ENVIRONMENTAL PROBLEMS

Vol. 7, No. 4, 2022

ENVIRONMENTAL INDICATORS FOR ASSESSING THE STATE OF THE RURAL TERRITORIAL COMMUNITY IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT

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https://doi.org/10.23939/ep2022.04.201

Received: 17.10.2022

Abstract. The article discusses the essence and concept of sustainable development, the results of the agro-ecological assessment of the given territorial community lands, and determines the indicators of the goals of sustainable development that can be used in the local territories. The author has worked on scientific materials in Ukrainian and international professional publications and outlined the prospects for further scientific research in this direction. The general scientific, ecological, sociological, and mathematical research methods are used in the work. A brief analysis of indicator systems for forecasting the state of the environment is provided using the example of the settlement of Velyka Snitynka. It was established that the excess content of heavy metals in the soil is mainly related to the incorrect use of mineral fertilizers. It has been investigated that the assessment of the ecological state of water bodies in rural areas is an important indicator for the development of a strategy for sustainable development: the main contribution to water pollution is made by anthropogenic sources, in particular, the livestock complex and domestic manure storages and dumps. It was determined that the air quality index is a relevant indicator: exceeding the average daily concentration of fine dust indicates the need to develop programs for local monitoring of the atmospheric air.

Keywords: sustainable development goals, indicators, rural areas, concept, agro-ecological assessment

1. Introduction

The concept of sustainable development began to shape in the 70s of the 20th century, due to the increase in the number of scientific studies on the rational use of natural resources and minimization of pollution of the natural environment. On the initiative of the International Union for Conservation of Nature and the World Wildlife Fund in 1980, the World Strategy for Nature Conservation, developed in accordance with the UN Environment Program, was published. The concept of sustainable development was in many ways similar to the concept of the noosphere proposed by Volodymyr Vernadskyi in the middle of the 20th century (Khashyieva, 2017). The next step was the creation in 1983 of the International Commission on Environment and Development headed by the Prime Minister of Norway, Gro Harlem Brundtland. Based on the results of her work, the report "Our Common Future" was published in 1987, which emphasized the need for immediate solutions to environmental protection issues and defined the concept of "sustainable development" (Brundtland, 1987).

At the current stage, the adoption of the document "Transforming our world: an agenda in the field of sustainable development until 2030" by the 70th session of the UN General Assembly had a decisive influence on the implementation of the sustainable development strategy, which defined 17 Sustainable Development Goals and 169 tasks for their

For citation: Pustova, S., Bogoliubov, V. (2022). Environmental indicators for assessing the state of the rural territorial community in the context of sustainable development. *Journal Environmental Problems*, *7*(4), 201–206. DOI: https://doi.org/10.23939/ep2022.04.201

achievement. The concept of sustainable development is based on an approach that takes into account ecological, social and economic indicators of the development of the country or territorial community. At the same time, in Ukraine, in accordance with the decree of the President of Ukraine "On the Sustainable Development Goals of Ukraine for the period until 2030" No. 722/2019 of September 30, 2019, ways of supporting the achievement of global sustainable development goals and the results of their adaptation taking into account the specifics of Ukraine's development were developed (Pro tsili staloho rozvytku Ukrainy na period do 2030 roku, 2019). Since Ukraine is on the way to membership in the European Union, it is urgent to develop directions for the development of settlements taking into account the Sustainable Development Goals and the Common Agricultural Policy of the EU. It is essential to consider the level of development of rural cooperatives because they are an integral part of the agricultural sector of Ukraine. The first stage should be the substantiation of a flexible system for assessing the condition of rural areas with the possibility of introducing effective monitoring studies on its basis. Operational information about the current situation in the rural territorial community will help local self-government bodies respond in a timely manner to crisis phenomena in the ecological, economic or social aspects of the population's life.

The development of an improved system of indicators during the comprehensive agroecological assessment of the territory of a rural territorial community will make it possible to determine the necessary sources of information, indicators and methods of their determination, taking into account modern scientific approaches.

2. Theoretical part

The theoretical basis of the study is the scientific works of international scientists, which detail the basics of the concept of sustainable development for the practical needs of public administration. (Kroll et al., 2019; Breuer et al., 2019; Abbas, 2021). The experience of environmental management in small towns and villages was formed in the works of Chinese scientists (Liu, et al., 2020; Gu et al., 2019). The work of the Ukrainian scientist M. Z. Zgurovsky is devoted to the issue of sustainable development in the context of solving the problem of the global ecological crisis (Zghurovskyi, 2018). Some aspects of the development of territorial communities are revealed in the works by M. O. Klymenko, A. M. Pryshchepa, and O. A. Brezhytska (Klymenko et al., 2018). Ukrainian scientists are actively working on the ranking of indicators of sustainable development, and the release of socio-economic and environmental indicators (Dalevska et al., 2019). The results of scientific research by the above-mentioned authors can be considered the basis for developing strategies for the transition of united territorial communities to sustainable development. Today, there is a need to develop and implement effective mechanisms for eliminating and minimizing negative consequences for the environment (Zgurovsky, M. et al., 2018) and stimulating territorial socio-economic growth (Departament suspilnykh komunikatsii, 2019). The importance and significance of these questions determined the choice of the topic, setting the goal and objectives of the research.

The research was conducted on the territory of the village of Velyka Snitynka, Fastiv district, Kyiv region.

The solution to the tasks set in the article is based on the provisions of a systematic and comprehensive regional holistic approach to the development of rural areas using modern methods of field research: general scientific methods; ecological research methods, which included methods of soil, water, and air analysis according to standardized methods; sociological methods (population survey using questionnaires); mathematical (statistical analysis) using EXCEL software packages.

3. Results and Discussion

According to the DSTU standard GOST 17.4.3.01:2019 Environmental protection. Soil quality. General requirements for sampling" the studied territory of Velika Snitynka was conditionally divided into 4 squares. The test sites were chosen in such a way that the entire territory of the settlement was covered and clean and technogenically loaded areas were investigated (Fig. 1).

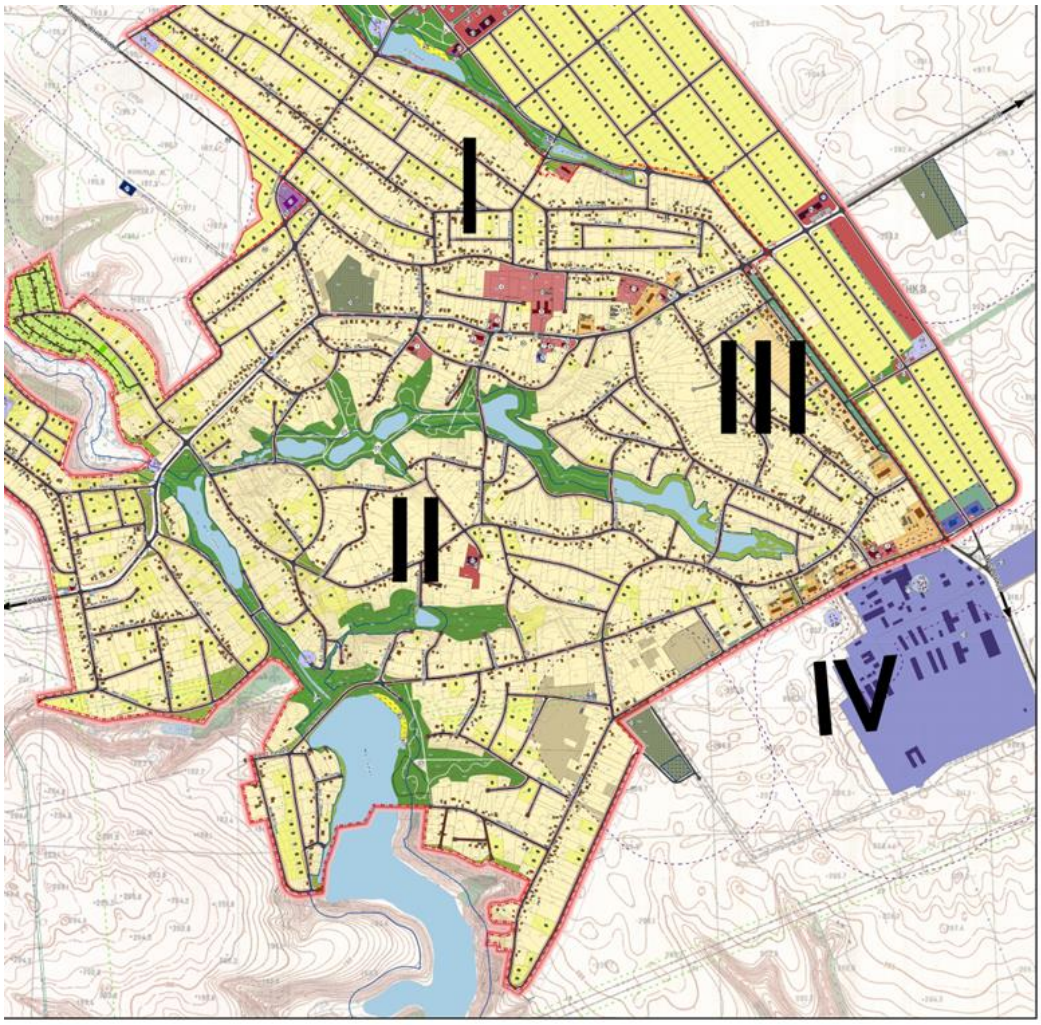

Fig. 1. General plan of Velyka Snitynka with conditional breakdown into polygons

Test site No.1 covers the northern part of the village of Velyka Snitynka. On the western side, it borders the railway road to the city of Kyiv, including the area of the village centre and public buildings. The landfill is characterized by the location of administrative premises, premises of local self-government bodies, educational institutions, a stadium and catering establishments. The local river Stugna flows through this territory. The majority of private residential and country (garden) houses are located in this landfill. Among the residents, it is considered the central part of the village.

Test site No. 2 covers the southwestern part of the village. In the west, it is washed by the River Velyka Snitynka and the Snitka River. In the north, the test site is separated by a cascade of lakes, the largest of which is Lake Palia, so this part of the settlement is called Paliivshchyna and is considered a recreation area. The residential sector is mainly represented by one-story buildings with private plots.

Test site No. 3. It is located in the east of the settlement, where there are private residential and summer houses. It is characterized by the presence of one of the most heavily trafficked highway intersections in the village. Near the highway to the city of Fastiv and the village of Fastivets.

Test site No. 4. Production enterprise of NUBiP of Ukraine "Educational and research farm named after O. V. Muzychenka", livestock farms, machine-tractor station, and agrochemical warehouse are located on this landfill. It is also represented by the residential sector with single-story buildings with private plots.

The objects of the study were the processes of changes in socio-economic indicators of community development, as well as soils, atmospheric air and drinking water.

Water sampling from surface sources and water quality assessment of centralized water supply were carried out at each landfill; soil sampling, assessment

of soil quality and contamination; analysis of atmospheric air quality. A questionnaire was also developed with a standardized list of questions and an algorithm for evaluating answers related to the anthropogenic load on the natural environment. Laboratory studies proved that the ecological situation in terms of soil supply with mobile phosphorus is mostly satisfactory at test sites No. 1 and No. 2. The content of mobile forms of copper and zinc is within the safe limits of the MPC for Cu (3 mg/kg) and Zn (23 mg/kg). The content of mobile forms of cadmium at test site No. 3 generally did not exceed the MPC (only in field No. 9 its content exceeded the MPC 1.8 times). The content of mobile forms of lead at test site No. 4 does not exceed the MPC (by the content of 2), and at test site No. 3, it exceeds the MPC 1.11–1.86 times. In our opinion, the excess of cadmium at test site No. 4 is related to its location near the highway. The maximum values of phosphorus and cadmium exceed the normative indicators where the owners of estates used organic and mineral fertilizers in large quantities. Mobile forms of heavy metals (zinc, copper, and lead) in 2 estates exceed the MPC 1.5 times. It was in these farms that mineral fertilizers were used for fertilization. An excess of cadmium was observed in 4 estates located near the highway (100–150 m).

The state of most non-centralized sources of drinking water supply does not comply with the State sanitary rules and regulations: "Drinking water. Hygienic requirements for water quality of centralized household and drinking water supply". Using the method of calculating the water pollution index (WPI), an assessment of the quality of groundwater in the village of V. Snitynka was carried out, and the quality class of water bodies was established. It was found that the well water belongs to different quality classes. The degree of pollution of these objects is different – 66.6 % of the total amount of water in the examined wells is moderately polluted (quality class III), 26.6 % is clean (quality class II) and 6.6 % is polluted (quality class IV) (Fig. 2).

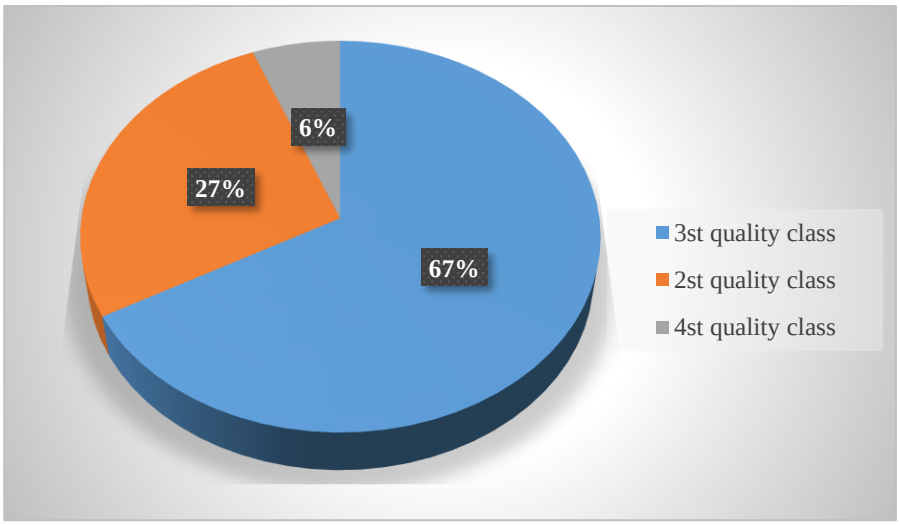

Fig. 2. Classification of the studied objects according to the index of water pollution

It should also be considered that only two groups of quality indicators were studied – sanitary-toxicological and organoleptic. Drinking water is characterized by the quality ranging from satisfactory to critical, depending on the place of sampling. The greatest excess of MPCs is observed for indicators of total and carbonate hardness, iron, calcium, magnesium, and nitrates. The water of the centralized water supply is characterized by the excess of the MPC according to the following parameters: total and carbonate hardness, iron, and calcium, which may indicate a negative state of the water supply network – the quality of the water is critical. The main contribution to pollution is made by anthropogenic sources, in particular, the livestock complex (the number of heads of cattle and pigs exceeds 2.5 thousand) and domestic manure storages and dumps.

The analysis of atmospheric air pollution for the first decade of October 2021 revealed the following: average concentrations of fine dust (PM2.5 and PM10 fractions) in atmospheric air fluctuated with a level of excess of 1.3 MPC and were recorded at test sites

No. 1 and 4; the concentration of carbon monoxide (CO), and sulfur dioxide (SO_2) at the limit of MPC was observed at test site No.4.

4. Conclusions

As a result of the research, the main components of the ecological state of the united territorial community were determined: the quality of the soil, atmospheric air, and water. Sustainable use and protection of land are the most important components of most sustainable development goals. A relevant indicator in local areas is the air quality index which is used by state bodies to inform the public about the pollution of the air at present or how polluted it will become. The assessment of the ecological state of water bodies in rural areas is an important indicator for developing a sustainable development strategy. A decrease in the birth rate, an increase in mortality, a shortage of decent work and growing social insecurity, the development of the education system and the health care system characterize the social aspect of the sustainable development of the community.

It has been established that the main environmental indicators for the assessment of the studied territorial community for the preparation of its transition to sustainable development can be:

a) the share of the rural population that has access to safe drinking water, %;

b) the share of the rural population that has access to centralized water supply, %;

c) volumes of polluted wastewater discharges into water bodies, million cubic meters. m;

d) the share of discharges of polluted wastewater into water bodies in the total volume of discharges, %;

e) volume of pollutant emissions into atmospheric air, %;

f) the total volume of pollutant emissions from stationary sources, %;

g) the total volume of pollutant emissions from mobile sources, %;

h) area of agricultural land of extensive use (hayfields, pastures), thousand hectares;

i) area of arable land (arable land), thousand hectares;

j) forest cover of the territory, %.

Carrying out a comprehensive assessment of the state of the environment using a scientifically based system of indicators will contribute to the solution of current problems of local development, oriented towards the community and greening of the population's life activities; it will create an opportunity to ensure the development of agriculture, which depends on ecological and food security. In developing and implementing the concept of sustainable development of territorial communities, the main direction is the creation of an effective system for assessing the state of the environment using qualitative and quantitative indicators.

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