Some aspects of urban green areas organization and management in Russia

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Abstract. Problems of creating green spaces and improving urban environment in modern conditions are on a par with such important issues as preserving population health, education, and a protective attitude to natural resources. In this regard, identification of the reasons for ineffective organization and management of urban green areas in Russia and the search for ways to address the existing problems seem to be a topical issue, and therefore is the subject of this review.

1. Introduction

Modern cities are complex systems with many elements interacting and influencing each other in time and space. Design of cities that can adapt to climate change, population growth, an increase in the number of vehicles, building density and other challenges of our time should to take into account a large number of components. Among them, preservation of existing and the creation of new planting systems in cities and green belts around them is gaining in importance. The purpose of this study is to find the reasons for ineffective organization and management of green spaces in Russian cities and identify the ways for improvement.

2. Methods and Materials

2.1. Urgent problems of urban greening

Experts note that random and/or evolutionary planting of green spaces without timely correction can lead to “stagnation of air, creating zones with increased maximum permissible concentrations of pollutants. Such an excess is found in parks located in hollows and ravines, when analysing the movement of air and the transfer of particles of city streets-canyons. The analysis convincingly demonstrates that most of the traditional street greening schemes worsen the ecological state according to the MPC. In the most difficult urban conditions for plants, their physiology can change, causing an increased production of pollen, which leads to an increase in allergic diseases. Plants are living organisms and can change for their own survival, and not for the sake of a person who has created unfavourable conditions for their normal existence”[1].

Low quality of green space maintenance and control of their condition is observed everywhere. “The care of green spaces is taken mainly along the “red line” of the city, under the power lines and consists in “rejuvenating” tree pruning, reducing the state of life, often changing the architectonics of...
plants and reducing the entire decorative effect of landscaping to zero. Untimely thinning and / or its absence reduces permeability of parks and urban forests, create clutter, and reduce insolation"[2].

The avalanche increase in the number of private cars and the acute shortage of alternative solutions for parking in Russian cities has given rise to another significant problem. The situation is becoming the norm when “underdeveloped areas within residential areas, which were designed as green areas, are used as parking lots, or garages are installed in them”[2].

Obviously, trees are forced to fight for survival in urban space, competing with urban infrastructure, experiencing the impact of drought and indirect causes in the form of a decrease in the population of urban birds and mammals, and an increase in the number of pests. At the same time, experts agree that urban greening is an effective way to adapt to climate change.

2.2. Approaches to assessing the impact of green space in cities

At the stage of consumer society domination, everything has a price; therefore the desire to evaluate ecosystem functions seems natural, especially when it comes to comparing investments in landscape architecture projects and the effects obtained from them. Experts note that “a comprehensive valuation of ecosystem functions is difficult due to their diversity, and therefore it is advisable to represent ecosystem functions as a subset of ecological processes and structures. In a study by de Groot et al., 23 functions and associated ecological processes and structures were described”[3, 4].

Among numerous ecosystem services of urban green spaces are the following: “oxygen supply, participation in carbon cycles, air purification from dust and harmful gases, creating a comfortable microclimate, increasing the concentration of negatively charged ions, bactericidal effect, protection from noise, creating a habitat for other organisms, participation in the formation of urban soils and their protection from erosion, snow cover retention, interception of surface runoff, neutralization of toxic substances”[2]. It is obvious that the economic effect from urban green areas increases manifold, if we take into account the benefits of ecosystem services[5, 6].

It is important to note that the effectiveness of the urban system of green areas is closely related to the green open spaces and forests that surround the city, therefore the cities and their suburbs must be considered as a whole. The concept of a forest-park belt in a suburban area – a green ring adjacent to the city and having a special conservation regime – is defined by the legislation in the Russian Federation[7].

"Indicators of greening, availability of public green spaces, the state and resistance of green spaces to the factors of the urban environment are included in the group of indicators of sustainable development of urbanization centers"[2]. The tests of the methods for assessing ecological functions of green areas have started only recently. Unfortunately, for decision-makers, the effect must be presented precisely in monetary terms in order to draw their attention to the "reduction in the area of green spaces in cities and the need for optimization measures aimed at maintaining the vegetation in a viable state"[2].

At the same time, we note that for most ecosystem services, it is possible to obtain monetary valuations, but if a market or visible trade operations are needed for their valuation, then the social value of ecosystem services is a much broader and non-obvious value for measurement[3]. Many ecosystem services do not meet market requirements, as their effect is inherently manifested as benefits for society as a whole, i.e. it makes sense to talk about a social effect. In the absence of an explicit market for such services, indirect assessment methods are used[3, 4].

The effect from improving comfort and greening of cities is also manifested in the possibility of attracting qualified personnel, and retaining those who are already in work. This is what urbanists mean by "improving the quality of the population." Development of urban green areas creates favorable living conditions, stimulates business activity, and generates a demand for social integration; it can promote a healthy lifestyle, and help to improve the image of the city at different levels, from local to international.

According to the 2007 New York City Massive Landscaping Report, “street greening increases the value of green property, which brings $52 million annually – accommodation near green areas is 11%
more expensive compared with the base price; in green streets people spend 12% more on purchases. One tree planted brings at least $90 annually to the city budget, and the amount depends on how early leaves appear, on the growth intensity, etc." [8]

It is also obvious that the results of urban environment improvement must be assessed in the long term: the growth of the investment attractiveness of the city and business, tax revenues, and real estate prices does not happen instantly.

In situations where the market value cannot adequately reflect the social utility of ecosystem services, various authors consider a number of methods of economic valuation [3, 9], including:

- “averted cost method: the costs that could arise in the absence of the provision of ecosystem services;
- method of replacement costs: the cost of replacing services with artificial systems;
- method of factor income: income from the provision of a service;
- method of transport costs: the demand for a service determines transport costs, reflecting the indirect cost of an ecosystem service;
- method of setting prices taking into account the comfort of the environment: the demand for a service can be expressed in the prices that people are willing to pay for related goods and services;
- method of probabilistic assessment: the demand for a service can arise from considering possible alternative scenarios;
- benefits transfer method, in which the valuation of ecosystem goods and services for one location or set of conditions is transferred to another;
- commercial value method;
- method of economic effect”[3].

It is obvious that in assessing the benefits for society as a whole, each of the listed methods has both advantages and disadvantages.

2.3. Promising directions for the development of urban greening

Thanks to digital technologies and interdisciplinary approach, the theory and practice of urban development has reached a new level. “Landscape architecture and urban climatology, plant physiology have become related directions in the study of the interaction of the environment and urban structures in the course of anthropogenic transformation of territories. The relevance of these studies has been enhanced by global climate change and an increase in summer temperatures in cities. Studies on the climatogenic (environment-forming) role of vegetation and water bodies, and bioclimatic effect produced by them in modern cities are carried out in almost all scientific centres around the world ”[1].

Bioclimatic indicators used to assess the level of human comfort in urban space, simultaneously take into account such parameters as humidity, wind, temperature, solar radiation and others in various combinations [1]. It became possible to model the urban microclimate using CFD (computational fluid dynamics) models, in particular ENVI-MET [10–12]. These models are based on the fundamental laws of hydro- and thermodynamics, supplemented by the capabilities of modern GIS technologies, which allow us to choose the optimal combination of environmental parameters from a variety of possible ones. These technologies are actively used in reconstruction of European, Asian and American cities, which aims at a general reduction in temperature and air pollution, localization of storm drains, and increase in city aeration, etc. [1].

In this regard, it should be noted that in Russia the concept of landscaping, as a rule, is implemented according to a narrow-branch basis, which is an outdated approach. “Cloud technologies make it possible to create domestic software similar to ENVI-MET, to be used for the formation of natural frameworks of cities and their correction in the course of city development. Modeling allows us to focus on different spatial levels: from individual structures to the master plan of a city as a whole and as an interacting organism in order to identify undesirable effects and enhance the regional potential”[1].
Planning and design solutions for urban public spaces are being revised in favor of simultaneously meeting a number of needs and achieving several goals. This is primarily due to the lack of available space and the problem of traffic congestion [13–15].

Open access for residents to schoolyards outside of school hours, or simply integrating schoolyards into public space is a positive example of efficient use of urban space and making it available to more people.

Observations confirm that measures such as “pedestrianization of parts of Broadway in New York City have benefited pedestrians while reducing taxi travel times, benefiting local store economies and improving overall road safety” [16].

2.4. The quantity and quality of urban green space in modern cities
Recent years have been characterized by a significant number of projects aimed to maintain the number of green spaces and greening cities around the world:

- Million Trees (MillionTreesNYC, New York, 2007-2015);
- greening London (green spaces should occupy more than 50% of the city's area by 2050 against 18% now, which is already more than the total area of railways and roads);
- greening of Paris involves the creation of four new green areas;
- in Saudi Arabia, as part of the Middle East Green Initiative, there are plans to plant 10 billion trees in the coming decades to reduce carbon emissions (it is planned to produce 50% of the country's energy from renewable sources by 2030), combating pollution and land degradation [17];
- since 1997, in Moscow, the state of green spaces have been monitored, according to which more than 90% of the trees were in a satisfactory and good condition by 2019. Moscow has one of the highest per capita indicators among megalopolises in terms of natural areas and the third place in walking distance to green areas; but in 2019 alone, 1.6 million trees and 79 thousand shrubs were planted in Moscow [18].

“Today, the task of increasing the area of urban green space is on the agenda of many cities around the world, but the focus is often on quantity rather than quality” [16].

It is known that even if a city has a significant area of green spaces, this does not guarantee that it is a healthy city. For example, in Chelyabinsk there are 52 sq. m of green spaces per capita against a required minimum of 50 sq. m, however this is one of the most hostile cities in the world in terms of its effect on human health.

The quantity and quality of green spaces has a beneficial effect on stress frequency and mental well-being. For the modern stage of development of the society it is equally important that green spaces have a direct and indirect impact on the physical activity of urban residents. In European countries, government efforts are increasingly focused on creating conditions for physical activity in the city centers. Such initiatives are attracting a lot of attention because they are focused on residential areas and create a conducive political environment. Obviously, the most preferable is the reconstruction of abandoned industrial and other sites that are not used for their intended purpose, since such an intervention is suitable for any settlement.

Research shows that the extent of green spaces usage is significantly influenced by qualitative factors: ease of access to parks, aesthetics, size and state of parks, availability of toilets and drinking fountains, cycling and jogging paths, and activities in parks.

In 2012, Moscow began implementing a master plan, which included such important initiatives as limiting parking in the city center, improving pedestrian crossings, and improving approaches to the embankment. As a result, Krymskaya Embankment has become an attractive and vibrant public space. This project opened up great opportunities for citizens in terms of physical activities, also in winter, and attracted a variety of visitors to the territory of the city park, which is one kilometer long.

It is advisable to supplement the green frame of a city by a system of small urban gardens in those places where it is impossible to set up a full-sized park or square. “A small garden can become a popular object of the urban environment, solving socially oriented tasks, connecting green spaces of
the residential area with the architecture of surrounding buildings and forming a natural landscape frame. A city garden is a green area in a development zone intended for recreation of the population and transit traffic, with the possibility of saturation with performances, sports, park facilities, and usually ranging in size from two to five hectares. The size of the territory of a garden under reconstruction is determined by the existing urban planning situation [19].

The experience of European countries confirms that “monitoring practice should accompany the gradual processes of urban landscape transformation. In particular, in Copenhagen, the authorities gradually removed parking spaces from the city center in order to create public spaces free of personal transport, and over time this approach has spread to other parts of the city” [16]. It is extremely difficult to make such decisions, since they lie more on the political plane. But the appeal to the monitoring data and confirmation of the already achieved positive results contributed to the invariability of the chosen course and everyday work in the name of the common good, regardless of which political party was in power at one time or another [16].

3. Results and Discussion

3.1. Some Causes and Consequences of Problems of Improvement and Greening of Russian Cities

It is sad to state that the critical level of deterioration of objects in the urban environment and their unsatisfactory operation best describe the current situation in the area of development of most Russian cities. A significant number of parks, gardens, lawns, green belts of cities are degrading; roads and adjacent territories require repair and reconstruction; recreation areas (beaches, reservoirs, sports grounds, etc.) require cleaning and restoration.

The reason for this situation is a complex of managerial and economic-organizational problems, among which is lack of competition and ineffective city management system, lack of finance for the maintenance and development (free mode of services provision, monopoly enterprises that are financed from the local budget), mix-up of management and implementation functions [20; 21]. The domestic experience in the development of the urban environment indicates an insignificant share of extra-budgetary funds and limited participation of business structures.

It is also important that in recent decades, the source of space transformation in Russian cities was mainly investments in commercial real estate, which led to the exploitation of existing public areas for other purposes in the absence of the creation of new ones. This contributed to the lack of public spaces and comfort zones, both in the city centers and in the outskirts.

For example, the data of Greenpeace Russia, obtained through the study of space imagery, indicate that within the borders of Moscow, the area of green spaces has decreased by more than 700 hectares since the beginning of the 2000s. According to the public movement "Open Coast", commercial development has led to a decrease in the green belt of the Russian capital from 168 to 60 thousand hectares over 20 years.

“The Russian municipal authorities have locked onto themselves all the rights and responsibilities for the maintenance of the territories and, apparently, do not succeed in solving this problem. Objects of the urban infrastructure provide services to the whole city, while they are owned by local authorities, acting as representatives of the population” [22].

“It is customary to divide the tasks of territorial management according to the subjects in whose interests it is carried out: residents are interested in improving the quality of the urban environment, developers are interested in increasing the value of real estate, the government, in attracting private investments for solving problems of urban development, construction of infrastructure facilities, implementation of state and municipal level programs, reducing social tension, and increasing the investment attractiveness of territories” [21].

Improving the quality of urban environment is one of the important objects of municipal management and is characterized by a variety of activities. With the approach existing in the Russian Federation, the solution of problems of landscaping and complex improvement of the territory is entrusted to various departments of the city. Each departmental service is responsible for a limited area
of work, and the entire range of tasks is coordinated by the department that serves the urban economy. As a rule, these departments do not have specialists capable of perceiving and developing the urban environment from economic and social positions, but are focused only on its utilitarian values.

3.2. Strategic vision of urban development and greening problems
Success in the implementation of measures for greening and urban development is closely related to the strategic vision of this problem by the authorities, primarily urban, but also at the regional and national levels. It is imperative to develop long-term strategies, their purposeful phased implementation, regardless of the possible change of top leadership in the city over time, and extensive media coverage of improvement initiatives with the involvement of residents on a voluntary basis.

It is also known that development strategies and programs often relate to a specific area of activity, for example, urban planning, health care, education, etc., which is fraught with missed co-benefits that projects, programs and strategies could provide at the intersectoral level. This is why it is so important to proactively assess the associated effects and develop comprehensive strategies. They can foster long-term investment in urban development and new funding streams.

Approaches to the management of land and property complexes, which are based on the basic principles of management, are becoming important. In particular, such an approach is urbo-saving.

An adaptive approach, according to which the city is perceived as a producer of services for its residents, should become the basis of the state policy in the field of urban improvement and greening. With this approach, city management cannot be pressurized by “paper” restrictions, otherwise an adequate and quick response to the challenges faced by the management is impossible [21]. If a city is a space for the provision of services, then the quality of these services can be assessed using a specialized system of indicators based on consumer reactions.

4. Conclusion
To summarize, we note that preserving and increasing the area of urban green spaces is important for many reasons, starting from increasing the attractiveness of cities for living, and ending with climate change adaptation.

At the same time, the lack of a strategic vision, combined with an ineffective organizational and management mechanisms, a low priority of greening problems in the eyes of the authorities, and a small potential for monetization of this field of activity lead to a reduction in green areas and a decrease in the quality of urban green spaces. At the same time, many successful landscape architecture projects have been implemented globally, which can be adapted to Russian realities, ensuring their contribution to the sustainable development of cities and regions in the long term.

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