

This paper tackles the problem of persistent organic pollutants (POPs). The POP action on the human body leads to increasing the morbidity caused by cancer. Warehouses, storing persistent organic pollutants were studied to see if indeed they could be a cause of cancer disease growth in the Republic of Moldova.

2. Persistent Organic Pollutants in the Republic of Moldova

The POP problem is considered one of the most stringent environmental problems in Moldova, because of the lack of adequate infrastructure to collect and store these chemicals and the lack of a proper management of dangerous household waste.

In the past, large quantities of pesticides were used in Moldova to fight against pests. The unused pesticides have been accumulated year after year. As a result, the stockpiles of obsolete and forbidden pesticides, including POP pollutants became a significant problem for the country and a major danger for the environment and population's health. Large quantities of obsolete pesticides have been cumulated for years now in the warehouses around the country and no management of these was provided due to the lack of a national strategy on obsolete pesticides management. Most of these warehouses are not properly equipped to store such chemicals. Packing materials have been deteriorated over time causing linkages of such chemicals in the environment. This is the most frequent cause of POPs circulating in the environment. The surveys undertaken in the immediate vicinity of the warehouses reveal a significant contamination of soil and surface waters with POPs.

3. Oncology status in the Republic of Moldova

According to the World Health Organization, cancer is one of the main causes of death in developed countries, yielding only to cardiovascular diseases. Thus, each year, about eight million people around the world die of cancer.

In the overall structure of diseases registered in the Republic of Moldova, cancer is on the twelfth place, but in the overall structure of mortality - deaths due to malignant tumors rank second, while disability due to these diseases are on the third place. Thus, cancer is presented as an aggressive disease and it causes huge socio-economic losses. Cancer is a public health problem, affecting very young people.

4. Materials and methods

4.1 Area explored

The country lies on 350 km from North to South and on 150 km from West to East. Moldova is divided in 32 districts, 5 municipalities and 2 regions with a special status. The country has a population of up to 4 million people. The explored area was the territory of the Republic of Moldova, excluding Transnistrien region and Cimislia district, which covers area of 29 100 square km.

4. 2 Initial data collection

Data on cancer were obtained from the Ministry of Health of the Republic of Moldova and include the number of cancer diseases for each separate district in 2010 and 2011 respectively. Thus, in 2011, 7476 primary patients were taken on record, compared to 7227 records in 2010. Data on the persistent organic pollutants were obtained from POP Sustainable Management Office, and include data on warehouses storing POPs, and risk levels of these warehouses. Soil data were obtained from the Institute of Pedology, Agrochemistry and Soil Protection "N. Dimo", Chisinau. These data contain information about the soil quality in the Republic of Moldova.

As a base map was used the map of the Republic of Moldova which includes the graphical data representing boundaries of districts and localities in Moldova. This data set has a shapefile format (.shp) and contains two layers – one with district boundaries and another with locality boundaries.

4. 3 Data processing

Cases of cancer disease for the years 2010 and 2011 were entered in an Excel database. By means of ArcGIS tools, these data were assigned to the layer containing the information about the boundaries of districts so that two columns were created: with the number of cancer illness for 2010 and 2011 for every separate district. This helped create maps showing the density of these cancer diseases in Moldova for the two years surveyed (Figure 1).

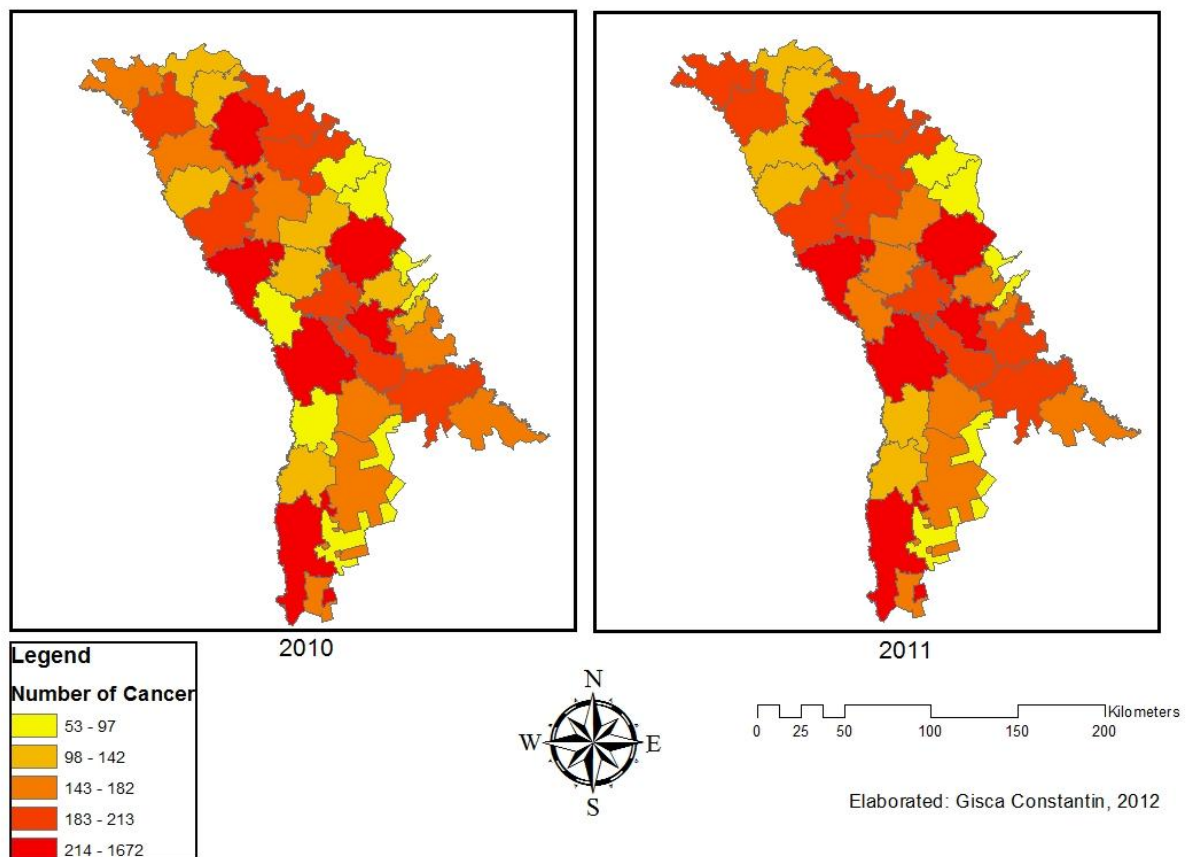


Figure 1. Districts of Republic of Moldova symbolized by the number of cancer

Data on the warehouses with persistent organic pollutants have been divided into five risk groups. From 0 to 23: warehouses with very low risk were represented, from 24 to 29 – low risk, from 30 to 35 - average risk, from 36 to 44 - high risk and from 45 to 80 - very high risk. These data were used to analyze the influence of POPs on human health, as well as to analyze the soil surface infected by POP.

5. The obtained results

To determine the soil surface contaminated with POPs, an area of about 100 meters radius was created around the warehouses. This area represents the surface of the ground contaminated with POP, mainly up to 4499.22 hectares, of which 4276.16 represents the soil with quality index of 65 and more.

For a more complex analysis of the impact of persistent organic pollutants on public health, warehouses located close to populated area were studied. For warehouses with low and very low risk indexes a 200 meter radius was used, for those with medium risk levels warehouses lying at a distance of 350 meters from localities were chosen, and for those with high and very high level of risk 500 meters distant warehouses were considered (Figure 2).

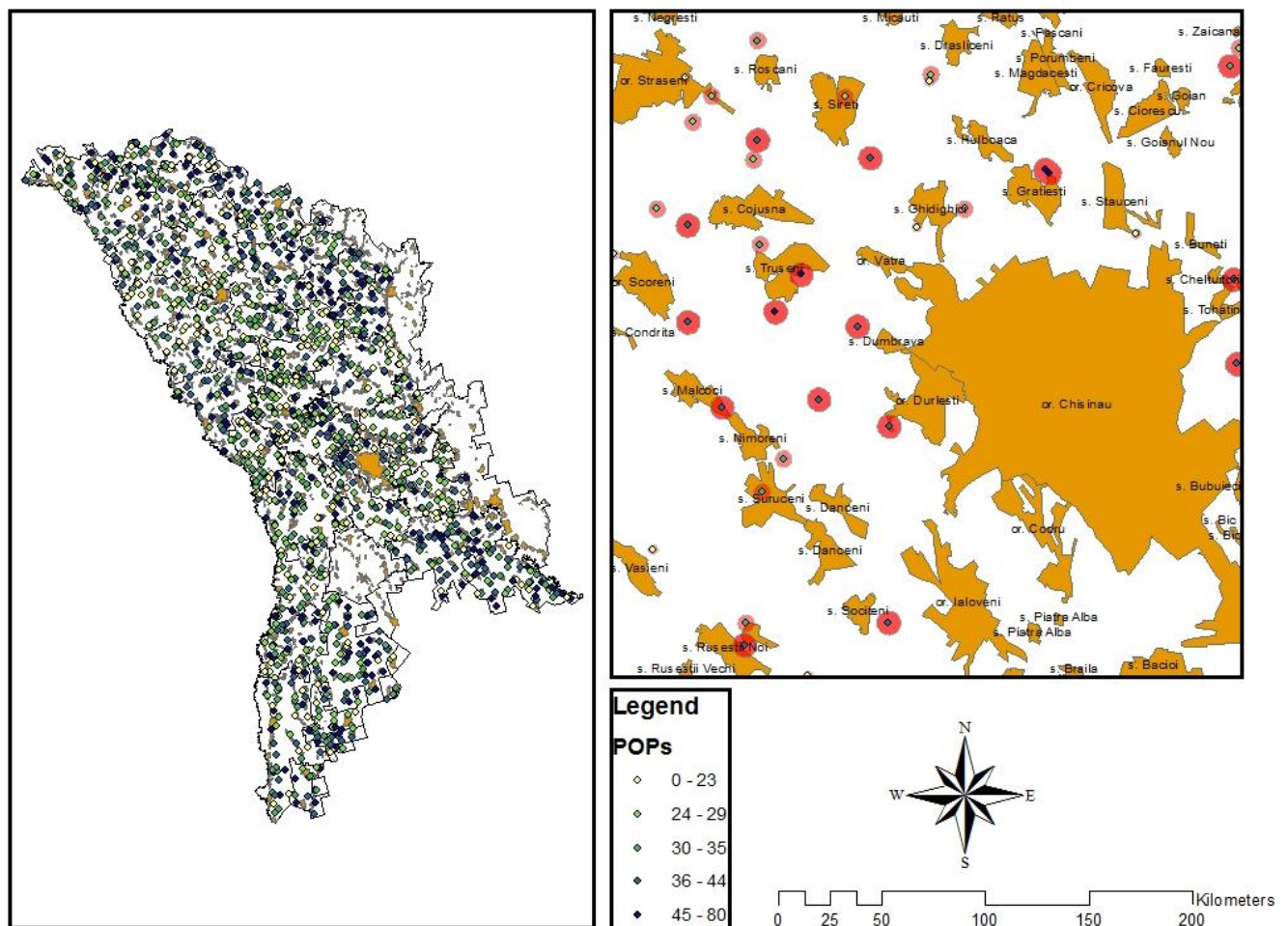


Figure 2. Warehouses located close to populated area.

First, districts with the largest number of cancer diseases were considered. Of these, seven districts that currently have a large number of cancers recorded, only Balti has two warehouses, but none of these are close to populated areas. Other districts have a larger number of warehouses. Thus, in Chisinau there are 20 warehouses, of which 70% are located nearby localities and 40% have a high risk index. Cahul district has 54 warehouses, of which 37% are located close to populated areas and 27.8% are dangerous, in Drochia there are 40 warehouses, 30% are located close to settlements and 27.5% have a high risk level. Hincesti district counts 71 warehouses and 39.4% are nearby populated regions, in Orhei – 39 warehouses, 35.9% within localities, in Ungheni there are 42 warehouses, of which 54.8% are located close to human settlements and 38.1% have a high risk index (Figure 3).

As you can see, these districts have a very large number of warehouses with persistent organic pollutants, and the rate of those located nearby localities and with a high risk index is also big. The incorrect management of persistent organic pollutants, but also the warehouses which are often in a lamentable situation, could lead to a large number of cancer disease in these districts.

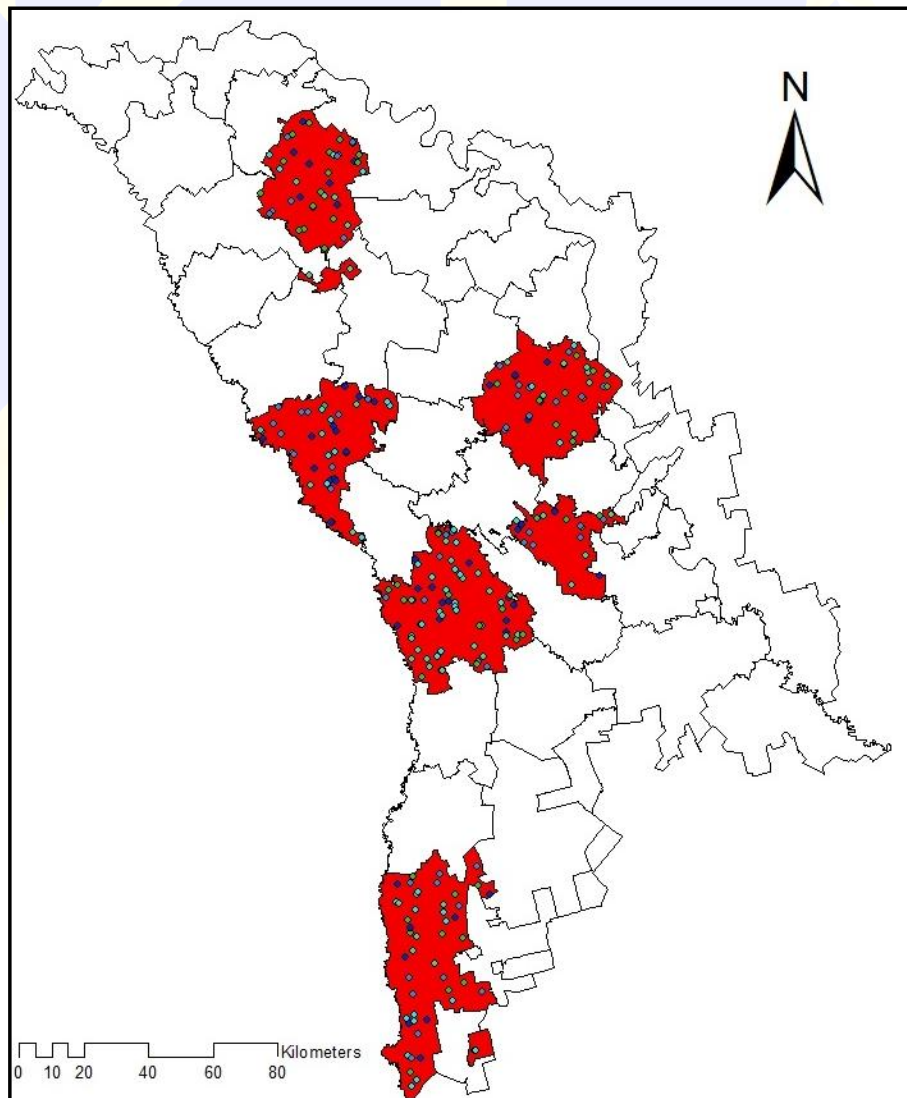


Figure 3. Districts that have a very large number of warehouses with persistent organic pollutants.

Also were analyzed districts where cancer disease increased in number. Districts that have experienced such an increase are: Anenii Noi – 51 warehouses, Briceni - 49 warehouses, Calarasi - 77 warehouses, Leova – 39 warehouses, Nisporeni – 46 warehouses, Singerei – 45 warehouses, Telenesti – 56 warehouses.

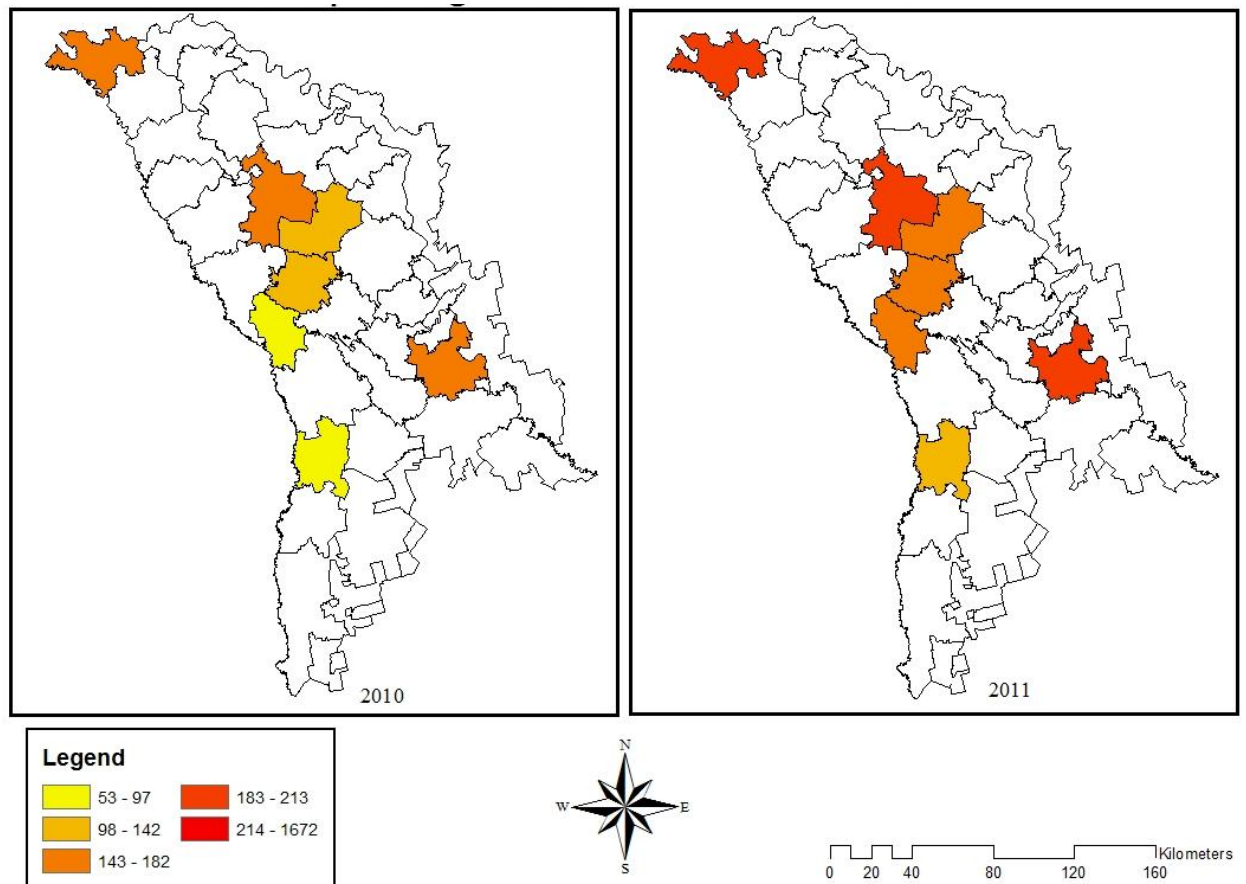


Figure 4. Districts reporting an increase of cancer diseases

The rate of warehouses with POP near the villages in these districts is of approximately 30%. So, as you can see, the increase in the number of cancer disease might be due to the large number of warehouses in these districts (Figure 4).

6. Conclusions

GIS analysis provides powerful tools that can empower public organizations to better understand issues related to human health and can intervene in due time with more effective solutions. The use of GIS in public health and environmental protection offers many advantages and disadvantages. Visualizing data is one of its strengths, still, for various reasons the information obtained does not always reveal the real situation. By analyzing results obtained from map analysis, we can get the necessary information to understand, control, and eliminate the problem from the public health and environmental protection areas.

The purpose of this paper was to show GIS contribution in processing, analyzing and displaying data to obtain best and effective results. The objective was the research of how persistent organic pollutants impact the public health and the environment.



The research revealed, based on data received and analyzed, that persistent organic pollutants (POPs) have a negative impact both on human health and the environment. Namely:

- Soil surface contaminated - about 4500 ha. Most of these soils have a quality index of over 65;
 - The number of warehouses with persistent organic pollutants, close to populated areas is still a considerable one;
 - The great number of cancer diseases in the districts surveyed is conditioned by the presence of a big number of warehouses with persistent organic pollutants in these districts.
- Thus, it was shown that POPs are highly dangerous to public health and quick interventions are required for their removal.

The development and implementation of new GIS technologies in public health makes us confident that the quality of human life will considerably improve.

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