The Current State of the Landscaping System of a Large Industrial Center (for Example, the City of Krasnoyarsk)

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Abstract. An important indicator of the state of comfort of urbanized territories is the provision of city residents with green areas. Green areas of common use include plantings of city-wide and district parks, inter-quarter gardens, squares, boulevards and embankments. Currently Krasnoyarsk is one of the largest centers in Eastern Siberia. Historical and new areas of Krasnoyarsk differ significantly from each other by the nature of landscaping. Protective zones located between residential and industrial areas along highways and railways should make a great contribution to the general greening system of the city. Analysis of the dendrological composition and distribution of species in plantings of the city shows that the main composition of plantations is represented by a limited number of species, among which balsam poplar and ash-leaved maple are unpromising species for plantings of general and limited use. The list of woody plants recommended for landscaping the city, tested in arboreums, plantations of the central part of the city and Akademgorodok, is represented by a fairly large variety, including both local species and species of various botanical and geographical regions. At the same time, an increase in the share of the main forest-forming species in the greening of urban areas, such as drooping birch, Siberian larch, Siberian spruce, their high decorative qualities will allow to more fully solve the problem of forming the individual appearance of a Siberian city. The combination of these rocks with the natural components of the landscape - relief, bodies of water and artificial elements (buildings, engineering structures) - will increase the artistic expression of urban development.

1. Introduction

Currently Krasnoyarsk is one of the largest centers in Eastern Siberia. Its industrial potential increased significantly in the 60-90s of the twentieth century. During this period, along with the reconstruction and expansion of many existing enterprises, about 50 new ones were put into operation. Residential and industrial areas on the left bank behind the Kacha River and on the right bank of the Yenisei embraced the historic center with a continuous belt of buildings. Modern Krasnoyarsk stretches for 25 km along both banks of the river [1, 2]. Historical and new areas of Krasnoyarsk differ from each other by the nature of greening. In the central part of the city and on the territory of the former settlements, due to the high density of building blocks, their small size and fractional structure, intra-block greening is
poorly developed. It exists only in the form of separate small areas of greenery with an area of no more than 5 - 10% of the quarter's territory.

2. Objects and methods of research
The right bank is still an industrial and residential area, where three large industrial hubs stand out: Eastern, Central and Western. The planning structure of the right bank is characterized by an alternation of industrial enterprises and residential areas with an insufficient number of sanitary green zones. On the left bank, in its eastern part, an industrial complex has developed on the basis of aluminum, metallurgical plants and enterprises of the construction industry. The construction of a bridge across the Otdykha and Tatyshnev Islands created conditions for the development of a sports and active recreation area outside the old city garden. However, the microclimate that has changed after the construction of the hydroelectric power station has a significant impact on the growth of plants on the islands. Reduced temperature extremes and higher air humidity are especially affecting islands and floodplains. Lowering the water temperature in the river led to a decrease in the temperature of the groundwater, the increased level of which requires special measures for engineering preparation and selection of moisture-loving rocks. In addition, harmful industrial emissions into the atmosphere "flow" to the island territories from both city shores and, interacting with humid air, form toxic aerosols, which most adversely affect the growth of woody vegetation in coastal areas.

As the city grows on both river banks, the Yenisei becomes the axis, the core of the formation of the city's planning structure, it is to him that the buildings should be turned. Therefore, one of the most important environmental tasks in the development of the city is the high-quality use of coastal territories. Their landscaping and building should emphasize the silhouettes of river banks, organically interact with the surrounding natural landscape. Improving the use of coastal territories is of particular importance among the reserves for improving the urban environment.

An important aspect of shaping coastal areas is scale regulation. The coastal areas of a large river contradict the desire of man to create an environment commensurate with him, and the linear planting of trees along the embankment visually lengthens the already long line of the coast. The placement of architectural elements and the monotonous rhythm of landings along the coastline negatively affect both the perception of the composition and the organization of the recreational function of the embankment. Visual and recreational changes in coastal areas are possible due to the creation of plant compositions that form a transitional scale from multi-storey buildings to natural landscape components, visual delineation of the environment.

The spit of the Yenisei and Kachi are among the historical elements of the city. Currently, landscape complexes are being created on the coastal areas of the Yenisei and Kacha, emphasizing its natural and historical significance for the city. Inconvenient territories with a complex hydrological regime are transformed into a component of the urban landscape, which leads to the return of natural components in a new ecological and aesthetic quality.

According to the degree of destructive impact on the urban landscape, transport territories are among the most aggressive. Therefore, it is necessary to search for natural resources that can minimize their impact. With the development of transport, the role of landscaping in the layout of streets and highways is changing. The conflict situation is aggravated by the increasing traffic intensity and the lack of natural elements that compensate for their negative impact. Creation of a hedge of smoke and gas resistant bushes along the roadway will to some extent help to solve the problem of isolating pedestrian and traffic flows.

Protective zones located between residential and industrial areas along highways and railways should make a great contribution to the general greening system of the city. At present, large areas remain not greened in areas of mass development (in the Severny, Vzletka microdistricts). The restoration and development of green areas depends on the choice of methods that are adequate to problem situations. At the same time, the formation of an expressive and comfortable city is possible with the rational use of natural resources for urban planning purposes. The increasing complexity of the relationship between the effects of technological development and the environment is an important feature of the current state.
of urbanized areas. The natural conditions of the territory have a decisive influence on the location, development and reconstruction of cities, determining the main directions of their territorial growth and saturation with industrial and transport facilities.

3. Results of research
As a result of the analysis of the state of the environment of the city of Krasnoyarsk, the main environmental problems arising as a result of the interaction of natural and anthropogenic factors were identified and a diagram of the interaction of natural and anthropogenic factors in the environment of a Siberian city was drawn up. Extremely unfavourable for the city are combinations of factors such as extreme climate, hollow mountainous terrain, the formation of surface inversions and calm weather conditions with the location of industrial enterprises, the unjustified use of suburban areas, which leads to the violation of valuable landscape zones surrounding the city and their replacement with spineless buildings. Urban green spaces are fractionally and unevenly located in the urban environment, there is no connection with the green zone plantations, natural forests recede from the boundaries of residential buildings, their species composition changes. This indicates the need for a deeper comprehensive development of the issues of rational use, protection and transformation of natural components of the environment, in conjunction with the man-made processes inevitably occurring in cities.

An important indicator of the state of comfort of urbanized territories is the provision of city residents with green areas. Green areas of common use include plantings of city-wide and district parks, inter-quarter gardens, squares, boulevards and embankments. The area of green spaces of this category in Krasnoyarsk is 476 hectares. Currently, the rate of green spaces in general use is 16 m² / person. According to the data of the perspective plan of gardening of Krasnoyarsk, it should be increased to 21 m² / person. The actual supply is 5.3 m² / person. Thus, the lack of landscaping in this category is 67% according to existing standards and 75% for the estimated period. Consequently, work is required to significantly expand the area of green areas for general use from 476 to 1873 hectares. Especially low provision of green spaces is noted in city districts in which complex man-made situations develop. The increase in the area of green areas in the micro districts of Vzletka, Severny and others under construction should be carried out in parallel with the commissioning of residential complexes and their improvement. The situation is more complicated with the increase in the area of green spaces in the central part of the city, in the Central and Railway administrative districts, in Plantations of limited use - planting in residential buildings, children's, medical, educational and scientific institutions, in industrial areas and sports facilities. Special-purpose plantings include landscaping of sanitary-protective, water-protective, protective-reclamation, fire-prevention zones, cemeteries, plantings along roads and railways, botanical and orchards, nurseries, flower and greenhouse farms. Among this category of plantings, special attention should be paid to landscaping of streets, roads, highways and squares.

When analysing the state of the city's greening system, it is necessary to take into account that only as a result of the joint development of all categories of green spaces, an integral environmental and aesthetic effect is formed in the urban landscape. The analysis of research and the results of practical testing showed that it is possible to achieve the desired level of comfort in the prevailing natural, climatic and environmental conditions in industrial cities of Siberia with a total area of green spaces of at least 30% of the area of urban land.

Currently, the area of the city of Krasnoyarsk is 37885 hectares. Thus, green spaces should be at least 11366 hectares and consist of green spaces and urban forests. Statistics show that the provision of the population with green spaces within the city is 9 m² per person. In general, the area of green spaces in the city is 802 hectares. Urban forests cover 6026 hectares. Thus, the total area of landscaping is 6828 hectares. The data obtained indicate that the greening of the city's territory lags behind by 40%, that is, 4538 hectares from the above optimal ratio of the area of built-up and "green" territories. At the same time, it is necessary to fill the deficit due to the additional creation of landscaping objects of various functional purposes. The compaction of buildings is often carried out due to the demolition of trees and shrubs.
An analysis of the qualitative (species composition and structural features) characteristics of green areas showed that, taking into account the collections of botanical gardens and arborets, the assortment of woody plants in city landscaping is quite diverse (more than 400 species and varieties). However, the main composition of woody plants in urban greening is currently represented by a limited number of species: balsam poplar makes up 41%; Siberian apple tree - 12%, Siberian larch - 11%, silver birch - 9%, elms (small-leaved, squat, pinnate) - 7%, ash-leaved maple - 6%, Siberian and European spruce - 5%, small-leaved linden - 4% and other types - 5%.

Over the past 10 years, the city's plantings have significantly replenished. Plants with high decorativeness and ecological plasticity, not typical for mass landscaping, appeared: Kuril tea, Durian rhododendron, Scots pine, common barberry, which led to significant changes in the species composition of the city's green spaces. However, these plantings did not have a significant effect on the increase in the area of green spaces in the city, since they were created in place of the demolished trees and bushes.

Poplar is still the leader in tree planting in the city of Krasnoyarsk. Balsamic and laurel leaves prevail; Canadian and silver poplars are less common. Meanwhile, the balsamic group of poplars is demanding on the fertility and moisture of the soil and the light characteristics of the territory. Insufficient consideration of the role of these factors in the creation of plantings, plant density and the use of plant care technology that does not correspond to the biology of the species negatively affect the state of poplar plantings.

Poplar is an indispensable breed for creating plantings for special purposes, as it has a number of positive qualities, such as fast growth, pruning, and resistance to air pollution. But at the same time, it also exhibits significant drawbacks: it is relatively short-lived, after 40 ... 50 years it is not decorative, during the period of seed eruption, the trees of female individuals pollute the air, often suffer from cytosporosis, are affected by poplar moth, and are damaged by the wind. Therefore, poplar should not occupy a leading place in the range of species for urban greening, especially in public plantings. At present, the age of planting of balsam poplar is 50-60 years, while about 60% of the trees have undergone anti-aging pruning, which is necessary for this species at this age, especially in an urban environment.

Hanging birch is an important species in the landscaping of the city of Krasnoyarsk. It is the main forest-forming species in the forests of landscape zones surrounding the city of Krasnoyarsk - a landscape of light coniferous taiga and forest-steppe. Hanging birch is a very light-loving breed, tolerates city conditions well, is drought-resistant, frost-hardy, undemanding to soil conditions, grows rapidly. Due to their unpretentiousness, birches are used in group plantings, to create alleys (but always on a lawn strip), small forest plantations, protective strips, for planting in squares and parks, landscaping recreation areas, etc. A single planting of birch is possible, however, it should be borne in mind that they lose foliage and twigs throughout the summer, so the area around them requires periodic maintenance. Birches are decorative with their openwork crown, bright colour of the bark, light green foliage in spring and golden yellow in autumn. Hanging birch looks especially good in combination with mountain ash, willow, oak, linden, maple, beech, bird cherry, and also against the background of conifers.

4. Conclusion
Analysis of the dendrological composition and distribution of species in plantings of the city shows that the main composition of plantations is represented by a limited number of species, among which balsam poplar and ash-leaved maple are unpromising species for plantings of general and limited use. The list of woody plants recommended for landscaping the city, tested in arborets, plantations of the central part of the city and Akademgorodok, is represented by a fairly large variety, including both local species and species of various botanical and geographical regions. At the same time, an increase in the share of the main forest-forming species in the greening of urban areas, such as drooping birch, Siberian larch, Siberian spruce, their high decorative qualities will allow to more fully solve the problem of forming the individual appearance of a Siberian city. The combination of these rocks with the natural components of the landscape - relief, bodies of water and artificial elements (buildings, engineering structures) - will increase the artistic expression of urban development.
The results of studies of the existing quantitative and qualitative state of the greening system show that the green spaces of the city of Krasnoyarsk represent not so much a system as a set of park, linear, courtyard, sanitary-protective green areas, insufficiently focused on the formation of a favorable ecological situation in various parts of the city. Among the most significant shortcomings are the following: inconsistency of the actual landscaping of the city's territory with urban planning standards and the current ecological situation in the city; autonomy, isolation from the forests of the suburban green zone; absence of continuous green corridors along linear landscape and engineering transport axes.

5. References
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[2] Avdeeva E V 2000 Green plantings of cities of Siberia: monograph (Krasnoyarsk: SibGTU) 150 p