

Justification of the optimal landscape and planning structure of Krasnoyarsk through the study of territorial and planning development of the city

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Abstract

Krasnoyarsk - officially acquired the status of a millionth city in 2013. Over the past decade, the ecological situation in the city has greatly deteriorated. The volume of housing construction and the road network are growing every year, the population of the city is increasing, and the urban area is expanding due to the expansion of the edges. At the same time, the number of natural and recreational territories in the city's ecosystem is also decreasing due to their building development. Recently, the question arose about adjusting the approved in 2015 city's master plan. In this connection, the question arose about the trends in the development of the planning structure of Krasnoyarsk. The article presents the results of a chronological analysis of the development of the landscape-planning structure of Krasnoyarsk. Special emphasis is placed on the modification of the territorial-spatial and planning structure of Krasnoyarsk over the past 50 years. Trends in the development of the landscape-planning structure of the city are revealed. The article proposes a strategy for urban green space management and planning in the context of urbanization through the assessment of ecosystem services and implementation of the green framework concept by means of legal regulation of urban planning activities. It can be included in a new document of the Krasnoyarsk master plan with the aim of its further balanced development.

Keyword: *Krasnoyarsk landscape and planning structure, geomorphology, green space, urban planning regulations.*

Introduction

Unique natural landscape features of Krasnoyarsk city - foothills of Eastern Sayan and rich hydrological network based on the Yenisei River and its numerous tributaries - have defined the development of urban planning structure, its visual appearance and even cultural traditions. Researchers of Krasnoyarsk in various fields of knowledge emphasize the fact that the development of the city was carried out with an incomplete consideration of local natural conditions in the urban design and planning, such a result led to the fact that Krasnoyarsk has taken a leading position in the country among cities with a tense environmental situation. Recently the question of alteration in the Krasnoyarsk city's comprehensive plan, enacted in 2015, became urgent. That is why the question of the optimal landscape and planning structure of Krasnoyarsk is especially relevant today.

Background subsection

The stages of the planning structure formation of Krasnoyarsk City were considered by many researchers on various issues. It is worth noting several works, the subject of research of which, in one way or another,

is connected with the landscape-planning structure of the city (Avdeeva et al., 2015 and Gaikova, Chui, 2011). In addition, the issues of transformations of the spatial planning structure of the city are studied in the works of G. A. Ptichnikova, B. Engels, I. V. Kukina, I. G. Fedchenko, A. N. Klevakin, V. I. Tsarev, V.I. Krushlinskii and others. The article presents some results of master's studies carried out under the scientific supervision of Unagaeva N.A., aimed at studying certain aspects of the formation of the Krasnoyarsk natural frame (Volkova, 2018 and Zlobin, 2021). The normative urban planning base of Krasnoyarsk was considered.

Of particular value for this work was the research by Hao Zou H. and Wang X. (Hao Zou, Wang, 2021) resulting a critical analysis of scientific articles - collection of Web of Sciences - published over the past 25 years, devoted to the morphology of green spaces. The main terminology used in the article is based on the research of Whitehand J. W. R. (Whitehand, 2019), and part of methodology - from Farinha-Marques P., Fernandes C., Lameiras J.M. and Guilherme F. (Farinha-Marques et al., 2014).

Methodology

The study of urban green spaces from the perspective of morphology is important for the strategic planning of urban green spaces, primarily for preservation and restoration of the functions of urban natural habitats and maintaining good spatial models of the urban ecological environment. It is important to emphasize what is meant by green space. According to the definition proposed by Swanwick C., "Green space is land that consists predominantly of unsealed, permeable, soft surfaces such as soil, grass, shrubs and trees." (Citation by publication of Hao Zou, Wang, 2021.) According to Russian regulations, "green spaces are a collection of woody, shrub and herbaceous plants in a certain area"¹. Thus, this definition is only suitable for areas where there are plantings.

The main stages of the spatial and compositional structure Krasnoyarsk City development

In the study dedicated to the development of the Krasnoyarsk city landscaping system the authors have distinguished five main stages in the development of the spatial and compositional structure of the city: from an Ostrog with a surrounding settlement with almost no green spaces, to the large city with a developed discrete planning structure and landscaping system, including the whole range of landscaping objects (public, limited use and special purpose), which nonetheless has fragmentary development (Avdeeva et al., 2015) (figure 1).

It is established that during the formation period, the compact nature of the layout did not contradict the unique climatic conditions and the natural surroundings. As a whole, the urban planning composition was characterized by the connection with natural environment, not only physically with the elements of the landscape, but also with external picturesque panoramas.

¹ State Standard "Urban planting. Terms and definitions". Developed by the Ministry of Housing and Communal Services of the Russian Federation. Date of introduction 1991-01-01 (<https://docs.cntd.ru/document/1200023332>).

In the 50-60s, the greening of streets and squares grew by 126%, the greenery of sanitary protection zones of industrial enterprises increased (Avdeeva et al., 2015). The appearance of a new morph type of Krasnoyarsk is a micro district and superblock (Kukina et al., 2018) provided the conditions for the unrestricted introduction of green open spaces and generally created the conditions for the development of the greening system (Fedchenko 2021).

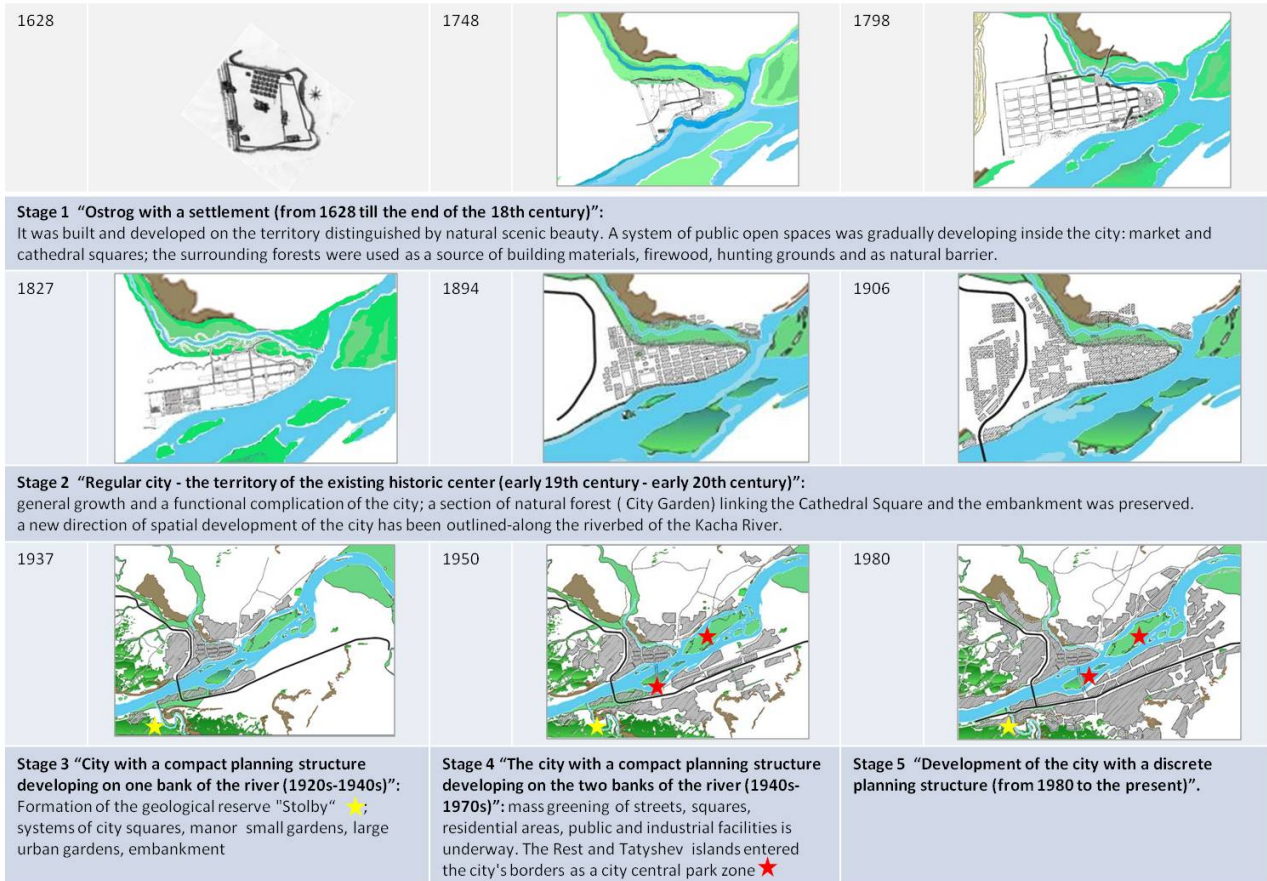


Figure 1. The main stages of the spatial and compositional structure Krasnoyarsk City development and its influence on the formation of the green space system (Avdeeva et al., 2015). Spatial development schemes were drawn by the author on the basis of fixation plans and later official general plans of Krasnoyarsk, published on the Internet, articles, archival sources; the later ones are based on satellite images of the city.

Otdykha, and later Tatyshv islands were included in the city borders and regarded as a central park zone of citywide significance (Tsarev, Krushlinskii, 2001). The proportion of green areas in the overall balance of Krasnoyarsk territory and provision of the population with green spaces were increasing, improving its ecological condition. Development of areas on the periphery of the city near industrial enterprises and urban sprawl continued until the 1980s (Klevakin, 2008).

From 1980 researchers distinguish only one stage of Krasnoyarsk development (Avdeeva et al., 2015). But, here, one can distinguish additional periods based on the general milestones of urban development typical for Russia (Ptichnikova, 2018), and in particular for Krasnoyarsk: the mass construction development (Fedchenko, Lipovka 2021), the morphology transformation of urban tissue (Kukina et al., 2018) and the Siberian Blue Cities and their public spaces transformation in post-Soviet times (Engel, 2006) (figure 2).

Stage “The growth of industrial potential, the beginning of urban fabric densification and strengthening of the framework” (1980-1990s) accompanied by the active construction of public and residential buildings, the emergence of new microdistricts (Fedchenko, Lipovka, 2021). The planning structure of the right bank is characterized by the alternation of industrial enterprises and residential districts with a shortage of green sanitary zones (Avdeeva et al., 2015). In general, the period is characterized by the transition from selective to comprehensive city development: integration residential buildings with the objects of the social sphere and landscaping. Against the background of an increasing negative attitude to unification of mass residential development, a new spatial paradigm of "humanization of the architectural environment" is being formed (Fedchenko, 2020). In 1983, a protective zone with the limited natural resource management regime was established around the Stolby reserve².

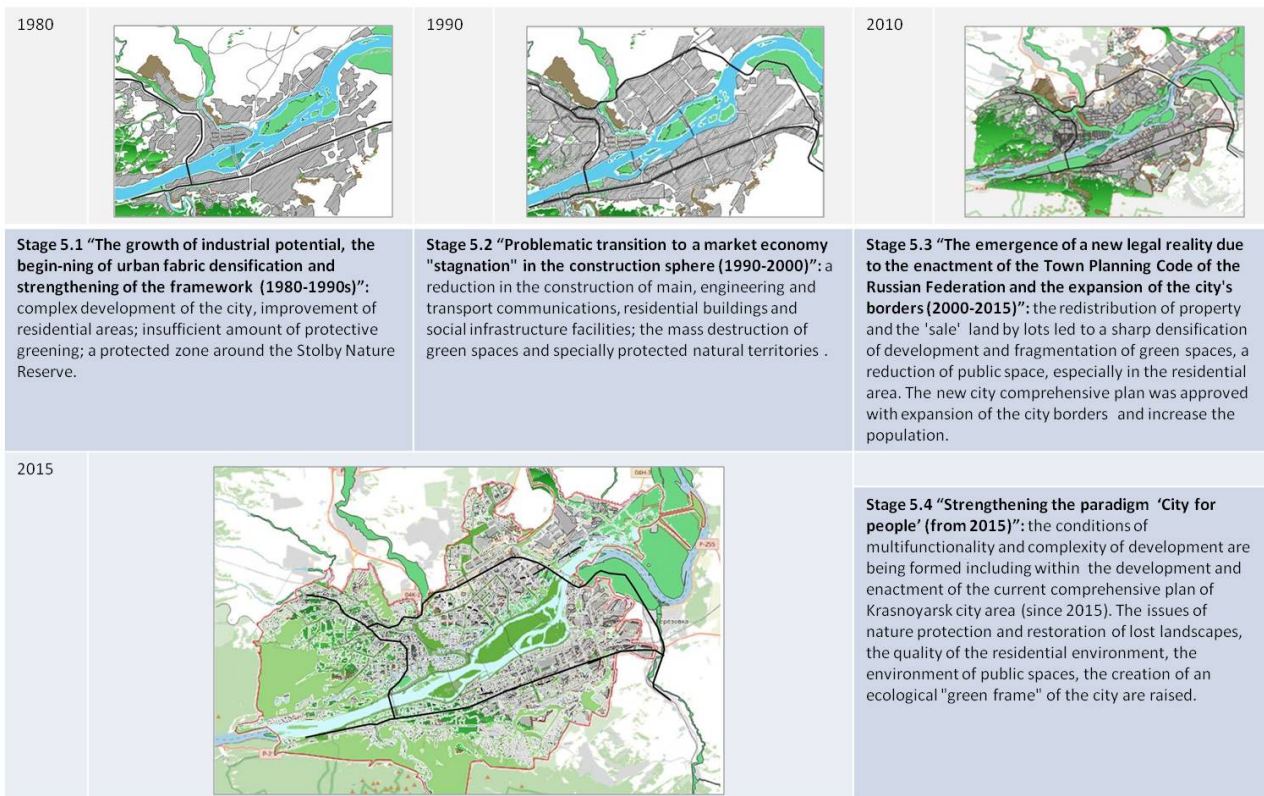


Figure 2. The names of the periods are formulated by the author on the basis of characteristic processes in urban planning activity. Spatial development schemes were drawn by the author on the basis of official general plans and satellite images of Krasnoyarsk.

Stage “Problematic transition to a market economy; “stagnation” in the construction sphere” (1990-2000) is characterized by reduction in the volume of construction in all spheres. An additional feature of this period was the emergence of numerous temporary buildings and constructions on vacant sites (Klevakin, 2008).

² Official information from the internet site “National park Stolby. Krasnoyarsk” <https://kras-stolby.ru/about/#history>

Stage “The emergence of a new legal reality due to the enactment of the Town Planning Code of the Russian Federation³ and the expansion of the city's borders” (2000-2015) is characterized by the redistribution of property. In 2001, a new comprehensive plan of Krasnoyarsk was adopted⁴. The 'sale' of lands by lots led to a sharp densification of development and fragmentation of green spaces, a reduction of public space, especially in the residential areas. Aggressive expansion of the city was mainly at the expense of agricultural land on the outskirts and also by including suburban settlements in order to increase the population⁵ (Ptichnikova, 2018). But large municipal public spaces in the mass residential areas remain unimproved and "deserted" (Engel, 2006 and Kukina et al., 2018).

Stage “Strengthening the paradigm ‘City for people’” (from 2015) is characterized by shift in emphasis from indicators of production to indicators of the level and quality of the population life. In despite of active reshaping of the spatial structure continues (especially, the morphological structure of the historical territory), conditions emerge for multifunctional and integrated development. The areas of transport-oriented development (TOD) are beginning to form (Kukina et al., 2018). Issues of environmental protection and restoration of lost landscapes are raised (Krushlinskii, 2016). "Ecology" and "recreational framework" were declared as major strategic directions of the current Comprehensive Plan of Krasnoyarsk city, but a separate plan of the natural framework was never developed, and the information about its structural elements is contained on the map of functional zones of the city and the map of use-restricted areas (figure 3) (Unagaeva et al., 2021). Nevertheless, historical public and green spaces have a special status in the urban planning documents, which is undoubtedly a part of the city's genetic code. Since 2017, Krasnoyarsk has been active in the national project "Housing and Urban Environment", improving public and recreational spaces and courtyard areas. But the city landscape zoning (Kirillov, 1998) is not always taken into account when greening and directly affects the plant survival.

Results and Discussions

The chronological analysis of Krasnoyarsk landscape and planning structure development demonstrates that a significant share of the natural landscaping zones falls on the fringe belts; a complex geomorphological structure physically constraint the city growth (figure 4). This highlights a global trend (Whitehand, 2019). The urbanized area is expanding every year to the detriment of territories, originally having the status of “limitedly suitable” or “not suitable” for urban construction (river floodplains and slopes). The influence of industrial sector as the main source of anthropogenic impact on the natural system is noticed in all areas of the city (Volkova, 2018). That is why it's necessary to prioritize the

³ The Town Planning Code of the Russian Federation was adopted by the State Duma on April 8, 1998.

⁴ The new city comprehensive plan, developed in 1999 by the Russian State Research Institute of Urbanistics, was approved by the decision of the Krasnoyarsk City Council of March 30, 2001 N B-23 "On the General Plan of the city".

⁵ In 2013, Krasnoyarsk officially acquired the status of "millionaire" in terms of the number of residents.

preservation of nature areas, landscape identity and ecological efficiency along with the issues of cultural heritage protection (Unagaeva et al., 2021).

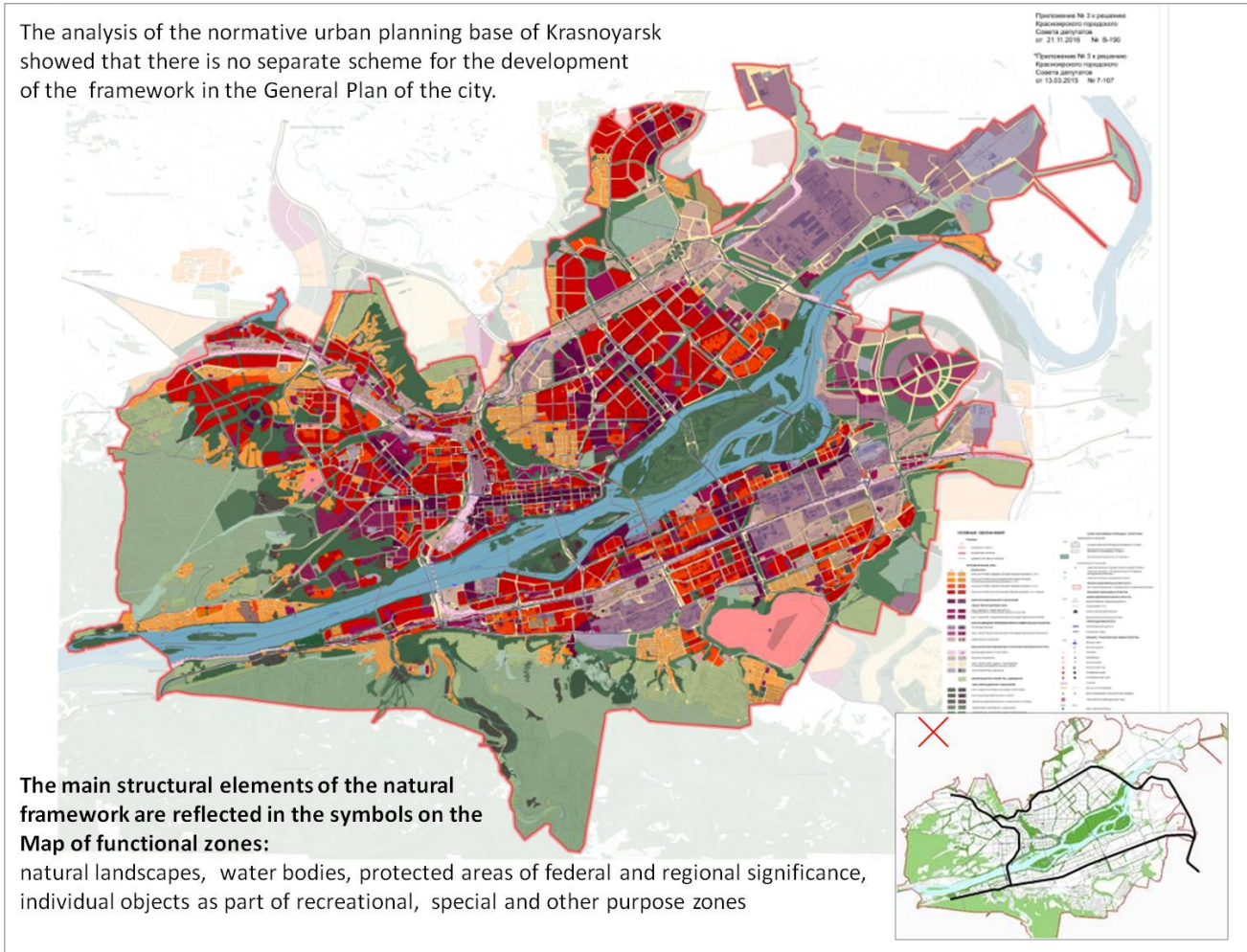


Figure 3. The General (Comprehensive) Plan of Krasnoyarsk City. Map of functional zones of the city district. Main drawing (http://www.admkrsk.ru/citytoday/building/town_planning/Pages/osn_shema.aspx).

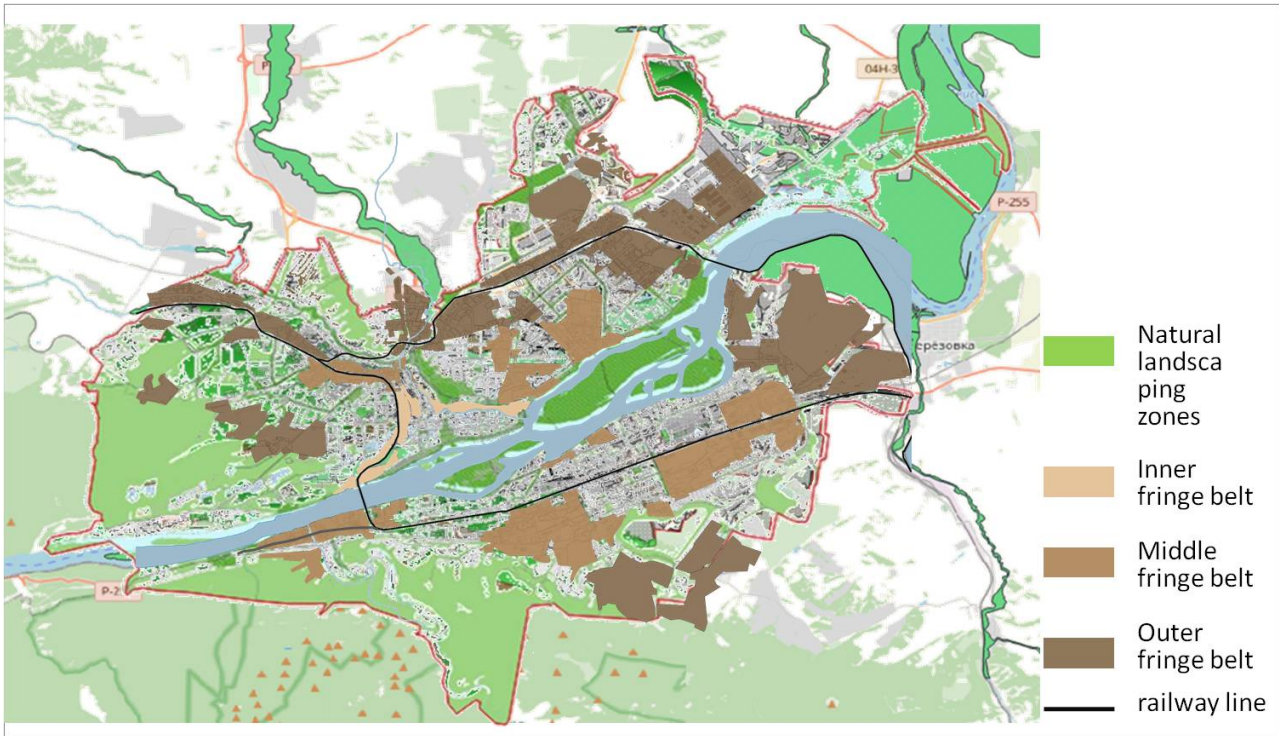


Figure 4. The plan of location of the natural landscape zones (suburban forests, floodplain areas, slopes) and the fringe belts of Krasnoyarsk. The scheme of the fringe belts of Krasnoyarsk is provided by E.N. Logunova (researcher of the morphological evolution of the fringe belts of Krasnoyarsk).

The study of world experience confirms that the allocation of landscape-planning zones within the boundaries of a settlement allows fixing the ratio of natural to urbanized areas and regulating economic activity (Unagaeva et al., 2021).

Economic valuation of urban woody plants in Russia has only begun in 2017, although the ecological efficiency of individual elements of the natural framework has been actively considered by scientists since the 1980s, and ecosystem services of forests have been valued since the 1970s. Indeed, as the world practice shows, the implementation of the ecosystem services and city green framework concepts could improve the environment in the city (Zlobin, 2021).

The analysis of urban planning documentation of Krasnoyarsk shows that urban green spaces are contained in absolutely different territorial zones and accordingly have different urban planning regulations⁶. Unfortunately, the established maximum parameters relate to the size of land plots or the parameters of permitted construction, restrictions on the land use of plots and permanent structures. Whereas it is necessary to introduce an irreducible threshold level of grass and tree cover, and their biodiversity (to calculate not only the area occupied by the lawn, but "volume" of trees and shrubs crowns) (Zlobin, 2021).

Conclusions

⁶ The regulations of land use and development of territories of Krasnoyarsk City. Application to the decision of the Krasnoyarsk City Council of deputies dated 07.07.2015 no. B-122 (<http://www.admkrsk.ru/citytoday/building/Pages/pzz.aspx>).

An analysis of Krasnoyarsk landscape and planning structure development demonstrates the chronology of structural transformations. The identified reduction of green areas over the past 50 years confirms the deterioration of the ecological state of the urban environment. Thus, the study of urban green space morphology at the city scale is of both theoretical and practical importance for a thorough understanding of the general ecological functions and effects of urban natural elements and spaces, as well as their application to urban planning (Whitehand, 2019). It is necessary to implement the green framework concept by means of legal regulation of urban planning activities and more actively apply the methodology of landscape-ecological planning at the city level, also legislatively securing the natural framework of a settlement.

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