

GIS ANALYSIS OF POLLUTING SUBSTANCES INFLUENCE RESULTS ON THE EXAMPLE OF ZESTAFONI MUNICIPALITY (GEORGIA)

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Abstract

With the development of the modern world, the extraction and processing of natural resources is increasing. Therefore, the impact on the natural environment is also getting bigger. For example: Air pollution, increase of/growth in diseases. The same process is also ongoing in Georgia. One of the active areas in this direction is the municipality of Zestafon, where the "Zestafoni ferroalloy factory" is located (working since 1933). This development of which contributed to the development of Zestafoni, and the improvement of socio-economic background in the municipality and in the country. However, the pollution began to affect the natural environment, including ecosystems. It is important and promising to research the mentioned issues in a geographical and cartographic context, as a result of which a GIS analysis of the collected material was carried out. Appropriate thematic maps were drawn up to promote the sustainable development of the municipality.

Keywords: *Ecosystem, geo-information system, environmental pollution, spread of diseases, cartography methodology*

INTRODUCTION

Every year environmental pollution is becoming a more and more considerable and debatable topic in the world. In this case, Zestafoni Municipality is one of the most interesting areas to discuss.

The development of the "Zestafoni Ferroalloy Plant" in Zestafoni along with its benefits over time created a number of environmental problems that affected the activity and health of the population of the municipality as a whole. Since, during the operation of the factory, emissions are dispersed in different amounts over the entire territory, pollution is high in some places and less in others, which is determined by the movement of air masses and the topography of the area. Apart from the exhaust emitted by the factory, the pollution of the environment of the municipality is greatly influenced by the exhaust of automobiles, because the highways of international and local importance, internal connecting roads, and railways pass here. In addition, the impact of other factors on the environment is also important, such as small enterprises in the area, household waste, and such. All of the above contribute to the emergence and development of various ecological problems in the municipality.

RESEARCH AND USED MATERIALS

The object of research is the territory of Zestafoni Municipality. The mentioned choice was determined by its geographical features, such as geographical location, climatic conditions, vertical division of the terrain, etc.

In the research process, indicators and results of the influence of observable substances polluting the environment were studied.

The data of the Ministry of Environmental Protection and Agriculture of Georgia, the National Environmental Agency of Georgia, the National Food Agency of Georgia, the National Statistical Service of Georgia, the National Center for Disease Control and Public Health and the Zestafoni Public Health Center were used for the research. Based on the processing of which the research period was selected, the principles and methodology were identified that will help to conduct similar types of research.

Zestafoni municipality is located in the central part of Georgia, within the administrative region of Imereti, in the extreme part of the Kolkheti plain and on the Imereti plateau. The area of the research area is 435,417 km². The hypsometric level varies from 90 to 1088 m. from the level of the sea.

The terrain is divided by river valleys. The main artery is the river Kvirala. Important rivers are: Dzirula, Chkherimela, Cholaburi and Buja.

The climate in the plain is average subtropical, winter is relatively cold, summer is dry. The average annual temperature is 14°C, the January average is 3,7°C-4,3°C August is 24°C, and the average annual amount of precipitation is 1190 mm. The temperature in hilly and mountainous areas is relatively low. Winds from the west and east are frequent, sometimes the sea wind also reaches.

The following types of landscapes can be found: lower mountains with cypress-oak and oak forests on brown and humus-carbonate soils of the forest; Foothills with polydominant forests and red and yellow soils have been altered by agricultural activities; The landscape of the plains is covered with thickets and thickets of forests and is written on soils. (Беруцашвили Н. 1979)

17.3 ha of the territory of the municipality is occupied by forest cover. Common varieties are: oak, chestnut, beech, walnut tree, etc. The territory of the municipality is also diverse in terms of fauna, wolves, deer, foxes, Caucasian squirrels and others can be found here. On the territory of the municipality, the Ajameti forest is spread.

The municipality includes 1 city and 18 communities. The population is 54.2 thousand (2023 Geostat).

In terms of farming, the leading position is occupied by viticulture, cattle breeding, pig breeding and poultry breeding.

Due to its location, the municipality is one of the transport hubs for the region. The international highway of Georgia, section S1 passes here (Picture 1.)

Among the branches of industry, ferrous metallurgy, on the example of ferromanganese, electrotechnical and food industries have been developed. Pottery is developed, and marble mining is underway. There are also small-scale enterprises that use various substances as fuel, additives, or resources, of which a maximum permissible concentration a higher concentration is harmful to both humans and the natural environment. Most of them work in metallurgy, making furniture, laminate flooring, building materials, etc.. Therefore, the following types of pollutants are found: TSP, MnO₂, CO, PB, SO₂ and others. of which a maximum permissible concentration is exceeding the concentration that harms the environment.



Figure 1. Ortho-photo image of the Zestafoni area

Based on all of the above, the municipality faces many challenges, including the impact of environmental pollution on human diseases, as well as animal and plant diseases. The research is related to the cartographic and GIS analysis of the mentioned issue. Specifically, in the research process, the spread of diseases in the communities (councils) of the municipality in 2013, 2018, and 2023 was selected, and the statistics of those under surveillance at the end of the year were analyzed.

In case of people, the following types of diseases have been identified:

1. Diseases of the blood and blood-forming organs and some disorders caused by the involvement of the immune mechanism. D50-D89
2. Nervous System Diseases. G00-G99
3. Diseases of the circulatory system. I00-I99
4. Diseases of respiratory organs. J00-J99
5. Diseases of the musculoskeletal system and connective tissue. M00-M99

The cartographic analysis of the materials obtained during the research showed the dynamics of the spread of each disease. As a result of GIS analysis, high-risk populated areas were identified. Specifically, high rates of D50-D89 tasks are recorded in the rural communities of Zestafoni, Lower and Upper Sakarya, which is related to their location, active economic activity. Accordingly, both production and transport emissions are systematically polluting. Despite the fact that the number of the population gradually decreased during the mentioned period, the statistical index of this specific disease did not change much. In the case of G00-G99 disease, high rates were observed in the population of Zestafoni, First and Second Svir, Shorapni, Lower Sakarya. The city of Zestafonia is still in first place according to three years of data, while the positions of rural communities are changing. A downward trend can be observed in the municipality as a whole. This fact can be argued by the fact that this disease is not only the result of environmental pollution and in some cases, it is manifested in the last stage. The I00-I99 disease is one of the current ones in the world, the causes of which are many, among them the excess entry and accumulation of polluting substances in the body. Based on the GIS analysis, it can be noted that there are high prevalence rates in rural communities. The results of the analysis and synthesis of the cartographic product of all three years show that the number of patients has decreased compared to 2013. The J00-J99 group of diseases is one of those that are actively affected by environmental pollution, especially the dispersion of harmful substances in the air. Accordingly, it is relevant for the population of Zestafon municipality. Cartographic and GIS analysis showed that in 2013 and 2018, high rates were observed in the same areas, and some changes are observed according to 2023, specifically increased rates of patients in areas that are relatively less polluted due to terrain and location. Therefore, such a change can be explained by the post-covid impact, which is clearly visible in the total statistics of employees by year. (Pic. 2; Pic. 3). In the case of M00-M99, the following populated areas are identified by cartographic analysis: . Zestafoni, lower Sakra, Kvaliti, etc. The statistics of patients have increased in the municipality over the years.

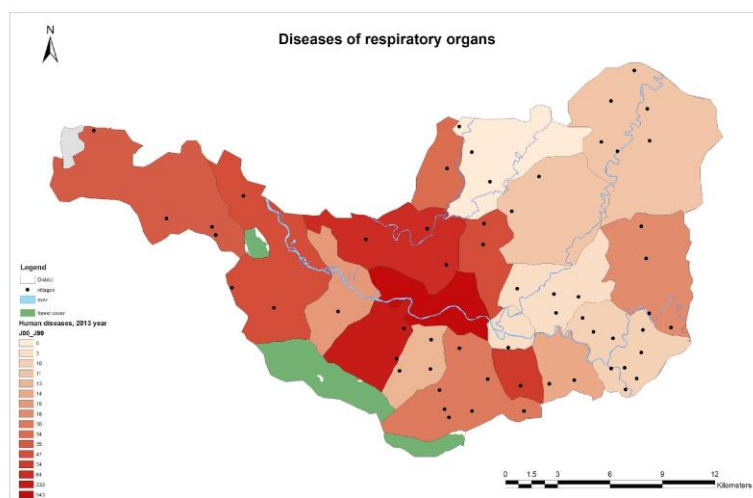


Figure 2. Diseases of respiratory organs according to the 2013 statistics

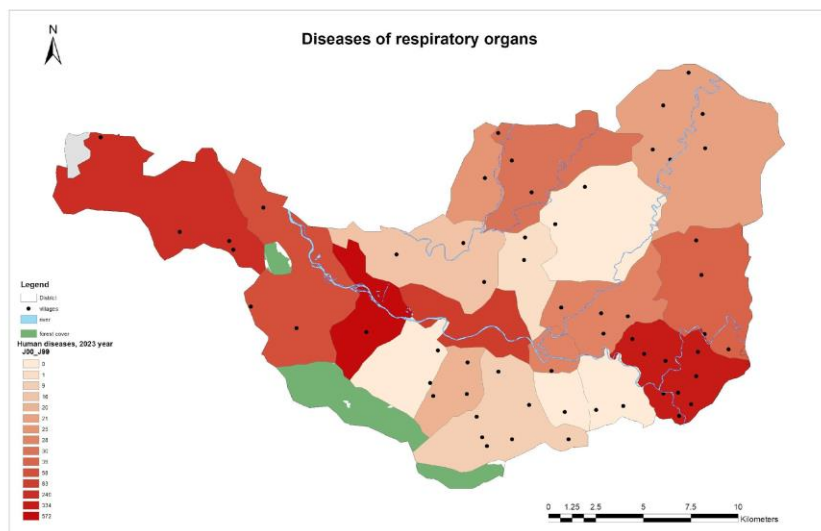


Figure 3. Diseases of respiratory organs according to 2023 statistics

The analysis of the diseases discussed above showed us that in the case of all five of them, high rates are observed in all three years in the city of Zestafoni and its adjacent settlements, which gives us the reason to assume that one of the main reasons is genetic, if other factors are the influence of environmental pollution, especially air and water, which It is an actual problem for the municipality.

In the case of animal diseases, at this stage, there is no active statistical observation in the territory of the municipality, except for several cases of domestic animals and birds. But, based on the available data, the situation is relatively stable in this regard. Anthrax and rabies diseases were detected in animals only in isolated cases.

The analysis of the study period shows that the yield has decreased in the municipality and the number of plant pests has increased. This is due to the introduction of additives into the soil, which pollutes the soil, and the influence of other geographical or anthropogenic factors. The areas of agricultural fields have decreased, while the forest area has increased, which is directly related to population migration and socio-economic background.

CONCLUSION

The active operation of enterprises and the existence of highways contribute to the economic development of the country, however, we must not forget its negative aspects and to take care of solving or reducing them.

It is important to address the reduction of various diseases caused by the contamination of harmful substances. The research methodology developed by us and the obtained results will contribute to solving the mentioned process, and will help the relevant authorities in the correct coordination. For this, it is necessary to create specialized scientific and technical groups that will study the effects of polluting substances on the environment and develop solutions.

It is also important to process the existing data and consider all the measures needed to minimize the impact of harmful substances that pollute the environment, it can be increasing the quantity and quality of air cleaning filters, improving the technical characteristics of motor vehicles, intensive cultivation of green plants in special risk zones, and others.

Operational works like these mentioned will prevent the increase of pollution indicators in the municipality of Zestafoni and will contribute to the regeneration of the natural environment, including the reduction of diseases

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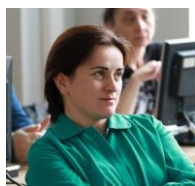
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BIOGRAPHY



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In 2013 she graduated from the Faculty of Exact and Natural Sciences of Tbilisi State University, majoring in geography.

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Since 2023, she has been participating in international conferences organized by the International Cartographic Association. She has participated in two local scientific projects..