

ENVIRONMENT AS A FACTOR OF THE SPATIAL ORGANIZATIONS OF THE BIG CITY  
(ON THE EXAMPLE OF THE CITY OF KHARKIV)

*К.А. Немець, А.В. Мазурова. ПРИРОДНІ УМОВИ, ЯК ФАКТОР ПРОСТОРОВОЇ ОРГАНІЗАЦІЇ ВЕЛИКОГО МІСТА (НА ПРИКЛАДІ МІСТА ХАРКІВА).* У статті охарактеризований рельєф території міста Харків та його вплив на формування міського середовища. Зокрема розглянуто орографічні та геоморфологічні особливості території міста, розповсюдженість ерозійних форм рельєфу, характер долин річок Харків, Лопань, Уди та Немышля. Визначені особливості гідрографічної мережі міста та їх використання у господарстві. Охарактеризовані кліматичні умови міста Харків, зокрема наведені особливості річного температурного та вітрового режиму. Розглянутий вплив зони високого тиску Воейкова-Броунова на формування клімату міста. Наведені особливості ґрунтового покриву, а саме розподіл типових та деградованих ґрунтів за територією міста. Охарактеризовані особливості розповсюдження флори та фауни на території міста Харків. Визначений вплив окремих природних факторів на формування просторової організації міста.

**Ключові слова:** природні умови, місто Харків, рельєф, річки, клімат, ґрунтовий покрив, флора, фауна.

*К. А. Немец, А. В. Мазурова. ПРИРОДНЫЕ УСЛОВИЯ, КАК ФАКТОР ПРОСТРАНСТВЕННОЙ ОРГАНИЗАЦИИ БОЛЬШОГО ГОРОДА (НА ПРИМЕРЕ ГОРОДА ХАРЬКОВА).* В статье охарактеризован рельеф территории города Харькова и его влияние на формирование городской среды. В частности рассмотрены орографические и геоморфологические особенности территории города, распространенность эрозионных форм рельефа, характер долин рек Харьков, Лопань, Уды и Немышля. Определены особенности гидрографической сети города и их использования в хозяйстве. Охарактеризованы климатические условия города Харькова, в частности приведены особенности годового температурного и ветрового режима. Рассмотрено влияние зоны высокого давления Воейкова-Броунова на формирование климата города. Приведены особенности почвенного покрова, а именно распределение типичных и деградированных почв по территории города. Охарактеризованы особенности распространения флоры и фауны на территории города Харькова. Определено влияние отдельных природных факторов на формирование пространственной организации города.

**Ключевые слова:** природные условия, город Харьков, рельеф, реки, климат, почвенный покров, флора, фауна.

**Introduction.** Formation of the big urban spatial organization is a difficult process which depends on many factors, among which are environment, population, settlement, production specialization, economic activity and many others. However, environment is a primary factor. Exactly by virtue of a favorable environment the effective city spatial systems are formed.

For Kharkiv, as the second by population city of Ukraine, formation of optimum city structure is an urgent need because in many respects it defines the city's efficiency of functioning. The social and geographical analysis of an environment gives the chance to optimize the spatial city organization, to define phenomenal features of urban infrastructure formation taking into account requirements and expectations of people.

**Literature overview.** The attention of many scientists is focused on the research of various aspects of urban processes. Some of the national and foreign authors have considerable scientific achievements in the urban spatial organization. They are A. Druzhynin, G. Lappo, K. Mezensev, E. Percyk, B. Rodoman and others. Characteristics of natural Kharkiv environment are represented in the works of Ju. Gamulja, L. Gorelova, K. Zvjaginseva, G. Strizhel'chik, Yu. Shubyn, and others. However, features of environmental conditions impact on the city spatial organization formation of Kharkov in terms of social geography is insufficiently investigated.

**The purpose of this article** is to analyse social and geographical environment of Kharkiv territory for definition of their influence on formation of the spatial city organization.

**Main content of research.** Kharkiv is one of the largest industrial, scientific and cultural Ukrainian centers, the core city of the Kharkiv agglomeration, the second millionaire city after Kyiv in Ukraine. For today, the extent of the city territory from West to East is 25 km, from North to South – more than 20 km; the total area of the city is 350 km<sup>2</sup>. City borders gradually continue to extend, the spatial city organization becomes more difficult every year. For April 1, 2015 the population of the city made 1451522 people [6], the population density was the 4157 persons per km<sup>2</sup> on April 1, 2015.

The territory of Kharkiv is located in the northeast of Ukraine within the East European Plain on the southern border of the Forest-steppe. On tectonic division the city territory carry to a northern onboard zone of the Dniepr-Donetsk avlakogen. In the orographical light, the biggest part of the territory of the city, respectively, is in the limits of southeastern part of the Dniepr-Donetsk Basin. The surface of urban area is defined as the wavy plain, slightly inclined in the southern direction (fig. 1). The most part of the Kharkiv region is located within Dnieper Lowland, northern part – on a Spur of Central Russian Upland, eastern part – on a spur of the Donetsk Upland.

In the territory of the city of Kharkiv fourteen geomorphological levels are allocated: water separate plateaus, in the Uda River valley (and partially in valleys of its tributaries) twelve terraces and floodplains [5].

The city is located in rather deep erosive hollow formed by the activity of the Uda, Lopan, Kharkiv and Nemyshlya rivers (fig. 1). The hollow shape has an amphitheater appearance formed by terraces of the rivers widely open to the south and the southeast, towards falling of the Uda River, and with exits to the north on valleys of the rivers Lopan and Kharkiv. The rivers divide the city into three main parts with different character of a relief.

Low sites with marks of 90-110 m make 46% of the city territory, average marks of 110-160 m – 49% and high with marks of 160-205 m – 5% of all urban area [7].

The highest point within Kharkiv is in the northern part of the city, namely near the Zhukovsk neighborhood (Kyiv district), is 205,5 m above the sea level, the lowest point is in the south of the city around Dikanevka (Chervonozavodsk district), is 94 m above the sea level. Generally, the minimum marks are observed in valleys of the Lopan and Kharkiv rivers, on the northern and northeast suburb, in confluence near the downtown.

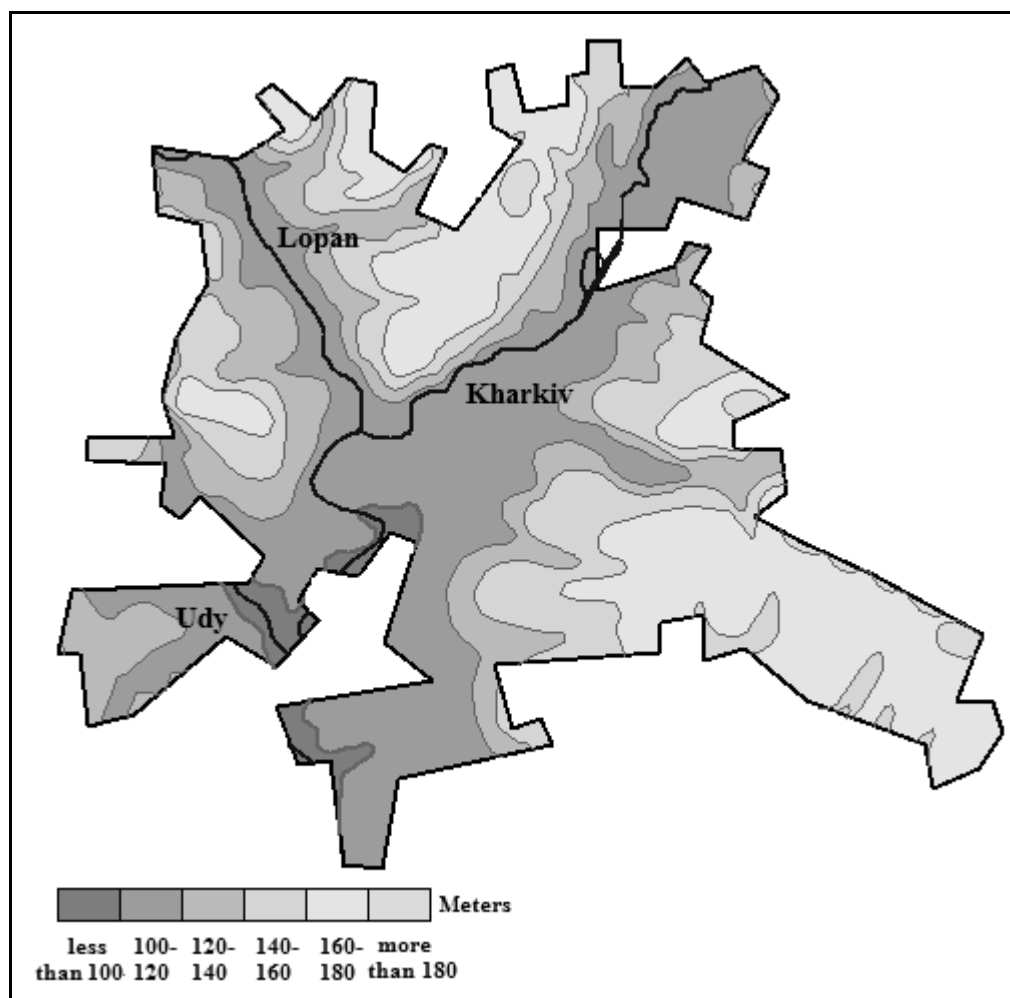


Fig. 1. The relief and hydrographic Kharkiv network (built by authors)

The central city part formed on the terraced interstream between the Lopan and the Kharkiv with maximum surface marks (160-165 m) are dated for its northeast part near Vesnin and Novgorod str. The second elevated city center area is in the western part, in the right Lopan bank, where the Holodna and Lysa mountain slopes tagging reach maximum values and then gradually decrease toward the river valleys at the city center.

Characteristic forms of a city relief are also gullies and ravines. The sizes of gullies depend on

their age. Younger gullies are about 2-3 km long, and olden reach 10 km. The depth of gullies fluctuates from several meters to tens of meters. By form they are linearly extended outlines. There are also arched gullies (mainly on the right slopes of the river valleys). Unbranched and treelike ravines prevail in the region. Short, deep and strongly branched ravines are widespread on high and steep right slopes of the river valleys. Depth of ravines reaches 20 m. Total length of gullies network in the city boundaries reaches 194 km, that averages

0,6 km/km<sup>2</sup> of an urban area. The area occupied with gullies and ravines is 13,9 km<sup>2</sup> that is about 3% [7]. Now the small size of the gullies network has no considerable impact on formation of the spatial city organization. However, the gradual growth of gullies and ravines quantity demands monitoring and an artificial revegetation of certain territories.

Flat urban relief and an unbranched gullies network are favorable factors for creation of the optimized city space system. Rather equal surface allows construction of any architectural designs without probability of further destruction of an adverse environment. Lack of considerable height differences of a territorial surface gives the chance evenly to arrange objects of city infrastructure.

The Uda, Lopan, Kharkiv, Nemyshlya rivers, belonging to the Don basin, small reservoir storages and ponds represent the hydrographic network of Kharkiv. The rivers of Kharkiv are typically flat. They have wide valleys with well-developed flood plains, quite often boggy with cutoff lakes. For all valleys existence of 3-4 terraces and well expressed asymmetry is characteristic at the cliff right and glaxis of the left slope. By nature of flood the Kharkiv rivers belong to the type of snow flood rivers which makes 70-80% of an annual runoff. The significant role in flood of the Kharkiv rivers is played by underground waters and rain [1]. Underground waters in the Kharkiv territory are dated for the main water layer relating to the province of hydrocarbonate-chloride and chloride-sulfate waters of the Donetsk artesian basin and lie in Mesozoic deposits.

Existence of four rivers within the city has a great influence on its spatial structure. Kharkiv city as a large settlement was formed on the basis of the rivers. Rivers play a significant role in economic activity of the Kharkiv city of the modern period. They are used for drinking, agricultural water supply, fishing, recreation and ground irrigation.

Now on the basis on the Lopan and Kharkiv interstream area in the downtown, a city recreation area for inhabitants and city visitors is being created. The successful combination of natural beauty of the river system and urban architecture creates an attractive recreational zone.

The analysis of the current condition of the rivers of Kharkiv and assessment of their economic use have shown that at low-water content and big unevenness of a river flow intensive water use will lead to exhaustion and considerable deterioration of water resources. The comprehensive analysis of interrelations of all landscape and geographical system components in general taking into account their properties, formation regularities and changes under the influence of natural and anthropogenous

factors is necessary for rational use of water resources within the big city. Further, if appropriate measures are not taken, the intensive use can lead to their exhaustion and excessive pollution.

The climate in Kharkiv is moderately continental and changeable. During the winter period frosts often alternate with thaw. Average annual temperature is +7,5 °C. The coldest month in the city is January with an average monthly temperature about -7 °C, however, sometimes temperature falls to -15 - -30 °C. The winter begins in the middle of November and is rather long, but not severe, with frequent thaw, sometimes so intensive that the ground surface is completely exempted from snow cover. The spring comes in March. The beginning of summer can last till the middle of May. Summer is moderately warm or hot, the warmest month is July with an average temperature of about +21 °C. In June and July the greatest number of rainfall drops out. Upon transition of average daily air temperatures through +15 °C that occurs in the first half of October, the summer ends and the fall begins.

The district of Kharkiv and the Kharkiv area in general belong to a zone of insufficient humidification. The average annual rainfall amount for Kharkiv is 522 mm. Long shortage of rainfall at air temperature increase during the warm year period causes droughts and dry winds (spring, summer, autumn). Dry winds are observed in April-September, with maximum in August. This phenomenon arises at air temperature increase of more than +25°C, decrease of relative humidity to 30% and the wind speed of more than 5 m/s.

A climatic Kharkiv feature is that a high pressure zone of Voyeykov-Brounov crosses its territory serving an important wind separator and increasing repeatability of winds of the southern, southeast and east directions, promoting formation of a powerful steady anti-cyclone. In the summer influence of a high pressure zone is almost imperceptible, however accurately expressed in the winter. This area is the boundary distribution of moist air masses and precipitation in Ukraine. The displayed climatic feature also has a significant impact on the spatial city organization, including stable weather and the lack of strong winds that allows you to build high-rise structures, reduces the likelihood of natural disasters.

The soil of the city is characterized by a wide range of soil types and corresponds to features of a forest-steppe zone. Considerable territories are occupied by the real gray and light -gray podsolich soils and degraded chernozems in the central and northwest city part. These soils are widespread in the basic under the woods, along rivers coast and interstream of the Uda, Lopan and Kharkiv Rivers.

Under the pine woods (the left coast of river valleys) turfy-podsolic and turfy-sandy soils were created. Typical chernozems stretched in wide strips which are divided by massifs of the podsolic soils, in the Kharkiv and Uda interstream mainly in the east part of the city. However, long intensive anthropogenic influence and considerable scales of transformation of soil caused emergence of inadequate to the natural analogs soils.

In general, urban flora largely reflects the regional flora, so most species peculiar to the region is also city characteristic [3]. Zoning types of vegetation are upland oak on the high right banks of rivers and watersheds, meadow and forb-fescue-grass steppes mainly used as farmland. In zonal vegetation types, widespread steppe pine and pine-oak forests, meadows in river valleys, higher aquatic vegetation and flora of open sand are found. At the same time, the urban area is a place where the natural vegetation affects human activities. Through a combination of natural conditions and natural vegetation, on the one hand, and the influence of anthropogenic factors on the other, historically constituted today flora and vegetation of the city are represented as the remnants of natural vegetation (indigenous flora) [2].

Mixed type of forest-steppe fauna is typical for Kharkiv territory. But in the city because of human impact fauna is altered.

Conclusions. Due to the rapid area growth and the changing nature of its use (the emergence of

new districts and dwelling areas, new parks and gardens, etc.) there is a constant redistribution of natural resources with a significant degree of influence of the spatial city development. Relief, river system, climatic conditions, soils, flora and fauna of the area have significant impact on the features of the urban environment formation.

The flat city relief in Kharkiv and straight gullies and ravines are favorable factors for creating of urban space optimized system. Relatively smooth surface allows construction of any architectural designs without probability of further destruction due to adverse natural conditions.

A large number of rivers in the city has a great influence on the formation of its spatial organization. Rivers play a significant role in the economic activity of Kharkiv, particularly used for drinking, agricultural water supply, fishing, recreation and irrigation.

The zone of high pressure of Voyeykov-Brounov crossing the city forms stable weather and the absence of strong winds, which allows high-rise construction of buildings and reduces the likelihood of natural disasters. Soils territory is favorable for farming in the city and suburbs. Forest-steppe flora and fauna are changing through human impact.

Natural Kharkiv city conditions are favorable for creation of complex spatial organization of the big city.

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