Strategies ensuring the Stability of Natural and Urbanized Biotopes in hybrid multifunctional objects

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Abstract. The typology and strategies for integrating hybrid multifunctional objects into the urban fabric will be presented in the article. The dominant feature of the third group is the hybridization of functions between the building and the environment based on blue – green technologies for the sustainable development of urban areas and urban management. Three groups of hybrid objects have a compact and dispersed influence in different parts of the city. In the process of urban territory restructuring, the question arises of preserving and maintaining a natural or urbanized biotope, either by using natural components or by imitating natural communities using new technologies. Thus, different types of phytocenoses are formed in hybrid objects, which need to be preserved and adapted to the new socio-cultural and economic scenario of urban life. Artificial forms of urban nature require new strategies for the development of territories at different urban planning levels and in different parts of the city. Therefore, the topic of the article is of interest to a wide range of specialists.

1. Introduction
The issues of hybridization of a building with a landscape in the urban fabric have not been studied in Russia. The terms "hybrid quarter" [1] or "hybrid space" [2] are of great interest and discussion in the professional community. The appearance of domestic hybrid objects, such as Zaryadye Park [3] in the historical center of Moscow, did not clarify the issues of their typological modeling and principles of formation depending on the selected environmental technologies and natural components of the landscape. In world practice, we can distinguish the stages of formation of multifunctional objects that integrate new technologies into the building design and landscape typology [4, 5]. The Heyday of technologies for collecting rainwater and integrating nature components on vertical and horizontal surfaces (artificial and natural) has covered countries with different climatic, social and economic conditions – from Asia and America to Europe and Scandinavia [6, 7]. Global problems of urbanization direct professional search towards solving issues of environmental stability, food problems, reducing risks from floods, fires and droughts in order to live comfortably in megacities [8].
A special place in this process is occupied by the restructuring of the city territory with the definition of non-architectural sites for construction in the Central, middle and peripheral parts of the city. Returning the city to the signs of environmental, social and economic sustainability in the XXI century is an urgent issue and will require professional flexibility in analyzing the features of the formation of hybrid multifunctional objects and developing new strategies for urban planning forecasting in accordance with the climate, policies and traditions of each particular country.
2. Methods

At the present stage of urban planning forecasting and design, it is safe to say that the definition of "Blue and green Infrastructure" (blue-Green Infrastructure – BGI) has undergone a significant change under the influence of new water and green construction technologies that mimic natural processes. Hybrid objects in which the architecture and landscape, including the social scenario of the space and the economic profitability of the object, are transformed both individually with changes in typological characteristics, and integrated with sustainable components of nature by technological means. At the same time, the issues of conservation and adaptation of an urban landscape with natural components are given increased attention as an identifier of the typology of the future natural biotope of a place [9].

The restructuring of vacant lots in the Central, middle and peripheral parts of the city allows us to determine the typological structure of the territory. On the one hand, the composition and condition of plant components together with the landforms gives specialists an idea of the possibility of collecting and redistributing rainwater in the territory under consideration. On the other hand, the area of the site and its location in the planning structure of the city actively affects the integration of multifunctional hybrid objects of various typologies. These dependencies and indicators will allow us to formulate new strategies for biotope stabilization based on groups of Multifunctional Hybrid Objects (MHO) and propose a new scenario for the natural framework of the Blue - Green Infrastructure (BGI) of the city. The lack of extra-architectural space during reconstruction in the Central part of the city will affect the choice of building design and green technologies for sustainable development of the territory with a minimum land area. This is the first group of MGO with a dominant architectural feature. The main carrier of changes is the shape, shell, and structure of the building.

The first group is characterized by solutions depending on the method of integrating natural components on horizontal and vertical surfaces: greening roofs, external green facade and balconies [4], internal green component, collecting rainwater from surfaces and filtering it at different levels and in the near contour of the building as part of social design on the object [10]. The second group includes multifunctional hybrid objects with a dominant urban development feature. In these cases, landscape typology plays a special role in the integration between landscape and technology. This group includes solutions that focus on landscape sustainability, recreation, and a new socio-cultural scenario. However, the landscape in them acts as the main typological unit of the urban fabric, which can, with the support of the latest green design technologies, return the urban environment not only to a state of ecological balance, but also support the sustainable urban development of territories for many decades to come. The second group of objects is characterized by solutions depending on the typology of the landscape and the selected environmental technologies [4]: urban trees in the rainwater filtration system and open channels for the movement of rainwater to the collection point, urban biological reservoirs, urban gardens, rainwater collection and storage of water volume with subsequent use. All hybrid objects with a dominant landscape feature have a high potential to improve the environmental quality of the environment where there is a reserve of territories. These include areas with "spontaneous" nature, vacant lots, the near contour of natural territories, and areas of industrial zones that can set a new social scenario for development in the middle and peripheral parts of the city [11].
There are more opportunities for a group of objects that integrate architecture and landscape using environmental technologies in order to obtain hybrid multifunctional architectural and landscape objects with new scenarios for the development of the urban fabric and indicators of environmental sustainability against various urban risks. The appearance of the third group of hybrid objects, in which properties and typological characteristics are hybridized in three directions between the building, landscape and technologies, is predetermined by the variability of the influence of technologies on both the building and the landscape, especially in the middle and peripheral parts of the city [12]. It is characterized by solutions depending on the way water and green technologies are integrated into the building envelope with the typology of artificial and natural landscape.

For specialists on the field of urban planning and landscape design, multifunctional hybrid architectural and landscape objects of the third group are of interest (table 1), since it is their typological characteristics that can support the state of environmental sustainability and social demand for sites in the middle and peripheral parts of the city. Where there is a surplus of territories due to the restructuring of industrial zones (both landscape and water areas), vacant lots, and sections of railway and transport communications.

Table 1. The 3-d Group - Typological Features of different Types of hybrid multifunctional Objects

| Group | Water and Natural Components Integration | BGI-A+L technologies |
|-------|-----------------------------------------|----------------------|
| Types of different hybrid objects | Hybridization of a mini-Park space based on a sustainable biotope with a part of the green facade of a modern building in a historical city center | Le musée du quai Branly – Paris, France (photo by author) |

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| Image | Text |
|-------|------|
| ![Punggol Neighbourhood and Polyclinic, Singapore [7]](image1.jpg) | Integration of public functions through transformation of the building shape for the development of a scenario of recreational and rehabilitation spaces. |
| ![Covers Brooklyn Highway in Landscaped Waterfront Park [7]](image2.jpg) | Integration of the transport object with the urban landscape. |
| ![Bogota's Bicentenario Park [13]](image3.jpg) | Rainwater collection and storage location for the volume of water to be used. |
The examples in the table 1 clearly show the typology of BGI A+L solutions, where A – hybrid architectural objects of the 1st group with the integration of green technologies through the building shell, L – hybrid landscape objects of the 2nd group with the integration of green technologies through the landscape typology. Therefore, the 3rd group of objects is the most interesting in terms of a set of typological options for integration between the building, landscape and blue-green infrastructure in different parts of the urban space-from the center to the periphery.

3. Results
Conservation and restoration of natural areas in different parts of the city is possible with technologies that mimic natural processes. The integration of the aesthetics and design of the urban area with technologies for using natural resources is represented in many projects of world practice [14]. For example, the Copenhagen architectural firm SLA won the Nordic Built Cities Challenge Award, the most prestigious architectural competition in Scandinavia. In it, "the SLA receives an award for Copenhagen's natural climate adaptation, which shows the way to use nature and create better and more livable cities" [15, 19] (Pic. 1).
This is just one example of the use of Park space as a rainwater catchment area during seasonal precipitation, which can accumulate a significant part of the volume (tens of thousands of cubic meters) of water at a time without harming nature. Technologies for collecting and moving rainwater allow some of it to be removed to the nearest water source (lake or river). On the "route" (the terrain of the place) it will be cleaned biologically with urban natural greenery that mimics natural biotopes near and on the water. Thus, "new water" will contribute to changing the visual characteristics of the site with and without flooding, as well as irrigation and improvement of the local microclimate and the structure of the biotope of a particular place, creating a number of new blue-green public spaces with their own socio-cultural scenario. The same principles were used in the well-known design bureaus Turenscape (China) [16] and Ramboll Studio Dreiseitl (Germany) [17] (Pic. 2), in which Park spaces were created on the site of former industrial areas with the highest pollution using surface water collection and purification technologies. These events helped to change the image of the place, social activity of the population, increase recreation areas in the natural and water environment, and confirm the theory of sustainable development in the use of new design technologies.
The issue of rational adaptation of industrial territories to the new social demand for natural and recreational zones in the near contour of residential territories and water areas is relevant for Russian cities and Moscow. Currently, the territories occupied by industrial zones occupy more than 18 thousand hectares, which is about 18% of the total area of "old" Moscow [18]. Considering the General plan of the city, you can see that they tend to the largest elements of transport infrastructure – highways, Railways, grouped in clusters in close proximity to transport hubs [18]. About a third of them form the so-called "industrial belt of the capital". It is worth noting the characteristic feature of its location in the structure of the city – the industrial zones that make up it are connected by the Moscow ring railway (MKZHD). Indeed, it was originally used as a line for freight transport between ten railway lines in the capital, as well as for connecting industrial enterprises. On the map of Moscow, by placing industrial zones, you can mark local large fragments of territories in the middle part and dispersed – on the periphery of the city. They represent a huge reserve of urban fabric for creating new parks and public spaces of various types of natural biotope from dry and moist meadows to areas with changes in terrain marks in order to accumulate and move rainwater. Modern design trends at different urban planning levels will address the theory and methodology of new strategies for transforming industrial zones in the middle and peripheral parts of the city, the use of blue-green technologies in hybrid facilities that meet the principles of sustainable development and urban management.

Picture 2. Use of the territory under seasonal climate changes as a new model of hydrology of tropical cities on the Singapore example – Singapore [17]
On the other hand, the preservation and maintenance of natural territories in the city structure is becoming increasingly important due to the increasing risks of compaction of development and attempts to capture plots for residential high-rise construction in the contour of such objects. Experts face questions not only about preserving natural territories as a green framework of cities, but also in trying to understand the world experience and create a domestic theoretical and practical base for recreating natural biotopes of varying degrees of hydrophilicity in the structure of hybrid objects of the third group. According to the map of Moscow, the territories of the natural complex are mostly fragmented. Ecological systems can exist only if various internal relationships between their components are preserved [17]. Recreational and ecological planning elements formed by the reorganization of industrial zones will ensure the relationship between large woodlands and small green areas of the city. The artificial urban environment should bring back natural landscapes that, intertwining with urbanized space, harmonize the urban environment and give a new impetus to the development of urban planning and design.

Preserving the biodiversity of a place as the basis of the concept of ecological design by selecting endemic plants in the existing natural biotope or recreating it according to the principles of natural biocenoses [11] led in the early XXI-st century to the emergence of projects that imitate natural plantings in order to save costs for maintaining the landscape, increase sustainability in urban conditions and bring people closer to nature for recreation without compromising the aesthetic and artistic indicators of the urban environment. Awareness of experts on the field of urban planning and landscape design the need to maintain blue-green infrastructure and restoration of natural frame for the humanization and greening of the environment of cities displays technologies that mimic natural processes to a new stage of understanding their role in modern engineering and adaptation to climatic and environmental conditions of a particular country. The use of technologies makes it possible to predict climate risks and take the first steps in managing urbanization.

Thus, the experience of Europe and Scandinavia is represented by examples of competent conservation, identification and adaptation of natural territories on the site of wastelands and industrial zones to new concepts of urban development in different parts of the city. In Germany, for example, the projects Der Park am Gliesdreik and Der Park am Nordbahnhof in Berlin are vivid examples of using the potential of "spontaneous" nature in the city center, when a Park space is organized in the contour of railway communication on the basis of a natural oasis formed over decades, which allows you to get the maximum effect with minimal investment. In this regard, it is necessary to formulate a new understanding of the organization and functioning of the system of interaction of multifunctional hybrid objects of different groups with urbanized territories of different typological structures in the city that meets the requirements of environmentally sustainable development. We need new links and science-based strategies for the development of urbanized areas between former industrial zones and natural territories, on their borders and/or in their buffer zones. Special attention should be paid to the restructuring of natural areas in terms of preserving the place's biotope and/or imitating it, adding plants to the local flora. Based on the analysis of world experience in designing sustainable urban areas and infrastructure, its adaptation to domestic urban planning realities and traditions, the main priority strategies for such integration were formulated. Understanding the mechanisms of interaction between buildings and landscapes with blue-green sustainable development technologies in different parts of the city based on urban management strategies will allow us to offer new principles, methods and tools for their implementation.
4. Discussion
For the first approximation to the theory and subsequent practice of domestic multifunctional hybrid objects, the following three strategies are proposed: the strategy of biological polarity of green landscape components, the strategy of the trilogy of key components, and the strategy of multicoding the urban landscape.

The priority of the biological polarity strategy for green Landscape components is the Green Landscape Strategy (GLS) as the basis for sustainable urbanism, which includes the restructuring of all urban and peripheral areas in order to determine the typological structure of the place's biotope and its regeneration with green technologies for managing urbanization and climate risks. The so-called biological polarity of natural and urbanized sections of the urban fabric determines the subsequent work with them to determine the typological characteristics of each group. The green landscape components strategy (GLS) for urban territory restructuring has a huge resource for accounting for all non-architectural spaces located in linear and dispersed locations in the city: from vacant lots in the contour of railway communications to former industrial zones. Operating on the macro-scale of the city, these territories have an established natural resource that needs to be carefully preserved and adapted to new functions as part of different groups of hybrid multifunctional objects.

Strategy for Key Components (SKC) is a trilogy of key Components that provide the basic structure of the territory and the restoration of the urban fabric at different urban planning levels through groups of hybrid multifunctional objects with green technologies in different parts of the city. This strategy involves local regeneration of streets, squares and parks as a connected structure, which improves the perception of the qualities of a resilient city as a public space consisting of groups of multifunctional hybrid objects with technologies for restoring the natural environment.

The urban landscape multicoding strategy (LMS) is based on the development of a socio-cultural scenario of the territory with sustainable technologies of multifunctional hybrid objects to strengthen cross-cultural ties and social communication of citizens. The main function of this model is to preserve urban nature and create productive landscapes for the purpose of educating the population, recreational communication, and developing psychological comfort in an urbanized environment.

All three strategies actively complement and develop the theory of hybrid multifunctional objects in different parts of the city and serve the goals of maintaining sustainable development of territories, managing urbanization and climate risks on the planet.

5. Conclusions
The concept of "environmental sustainability" is related to many aspects. This article examines the relationship between the conservation of natural biotopes of different typologies and the introduction of blue-green technologies in the structure of buildings and landscape in different parts of the city. Considering the connections of blue and green infrastructure with different groups of hybrid multifunctional objects, we can say with confidence that the role of technologies that imitate natural processes is increasing. The integration of different groups of hybrid objects with the structure of biotopes in the restructured territories, either locally or dispersed in the center, middle and periphery of the city, allows us to predict and model modern urban planning strategies for sustainable development and reducing urban risks. In this case, the strategy of ensuring the sustainability of natural and urbanized biotopes in
hybrid multifunctional objects becomes one of the priority strategies and requires a comprehensive study.

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