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# The climate of the city and its ecological significance

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Literature review on natural-climatic conditions of urban areas is conducted in this article. Environmental assessment of urban areas is given. Natural and climatic environment of urban areas continues to lose its quality that makes it not only uncomfortable, but also dangerous to public health. Loss of quality of urban environment is associated not only with an extremely high level of physical-chemical air pollution, but also with noise, vibration and other anthropogenic impacts. These impacts on the surface layer of the atmosphere adversely affect the health of the population that uses urban areas both for recreation and for a walk or for other purposes.

*Key words:* environment, population, health, the climatic conditions, temperature, weather, desertification, area, urban lifestyle, creation.

The natural and climatic environment in urban areas continues to lose quality, which makes it not only uncomfortable but also dangerous for population health. Loss of urban environment quality is associated not only with an extremely high level of physical-chemical air pollution, noise, vibration and other anthropogenic impacts, but also with the appearance of climatic anomalies of meso-and microscale on the territory of cities. Seal construction, the growth of anthropogenic heat emissions, destruction of green space, increase of the area with artificial turf and other types of anthropogenic transformation of Earth's surface lead to a change in the radiation and heat balance, fields strain of wind characteristics, air temperature, precipitation and redistribution of many other consequences. These effects on the surface layer of the atmosphere adversely affects the well-being of the population using urban areas as for recreation or just walking place to and from work or for other purposes.

Increasing demand on the qualitative and quantitative assessment of environmental components is responsible for the relevance of the space-time distribution of climatic parameters studied area as climatic and ecological condition of the place of residence of a person in many ways defines the aspects of his life. To characterize the climatic conditions from the standpoint of preservation of human health, it is necessary to determine the level of climate discomfort because question about people's health in the third millennium is increasing to a problem of the future. Humankind has already faced a global problem — the restoration of the natural quality of the environment, using the experience of all countries. Certainly, interest concerns monitoring of the geographical environment changes and human health. The resulting schemes of the spatial distribution of climatic indices (indicators) in the study area allow informatively and graphically display data calculations of the resulting analysis and synthesis.

In recent years cities like objects that fully satisfy social needs of modern society receive special attention. Today the concept of the city as an artificial entity does not meet dictates of the time and must be replaced by the concept of cities as ecosystems, human habitat in creation of which along with anthropogenic factors natural factors also play an important role. Urbanized area should be considered as a physical-geographic entity with its inherent climatic and landscape features as defined by landscape and geological and geomorphologic conditions, which provide its ability to perform the functions of the spatial basis of society, to create conditions for social and industrial infrastructure and ultimately for the sustainable development of the city as a whole.

Observations of climate change show that the average temperature over the last thousand years has increased — this is the first factor. The second — an increase $CO_2$ concentration in the atmosphere that occurred as a result of huge industrialization growth after World War II. There is a definite correlation between these two factors. Look at the change in $CO_2$ concentration and changes in average global temperature. The obvious correlation is a scientific fact. Now look at the graphs of change in temperature, $CO_2$ concentration in the atmosphere and a rise in temperature observed over the last 40 — 50 years — a sharp rise. Whether the growth of 0.6 degrees proved over one hundred years is important? At first glance, it does not matter, but

nevertheless has a greenhouse effect on the environment development. In this case there is no doubt that $CO_2$ is a greenhouse gas [1].

Global climate change is already instilled to the local manifestation of a significant and extreme weather changes as snowfall and rainfall, hurricanes, etc. In recent years there are extreme manifestations of weather in those regions where it had not previously seen. The main economic loss due to this fact is increasing. There are studies that show increased incidence of various types, such as malaria in the case of moisture. There are various forward-looking scenarios — do not exclude the possibility that it would begin to melt the permafrost in Russia or the Gulf Stream would turn its direction. The process of desertification is developing for many reasons. But they all relate to climate and human activity [1].

If we talk about Kazakhstan, then we should not forget that we live in a zone of risky agriculture. And if someone hopes to benefit in our harsh conditions, he is much mistaken, the loss of unbalancing the climate system will be much higher. Processes of desertification are developing. If Kazakhstan is seen as a land that has defined biodiversity and not as a barrel of oil, we should be concerned about the preservation of this unique area. In addition, a major problem for the republic even regardless of climate change, was and will be a small amount of available fresh water on the territory [1].

City is a complex, territorial, multistructural, open, controlled system. Definitions of city term are numerous, but in general the main features of the cities selection are high concentration of population, special activities, unique types of buildings and so-called urban lifestyle. In view of the heterogeneity of the essence and multifunctional of city the problemof its study is at the junction of various sciences — geography, ecology, history, sociology, cultural studies, economics and others. At the present time a considerable amount of empirical data has accumulated, but there is no common understanding about the city as an object in which economic, environmental, social and cultural processes are inextricably linked to the place where they occur and, therefore, spatially «fixed» in it [2].

The transition from a planned economy to market economy demands new approaches to the management and development issues of urban space. There is a rethinking of the concept of the urban environment as a space for a comfortable life, which determines the formation of new urban area. Obviously, the creation of the modern concept of formation and dynamics of urban space should be based on the achievements of both the natural and technical sciences and humanities. Scientific direction in which this synthetic study may be conducted is the geo-ecology. Geo-ecology is an area of geographical science which studies the geographical environment and its constituent natural and natural-anthropogenic geo-systems and use of humanitarian and ecological approach to develop the theoretical foundations, principles and standards for environmental management, sustainable development of society and to optimize its interaction with the environment [3, 4].

Creation of cities is dictated by the desire of a person to live in comfortable conditions. Comfort criteria are: 1) security from natural disasters, accidents and natural hazards, sustainability of the environment; 2) availability — for communication with other regions, at the same time, the unavailability to potential enemies; 3) resources — natural, social, and optimality of their territorial position in relation to the city; 4) appeal — aesthetic and spiritual terrain, macro and micro-landscapes, and 5) health — to save the lives of individuals, social groups and ethnic groups as a whole, recreation.

The relief of the Earth, rocks and vegetation are the environment of a living and ecological condition of the development and functioning of the biosphere. A person as a part of the biosphere also has its own environment, its ecosystem. Like all other organisms, a person changes this environment in accordance with its social needs. Most of the cities appear in junction node of morfosystems, mainly in river valleys of 2–3 orders. But cities are not really on morphostructural site, but on a more stable water-divide and terrace surfaces near waterways to provide the city with water, energy and communications. River valleys are natural geomorphic boundaries, first by external as well as the growth of the city, the internal dividing of districts, microdistricts, quarters.

Relief, composition and properties of soils determine microclimatic differences, redistribution of material and energy in the landscape, formation of water balance of an urbanized area. These indicators by creating a framework of urban ecosystems affect the character of building, construction of communications, maintenance of buildings and the sanitary-hygienic conditions, including formation of technogenic geophysical and geochemical fields, landscape and architectural design of city, public health and its psychophysical condition, so literally control the budget of the city.

It is necessary to distinguish between favorable (comfort) and negative (discomfort) geomorphic conditions. Favorable conditions are conditions that lead to the improvement of human health, ensure the safety of his own, dwelling, household objects, contribute to maintaining and developing the necessary social conditions and economic ties. Unfavourable conditions harm directly to the person, his business activities, his habitat, cause discomfort.

Main conditions among uncomfortable geomorphologic conditions and facilities in urban areas are: 1) closed basin with a long stagnation of air and temperature inversions; 2) areas not protected by natural barriers against strong winds and storms; 3) territories situated on the windward side of the sources of atmospheric issues (of any nature); 4) territories with large daily fluctuations in temperature and humidity; 5) flood plains, steep slopes, badlands; 6) zones of dangerous exogenous processes — erosion, karst, suffusion, flooding, water logging, thermo erosion and others; 7) zone of active faults and zones of increased fracturing of rocks; 8) zones of geochemical anomalies and discharge of fluids from the depths of the earth's crust; 9) zone of high seismic activity; 10) geopathic zones of unknown origins [4].

The city is a too complicated system in order information about its constituent parts would be concentrated in one place. Moreover, the data of any area of activity, complex objects, components, territory, etc., often are at the disposal of various departments and organizations, mostly are independent from each other. A striking example of this situation is a relief. If information about past natural terrain is still available to research institutions, information about his past and the present artificial is not subjected to any scientific classification accumulating useless in the city archives. And it is wrong, since plans for urban areas cannot rely on the natural frame. Therefore, we define the basic techniques of geomorphological researches and environmental designation for urban areas.

For assessing ecological and geomorphological discomfort in urban areas several criteria are chosen that reflect potential anomalies of geophysical and geochemical fields. Among of geophysical fields gravitational and structural abnormalities are the most informative. Factors that have a mixed nature and the cumulative effect, such as physical and chemical processes in the soil horizons and their underlying rocks, influence a great threat to human health and safety of household infrastructure. Such dangerous process in the city is a soil-corrosion. In analyzing the causes of failure of underground utilities, including cable networks, it became clear that the share of damage as a result of soil and groundwater corrosion accounts for around 30 % of total damage [5, 6].

In the cities pollution is concerned with the propagation of liquid municipal waste, solid waste of industrial production, domestic and industrial illegal dumping, filling stations and tank farms, waste gases of motor vehicles, industrial plants, power plants, which with the rain and snow melt into the soil and then into the groundwater. The highest concentration of the polluting components is found in low areas of relief. On the territory adjacent to major highways, there is a significant accumulation of chlorides in connection with the use of sand-salt mixtures against icing.

The danger will represent physical fields of technogenic character, such as a field of stray currents. Sources of stray current (industrial energy-intensive industries, electrified rail transportation, power lines, cable networks, power plants, etc.) excite the field pulse of varying amplitude and frequency. The total level of exposure to stray current is determined by the superposition of the effects of different sources. The high level of stray current field (up to 1000 mV/m) provides intensive energy corrosion influence on underground metal and concrete structures and communication.

Vibratory field is a type of technogenic physical impact and one of the factors affecting the strength and deformation properties of soils. Highways form a complex system of linear constant sources of vibration and intermittent operation. The amplitude and frequency of oscillations, the size of the zone of influence transport sources depend on the traffic flow and its composition, condition and quality of road surface, the coating material, its includings, the presence of irregularities on its surface, the local geological and geomorphologic conditions [7].

Thus, as a result of an integrated approach a certain scheme (algorithm) of formation of uncomfortable living conditions of people in urban areas can be structured. Tectonic processes violate the structure of the surface areas of the earth's crust, formed fault zone and zone of increased fracturing. On them removal of chemical elements on the surface is made, but river valleys also lay. Erosion processes in the last will increase the contrast of relief. Bottom of valleys, slopes and watersheds are forming. Gravity anomalies appear on the slopes, which are associated with many dangerous geomorphological processes, landslides, rock falls, etc. Type of relief (in the broadest sense) affects the nature of migration flows of chemical elements, deter-

mines their structure and orientation. Redistribution of chemical elements in the components of geo-and ecosystems (air, water, soils, unconsolidated sediments, living organisms) creates a biochemical background of the human environment. Biogeochemical environment background fundamentally affects the performance of the last and most important element in the proposed algorithm — the health of the population. Therefore, a natural component of medical and ecological problems is extremely important in studying the health of the urban population.

Urbanized territories are the most active arena of human economic activity, which results to an active change in the morphology and the nature of the surface soils. Within the city person actually creates an artificial topography: buildings, surface and underground communications, waste heaps, road slopes, ditches, canals, ponds, etc. [8]. These artificial forms of relief sometimes make a significant contribution to the redistribution of migration of chemical elements, in the formation of local climate, geophysical anomalies. In this regard, usually assessment of technogenic component of city relief and its influence on the formation of zones of ecological and geomorphological discomfort is conducted. Using special maps one can determine the impact of economic activities in changing not only the terrain but also the entire lithogenic basis, the nature of migration of chemical elements, formation of geochemical and biochemical anomalies, etc.

Overall, the evaluation of ecological and geomorphologic discomfort in urban areas is a complex task, geoinformational. For its solution it is necessary to involve collection and study of a large number of actual (empirical) and analytical statistical material in various fields of knowledge. Today solution of this task is impossible without the use of new geoinformation technologies and digital elevation models in studying spatial relationships of objects. The main method of the GIS-researches is spatial-temporal modeling, based on the integrated use of various types of geospatial data. For the eco-geomorphological researches the key moment is creation on the basis of fact sheets of digital elevation models and their subsequent interpretation of a specific task.

Hopes to create a favorable environment for people with engineering and technical resources that can offer modern scientific and technological progress, often not met. The urban environment in many cities is continuing to lose quality by becoming not only uncomfortable but also dangerous for your health. The loss of quality of city environment is associated with extremely high levels of chemical pollution and noise impacts and the emergence of climate anomalies of meso- and microscale in cities. Sealing of buildings, increase the number of floors, emission of technogenic heat, destruction of green spaces and increase in the area with artificial turf and other types of anthropogenic transformation of the earth's surface in the process of town planning activity lead to changes in radiation and heat balance, fields strain of wind speed, air temperature, precipitation and redistribution of many other consequences. Most of these impacts on surface air adversely affect the well-being of the population as using city territory for recreation or simply for moving on it.

These problems make us to think about possible ways to improve the microclimate conditions — «micro-climate melioration». Obviously, for the most part of open urban spaces is not applicable to the active influence of microclimate such technical facilities as are enjoyed to create micro-climatic conditions of the internal environment of buildings. Therefore, the focus of this issue is to use the influence of microclimatic conditions on compositional development and design features of individual buildings, use of facade cladding materials and artificial surfaces that direct microclimatic impact have, organization of green space so that they fully smooth negative microclimatic effects that occur in urban environment.

The climate has a great importance. For all the differences of individual weather days, months and years in each area one can distinguish well-defined environment. Climate is called the set of atmospheric conditions (weather) that is typical to that local inherent depending on its physical and geographic location. Under the physical-geographical position it means not only the latitude, longitude and altitude, and terrain, position relative to the water bodies, soil and vegetation and other features of the underlying surface and the landscape, providing a sustainable impact on the state of the atmospheric boundary layer [9].

The main reasons for the formation of specific to a particular area of climatic conditions are particularly atmospheric circulations that determine the seasonal trend and frequency of synoptic situations in the area, as well as its ability to create their own, smaller circulation mechanisms and transform properties coming to the area of air masses.

In the cities the transformation of air is related mainly to the restructuring of the heat balance, leading to the entrance surface air an additional quantity of heat energy, so built-up areas that are large enough create specific climatic conditions, different climatic conditions of the surrounding landscape. Urban climate has an

impact on the population and almost all economic activities: construction and operation of buildings, roads, bridges, utilities (primarily sewer and heat supply).

The most important in terms of architecture and climate analysis climatic characteristics are: solar radiation (direct and indirect), temperature and humidity conditions, cloudiness and rainfall, wind speed and direction, nature of its impulsiveness and frequency of calms. These climatic parameters in the complex and each itself affect mode and conditions of use of buildings, structures, utilities and transport infrastructure of the city.

If you say about influence of climate on a person who is in the open space located in the temperate climate of urban development, then important factor is not a particular climatic factor alone or its status, but an objective reality, such as weather, i.e. combination of many factors affecting the human population and determine its condition. Therefore from a physiological point of view, the most important characteristic is a local climate through the possible set and the likelihood of recurrence of certain weather. This approach to climate analysis section as general climatology has been named the complex climatology.

From the physiological point of view we can talk about two ways of weather impact on humans. The first is its influence on the thermal state of man, the second is its impact on the psyche. The latter is possible even when a person is not directly exposed to the weather. This happens due to a complex set of conditioned reflex and mental reactions, based on the restriction of freedom in the open air or the fear of the elemental forces of nature. Such states are not relevant to the subject of architecture and climate analysis. Effect on thermal condition is an objective interaction with the environment by heat exchange, characterized by its degree of stress thermoregulatory state.

For the systematization of research and their application to the needs of business climate the notion of climate scales is used. The main ones are the macro-, meso-and microscale. Macro scale is used in meteorology and climatology for the study of processes and phenomena, comparable in size with the Earth's hemisphere and its major regions (seas, continents). He is too big and is not used in architectural climate analysis. In urban climatology given the scale of the phenomena under study and their applicability to the city's volume of different levels an additional intermediate «local» scale — submezoscale is introduced.

Under the mesoscale climate change the processes occurring under the influence of a city, or any territory — a large lake, river valley, mountain, etc. are usually described. Cimate of Moscow as a whole is referred to as mesoclimate, climate of individual districts, neighborhoods, city parks — as submezoclimate, climate inside a courtyard of individual spaces — as microclimate.

Local scale (submezoscale) is the scale that characterizes the climate within the blocks with the same intensity of urban use, similar morphotype development, relief, uniform system of green spaces, i.e. area with repeated similar microclimatic conditions. A typical dimension of this scale is from hundreds of meters to several kilometers.

For most of cities of temperate climate integral albedo in summer is between 10–30 % at the most common value of 15 %. Green areas usually tend to have greater reflectivity compared to the buildings and a wider range of seasonal changes.

Anthropogenic transformation of the physical properties of the surface of the active layer leads not only to change its albedo, but its penetration for precipitation and groundwater. Under natural conditions cost of heat for evaporation are major consumable parts of heat balance the earth's surface. The ratio of these costs to the radiation balance is annual average of 80 % in the forest zone of the European territory of Russia decreasing to 70–50 % in the plains and up to 10–30 % in the desert, where the evaporation is limited precipitation [10].

Urban sprawl affects evaporation, which occurs due to violation of the natural water balance of the surface water catchments. Urban sprawl reduces the magnitude of the evaporation layer at the expense of evaporating area and removal of runoff storm water networks. Changes in the level and mode of supply of groundwater is due to redistribution of the catchments area with different coefficients of runoff and leakage from water communications.

Moisture deficit that is available for evaporation significantly affects not only water but also the heat balance of the earth's surface in the city, especially in warm period. As a result of evaporation from the territory of Moscow in the average during warm period about 90 MJ/m$^2$ per month, including in July 48 MJ/m$^2$ is not consumed. By reducing the cost of heat for evaporation energy of the radiation balance is more spent on the turbulent heat exchange with the atmosphere and its own infrared radiation surface, enhancing the effect of «heat island». Locally by changing the runoff coefficient and heat losses by evaporation from surfaces

with a balance of artificial and natural finishes, you can effectively regulate the microclimate conditions of the territory of urban development [11, 12].

Utilities, industry and transport give a huge electric and thermal load on the fuel and energy economy of cities. Coverage of this load requires a huge amount of fuel, which in turn leads to a massive impact on the urban environment, in particular, its chemical and thermal pollution and, consequently, to change of the city mesoclimate. It is believed that in large cities that situate in middle and high latitudes heat flows of technogenic origin of its size comparable to the radiation balance.

Thermal energy supplied to inside of the building is used for heating and ventilation. Thermal energy ff the buildings consumed by the removal of hot air with exhaust ventilation systems, by its infiltration outside through the building envelope, ventilation in buildings through open windows, transoms, doors windows. Transmission of heat from buildings into the environment occurs through the building envelope due to their thermal conductivity.

Positive anomaly of heat balance compared with natural conditions is due not only to technogenic energy consumption, but also with the transformation of physical properties of the surface active layer of soil. Town by creating its own extra energy flows distributes natural flows. Therefore in order to understand the reasons for formation of specific mezoclimate conditions in city analysis of the structure of positive anomalies of the heat balance and its comparison with the structure of the heat balance of the surrounding city territories is interesting [13].

Analysis of the structure of positive anomalies of the heat balance shows that positive anomaly in summer more than half is formed by transforming physical properties of the surface active layer, while in winter the main reason for formation of positive anomalies in the thermal balance is technogenic emission of heat into surrounding space.

From the analysis of the structure of the anomalies of the heat balance another important rule follows: the main reason of the positive anomaly in summer time is the lack of moisture available for evaporation that occurs at the expense of draining the city by storm sewer system. Therefore evaporation in July is almost 2 times more energy under expenditure than an additional area of the city receives due to its lower albedo.

Conclusion from here follows that the main activities on reclamation of microclimatic conditions in the building should make the structure of the heat balance approach to natural conditions by increasing the integral albedo of urban sprawl; reduce the runoff coefficient and increasing evaporation from the urban area. The first condition is achieved by using lighter materials with high reflectivity for roofs, facades and paving, the second — by increasing the proportion of green areas in the balance of urban areas.

The natural and climatic conditions continue to be a critical factor of the environment that largely determines the comfortable living person throughout his life.

## References


1 *Baigarin K.* Rational use of energy, the most important thing in the Kyoto puncture // Ecology. — 2005. — № 7, 8. — P. 65–69.

2 *Ivanova E.V.* Formation and social infrastructure of the space of a large city on the Volga in the second half of the nineteenth — early twentieth century: on the materials Saratov: dissertation theses of candidate of historical sciences: 07.00.02. — Saratov: Saratov State University named after N.G.Chernyshevsky, 2008. — 30 p.

3 *Vitchenko A.N.* Geoecology: lectures. — Minsk: BSU Publ., 2002. — 101 p.

4 *Likhacheva E.A., Prosuntsova N.S., Lokshin G.P.* Criteria of ecology and geomorphic assessment of the urban area // Problems of safety in emergency situations. — 1998. — Vol. 6. — P. 3–16.

5 *Likhacheva E.A., Prosuntsova N.S., Lokshin G.P.* The impact of technogenic physical fields in the large cities // Problems of safety in emergency situations. — 1996. — Vol. 12. — P. 30–56.

6 Moscow: Geology and the city. — Moscow: Moscow books and kartolitografiya, 1997. — 400 p.

7 City is an ecosystem. — Moscow: Publishing House of IGRAN, 1997. — 336 p.

8 *Kotlov F.W.* The anthropogenic geological processes and phenomena on territory of cities. — Moscow: Science, 1977. — 287 p.

9 *Ivanov S.I., Gubernsky Y.D.* Ecology and hygiene of living environment. — Moscow: Science, 2008. — P. 25–30.

10 *Revich B.A., Shaposhnikov D.A., Semutnikova E.G.* Climatic conditions and atmospheric air quality as risk factors for death rate in Moscow // Work Medicine and Industrial Ecology — 2008. — № 7. — P. 29–35.

11 *Rakhmanov R.S., Gadzhiibragimov D.A. et al.* Valuing the climatic conditions as risk factors for health // Hygiene and Sanitation. — 2010. — № 2. — P. 44–46.

12 *Mozhayev E.A., Pechennikova E.V.* Some questions of the study of atmospheric air pollution abroad // Hygiene and Sanitation. — 1994. — № 3. — P. 3–4.

13 *Rakhmanin Y.A., Novikov S.M., Ivanov S.I.* Problems of assessment of risk to human health under the influence of environmental factors // Modern problems of preventive medicine, environment and health of industrial regions of Russia. — Ekaterinburg, 2004. — P. 57–59.

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## Қала климаты және оның экологиялық маңыздылығы

Мақалада урбанизацияланған аумақтардағы табиғи-климаттық жағдайларға әдеби шолу жасалып, олардың экологиялық жағдайына баға берілген. Табиғи-климаттық жағдай адам өмірінің қолайлығын анықтайтын болғандықтан, қоршаған ортаның маңызды факторларының бірі болып есептеледі. Урбанизацияланған орта сапасының бұзылуы, атмосфераның физикалық-химиялық қалдықтарымен ластануы, шу, діріл мен басқа да техногенді ықпалымен де байланысты болып отыр. Атмосфера жер қыртысына мұндай ықпалы урбанизацияланған аймақтардағы халықтың денсаулығына кері әсерін тигізуде.

В статье проведен литературный обзор по природно-климатическим условиям урбанизированных территорий, дана их экологическая оценка. Природно-климатическая среда урбанизированных территорий продолжает терять качество, что делает ее не только дискомфортной, но и опасной для здоровья населения. Потеря качества урбанизированной среды связана не только с чрезвычайно высоким уровнем физико-химического загрязнения атмосферы, но и с шумовым, вибрационным и другими видами техногенного воздействия. Эти воздействия на приземный слой атмосферы неблагоприятно сказываются на самочувствии населения, использующего урбанизированные территории как для рекреации, так и для прогулки или других целей.

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## Динамика численности хомячков Центрального Казахстана и определяющие ее факторы

В статье рассмотрены основные характеристики и динамика численности трех видов хомячков (*A11ocricetulus eversmanni, C. Migratorius и Ph. Sungorus*) Центрального Казахстана. На основании собранного и обработанного материала определена относительная и сезонная биотопическая численность, структуры доминирования трех видов хомячков, обитающих в различных районах Казахского мелкосопочника. Определены влияние метеорологических факторов, изменения запасов кормов и числа хищников на динамику их численности. В ходе изучения популяционных циклов хомячков проанализирован комплекс экологических параметров, отражающих состояние трех их видов непосредственно в природной обстановке. Обобщены материалы собственных исследований и обширные литературные данные.

*Ключевые слова:* динамика численности, грызуны, популяция, рождаемость, смертность, ареал, териофауна, колебания, циклы, доминирование.

Изменения численности животных и факторы, их вызывающие, всегда являлись одной из основных проблем экологии. Динамика численности различных видов мышевидных грызунов строго видоспецифична [1]. Больше того, популяции вида также различаются между собой по характеру изменений численности [2]. Принято считать, что динамика численности позволяет надёжно выявлять популяции. Ритм движения численности животных определяется комплексом экзо- и эндогенных факторов, или, другими словами, особенностями популяционной и морфофизиологической организации и конкретными условиями местообитаний [3].

Пространственная структура популяции тесно связана с численностью населения. Ход движения численности обусловливается соотношением двух демографических показателей — рождаемости и