

Integral assessment of ecological safety of the Eastern Carpathians using sanitary-microbiological indicators

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Abstract – The sanitary-microbiological indices of the main components of the mountain ecosystem habitat of the Eastern Carpathians are investigated. As the benchmark for comparing anthropogenic impact on natural ecosystems, the territory of the nature reserve fund of the research area has been selected. The efficiency of using sanitary-microbiological indicators for monitoring observations and drawing up of long-term forecasts of ecological safety of mountain territories is shown.

Keywords – ecological safety, mountain ecosystems, nature reserve fund, anthropogenic activity, sanitary-microbiological indicators, sustainable development..

Introduction

As a result of anthropogenic influence in the mountainous part of the Eastern (Ukrainian) Carpathians in recent years, the threat of violation of the ecological safety of the region has become acute. Our analysis of the literature shows that due to human economic activity, mountain ecosystems became quite vulnerable and require more careful attitude and balanced use. Endowed with appropriate environmental status and zoning, the land of protected areas is a kind of benchmark for monitoring research of ecosystem changes under the influence of anthropogenic activities. Studying their status enables to predict changes in the environment for a long-term perspective. However, it should also be noted that the use of sanitary and microbiological indicators of soil for assessing the status of protected objects, to date, is episodic and does not apply to specific functional areas of these territories [1, 2].

Main part

We conducted the study of the sanitary-microbiological state of the main components of the physical environment of the mountain ecosystem: the hydrosphere, the lithosphere and the atmosphere of protected areas and economic landscapes with a high level of anthropogenic loading.

In the study of soils it was established that the number of microorganisms studied and the biological activity of soils of various functional zones of the protected areas of the nature reserve are directly dependent on the level of anthropogenic loading. Representatives of the pathogenic microflora appear among the microbioty of the soil environment of territories of active economic activity, as evidenced by a change in the index of perfringens titres, titres of enterococci and the number of thermophilic bacteria (indicators of fresh faecal contamination). In this case, there is a violation of the metabolism and energy in the trophic chains, the intravivoid and inter-species competition for nutrients increases. The activity of soil microorganisms acts as highly sensitive indicators of biological activity of soils, which becomes of particular importance for monitoring the status (protected) territories - centers (nuclei) of the ecological network, centers of conservation, restoration of landscape and biological diversity and maintenance of ecological safety of these territories.

Anthropogenic activity has also spawned a number of risks and challenges for the water ecosystems of the Eastern Carpathians, which exceed the economic capacity of the biosphere to date. The main pollutant of the river network of the studied region is forestry activity. The accumulation in the watercourses of wood wastes leads to a sharp deterioration of the hydrochemical regime and the basic hygienic parameters of the mountain hydroelectric system, which is the result of the indicators we received (BOC, ChOC, nitrate content, the coli-index, the coli-titre, the total microbial number, etc.).

Violation of the integrity of mountain forest ecosystems, accompanied by significant economic losses, degradation of landscape and biological diversity. So, in particular, in the water of the economic zone, with the growth of organic detritus, the species composition of the periphyton is replenished at the expense of detritophagous incl. nematodes, oligochaetes, dreisen and others. The increase in the species composition of hydrobionts in the "biofilters" of the watercourses of the economic zone indicates the complications of the nutrient chains due to the increase in the level of organic pollution of the hydrosphere.

At the population level there is a violation of the dynamics of the number of microorganisms, invertebrates and algae, the change in age structure of the population. In the periphyton, used by us fibrous carriers "Vija", a specific micro-ecosystem is created. In this microsystem, the fibrous carrier serves as a "home" for microorganisms, plant and invertebrates, and serves as a kind of model of artificially created nutritional chain. By the species composition, the quantitative correlation of organisms, the peculiarity of the accumulation of biogenic elements in this model system, one can judge the specificity of the course of the biogeochemical colloid of substances and energy in a holistic mountain ecosystem. It is found that the transition from reserve to the economic zone of the nature conservation, characterized by different levels of anthropogenic activity, there is a descending gradient of concentration of light ions that clearly indicates the value of coefficient unipolarity. Significant influence on the quality of the atmospheric air of the mountainous territories is due to the species composition and completeness of green plantations.

Conclusion

The long-term systematic studies conducted by us made it possible to substantiate the structure of sustainable development of the region taking into account the ecosystem approach. The basis of the proposed concept is the combination of components that determine the level of environmental safety at different levels of organization of matter: from atomic-molecular to ecosystem. The long-lasting stable links between the individual blocks of the biotic and physical (abiotic) environment determine, ultimately, the sustainable development of the mountain ecosystem and the level of environmental safety (in fact, the "integrity ecosystem health").

References

- [1] Emőke Páll, Mihaela Niculae, Timea Kiss, Carmen Dana Şandru, Marina Spînu. "Human impact on the microbiological water quality of the rivers". *J. Med. Microbiol*, vol. 62, pp. 1635–1640, 2013.
- [2] O. V. Mudrak "Funktsional'no-prostorovyy analiz pryrodno-zapovidnoho fondu Vinnyts'koyi oblasti v konteksti stratehiyi zbalansovanoho rozvytku" (Functional-spatial analysis of the nature reserve fund of the Vinnytsia region in the context of a balanced development strategy). *Naukovyy visnyk NLTU Ukrayiny*, vol. 24.7, pp. 100-109, 2014 (in Ukraine).