

Investigation of the effect of anthropogenic influences on the change in the geoecological conditions of urbanized territories

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ABSTRACT

The types and degree of anthropogenic impacts have an effect on the ecological state of the environment. There are two main sources of pollution on the territory of cities: industry and motor transport. Currently, with a significant reduction in industrial production, road transport is one of the main sources of environmental pollution. The largest amount (more than 200) of air pollutants is provided by gasoline carburetor engines: carbon monoxide, nitrogen oxide, unburned hydrocarbons. When 1 liter of gasoline is burned, 200 - 400 mg of lead is released, thus, one passenger car emits up to 1 kg of lead into the city atmosphere per year. Diesel engines pollute the atmosphere with soot, sulfur compounds, benzo pyrene. According to American geochemists, in cities more often than in rural areas, we observe cloudy weather, more rain and less snow. Atmospheric dust in cities is 100 times more, exhaust gases, 5-25 times more than in agricultural landscapes. All this affects the health of the population. The favorable factor is that the main streets with heavy traffic are located on the watersheds, in the upper part of the city, where conditions are better for dispersing impurities. However, on streets descending into depressions, where air stagnation and surface inversions are more likely, and where uphill vehicle emissions increase, air pollution is upraised.

Keywords: Anthropogenic factors, Small towns, Anthropogenic impact, Landscape, Environment, Geoecology, Urbanization.

Article type: Research Article.

INTRODUCTION

The geoecological state of small towns in the Kursk region is influenced by the following factors (Antipov & Korytny 1981; Alekseenko 2000): 1- technogenic: the intensity and volume of emission of harmful substances, the size of the territory where the pollution occurs, the level of technogenic development of the region, etc. 2- natural and climatic: characteristics of the circulation regime, thermal stability of the atmosphere, atmosphere pressure, air humidity, temperature regime, terrain relief, soil and plant conditions, etc. In the natural environment, the air temperature, wind speed, strength and direction are constantly changing. The following synoptic situation is unfavorable - an anticyclone in intermontane closed basins. Precipitation and high temperatures contribute to the intensive decomposition of toxic substances. The maximum dustiness of the atmosphere in the cities of the Kursk region was noted during the transitional seasons, when large areas of agricultural land are plowed up or covered with vegetation. With strong winds (the highest speeds occur in March and November), the dust content of the air increases many times over. Dustiness of the air is the most important environmental factor that

accompanies us everywhere. Dust is considered to be any particulate matter suspended in the air (Antipov & Korytny 1981). There are no harmless dusts. Their nature and concentration in the air determines the environmental hazard to humans. Dust particles can accommodate harmful microorganisms, even smaller particles of harmful substances (e.g., heavy metals and organic compounds) can be adsorbed. It is very important to be able to assess air quality by the content of dust in it, knowing its diversity and representing an environmental hazard. Observations must be carried out everywhere and for a long time (Vasilevskaya 2012). Among the polluting elements, there is a "terrible trinity": Hg, Pb, Cd. Studies on the content of lead, nickel, copper, chromium, zinc in snow have shown that they form areas of increased content. Within the region, a man-made air flow is formed due to dust and gas emissions from industrial enterprises, thermal power plants and boiler houses, emissions from vehicles, construction dust and deflation products of contaminated soil cover. Industrial dust has a high concentration of a number of trace elements. Dusts from chemical production, production and processing of non-ferrous metals, electrical engineering enterprises, where various alloys, and tool production are widely used, are especially toxic. Construction dust, which has a significant proportion in the total mass of industrial dust, as a rule, has a low level of concentration of chemical elements. The results of atmospheric observations have shown that at present, secondary pollution of the city's air basin with road dust raised during the movement of vehicles and products of tire combustion dominates in atmospheric pollution. This man-made dust scatters around the city and the toxicants accumulated in previous years are gradually redistributed (Vasilevskaya 2009; Vasilevskaya & Kosinova 2014).

MATERIALS AND METHODS

The theoretical and methodological basis of the study was the results of scientific works of domestic and foreign scientists on the problems of anthropogenic pollution factors in small towns. The main research methods are: Method of comparative analysis; Comparative geographical method; Statistical method; Cartographic method; Analytical method; and Complex method.

RESULTS

Air pollution is one of the processes of general anthropogenic impact on the natural environment. It significantly changes the conditions for the existence of the biosphere (including worsening air quality), adversely affects the conditions of human life. Pollution of the atmosphere is a source of economic activity of society. A number of natural processes and phenomena are accompanied by the emission of pollution (weathering of the soil, the death of vegetation, etc.). However, anthropogenic pollution of the atmosphere prevails over natural sources, and this ratio is constantly increasing. Human society is becoming a unique agent in the biosphere, the power of which grows with the passage of time with an ever-increasing speed, changing the structure of its very foundations. Human impact on the environment can pursue the following goals (Kosinova & Lomova 2015; Kosinova & Lomova 2016):

1. An increase in the biological productivity or resource-reproducing capacity of landscapes necessary for a person.
2. Accumulation of any resources (creation of their reserves).
3. Improvement of the human environment.
4. Improvement of operating conditions (landscaping)

Despite these goals, human impact on nature can be as follows (Vasilevskaya & Kosinova 2015):

1. Intentional and unintentional.
2. Direct and indirect.

Intentional impact is a previously decided and carried out for a specific purpose impact on nature. Human actions in this case are aimed at using natural resources and often lead to their depletion (deforestation and fishing). Deliberate human actions can also be aimed at restoring and multiplying natural resources (planting forests and raising fish). These human impacts on nature are the easiest to control and plan.

Human impact on nature is quite often unintentional, spontaneous. Since such impacts are not organized and act in different directions, their result often remains insignificant. But when these impacts are summed up, the result can be quite tangible (the release of pollutants into the atmosphere from thermal power plants, industrial enterprises, vehicles). Direct impact is most often intentional, but often unintentional. An example of a direct impact is forest felling and chemical emissions into the atmosphere (Lomova & Kosinova 2015; Vasilevskaya & Kosinova 2015). With an indirect impact, human activity is directed not at a given object of nature, but at a

completely different one, but due to the existing relationships in nature, it is reflected in the state of these natural objects. For example, pollution of the atmosphere by chemical substances, in relation to the atmosphere, is a direct effect, but it causes pollution of the lithosphere, hydrosphere, contributes to the death of the animal world, and leads to human diseases. Under the influence of an ever-aggravating and deepening ecological crisis, the point of view has become widespread, according to which the activity of a person, society as a whole, has a mainly negative impact on the state and development of nature. Indeed, industrialization, urbanization, the waves of which are rapidly growing, cause in nature certain negative shifts and deviations from the natural course of its development. But man not only destroys, but also creates. Only within the framework of the unity of opposites in the "man - nature" system is it possible for man to have a beneficial influence on the preservation and development of nature. The contradictions between man, society and nature appeared long ago, they are generated by the very act of man's emergence, and with the progress of society they grow and become more complicated. Negative human activity according to EA Arustamov manifests itself in the following three directions (Klindukhova 2007; Vasilevskaya 2014):

1. Pollution of the natural environment,
2. Depletion of natural resources,
3. Destruction of the natural environment.

Environmental pollution is understood as physical and chemical changes in the composition of natural matter (air, water, soil), which adversely affect it. Anthropogenic pollution of the environment is subdivided into dust, gas, chemical (including soil pollution with chemicals), aromatic, thermal (changes in the temperature of air, water, soil), and radioactive. The source of pollution is human economic activity: industry, agriculture, transport, etc.

The classification given below gives a general idea of the change in the components of nature under anthropogenic impact. With its help, it is possible to systematize all types of anthropogenic impacts on the natural environment, given their huge variety. However, among them priority species can be identified, which are manifested most clearly and amenable to parametric estimates. Perhaps these are impacts that are stable over time, as a result of which natural conditions change over large geographical areas (Kochurov 1998; Klindukhova 2007).

According to VG Morachevsky and KM Petrov, three classes are distinguished in the classification of anthropogenic impacts.

Class I - emission effects, i.e. emissions of substances polluting the natural environment in all its spheres (air basin, soil surface, water bodies, etc.). This class includes emissions of all types of pollution sources - areal, local, ground. The pollutants can be gaseous, liquid and solid substances in dispersed (crushed) form.

II class - background-parametric influences. The peculiarity lies in their uniform distribution over significant areas of the planet's surface and surrounding geospheres. This is thermal, radioactive, noise pollution. They can be quantified at any point in space by direct measurements of their parameters.

III class - landscape-destructive impacts. This is the most extensive group of anthropogenic impacts [deforestation, extinction of biological species, urbanization and other forms of destruction of natural (natural) biocenoses].

Let us consider in more detail the subclasses of anthropogenic impacts on the natural environment, distinguished within the named three classes. Anthropogenic emission impacts are subdivided into the following subclasses:

1 subclass - gaseous emissions of substances into the atmosphere - is subdivided into the following groups: neutral gas emissions, toxic gas emissions, thermodynamically active gas emissions.

Subclass 2 - aerosol emissions into the atmosphere - is divided into two groups: inorganic liquid and solid particles, organic liquid and solid particles.

Subclass 3 - aerosols sediment on surfaces - is divided according to the degree of discreteness. The size of aerosols determines the rate of their deposition from emission points located above the surface.

4 subclass is divided according to the degree of biological toxicity, as well as biogenic properties, depending on the ionic composition.

Background-parametric anthropogenic impacts have four subclasses (Kravchenko 2006; Vasilevskaya 2012).

1 subclass - impacts leading to the heating of all geo-components of the natural environment, which leads to an increase in its temperature.

2 subclass - an increase in the radioactive background of the natural environment as a result of the activities of atomic energy and nuclear weapons tests.

3 subclass - noise impacts.

4 subclass - a change in the ionization state of the natural environment, mainly in the upper layers of the atmosphere, under the influence of a number of production processes. A polluted atmosphere has the effect of air toxicity.

The landscape-destructive anthropogenic impacts have a distinct geographical aspect. Landscape destruction not only has a destructive effect on abiotic factors such as climate, precipitation regime, etc., but also directly leads to catastrophic changes in the biotic characteristics of ecosystems.

1 subclass - urbanization.

Subclass 2 - replacement of natural bio-geocenoses with agro-cenoses.

The classification of anthropogenic impacts makes it possible to introduce a certain order in the understanding of the multiplicity of connections within the components of the natural environment and the spatio-temporal nature of exogenous processes occurring in it.

Anthropogenically modified systems have the same dynamic tendencies as undisturbed structures, which consist in a regular change of states in time. The change in anthropogenic changes in the geosystem can be considered as a transformation of the structure, depending on the degree of anthropogenic load. At the same time, as VS Mikheev notes, geosystems "... are ordered according to the tendency of their modification, and not morphological combinations, and act as transformations (deformations) ...". When anthropogenic loads increase, the geosystem passes through a number of states (in time - slowly or quickly), moving away from the root state (digression series of structures), with weakening - approaching it (recovery series). With a significant excess of anthropogenic loads (large volume or high toxicity of emissions, creation of reservoirs, etc.), the geosystem completely degrades, collapses and passes into a new qualitative state (flooded and contaminated areas, etc.).

Based on this, BI Kochurov proposed the following classification of types of anthropogenic impacts.

Table 1. Main environmental problems for different types anthropogenic impacts.

№	Type of anthropogenic impact	Environmental problems
1.	Hunting and fishing economy	B
2.	Grazing	B, P
3.	Forest felling	B, P, V
4.	Rainfed agriculture	P, B, V
5.	Dehumidification	P, V, B, H
6.	Irrigation	P, V, H
7.	Hydraulic engineering	H, V, P, B
8.	Urbanization, manufacturing industry	A, H, V, B, P
9.	Transport	A, H, P, B, V
10.	Prospecting and extraction of minerals	H, V, B, P, A
11.	Thermal energy	A, V, B, P,

Environmental problems in decreasing order of importance.

Legend: A - air pollution; V - depletion and pollution of water, violation of the water regime; P - soil degradation and pollution; B - degradation and depletion of biota; H - complex disturbance of lands and destruction of local geosystems. When studying the interaction in the "population - economy - nature" system, an idea is introduced about the influence of the economy on nature, changes in nature caused by these influences and the consequences (social, economic) arising in the economy and the population under the influence of the changed nature. There are the following main types of impacts (Lomova *et al.* 2018):

1. Withdrawal of matter and energy.
2. Territorial redistribution of matter and energy of nature (without withdrawal).
3. Introducing artificial substances and energy into natural complexes or substances and energy inherent in them, but in increased concentrations.
4. The introduction of man-made structures as a special case of transformation and introduction.

Assessment of the impact of human activities on the environment can be carried out over different periods. The assessment process consists of two stages:

1. Study of the impacts, changes and consequences caused by a person and his activities, and the links between them (identification, parameterization, measurement, modeling (mathematical, cartographic, graphic, matrix), establishing dependencies, determining the degree of change of the studied objects and processes), which collectively constitutes pre-assessment studies.

2. The actual assessment of the identified consequences (identification of the types, forms, content of criteria, assessment indicators, rating scales, drawing up assessment models). The study of impacts, as an initial stage, in the territorial system "population - industry - nature" is advisable to begin with identifying the sources of impacts that can spread over the territory. Different types of impacts are characterized by their characteristic speed, area, direction of propagation. As a result, zones with different saturation of the introduced substance, with a different scale of withdrawal of the substance, with a different degree of transformation, etc., are created across the territory. The introduction of substance or energy into nature in increased or artificial concentrations is carried out as follows (Vasilevskaya 2010; Lomova 2015):

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1. Emissions into the atmosphere: total polluted air, cu. m, including the content in it:

- Solid particles (dust, ash) - t;

- Gaseous substances (SO, NO, CO) - m;

2. Emissions can be subdivided according to the degree and nature of hazard, toxicity, chemical activity, calculated as a whole (m, t) or per unit of emissions, in% of the volume of emissions.

The study of changes in nature for assessment purposes has the following characteristics. For the atmosphere, these are gas composition, temperature and radiation regime, transparency, wind regime, wind rose, the content of mineral particles, chemicals in the air, etc. To characterize the change, point estimates are often used based on scales such as:

- No change - weak - medium - strong change;

- Minor - significant - significant, etc.

Often these scales are based on measurable indicators. Although this assessment does not say anything about how important these changes are, the very depth of change in a number of cases serves as a warning for a person in the development of certain forms, methods, directions of his activity (Lomova 2015; Lomova et al. 2019)

Atmospheric pollution has a negative effect on living organisms, which leads to a decrease in the number, species diversity of animals and plants, and human morbidity. There are three groups of the main components of atmospheric air:

1. Permanent;
2. Variables;
3. Random.

The first group includes oxygen (21% by volume), nitrogen (about 78%) and noble gases (about 1%). The second group includes carbon dioxide (0.02 - 0.04%) and water vapor. The third group includes random components determined by local conditions. So, in places where organic residues decay, air often contains ammonia and other gaseous and liquid substances (Karelov *et al.* 2013; Lomova *et al.* 2020).

The most significant sources of anthropogenic nature that cause atmospheric pollution, as well as serious disturbances in the ecological balance in the biosphere are industry and transport (Aksenova 2013; Yemelyanov *et al.* 2020). From transport, nitrogen oxides, lead compounds (its amount is directly dependent on traffic intensity), sulfur dioxide get into the atmosphere. From industry - sulfur dioxide, carbon monoxide, ammonia, hydrogen sulfide, phenol, chlorine, hydrocarbons, heavy metals, aerosol dust and many other harmful substances (Sedov *et al.* 2014; Cherepovitsyn *et al.* 2016; Bukharina *et al.* 2018; Kuzmin *et al.* 2018; Zaripova *et al.* 2019; Kuznetsov & Kuznetsova, 2019; Korzhev *et al.* 2019; Arzehgar *et al.* 2019; Latha *et al.* 2019; Prischepa *et al.* 2020; Malarev *et al.* 2020; Abegunde *et al.* 2020; Srikanta *et al.* 2020; Alekseevna Fedorova 2020; Vlasenko 2021; Mirabootalebi *et al.* 2021). In addition to chemical emissions, serious air pollutants are emissions of large amounts of water vapor, noise, electromagnetic radiation, thermal pollution, including emissions of large amounts of heated air.

CONCLUSION

The growth in the size and size of the population is exacerbating the environmental problems of cities. The situation is getting worse every day, under the influence of the scientific and technological revolution and the accelerated development of industry. In cities, the permissible values of harmful substances are exceeded, which destroys the environment and harms human health (Kuzmin *et al.* 2018; Kuznetsov & Kuznetsova 2019; Korzhev *et al.* 2019; Arzehgar *et al.* 2019; Prischepa *et al.* 2020; Malarev *et al.* 2020). In large cities, the problem of pollution is growing along with the number of inhabitants and the number of sources that harm the environment: factories; cars; factories; power plants; agricultural enterprises. The amount of waste (liquid, solid, gaseous) emitted into the environment is so great that nature has ceased to independently cope with their processing. A city dweller experiences the consequences of pollution: a drop in living standards, an increase in the number of diseases, a decrease in life expectancy, and a decrease in productivity. But this provision does not force him to reconsider his attitude to ecology, the destruction of the surrounding nature continues. Main problems: Degradation of nature. Flora and fauna are dying, they are replaced by a monotonous "urban" environment. The variety of plants, the number of "green" areas is decreasing. Relief change. This is due to serious pressure on the lithosphere, the territories become deserted, unsuitable for flora and fauna. Air pollution. The atmosphere contains harmful, life-threatening substances in big cities and small towns. Dusty air, acid rain affect human health and the environment. Plants are able to process carbon dioxide, but because of the massive deforestation, there are fewer of them. Violation of the water supply process. The planet is 71% water, which is polluted by industrial and domestic wastewater. Underground waters, rivers, lakes, the World Ocean suffer. This pollution will lead to an acute shortage of drinking water and cause the death of hundreds of thousands of people. Household waste. Rubbish pollutes soil, water and air. The decomposition of some of its species takes hundreds of years. This time there will be emissions of harmful substances into the atmosphere, destruction of the environment. Industrial zones and agriculture are actively developing in all cities of Russia. The urbanization process in the country is becoming uncontrollable due to the rapid socio-economic development. The state provides support to environmental organizations and nature conservation enterprises. But nature is harmed from all sides. Mankind, in its striving to improve the conditions of existence, is constantly increasing the rate of material production, without thinking about the consequences. For example, modern man has increased the volume of pollution habitual to nature so much that it does not have time to process them. Moreover, he began to produce such pollution, for the processing of which there are no corresponding species in nature, and for some pollution, for example, radioactive, they will never appear. Therefore, the "refusal" of the biosphere to process the fruits of human activity will inevitably act as an increasingly growing ultimatum factor in relation to man. And the future of man as a biological species is predictable: an ecological crisis and a decline in numbers. Analysis of modern literature has shown that the main problems of ecology are rash and sometimes cruel human actions, mainly associated with the violation of natural

processes and phenomena. Having studied the influence of anthropogenic factors on the environment, we can say that people initially cannot foresee the scale and consequences of all the changes that they undertake. Basically, such serious changes in people are caused by the desire to move forward, in step with industrial progress, improving the economy and completely moving away from the natural environment. And without it, as the consequences of many environmental disasters show, a person is absolutely not adapted to life.

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