



Geocological assessment of urban areas (for example, the city of Klin, Moscow region)

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Abstract The impact of human life on nature is increasing every year and becomes commensurate with the action of natural environmental factors. The deterioration in the urban environment of the air basin, soil cover, water quality in surface and underground sources, the accumulation of household waste and garbage inevitably leads to environmental disaster - the death of the ecosystem, the extinction of many species of microorganisms, representatives of flora and fauna and, in the end, is a threat for the existence of an urbanized system.

Modern urban ecology aims to create in the urban environment a system of integrated urban culture of its residents in the field of environmental protection as the basis for their existence, which is designed for a long period of favorable existence.

The article is devoted to the geocological assessment of the city of Klin, Moscow Region. The main objective of the study is to compile a geo-ecological map with areas of increased pollution in the city of Klin, to assess environmental hazards, and to develop a set of measures to improve the ecological state of the city of Klin.

Keywords: Wedge, Pollution, Assessment, Ecology, Impact.

1. Introduction

Klin is an urban settlement in the Moscow region (fig. 1), the administrative center of the Klinsky district. Located on both banks of the Sestra River (Volga basin).

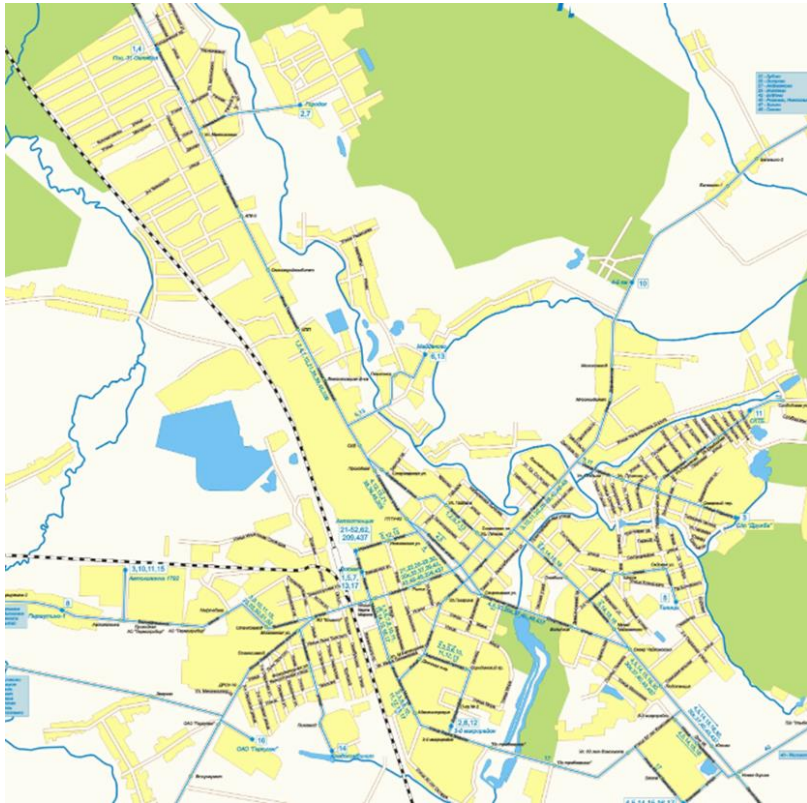


Figure 1 - Map of the city of Klin [1]

The ecological situation of the city of Klin leaves much to be desired. The presence of a working chemical plant and constant traffic jams on the Leningradskoye Highway do not affect the city's ecology in the best way. Klinsky city district has its own landfill for the disposal of municipal solid waste. The MSW landfill is intended for the burial of industrial and household garbage of hazard class IV [4].

The negative impact on the environment of the district is mainly provided by the industry sector, in particular, large Klin enterprises, such as: AGC Flat Glass Klin LLC (the largest glass production and chemical processing plant not only in Russia but also in Europe); LLC "GROFILLEX CIS" (a large enterprise producing polyvinyl chloride (PVC) products; OJSC "San InBev" (brewery) [7].

2. Research methodology

Research methods used in the work: the empirical research method consisted in the analysis of literature and comparative analysis. Theoretical methods - analysis and synthesis; mathematical statistics method - a graphical method that allows you to visualize statistical data.

Also, the cartographic method is used in the article (creating map schemes in ESRI ArcGIS program).

To construct the map, we used the Natural Neighbor algorithms, which are based on the background distribution of values, and Kriging, based on statistical characteristics of the input data, such as the average value.

When assessing the geo-ecological state of an urban area, three main components must be taken into account:

- 1) natural conditions;
- 2) determination of the cumulative impact of technogenic pollution of the environment;
- 3) an assessment of the social consequences of the environmental policy carried out in the city, which makes it possible to give scientifically sound recommendations for its adjustment [2].

In order to assess the ecological state of the territory of the city of Klin, point-rating maps were compiled that characterize the general pollution of air, soil cover and surface water in the study area in the ESRI ArcGIS program using the Natural Neighbor and Kriging algorithms obtained in the testing process, conducted in August 2018 (fig. 2).

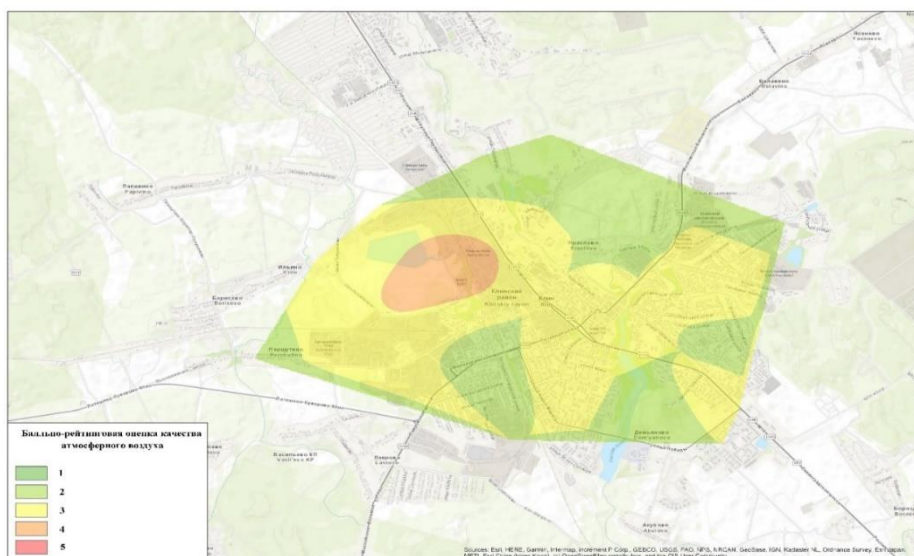


Figure 2 - Score-rating map of the general state of atmospheric air in the Klin'sky district

The greatest air pollution is concentrated directly in the city of Klin, the rest of the territory is under a small influence of toxic emissions of the Klin Machine-Building Plant (sulfur dioxide, nitrogen dioxide, soot). In the northwest, pollution is estimated at 4 points. In general, throughout the city of Klin, air pollution is rated at 3 points as moderately dangerous. The main environmental problems in terms of water supply to the population and industry of the city of Klin are the depletion of fresh groundwater resources and the deterioration of their quality.

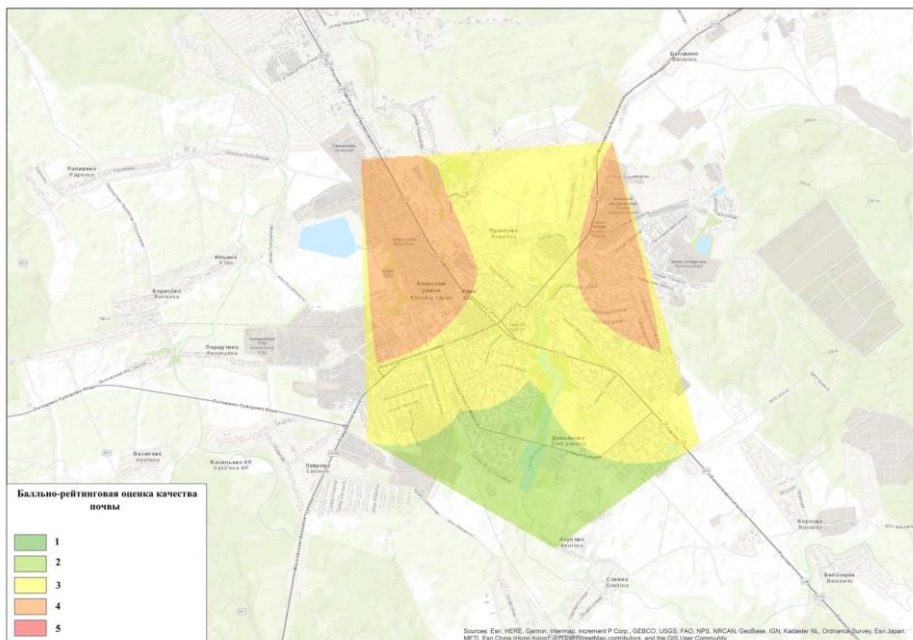


Figure 4 - Map of the point-rating assessment of soil quality in the city of Klin

According to the map data (Figure 4), one can see significant soil pollution with heavy metals in the northwestern and eastern parts of the region, where there is an excess of copper and lead. Given the toxicity of lead and its danger to humans, it can be concluded that these soils are hazardous.

Considering that the soils in this region have a highly alkaline environment and the relatively high humus content, the studied metals will be in mobile form and accumulate in the upper horizons [5]. Thus, the soils in the area require increased attention and constant monitoring. In general, the ecological condition of the soil cover is estimated at 3 points.

3.Results and Evaluation

A geoecological assessment of the state of the environment according to the results of studies conducted in August 2018 showed that the components - atmospheric air, soil and surface water are contaminated unevenly.

Based on the obtained data constructed by the map, a comprehensive map of the environmental state assessment was compiled in the ESRI ArcGIS program using the Natural Neighbor algorithm (Figure 5).

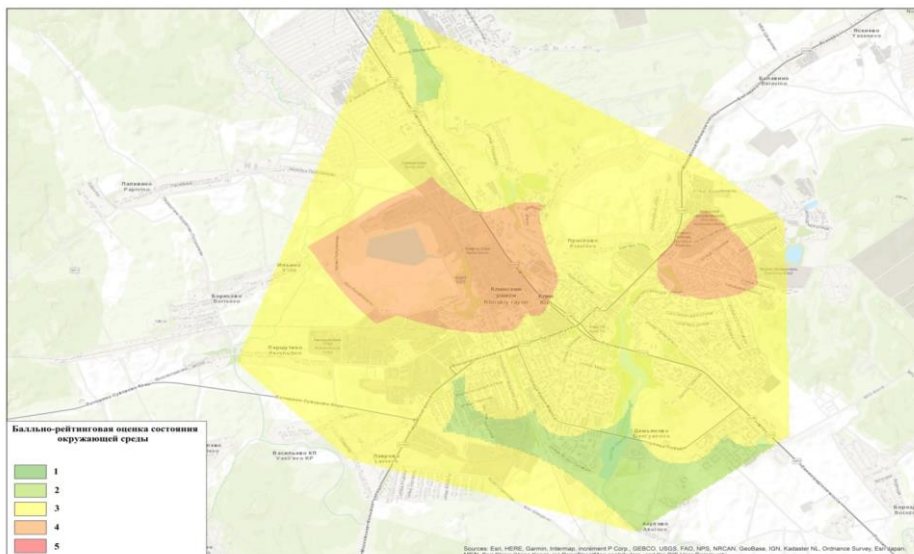


Figure 5 - Point-rating assessment of the state of the environment

On the territory of the city of Klin, there is a noticeable shift towards alkaline pH values relative to background values in soil and groundwater.

The concentration of heavy metals in the soil of the Klinsky district exceeds the hygiene standards of the MPC (MPC) several times (zinc, copper, lead), but is significantly higher than the background values. Given the hazard class, the soils of the city of Klin belong to the average degree of inorganic pollution [8].

Differences in the concentration of heavy metals in the soil depending on the functional zones are established: the maximum concentrations of all the metals studied are characteristic of the soils of industrial zones. Differences in the content of metals in residential and recreational areas are insignificant. According to the total indicator of the heavy metal load, the entire territory of the city settlement of Klin refers to the average level of pollution. According to hydrochemical indicators of groundwater, the entire territory of the city of Klin is unfavorable, exceeding the MPC by an average of 3 times. The greatest excess is in the central and southern parts of the Klinsky district.

In general, the assessment of the ecological state of the environment in the city of Klin and the Klinsky district is characterized as dangerous, a score of 3 is assigned. Conclusion The ecological situation of the Klinsky district of the Moscow region is generally assessed as unfavorable. Anthropogenic impact due to various types of economic activity. According to the degree of transformation of the natural environment, the territory belongs to natural and technogenic with a high and medium degree of resistance to technogenic loads. One of the main problems of the city is the quality of drinking water and the condition of the soil cover [3].

Consideration of the current environmental situation of the city revealed the need to develop a set of environmental measures in the following areas:

- reduction of air pollution;

- improving the quality of drinking water supply;
- reduction of soil pollution;
- streamlining the waste collection and disposal system;
- Enlightenment of environmental education and promotion of environmental knowledge among the population of the city.

To improve the environmental situation of the city of Klin, a set of environmental measures is proposed. The main activities in this complex are:

- development of the road network, including a bypass road, which will allow the main flow of transit transport to be removed from the residential part of the city;
- restriction of arrival in the city of heavy vehicles;
- conversion of all city boiler houses to gaseous fuel and electricity;
- increasing the number of observation points for the state of atmospheric air to organize more complete monitoring of air pollution;
- development and approval of sanitary protection zones of the surface and underground water intakes of the city;
- transfer of disinfection of drinking water from chlorination to ozonation;
- replacement of intra-house and intra-quarter water supply networks from metal to plastic;
- construction of water treatment facilities for urban underground water intake;
- an inventory of the city's land in order to identify disturbed lands and develop measures for their restoration;
- inventory of unauthorized landfills and organization of measures for their elimination;
- development of standards for the accumulation of municipal solid waste for enterprises and institutions located in the city;
- development of a general scheme for cleaning the territory of the city;
- environmental education of citizens.

These measures will reduce the overall level of air pollution and reduce the content of phenol and benzo (a) pyrene to values commensurate with the MPC.

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