

Ways of Environmental Improvement of Urban Recreational Zones on the Example of the Uritsky Park

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Abstract

This paper deals with the problem of ecological improvement of urban recreational zones. This problem is currently also relevant in Kazan. Despite the significant number of city parks and squares in the city of Kazan, their condition had not been given sufficient attention. The situation radically changed in 2016 after the announcement in the Republic of Tatarstan of the year "Parks and squares". The result of this program was the creation of initiative groups for the development of concepts of public areas. According to the developed program, 27 out of 130 green zones in the territory of Kazan were subject to renovation and reconstruction. Among them was the Uritsky park. In 2016-2017 the landscaping project of the given territory was implemented. The final project for the reconstruction of the Uritsky Park was developed by the Kazan architectural bureau – Evolution. During the implementation of the project in this area, a number of mistakes were made that do not allow it to be classified as an ecological improvement. This paper presents a new elaborate version of the improvement. The proposed project envisages overcoming some of the negative consequences of the previously implemented project. The proposed project is based on the already implemented project solutions. This will avoid additional costs.

Keywords: Ecological improvement; Eco-rehabilitation; Urban recreational zones; Parks; Ecological framework; Urbanization; Small lakes.



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1. Introduction

It is generally accepted nowadays that the growth of urban areas is an indispensable attribute of the development of modern civilization. Obviously, the process of urbanization involves a radical transformation of the natural environment with a parallel increase in environmental pollution. The latter is most typical for cities located near industrial and manufacturing centers (Estrada, 2017).

An important feature of the ecological well-being of urban areas is the correct, scientifically-based organization and arrangement of park territories. The need for a well-elaborated arrangement of green areas in cities is difficult to overestimate. This directly affects the lives of citizens, their performance and psychological health.

Various studies suggest that the development of cities is directly associated with the destruction of natural sites, which adversely affects the habitat of plants and animals (Ishchenko and Mitchell, 2008).

In this regard, the presence of parks and squares is an objective necessity for the sustainable development of urban areas. The most important function performed by urban parks is optimizing the ecological condition of the city, providing better ecological comfort level (Aghamirloo *et al.*, 2015; Wolch *et al.*, 2014).

The city of Kazan is not an exception to the general rule. This territory is of particular interest due to its specific natural environment (Bagautdinova *et al.*, 2015).

The current policy of the improvement of the urban area is due, among other things, to the significant number of sports events of various scales carried out here. For this reason, the problem of ecological improvement of the territory of Kazan remains relevant (Bagautdinova *et al.*, 2015).

The solution of such problems is unthinkable without further development of the network of city parks. The main objective of this paper is to highlight the problem of environmentally literate improvement of urban green areas on the example of the Uritsky park in the city of Kazan.

2. Methods

The main object of work is the Uritsky city park, located on the territory of the Moskovsky district of Kazan. It is located in the Moskovsky district between Khassana Tufana, Akademika Koroleva, Vasilchenko and Gagarina streets. The park got its name because of Uritsky Palace of Culture located on its territory (Novikova and Iupina, 2012).

This research was carried out during the period of 2016-2018. The material was based on the data of field research conducted in 2016-2017, and the ecological certificates of the reservoir and park (Iupina and Anufrieva, 2014).

The authors of this paper carried out an assessment of satellite images of the park area at different time periods and analyzed information on the basis of the 2016-2017 landscaping projects. The authors constructed a preliminary design taking into account environmental requirements. For this, a number of computer programs were used. The tool for creating a preliminary design project was Corel Draw X7.

3. Results and Discussions

The investigated territory of the forest park is located in the Moskovsky district of Kazan and belongs to the area of low-lying accumulative urban landscapes, to the urban landscape area of the first and second terrace above the floodplain (Galialutdinova *et al.*, 2018).

In geochemical terms, these are supra-aquatic and accumulative landscapes. These are the usual landscapes of high flood plains and the first above-floodplain terraces.

The territory of the park is a site of a natural pine forest, within the city limits. Over time, this area has been strongly transformed. The species composition of the park trees is represented by 24 species. The dominant species are *Pinus sylvestris* and *Betula pendula*. Widely

distributed are *Tilia cordata*, *Acer negundo*, species of *Populus*. Rare representatives are *Ulmus laevis*, *Salix alba*, *Picea abies*, *Sorbus aucuparia*, *Quercus robur*. The main species composition of trees is the plants of the natural climatic zone of the middle belt of Russia. Exotic plants include: *Picea abies*, *Larix sibirica*, *Malus sp.*, *Padus virginiana*, *Padus racemosus*, *Fraxinus Pennsylvanica*.

The territory of the Uritsky park has 20 species of shrubs identified. The most common are *Physocarpus opulifolia* and *Acer negundo* shrubs. Woody-shrub vegetation is represented in the form of a woodland, alleys, landscape groups, hedges, and single trees.

As for the life condition of the plantations, 50% of them are moderately and severely weakened, and belong to the 4th class of the state of life. The life condition is influenced by both abiotic and anthropogenic factors.

The lake in the park is a natural closed oval pond, elongated in the sublatitudinal direction, measuring 150x95 m. When creating an artificial duct laid in the west, 190 m long and ending with a ring-shaped bend, the natural regime of the lake was disturbed.

The lake feed is mixed, the main one is incoming in the spring with a surface runoff during snow melting. In addition, the lake feeds water springs, boiling at the bottom of the lake, according to the results of geophysical studies (2004-2007). The flow of spring water partially compensates for active evaporation from the water surface in summer.

Artificial replenishment of lake water is carried out by supplying groundwater extracted from a well located in the western part of the canal. The shores of the lake are lined with concrete slabs. An artificial canal with concrete banks branches off from the lake in the western direction.

The fauna of the reservoir is rich and diverse; it is predominantly a set of synanthropic species. Among the insects there are numerous representatives of the order of beetles (Coleoptera), dragonflies (Odonata) and diptera

Diptera. Amphibians include the common newt *Lissotriton vulgaris*, the pond frog *Rana lessonae*, the common scabbard *Pelobates fuscus* and the green toad *Bufo viridis*. House sparrows *Passer domesticus*, blue pigeons *Columba livia*, usual representatives of crows (magpie *Pica pica*, gray crow *Corvus cornix*, jackdaw *Corvus monedula*) are found on the coast. There are also very few common nightingales *Luscinia luscinia* and white wagtails *Motacilla alba*. Mammals in the pond are represented by the muskrat *Ondatra zibethica* (1 family).

By origin, the lake, natural in the past, now is actually semi-artificially, the shores and part of the bottom are concreted to prevent water withdrawal. The Uritsky Park and the lake were reconstructed in 2004, continuing in 2016 - 2017...

In 2004, in the course of works on improvement, measures were taken to drain the lake, repair slabs, a bed, and collect garbage from the bottom of the lake. Clearing the bottom of the lake from debris was carried out manually using the shovels and rakes, without removing the silt, bottom, sediments and deepening of the bottom. The main reason for the loss of water for filtration is the high permeability of the soils that make up the bowl and slopes of the reservoirs. Anti-filtration measures were carried out in an artificial duct, consisted of embedding clay or clay-cement solution of the channel bed, with layered compaction of clay.

In 2016-2017 a complete reconstruction was carried out not only of the lake and the canal, but also of the entire forest park area.

In the course of the evaluation of the implemented improvement project, we identified the following shortcomings and violations from the point of view of the ecological design:

Insufficient screening of the park territory from the streets.

Drying of the planted tree and shrub vegetation in view of insufficient watering.

Poorly developed road and pathway network.

Concreted banks of the reservoir.

A large proportion of the trampling of green lawn areas.

Close arrangement of recreation areas to old trees (age 100 and over).

Presence of bare plots.

Strong smell of pavement covers and other elements.

The presence of asphalt covering under the trees, which leads to the inhibition of the root system and the slow growth of the tree.

A large number of trees with mechanical damage to trunks, bark, branches.

Unguarded heating main, insufficient number of passages over it along the entire length.

The proximity of the playground to the roadway.

Unfavorable territory behind the heating main, with a large number of wastelands and destroyed structures.

Insufficient coverage of the territory.

Lack of recreational zoning of the territory.

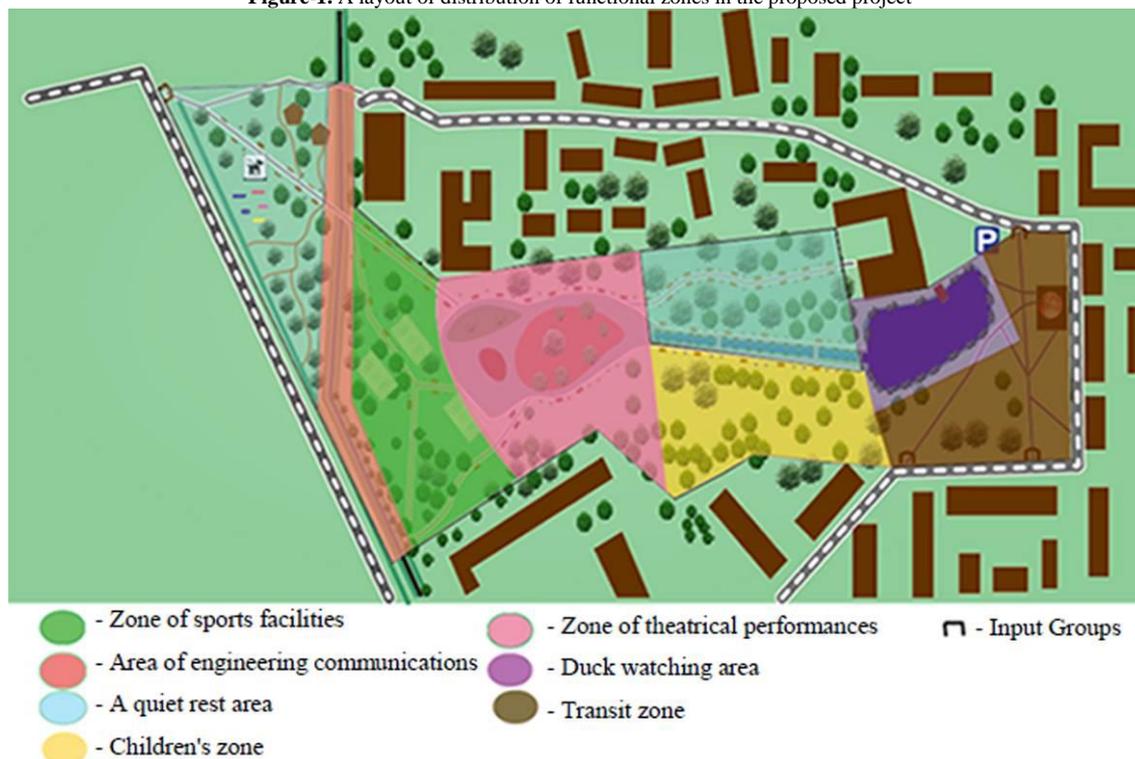
The implementation of the landscaping project neglected important properties of natural ecosystems, the possibility of redistribution of recreational load on the territory.

Based on the data obtained, the analysis of the ecological features of the territory, we proposed an alternative draft design. It includes a number of changes to the landscaping plan of 2016-2107, as well as the improvement of the untouched territory of the far side of the park. The proposed project should be considered as a refinement of what has already been implemented. It was based on environmental principles, as well as the rules of gardening in the park.

Principles of ecological design are the account of ecological and biological features of the territory, the use of local materials, natural lighting most of the time, reasonable zoning of the park and distribution of recreational load. All of the above was implemented in the projects of eco-rehabilitation and improvement of Lake Chishmale [10].

Zoning of the Uritsky park was carried out based on the flow of visitors and activities in each part of the park. Two zones of activity were identified: an active recreation area and a passive rest zone (Figure 1).

Figure-1. A layout of distribution of functional zones in the proposed project



The first zone is characterized by an increased level of recreational load, that is, a large number of people in this part of the park. All the main facilities are located here. This leads to an increased recreational load on the territory, and, as a consequence, to the destruction of the green cover, the accumulation of debris in this part.

The second zone is for passive rest with no facilities for improvement available. The reason for the lack of popularity of this territory is the lack of proper landscaping of this part of the park. This leads to an uneven recreational load of the park as a whole.

The task of alternative improvement is the creation of a project that takes maximum into account the ecological and biological features of the territory. Therefore, a landscape style was chosen for the park, which more emphasizes its nature. The idea of style is to minimize deformation of the natural component and preserve the natural landscape.

Given that the main landscape of the park consists of light-coniferous tree species (Scotch pine), when selecting the species composition, preference was given to plants ecologically appropriate for this habitat and typologically related to the type of park massif. We offer the following types of wood and shrub species for greening the parkland:

- the first and second tiers: Siberian larch, Scotch pine;

- underbrush: silverberry, black-fruited aronia, sea-buckthorn crescent, tree pea-shrub;
- xerophytic bushes: savin juniper, Russian broom, tinctorial greenweed, common barberry, Nanking cherry felt, golden currant.

Also, the honeycombs that attract the attention of bees, birds and small animals are well integrated into the given landscape of the plant. As the underlying surface in the selected area, based on the conditions, we offer a lawn from meadow vegetation (cerastium, cudweed, bearberry, glaucous carnations with a ryegrass).

This will increase the natural biodiversity of the park zone, increase the criteria for the sustainability of this territory, and also enrich the diversity of fauna.

One of the tasks of improvement is the greening of the Uritsky park area and the creation of a green screen to fence it off the road. We propose to locate this green screen along the carriageway, as well as to cover the heating main. This will create a beautiful green background, and in the autumn will add bright colors to the general foliage background.

With the improvement, we are offered two green screens. One will pass along the busy high road along Vasilchenko Street. The second will perform the function of masking the heating main, which runs in the far part of the park.

For these purposes, we recommend to create a sanitary zone along the motorway, which will become a protective zone of the park. For this, it is necessary to longline plant the plants of 2 and 3 tiers (tree-like pea-shrub, birch, silverberry, types of elms). The proposed species are resistant to gas pollution and emissions of motor transport.

One of the significant objects of improvement are running, sideways and footpaths. The proposed tracks in this project are also as natural as possible. They pass along existing pathways, naturally meander, like in the present forest, are made of natural materials.

The paving of the tracks is divided into rigid and soft pavement. Rigid materials are paving slabs, concrete, wood, stone. Soft materials include gravel, crushed stone, sand, bark of trees. Soft coating has a number of advantages: easy installation, more comfortable for walking, simple and natural look and high security. Proceeding from this the dominant type of coverage of the secondary tracks we have chosen is soft. Since it is able to fulfill the requirements we need, such as security, comfort and naturalness. For this purpose, it is advisable to use gravel, natural stone, etc.

It is necessary to change the situation with an artificial reservoir located in the park. Complete replacement of water at the wrong time led to the death of almost the entire aquatic ecosystem. Natural and artificial water bodies can be exposed to both natural and man-made pollution. Based on the principles of eco-rehabilitation, only partial (no more than 50%) cleaning and substitution of bottom soil is allowed.

The time of reproduction of aquatic organisms should also be considered. It is inadmissible to lower the water level in the spring-summer period. During landscaping in 2016-2017 the water body was drained in spring, which has become disastrous for many populations. Therefore, at the moment, it is necessary to add new species of flora and fauna. We also offer landscaping of the water surface of the reservoir.

For the favorable existence of flora and fauna, green areas are needed, including around the reservoir. The shores of the lake are now decorated with an artificial stone and filled with concrete.

To create additional biotopes, it is proposed to arrange green shores that repeat natural analogues of water bodies. For gardening of beaches it is possible to apply a lawn geogrid. It looks like an ordinary lawn, but the base is a three-dimensional lattice. It simultaneously protects vegetation from loads on the slope, and also enables it to absorb moisture and substances coming in from the drains.

One of the necessary objects of the park is small architectural forms. The concept implies the use of primitive furniture and objects. Included in this list are benches made of wood, simple litter bins, vine-covered arbors made of natural material, fireplaces, canopies, sculpture stones, a simple fountain, bird feeders, hammocks, etc. All service buildings are decorated with natural materials.

Each park needs lighting in the evening and at night. To comply with the principles of environmental friendliness, practicality and economy, street lighting on solar panels can be used. Such lighting devices can be used in different parts of the park, and also use their different modifications based on our needs. With the improvement of the park area, we propose to use solar-powered lanterns because of their convenience, economy and environmental friendliness.

The concept of landscaping the located behind the heating main zone is making it quiet, calm, with a large amount of greenery and objects of natural materials. For example, wooden benches and litter bins, stone sculptures, as well as arbors with climbing plants. Thus, the landscape of this territory will be emphasized to the maximum due to suitable vegetation, materials.

4. Summary

Based on our work, we can draw the following conclusions:

1. We have identified great opportunities for creating an ecologically and socially more comfortable environment in the Uritsky city park of Kazan.
2. An alternative draft design was developed, taking into account the ecological component of the proposed territory. The main difference between the alternative project and the previous one is the analysis of the natural features of the park and their accounting for landscaping.

5. Conclusions

The solution to the problem of ecological improvement of city parks is one of the most important aspects for the sustainable development of urbanized territories. It is obvious that urban planners, designers and ecologists need to focus on urban green space strategies.

Previously insufficient attention to this issue was noted in Kazan. The situation has radically changed since 2016. However, an irrational solution of the problem leads to the implementation of non-environmental projects. Changes in the situation can be facilitated by projects that provide for the correction of initial mistakes.

Acknowledgements

The work is performed according to the Russian Government Program of Competitive Growth of Kazan Federal University.

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