

Industrial impact on the environment (as exemplified by the Baikal region and Mongolia)

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Abstract. The paper presents the results of ecological and geographical studies of the Baikal region and Mongolia to identify the negative industrial impact on the environment. The industrial impact on the environment depends on the nature of its territorial location, extraction and consumption of raw material volume, materials and energy, waste recycling and completion degree of energy production cycles. We analyzed location of the leading industries and its impact on the environment. The identified industrial centers have their own influence on different natural environments. Each industry and individual industrial facilities "invade" the environment and have a different features and impact, including on human health. The problem of the industrial impact on the environment is global, and makes it important to study this topic. During the research we took into account the specifics of industrial development of the territories, as well as the existing ecological situation around Lake Baikal, and based on theoretical and methodological approaches to socioeconomic geography. Zoning and mapping approaches we used in this research. Based on the analysis of the location of industrial facilities and their impact on various natural environments, the areas of maximum and local impact on the environment within the boundaries of the considered territories were identified. Ecological-geographical studies of the areas where industrial objects were located enabled an overall assessment of anthropogenic impact both on the environment and on certain natural environments, taking into account the demographic pressure. The territorial features of the heterogeneous impact on the natural environment are determined by the unevenness of economic development of the territory.

1. Introduction

Currently, human economic activity has a significant impact on the environment, where the main pollutant is industry. The higher the concentration of industrial facilities, the wider is the zone of environmental change.

The current borders of industrial impact areas on the natural environment are very relative, since the expansion of technogenesis from certain industrial sources, especially in the aquatic environment and atmosphere does not have clear borders and often reaches tens and hundreds of kilometers. The nature of the environmental impact is integral, since any contamination of one of the spheres of natural environment is reflected in others (violation of lithosphere indirectly affects the regime of surface and groundwater, predetermines dust and gas pollution of the atmosphere, etc.).

The industry has a leading role among the branches of the national economy; it determines the specificity of regions and its place in the territorial and sectoral division of labor. Industry remains the



basic sector of the economy (which can also be interpreted as an element of sustainability), setting a vector for regional development and major cities, although in the latter case the industrial function is complemented by service, management, and scientific and educational specializations [1].

The industrial impact on natural environments is considered by the example of the subjects of the Baikal region (Irkutsk region, the Republic of Buryatia and the Transbaikal region) and Mongolia, which have a similar industry structure, but different natural conditions for its location and functioning.

2. Data and Methods

The research is based on theoretical and methodological approaches to social and economic geography, including scientific concepts on territorial systems for placing industrial objects, combining environmental and socioeconomic priorities for their location and further functioning.

Since the 80s of the last century, the increasing anthropogenic impact on the habitat has led to an active study of environmental issues by economic geographers [2]. The assessment of environmental factors for the location of industry formed the basis for ecological and economic regionalization [3]. The research used the approach of developing the ecological component of sustainable human development at the regional and national levels [4].

The most complete picture, with the allocation of zones of industrial objects location and its impact on the environment, can be represented by mapping where the industrial center serves as the object. It is one of the most widespread forms of territorial organization of industrial production and represents a local (within the boundaries of a populated area) group of enterprises [5]. Several lands were separately allocated, disturbed by the mining industry, and areas of maximum impact on the environment.

Based on the analysis of the influence of industry on various natural environments, the areas of maximum and local impact on the environment within the borders of the Baikal region and Mongolia have been identified. Using the cartographic method, the research results are presented in the form of a cartographic work [6, p. 74-75]. As the object of mapping serves the industrial center, since it is the most widespread form of territorial organization of industrial production and represents a local (within the boundaries of a populated area) group of enterprises.

3. Results and Discussion

Our research has determined that in all territorial units under consideration, the territories are mostly susceptible to anthropogenic impact from the industry of the fuel and energy complex, the pulp and paper industry and transport. Objects of the mining industry form local centers of anthropogenic impact.

On the territory of the Republic of Buryatia, the maximum industrial impact on the environment is observed in almost all large industrial settlements. The most significant ecological problems are in the areas: Zakamenskii, Kyakhtinskii, Gusinozerskii, Nizhne-Selenginsky (Kamenskii), Severobaikalskii and Ulan-Udenskii. Industrial production of these territories is not only the main participants in the pollution of atmospheric air, but also suppliers of precursors of acid precipitation.

The main industries that have a negative impact include the enterprises of the fuel and energy complex, mining, pulp and paper and food industries. The main pollutants are Ulan-Udenskii CHPP-1, aircraft plant, locomotive and car repair plant, glass plant, Selenginskii pulp-and-cardboard mill, as well as light and food industries. Significant damage to the environment is caused by large and medium dumps of domestic and industrial waste [7].

The main share of emissions from stationary sources falls on the enterprises for the production and distribution of electricity, gas and water; processing industries and mining. In the structure of emissions, the share of solids is 24.8%, of gaseous and liquid is 76.2%.

The complexity of the ecological situation in the Transbaikal Territory is due to several reasons, primarily the active development and exploitation of uranium deposits, the extraction of brown and coal and precious metals. In large cities there are enterprises of food and light industry, building

materials are produced. On the territory of the region, there are a number of features that exacerbate the negative impact of industry. First, in the region the largest, most powerful enterprises of the extractive and manufacturing industries were created for many years. Some of them are particularly dangerous for nature and people (non-ferrous metallurgy, oil refining, pulp and paper and chemical industry). At many of these enterprises, treatment facilities do not meet modern requirements. The second reason is that local meteorological conditions are unfavorable for purifying the atmosphere. Winter months are characterized by a large number of windless days and deep temperature inversions. The lowest air temperatures at this time are due to the maximum consumption of fuel and cause the highest pollution of the atmosphere by the products of their combustion. The largest area of negative impact on the environment is the Chita industrial complex, where the main pollutants are the enterprises of the fuel and energy complex (CHPP-1 and CHPP-2), machine building and metalworking, and transport.

On the territory of the Irkutsk region, the main sources of pollution are the mining, chemical and pulp and paper industries, as well as transport and energy companies. Irkutsk-Usolye-Sibirskoe, Ziminskii and Bratskii belong to the high-impact areas. Special areas with a high and very high impact on the lithosphere and hydrosphere were formed as a result of the mining industry in Bodaibo, Cheremkhovo, Tulun and Nizhneilimsk. In the Bodaibo district gold deposits have been exploited for almost a half a century (mainly by drainage method). In the Tulun and Cheremkhovo districts open-pit mining of coal is conducted, and in Nizhneyilimskii the iron ore mining.

The most unfavorable cities on the status of atmospheric air are: Bratsk, Angarsk, Shelekhov and Irkutsk. The air in these cities is oversaturated with such harmful substances as: benzopyrene, nitrogen dioxide, formaldehyde, hydrogen fluoride, carbon disulfide, suspended substances, carbon monoxide and sulfur dioxide [8]. The total amount of all pollutants in the atmosphere of the region by stationary sources of pollution amounted to 3126.687 tons in 2015. The highest rate in the cities: Angarsk is 1032.257 tons; Bratsk - 366.353; Sayansk - 557.841; Irkutsk - 390.830; Ust'-Ilimsk - 263.809; Shelekhov - 141.307 thousand tons and in Usolye - Sibirskoe 130.619 tons.

The administrative center of the Irkutsk region - Irkutsk is included in the list of cities with the highest emission level. The main air pollutants of the city are car exhausts (52% of emissions), heat power sources that are not equipped with filters (46% of emissions) and production plants account for about 2% of all emissions.

The main wastewater discharges to the Angara are made by the Irkutsk Aviation Plant and the city's water utilities. The number of unauthorized landfills near the city is increasing.

A separate place is occupied by the Olkhon region, where the main source of environmental pollution is recreational activity. The problem of utilization of solid domestic waste, as well as pollution of the water area of Lake Baikal, is associated with tourist activities.

On the territory of Mongolia, the main areas of industrial impact on the environment are also represented by industrial centers where a large part of the population is concentrated and industrial enterprises are located (Ulan Bator, Darkhan, Erdenet, etc.) and local mining areas and light industry enterprises (wool and leather processing). In northern Mongolia, apart from Ulaanbaatar, Sukhbaatar and Altan-Bulak are distinguished, where the anthropogenic impact is less strong.

On the territory of Mongolia, the issue of the impact of industrial facilities on water resources is particularly acute. In the last 20 years, 852 rivers and 1131 lakes from five thousand rivers and lakes have dried up due to mining [9]. In addition, intensive pollution of water bodies is noted in all the allocated areas and large industrial centers (water quality belongs to 3-4 water pollution class), and the main elements-pollutants of water are petroleum products, phenols, and there is also increased oxidation [10].

The combination of extreme natural conditions and various types of anthropogenic impact establishes the most intense ecological situation in the central part of Mongolia. All natural areas in the area Naushki-Ulan-Bator and Kyakhta-Altan-Bulak are especially impacted. The main reasons of the environmental problems are the increased urbanization and industrialization of the country. The population in the country grew by 330 thousand people from 2012 to 2017 (in 0.8 times). In the

metropolitan district Ulan Bator there is more than 1/3 of the total population of the country (1.405 thousand people for 2017).

4. Conclusion

The analysis of the location of industrial facilities and environmental conditions of the Baikal region and Mongolia enables identification of areas with highest industrial impact on all natural environments (large industrial centers), and with local impact on the environment of individual industries. Such spatial location is associated with the unevenness of economic development and population location. As a result, large industrial centers (Irkutsk, Bratsk, Ulan-Ude, Ulan-Bator, Darkhan, Erdenet, etc.) are mostly affected by a high concentration of industrial enterprises, which are characterized by significant emissions and sewage waters discharges in large volumes, as well as mining industries. It is the latter that pose the greatest danger of contamination of land, surface and groundwater by toxic substances from tailing dumps.

Ecological-geographical studies of industrial areas provide an assessment of anthropogenic impact both on the environment and on certain natural environments, taking into account the demographic pressure.

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