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TÍTULO: Desarrollo de los Paisajes Urbanos de Kazán en el alivio de los barrancos como factor de mejora de la calidad del Medio Ambiente Urbano.

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RESUMEN. Los territorios de erosión de barrancos ocupan áreas significativas en las ciudades, representando una reserva importante en condiciones de escasez de tierra. El artículo analiza la implementación de enfoques de uso de barrancos en la ciudad de kazan como un factor para mejorar la calidad del entorno urbano. Existen dos enfoques principales para el uso de barrancos de lo urbano: reciclaje y destrucción, y cada uno de ellos tiene ventajas y desventajas. Actualmente, se está implementando el enfoque de utilización. El estudio de la opinión de los ciudadanos sobre el uso de barrancos nos permite determinar las instrucciones para usar estos territorios y cambiar (mejorar) la calidad del entorno urbano.

PALABRAS CLAVES: ciudad, relieve, erosión, barrancos, calidad del Medio Ambiente Urbano.

TITLE: Development of the Urban Landscapes of Kazan in the relief of ravines as a factor to improve the quality of the Urban Environment.

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ABSTRACT: The territories of erosion of ravines occupy significant areas in the cities, representing an important reserve in conditions of scarcity of land. The article analyzes the implementation of approaches to the use of ravines in the city of Kazan as a factor to improve the quality of the urban environment. There are two main approaches to the use of urban ravines: recycling and destruction, and each of them has advantages and disadvantages. Currently, the utilization approach is being implemented. The study of the opinion of the citizens about the use of ravines allows us to determine the instructions to use these territories and change (improve) the quality of the urban environment.

KEY WORDS: city, relief, erosion, ravines, quality of urban environment.

INTRODUCTION.

The settlements were originally set up in places most attractive to human life [Anthropogenic geomorphology. 2013]. Due to a number of objective reasons, the development of settlements is closely connected with the features of the relief, to which, of course, the ravine network also applies [Kovalev S.N. 2010, The relief of the human environment (environmental geomorphology) / 2002; Likhacheva E.A. 1997; Guzel R. Safina, Oleg P. Yermolaev, and Regina A. Gayfutdinova; 2015].

In different periods of town-planning history, the attitude towards the terrain changed. J. Bože-Garnier and J. Shabo [Bouge Garnier J. 1967] studying both the geographical location of the city in the district and the micro-location of the city in a specific area of the territory distinguish two main causes of the emergence and development of cities in a complex terrain: historical and operational. In our opinion, the increase (expansion) of the urban area can also be attributed to the current reasons for the emergence of a complex relief in cities. The increase in the urban area, as a rule, occurs by the inclusion of suburbs in the city boundaries, which are not always suitable for agricultural development - inarable and/or gullied lands, etc. [Safina G.R.; Fedorova, V.A., Sirotkin, V.V.; Gasanov I.M., 2016; Vanmaercke M., Poesen J., Golosov V., Dvinskih A., Yermolaev O., 2016].

On the one hand, the relief helped to increase the city's defense capability, on the other hand, it created potential problems in the construction and operation of the city. The activity of mastering a complex relief at a particular historical stage depends on the ratio of "desire" and "possibility" of such development, determined by a number of factors [Krogius V.G. 1979].

DEVELOPMENT.

The city of Kazan is a city on the Middle Volga, located on its left bank, in the lower reaches of the left tributary - the Kazanka River. Unlike the cities of the right bank (Cheboksary, Nizhny Novgorod, Ulyanovsk, Saratov), the Volga banks in Kazan are not subject to slope processes (landslides, screes). However, the features of the geological and geomorphologic structure of the left bank of the Volga contributed to the active development of ravine formation in the city.

Specific geomorphological structure of the territory of Kazan is its position in the valleys of the Volga and Kazanka rivers - within the complex of accumulative terraces: four terraces above the floodplain are distinguished, but the third terrace, which rises above the second pronounced ledge,

is most vulnerable to ravine erosion. The surface of this terrace has a developed ravine network with erosion-hilly relief [Scientific guide to Kazan and its suburbs, 1990].

In addition to the geomorphological structure, the formation of ravines in the city is promoted by rocks of sandy loamy loess and sandy differences, which are highly erosive. In addition, summer and autumn rains also contribute to the development of gully erosion [Malysheva O.N., Nelidov N.N., Sokolov M.N. 1965; Shevelev A.I., Zharkova N.I., Bubnov Iu.P., Latypov A.I., Khuzin I.A., Galeev R.K., 2014].

The objective of the research is to study the implementation of approaches to the use of ravine territories in the city of Kazan as a factor in improving the quality of the urban environment.

Methods.

The main method of research is the geoecological method that allows from the viewpoint of the humanitarian-ecological approach evaluating the environment as for human activity on the basis of natural and natural-anthropogenic geosystems.

The types of use of urban ravine territories in the city of Kazan are determined by retrospective analysis based on the cartographic method [Yermolaev O.P., 2017].

In determining the main methods and directions that contribute to improvement of the quality of the environment, taking into account the opinions of residents of different age groups living in the city of Kazan, the questionnaire survey method was used. This method is classified as operational, economical, and also organizationally accessible. The survey was of an individual and anonymous nature.

As a general population, the population of the city of Kazan was involved at the age of 18 years. The structure of the sample was determined on the basis of state statistics, its volume was 1000 people.

Results and Discussion.

Human activities in urbanized areas, including Kazan, in the late twentieth century became significant, which caused the formation of new ravines and necessitated the identification of a special type of ravines. E.F. Zorina [1987] distinguishes three groups of anthropogenic ravines:

1) Ravines in the plowed field, developing on natural catchments.
2) Ravines on anthropogenically disturbed catchments.
3) Technogenic ravines - ravines developing under the influence of artificial sewage.

Technogenic ravines are studied quite actively, which is reflected in the detailing of the existing classification.

B.N. Liubimov et al. [2005] distinguished urban gullies as a separate group, which in turn was divided into city-forming and urbanogenic (Table 2).

Table 2. Gullies classification by B.N. Liubimov et al, 2005.

Gullies.				
Natural	Anthropogenic		Urban	
	Agricultural	Technogenic	City-building	Urbanogenic

City-building ravines are ravines that affect the development of the city, which in turn are divided into 2 types:

1) Structural and elemental, which are part of the urban infrastructure in the form of recreational areas and used in the planning of the city.
2) Bounding, unifying ravines and gullies, for one reason or another not fitting harmoniously into the urban landscape.

Urbanogenic ravines are ravines that have arisen as a result of the development of the city, which are divided into planning, operational, recurrent and repetitive, which reflects the reasons for their occurrence or the place of development [Liubimov B.P. and Kovalev S.N., 2005].

With respect to the ravine relief, the entire history of urban development in the city of Kazan falls into three stages.

The first stage began in ancient times and continued to the era of industrial revolutions; it is characterized by the development of the city on a complex terrain in order to enhance defense. The historical and administrative center of Kazan is located on the left bank of the Kazanka river - it is, first of all, the Kremlin, built on the promontory of a high Middle Pleistocene terrace. At this stage in Kazan, the role of city-building ravines is great. The ravine, which cut the ledge of the Kazanka river northeast of the Kremlin, along with water objects, enhanced the defensive capacity of the city. The ravines also existed in other parts of the city [Loshadkin A.G., 2016].

The second stage dates back to the era of the industrial revolution and continues until the beginning of scientific and technological progress. At this stage, there is a restriction of the development of a complex relief, because the rapid development of military technology virtually eliminated the special role of relief in defense significance. During this period, the northern industrial hub, residential quarters “Kvartal", "Sotsgorod”, residential areas "Gorki-1" and "Gorki-2", located on the Volga-Noksinsky interfluve, etc., were created in Kazan on the flat right bank of the Kazanka river. During this period, there was a "sprawling of the city in breadth", an increase in its area and the inclusion in the city line of new ravine systems (Gorsko-Ametevskaya, Tsaritsynskaya, Karavaevskaya, Zarechenskaya, Kadyshevskaya, etc.).

The third stage covers the period of the scientific and technological revolution. The development of the city in this period is characterized by an increase in demand for complex terrain, because firstly, the deficit of territories increased due to the continued concentration of production and population; secondly, there was an increase in the technical and economic potential of urban development [G. R. Safina, V. A. Fedorova and R. A. Medvedeva, 2017].

Feature of the 1st and 2nd stages is the formation of urban gullies in the city of Kazan, which develop in different parts of the city and occupy small areas, but represent a significant threat to the destruction of buildings, structures and communications. Traditionally, the reason for the formation of urban gullies is the improper organization of water and drainage networks.

The options for using urban ravine and gullies can be divided into two groups: utilization and destructive [Seniushchenkova I.M., 2011]. The relationship between the two main approaches to the use of ravines in the development of the city of Kazan has changed.

The destructive approach prevailed at the first stage of the city's development, when the territory was covered with earth: on the old construction site from the Kremlin to the territory of the Central Park of Culture and Rest, the relief was leveled at the expense of the cultural layer. However, the ravine and gully relief of that time is reflected in the name of the streets: Zasypkinskaya (Fedoseevskaya st.), Prigonnaya gora (Kasatkina st.), Popovaya gora (Telmana street). Uncovered ravines and gullies of this part of the city have survived to the present time - “Russian-German Switzerland” Stow (Skotskie gory) (SPNT nature monument of regional significance) on the territory of the Gorky Park; in the form of transport roads (Tolstogo st., former Institutsky spusk).

This method of using urban ravines is not effective and is not always justified. One can cover the ravines of no historical value, taking into account their hydro-geological conditions.

At present, the utilization of ravines is being implemented in the city. It should be noted the following main directions of the utilization approach in the city of Kazan:

1. Ravines and gullies can be used as a recreational zone. Recreational potential of ravines and gullies can be implemented in different directions - use for gardens, parks, creation of water objects, zoos, ecotourism, objects of physical culture and sports. In Kazan, it is the Gorsko-Ametevsky park, which occupies the upper Gorki ravine, used by the citizens for recreation.

2. The intact gullies are the habitat of rare plants and animals; therefore, it is possible to use them as nature protection zones with a special status of use.

When using ravines for recreational purposes, it is necessary to, if possible, preserve their ecosystem, and prevent activation of geological processes (landslides, landslides, etc.) during landscaping the gullies.

In Kazan, some ravines and gullies have the status of protected areas - "Russian-German Switzerland" Stow (Skotskie gory) and Karyersky ravine are nature monuments of regional importance.

3. Urban ravines and gullies can reduce the load on the city's transport roads. The use of ravines as urban highways creates the best conditions for increasing the speed of movement, as it becomes possible to create multi-level intersections; examples include: Pushkina street, Tankovaya highway (the bottom of the Gorkinsky ravine), Ametevskaya Highway (laid along the bottom of the Ametevsky ravine), and others.

4. The development of ravines is possible only after careful geological and engineering surveys. Practice has shown that the most effective for development is the arrangement of buildings primarily by a multi-level scheme (Pushkina street, Zaslonova street, etc.).

The general plan of the city of Kazan [The General Plan of the city of Kazan; http://old.kzn.ru/static_page/genplan (accessed date 15.06.2018)] provides for the development of the city at the expense of internal territorial reserves, including through the development of urban inarable lands - ravines, shallow water in the waters of the Volga and Kazanka rivers.

Implementation of the concept of improving the quality of the urban environment allows us to focus on the opinion of citizens. The results of the opinion poll make it possible to assess the opinions of the citizens about the inconvenient areas, to which, of course, ravine and gully systems belong.

Analysis of respondents' answers pointing to the need to restore such territories in their area of residence testifies to their availability in all districts of the city. Half (50%) of all interviewed residents of Kazan among the various proposed options for answering the question about activities that contribute to improving the quality of the urban environment pointed to the restoration (re-cultivation) of ravines and gullies.

In summary, in general, the territory of the city of Kazan is characterized by moderate ravine rate, - the density of ravine dispersal (Kor) is 0.44 km/km^2. The total area of ravines and gullies and landslide-dangerous areas is about 2.5% of the total area of the city [11].

Concern of the population about the fate of inconvenient territories within the city of Kazan is uneven: recultivation issues are most relevant in the old districts and historical parts of the city (Vakhitovsky, Privolzhsky, Kirovsky, Sovetsky districts) (47-56% of respondents). The increased concern of the residents with the state of inadequacy in these areas is explained by the fact that these territories are characterized by the largest indicators of the density of the ravine network and are experiencing a shortage of territorial reserves.

Citizens living in new areas (Aviastroitelny, Moskovsky) show less interest in issues of developing inconvenient land - only 37-43% of respondents indicated the relevance of these processes. This is due to the relatively low density of ravine and gully systems within these areas and the implementation of regular development of the territory, which allows to some extent addressing the quality of the urban environment.

CONCLUSIONS.

The geological and geomorphological structure of the city of Kazan determined the development of the ravine and gully network. At the stage of the city's foundation, the ravine relief performed mainly a defensive role. However, as the city developed, ravines and gullies became interesting as a territorial reserve.

Analysis of the implementation of approaches to the use of ravine-gullies in the city of Kazan as a factor in improving the quality of the urban environment showed that the currently existing two basic approaches to the use of urban ravines and gullies are clearly reflected in the opinions of citizens on the use of these territories.

Taking into account the opinion of the citizens will in the future more specifically address the main approaches to the use of these territories, thereby improving the quality of the living environment.

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