Baku State University Journal of Earth Sciences & Environment 2024, v 1 (2), p.19-27

journal homepage:http://bsuj.bsu.edu.az/en

ENVIRONMENTAL QUALITY ASSESSMENT

Bahram H. Aliev[a], Akif S. Aghbabali[b*],
Lalanda N. Faradjeva[a], Bahar M. Mammadova[a]

[a]*Institute of Ecology, Baku, Azerbaijan*
[b]*Baku State University, Baku, Azerbaijan*

Abstract

The article notes the impact of the scientific and technical revolution that began in the 20th century on the environment, and analyzes the concept of environmental protection and efficient use of natural resources. Also, environmental quality standards were analyzed, cause-and-effect relationships between environmental components, as well as the possibility of their change and subsequent impact on socio-economic conditions were determined, methods of environmental condition assessment were shown.

Key words: environment, ecological assessment, pollution, standards, indicators, quality, standardization system, analysis of standards, anthropogenic impact.

1. Introduction

The twentieth century entered history as the century of great achievements, the century of discoveries of the atom and atomic energy, the century of man's breakthrough into outer space, the century of genetic engineering, computerization of all spheres of life and human activity, the century of the Internet.

In the twentieth century, scientific and technological revolution, progress in all spheres of life has advanced mankind to such an extent that there is a threat of extinction of the Earth's civilization. Aggressive human actions towards nature, habitat, insane attitude to the environment contributed to the destruction of nature, the deterioration of the ecological situation.

In the second half of the twentieth century, a new economic concept of realizing land as a multifunctional biosphere body began to take shape. It should be noted that land is an integral element of the natural landscape and ecosystem. Land has also attracted attention as a valuable natural resource that needs a versatile

quantitative and qualitative characterization. The tense state of the relationship between mankind and nature, caused by the discrepancy between the size of industrial and economic activities of people and the resource and ecological capabilities of the biosphere, leads to global environmental malaise, characterized by persistent negative changes in the environment, which can lead to an ecological crisis. Back in the 70s of the XX century, the famous American ecologist B. Kommoner (1974) stated in his book "The Closing Circle" that one of the main causes of the environmental crisis is that huge amounts of matter are extracted from the Earth, transformed into new compounds and dispersed in the environment without taking into account the fact that everything must go somewhere (Kommoner's 3rd law). As a result, perniciously large quantities (millions of tons) of these substances are produced, accumulate in places where they should not be by nature, disperse widely throughout the biosphere, and have a negative impact on the environment [1].

2. Preliminary

Any human activity inevitably associated interaction with the environment, and society is obliged to make decisions with an eye to nature.

The purpose of this article is to develop a unified standardization system, a basis for environmental assessment that ensures the preservation of nature.

Environmental quality assessment. The scientific basis for the development of environmental protection standards is environmental assessment. Environmental quality assessment is based on the comparison of its condition with certain standards. Environmental quality affects health, life expectancy and other important components of a comfortable human existence. To quantify the quality of the environment, indicators are introduced, which are used for quality standardization - determining the limits within which the change of these indicators is permissible. Norming is carried out in order to determine the permissible anthropogenic load on the components of nature, which will ensure the normal functioning of the ecosphere as a whole and its individual components (preservation of the genetic fund, the most rational use and distribution of natural resources, etc.). As a rule, all of them are associated with physical impact or with the influence of pollutants - chemical compounds that are not naturally present in

the environment (xenobiotic) or are present in much smaller quantities than in the territories subjected to anthropogenic impact [1, 7].

Normative indicators are established on the basis of special studies or expert assessments. The historical approach to norming is based on the retrospective interpretation of data about the system being evaluated. The following varieties of "norms" are distinguished:

- empirical norm is established in the course of an experiment, when the state of one of the systems is declared "control";
- theoretical norm appears when a mechanism of interaction of system components is built from some assumptions;
- expert norm is the most common approach.

Assessment of the state of the environment during ecological and geographical expertise includes:

- finding out the content of hazardous pollutants (in relation to MPC) in the atmosphere, surface and ground waters, soils, snow cover, vegetation, agricultural products, etc.;
- mapping of anomalies of chemical in environmental components and their hygienic assessment;
- finding out the levels of physical pollution of the environment (noise, vibration, electromagnetic, etc.);
- mapping of anomalies of physical fields and their hygienic assessment;
- finding out the state of public health (general morbidity, morbidity of individual diseases, morbidity in different age groups of the population); assessment of the state of public health;
- elucidation of the relationship between the anomalies of chemical substances, physical fields and the state of public health;
- assessment of environmental hazard of pollution; ranking by pollution zones: extremely hazardous, hazardous, moderately hazardous, non-hazardous.

To assess the state of the environment, areas subject to anthropogenic impact, it is necessary to analyze several approaches in combination, having a single final principle.

3. Analysis of environmental quality standards

Environmental assessment is mainly related to environmental protection norms. Currently existing standards in the field of environmental protection on the object of their application can be divided into standards of quality, impact and load. Quality standards are established for a certain range of environmental parameters and, depending on their purpose, are divided into sanitary, economic and environmental standards. The first ones ensure the harmlessness of the environment for human health and life, the second ones - the quality of natural resources necessary for their economic use, and the third ones - the preservation of natural ecosystems.

Sanitary and economic standards of environmental quality are mainly universal, i.e. unified for all territories and water areas, natural and natural-anthropogenic systems. Environmental standards should be individual in nature, i.e. established for individual objects or at least individual categories of objects, taking into account their natural features and specifics of anthropogenic load. Since this task requires a lot of time and money, environmental standards, the necessity of which has been discussed for many years [3, 4,8], have not yet materialized. This problem can be solved if we develop environmental standards not from scratch, but by modifying sanitary and economic standards taking into account the factors labeled as "X" and "Y" in Fig. 1.

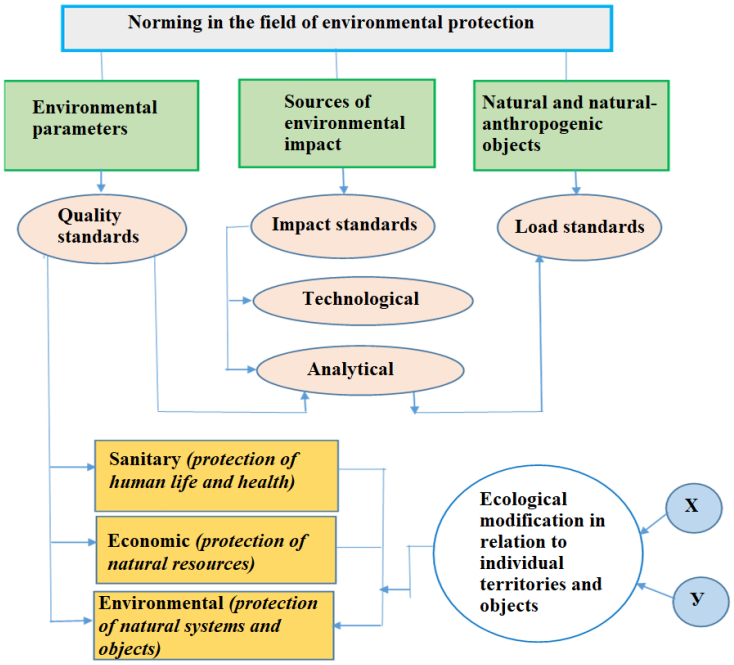

Fig.1. The system of standardization in the field of environmental protection

So, factor X is an assessment of the sustainability II (or vulnerability) of natural systems, taking into account its relationship with the sustainability I (or integrity) of natural systems. In turn, factor Y is an assessment of the amount (or better ecological activity) of anthropogenic factors. These 2 components of environmental assessment, in our opinion, are sufficient to establish environmental quality standards by modifying economic and sanitary standards.

From quality standards let us move on to impact and load standards. The former is established for individual sources, as well as economic entities, and the latter - for individual territories, natural or natural-anthropogenic objects. At the same time, both are designed to ensure compliance with environmental quality standards. In practice, this goal is achieved by converting mass units (in which quality standards are measured) into flow units (in which impact and load standards are measured), taking into account a number of factors (background, decomposition, dispersion, etc.). Exposure standards are classified according to the main factors of impact (emissions, discharges, waste) and the method of establishment (technological and analytical). Technological standards are

established taking into account the so-called BAT (best available technologies), and analytical (limits of emissions, discharges and waste generation) - taking into account the background caused by the total impact of all sources, except for the standardized one. Technological standards are more suitable for portable and small uniform stationary sources. We assess the attempt to extend technological standards to large stationary sources of impact negatively not only because it is difficult to select BAT for them, but also because these standards are set without taking into account the background. The link between environmental quality and the total impact (i.e. load) is more visible and stronger than that of a point impact. Therefore, load standards are more justified and objective than exposure standards. If under the validity of environmental protection standards to understand the degree of consideration of the state of the environment, adopted in the process of their development and establishment, then in the first place will be the norms of anthropogenic load, and in last place - technological standards, in the determination of which this state is not taken into account at all. Currently, we consider the degree of validity of environmental standards as a measure of their effectiveness, and given the main role they play in environmental protection - as a measure of the effectiveness of the environmental system as a whole [5].

4. Approaches and methods of environmental quality assessment

The concept of environmental quality assessment and rational use of natural resources consists of:

1. Regional approach to assessment. This approach first of all implies taking into account local natural, social, economic peculiarities within a group of physiographic provinces and administrative districts. Local conditions are taken into account when using the landscape approach, which is a special case of the regional approach.
2. Forecasting. This approach envisages the future state of the natural environment for different periods of time, and both the forecast of natural trends in the development of nature and its changes in connection with human economic activity. Landscape forecasting solves the problem of geosystem stability to external impacts. Geographers define the forecast

mainly as a scientifically grounded anticipation of trends in the change of the natural environment and production-territorial systems.

3. method of geographical analogies. The method of geographical analogies consists in the fact that when studying changes in a certain territory, similar forecasts are also applied to other similar locations. One of the most important conditions for applying the method of analogies is the correspondence of similar indicators. They consist of the following:

- similarity of relief conditions of the territories. In this case, both reliefs should be as identical as possible (river valley, plain, depression, foothills, uplands);
- similarity of rocks and their features. Both areas should have similar properties (water-permeable, waterproof, fracture-free, fracture-dominated, clayey, sandy, rocky), rocks with similar genesis (sedimentary, metamorphic, igneous);
- similarity of soil and its thickness, its features (e.g. must have soil of identical mountain virgin soil);
- similarity of vegetation cover;
- similarity of animal life;
- similarity of the impact of human activity on nature (reservoirs, mines, cities, crop fields, orchards, dams, roads, canals, etc.).

This method is predominantly used in predicting the environmental impact of a particular engineering structure. For example, when studying the environmental impact of the consequences of a previously constructed mine on the plain, the analogy method is used to assess and predict similar impacts for a planned mine on an identical terrain.

This method is the most well established and is a combination of methods (landscape, cartographic, geochemical, geophysical, computational).

1. Ecological assessment. This method reflects anthropogenic changes in the natural environment and natural complexes as a source of gene pool, guardian of its evolution, diversity and sustainability. In our opinion, the ecological type of assessment can be partially attributed to the natural one, if we are talking about the sustainability of natural systems [6].

Environmental assessment can be performed both by traditional methods and by creating special systems for analysis and modeling of natural information (GIS), i.e. by the method of geoinformation analysis and modeling. As the main stages of the technology of works on geoinformation analysis and modeling of the

natural environment should be highlighted: collection of complex information about the environment. This can be cartographic materials, results of remote sensing of the Earth, descriptive and statistical information, reports, etc.

Environmental assessment work is divided into the following stages:

- Construction of a series of maps of anthropogenic impact. To study environmental pollution, multi-element or semi-element maps are constructed. When constructing maps, one of the widely used methods is the method of overlaying maps for joint analysis.
- Area zoning for different tasks. By overlaying the map of actual pollution on the map of potential sustainability, different zones are distinguished: hazardous, safe, etc. Another task is to delineate appropriate contours, e.g. landscape map contours for migration, decomposition, destruction conditions.
- Mapping of secondary redistribution of pollutants in the landscape. For this purpose, an assessment of the horizontal structure of the landscape is given.

Ecological assessment of territories is an assessment of various aspects of development and placement of productive forces of the region, assessment of the current state of the landscape and forecast of its change, assessment of environmental protection measures, compensation measures to compensate for possible losses of land, forest, soil and other resources.

5. Conclusion

Environmental standards can be used to determine exposure and loading standards in the ways discussed above. In addition, they can also act as criteria for assessing the quality of anthropogenic factors as one of the components of environmental assessment.

Proceeding mainly from the environmental purpose, the basis of environmental assessment is the identification of territorial and sectoral contradictions in interaction with the environment. In addition, the totality of natural components, geological and geomorphologic conditions, air and water masses, soils, flora and fauna should be considered not as their sum, but as the interrelation and interdependence of the development of these components in the form of objectively existing natural-territorial complexes. Only in this way it is possible to determine the cause-and-effect relationships between the components

of the natural environment, the probability of their change and subsequent impact on socio-economic conditions.

References

[1] Геокчайский Ш.Ю. Основы географической экологии. Баку, 2017, 408 с.
[2] Данилов В.И., Лосев К. С. Экологический вызов и устойчивое развитие. М., 2016, с.164.
[3] Вопросы экологического нормирования и разработка системы оценки состояния водоемов: материалы объединенного пленума Научного совета ОБН РАН по гидробиологии и ихтиологии, Гидробиологического общества при РАН и Межведомственной ихтиологической комиссии. Москва, 30 марта 2011 г. — М.: Товарищество научных изданий КМК, 2011, 196 с.
[4] Дмитриев В.В., Фрумин Г.Т. Экологическое нормирование и устойчивость природных систем. — СПб., 2004, 294 с.
[5] Есина О.И., Монахов С.К. Современное состояние и перспективы развития системы нормирования и оценки загрязнения окружающей среды // Энергетический вестник, № 1 (13), 2012, с.45-52.
[6] Мусихина Е.А. Методологический аспект технологии комплексной оценки экологической ёмкости территорий. М., 2009, 218 с.
[7] Израэль Ю.А. Проблемы мониторинга и охраны окружающей среды. Москва: Гидрометеоиздат, 1989, 560 с.
[8] Опекунов А.Ю. Экологическое нормирование и оценка воздействия на окружающую среду. — СПб.: Изд-во СПб. ун-та, 2006, 261 с.