposure to wind and direct sunlight. A barrier in the form of a hedge or free-standing groups of shrubs and low trees is helpful for reduction of wind speed on the windward side. Protection against sunlight at noon and during the afternoon hours can be provided by trees growing on the southern or southwestern side. Trellises will also contribute to creation of a favorable microclimate – canopies and pavilions on playgrounds will allow for quiet games and outdoor exercises even on hot days.

Conifer species with marked phytoncide properties (junipers, spruces, pines, etc.) can be included in schoolyard plantings to improve sanitary, hygienic, and microclimatic parameters – eliminating harmful microorganisms in the air, they will make the area healthier for children.

Some researchers suggest children's educational achievements depend on visual and microclimatic effects of tree planting. Thus, C. B. Hodson and H. A. Sander found a significant, positive relationship between tree cover and reading performance, suggesting that initiatives aimed at increasing tree cover in student environments could support academic success [17].

2.1.2. Structural and space-organizing function of green plants. The structural and space-organizing role of green plants allows for apportioning the school yard into several functional zones: the parterre area in front of the main entrance intended for various official ceremonies; the sports ground used for fitness exercises and sports; the playground for children of various ages intended for outdoor games and recreation; the biological area consisting of a park for a study of trees or ecological trail intended for a study of natural sciences. Shrub hedges can separate functional zones. Furthermore, hedges will help organize direction of traffic on the premises. Depending on their particular features, plants can be used within the functional zones. The parterre area may include flowerbeds of a regular type, with clearly marked boundaries and preferably elevated above the ground. No trees are desirable in this zone, shrubs may be planted along the perimeter or, if the area is sufficiently large, in small groups. Low shrubs with a shaped crown are preferable for this area. A lawn with a low grass cover may be arranged at the sports ground and can also be applied at the playing and outdoor game zones. The composition of plants in the biological zone should be sufficiently diverse to serve the educational purpose.

2.1.3. Ornamental and artistic function of plants. The ornamental and artistic function of plants is of much importance for schoolyard planning, as the use of ornamental plants in landscaping allows for creation of a unique, memorable appearance of each individual area and the territory as a whole. Using plants, one can beautify unattractively looking structures and provide a gradual visual transition from large-sized structures of a residential area to smaller elements more appealing to a child. This will diminish the visual dominance of inanimate nature and increase the level of children's psychological comfort.

Through selecting particular assortments and using various ornamental properties of plants (color, size, and structure of flowers and flower clusters; particular features of trunk and branch bark structure and color; color and structure of leaves, etc.), one can create colorful accents for every season. Evergreen conifer plants and some deciduous trees and shrubs with a special color or texture of trunk and branch bark can provide an accent in the winter. Early-blossoming plants and unfolding tree leaves will create ornamental effects in the spring. Bright colors will be created in the summer by flowerbeds consisting of perennial and annual ornamentals and impart a positive emotional attitude on children, attract and hold their attention. Bright-colored leaves of various tree species, ornamental tree and shrub fruits will decorate the school yard in the autumn.

Continued change of ornamental accents produced by plants belonging to the wild flora will gear children's attention toward diversity and beauty of the native plant species and stimulate their interest in plant studies and conservation. Landscape compositions of tree species will complement seasonal flowerbeds of ornamental perennials and annuals. They will create bright colors which will impart a positive emotional attitude on children, attract and hold their attention. Three-dimensional living sculptures in the form of animals, birds, or fairy tale characters capable of arising vivid images and associations in children can be used for adding more complex visual accents in an area.

A scenic approach can be used to highlight aesthetic aspects of schoolyard areas, as the key feature of the scenic style is creation of an image mimicking a natural landscape. The scenic approach is helpful whenever the goal is overcoming human detachment from the nature and relieving tension associated with a certain hostility of the urban environment. When creating green areas in the scenic style, preference should be given to plants belonging to the native flora (Khrapko, Kopeva, et al. [18, 19]), as their use allows for implementation of the educational principle and familiarization of schoolchildren with the local flora.

2.1.4. Learning and educational function of plants. The learning and educational functions of plants is most markedly expressed through establishment of dendraria, ecological trails, and excursion routes within the schoolyard territory, when plants varying in their environmental requirements, biological features, and ornamental properties are engaged. The diversity of plants used in schoolyards should contribute to raising proactive cognitive skills in children, help make the science classes more engaging, allow teaching by visual demonstration, and ultimately enhance children's knowledge about the natural diversity. Arrangements and ornamental accents composed of wild plants is of special importance, as it would familiarize children with the diversity and beauty of wild plants and stimulate their interest toward learning and conservation. Involvement of children in the organization of the green space and care for plants plays an important educational role, as it encourages children for exploration, resulting in their more detailed familiarization with specific features of plants and at the same time raising their environmental awareness. In a broader sense, the schoolyard, created on the principles of ecological design, as well as dialogistic and semantic fullness of educational space is capable to become the modern learning environment of the new century (Maslovskaya [20]).

2.2. Types of planting patterns and assortments of ornamental plants for schoolyard landscaping

When addressing schoolyard design tasks and choosing plants for that, consideration should be given to composition principles, need for harmonization of components both within landscaped areas and the surrounding landscape, be it an urban or natural one. Various planting patterns and assortments of ornamental plants can be used for schoolyard landscaping. In case of tree-like shrubs, their number in the schoolyard should be reasonable. Trees can be included as specimen plantings. The purpose of the planting pattern is to attract one's attention, make the scenery more engaging, while distracting from less interesting details. As a solitary tree or shrub often serves a centerpiece of a composition, its ornamental properties should be sufficiently high during a long period of time. A solitary tree looks attractive when surrounded by low shrubs, with their habit and leaf color emphasizing the texture and color of the trunk and crown of the central tree. Quite frequently, specimen trees or shrubs are placed in the foreground of an open space, in which case they are intended for a close examination and their characters, such as the shape and color of leaves, flowers and fruit, acquire much importance. Conifer species (spruce, pine, larch, etc.) as well as mountain ash, bird cherry, weeping varieties of willow, and others can be considered suitable for specimen plantings.

2.2.1. Linear (row) planting pattern. The linear tree planting pattern can be used as an independent landscaping element along pedestrian paths or schoolyard perimeter. The attractive feature of the linear pattern is formation of longitudinal profiles which, if properly selected, may make plants more expressive. Alleys can be planted in front of the main building. The ornamental quality of an alley will depend on the beauty of planted species, the alley's width and length, material used for the pathway or road paving. Naturally shaped beautiful live fencing can be obtained using flowering shrubs such as lilac, woodland jasmine, dog rose, spirea, honeysuckle, or hawthorn. Territories can also be divided by borders composed of low, densely branched small-leaved shrubs. A narrow strip of such ornamental shrubs can be planted along pathways, boundaries of individual areas and lawns, or else used as a flowerbed border.

2.2.2. Ornamental groups of trees. Ornamental groups of tree species constitute an important landscaping element. Such groups may either consist of just trees or include both trees and shrubs. Components of ornamental groups should be selected with respect to the effect produced by the group as a whole. A group may include a distinguished core consisting of one or several trees along with other plants arranged in sub-groups surrounding the core. Shrubs make such arrangements look more complete, through the complementing coloration of their leaves, branches, and flowers. They can be used for emphasizing ornamental effects or creation of continuously blossoming groups, or else to unite the trees into a single inseparable group. ornamental tree/shrub groups can be accommodated in vacant areas or against the background of lawns.

2.2.3. Lawns. An important part of any green space, a lawn can serve either an independent landscaping element or background for other plants. It serves a good filler between individual landscape elements and creates eye-pleasing green spots. As science has demonstrated, a dense green lawn has relaxing therapeutic properties. Furthermore, the lawn grass is a kind of an ecological filter, a barrier to organic pollutants capable of containing heavy metal salts. A lawn is a useful element of an outdoor green area employed for both recreation and outdoor classes.

2.2.4. Vertical greening systems. Use of vertical greening methods in schoolyard planning allows for an increased green foliage surface within a smaller area. Climbing plants playing a leading role in vertical greening are capable of quickly covering a vertical surface growing up to several meters in height, thus opening opportunities for decoration of the school building, a fence, or auxiliary structures, or disguising utility facilities. When planning use of plants for vertical greening, it should be kept in mind that some climbing plants attach to wall cracks and thus may inflict damage to walls. Additional supports in the form of trellises should be provided for such plants. Lattices can be decorated with nicely blossoming trailing honeysuckles or ampelopsis species. Large lianas with dense foliage (Amur grape, Dutchman's pipe vine, etc.) can be kept on a large column-like support, and a tree snag entwined with lianas will produce an unusual ornamental effect.

2.2.5. Container gardening. Containerized plants will allow for creation of bright color accents against the background of stone or asphalt paving or add attractiveness to small plots and other areas wherever rooted plants or flowerbeds are impracticable, whatever the reason might be. The container gardening method is universal as it opens up broad opportunities for spatial arrangement of elements, both in plane and vertically; for use of a wide assortment of plants and diversity of container shapes, materials, colors etc.; for mobility and opportunity to change the composition any time. Plants with large and bright flowers (petunias, violets, marigolds, chrysanthemums) are often used in container gardening. Ornamental foliage species (painted nettle, pelargonium, plectranthus, and oxalis) are as well suitable.

2.2.6. Flower garden. Floral decoration plays a critical role in creation of favorable ambient environment on the territory surrounding the school, flower gardens being the basis for landscape design. They may be used for harmonization of landscapes and for selection of material for flower arrangements, which will have a beneficial effect on students and their attitude. The basic principle to be followed when designing a flower garden is the concordance of the floral decoration with the general idea of the project. Just like other ornamental beddings, flower gardens may be styled as classical (regular) or landscape (informal). Regular flower gardens are distinguished by austere geometric shapes and patterns and symmetrical arrangement. Typical features include neatly defined borders and pattern, contrasting plant height and flower color. It is appropriate to create such flower gardens within the territory surrounding the school near sites for ceremonies or the main building.

2.3. Basic principles for selecting plants.

Types of landscape plantings and plant material should be selected with consideration of specific characteristics of the area, including climate parameters, as well as peculiarities of the school territory layout. yet the underlying principle of selection must always be the children's safety. This is the reason why any allergic species, as well as those with poisonous above-ground or underground organs, plants with thorns, strong odor, or any other irritating effects, or those that can threaten children's life and health in any way cannot be used (Golovan [16]). Moreover, it should be taken into account that in addition to sanitary and hygienic, structural and ornamental functions, plants within the school territory also perform an important educational and instructional function. Landscaped areas should help facilitate the curriculum, serve as a training aid, and enable the students to get themselves familiar with peculiarities of different plants. Plant lists should contain sustainable plants of variable appearance, color and texture of foliage, characterized by abundant flowering and brightly colored

flowers. The basis of plant lists is formed by perennials and annuals, to which ornamental trees and shrubs may also be added.

3. Conclusion

Summarizing everything said here above, the key principles of landscape design within school territories, similarly to any other territories intended for children, must be safety along with creation of aesthetically appealing, favorable environment and cognitive opportunities for children. An important role with this approach is assigned to landscaped areas, which perform sanitary and hygienic, structural, organizational, and aesthetic functions along with educational and instructional. Types of landscape beddings and lists of ornamental plants should be selected with due account for natural settings, climatic conditions, and peculiarities of school territory layout, although the key principle of selection must be the children's safety.

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