

## THE ANALYSIS OF THE EXISTING TECHNIQUES OF THE ECOLOGICAL AND GEOGRAPHICAL ASSESSMENT OF THE REGIONS OF RUSSIA

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### ABSTRACT

The modern historical geography plays an important part in the complex historical and geographical study of a region and creation of the techniques of the ecological and geographical assessment of its landscapes.

The retrospective analysis of the evolution of the definition of the concept of the "ecological and geographical assessment" in the works of the leading Russian geographers showed the dependence of its treatment on the applied approaches, i.e. historical-landscape, comprehensive physical-geographical, socio-geoecological, etc.

The distinction between the approaches to the ecological-geographical assessment of various Russian scientific schools is shown through practical examples. The analysis of the structure of the criteria and the set of the indicators of the ecological-geographical assessment is carried out in the paper.

The potential of the stability of the landscapes, included by many authors along with the ecological and resource potentials into the structure of the ecological-geographical assessment, is important. The landscape potential assessment (ecological, natural-resource) is carried out within natural and administrative borders.

The paper considers the approaches to the integral assessment of the landscape potential based on the analysis of the duration and intensity of the territory's development at a regional level.

**Keywords:** historical approach, ecological-geographical assessment, spatial-temporal basis, the development of the territory, geo-ecology, historical ecology, behavioral ecology.

## INTRODUCTION

In recent decades, the concept of "the ecological-geographical assessment" of the state (of conditions, situations, landscapes, regions, etc.) has often been used by researchers due to the implementation of the projects on the scientific principles of the secure natural resource management, of the estimation of the current condition of landscapes, of the comprehensive assessment of the regions. The problem of the different interpretations of the concept "the ecological-geographical assessment" is related to the fact that the authors use it for different purposes and such assessments perform diverse functions. Thus, the landscape-geographical approach to the ecological-geographical assessment of a region focuses on the natural basis [1], and in the socio-ecological treatment, the emphasis is on the antropogenic factor [2].

When substantiating the methodology of the ecological-geographical assessment, it is necessary to take into account the ecological and resource potential of the landscape, along with it, the environmental component has been changing during the historical time from the adaptive properties of the landscape at the first stages of the development to favorable and unfavorable environmental situations for the life of the modern population. During the historical time the resource potential changes repeatedly over different geographical and historical periods of exploration, due to the development of the productive forces and the necessity of using an increasing number of natural resources with increasing intensity in the modern economy.

In the modern geographical science, the assessments of the potential, i.e. environmental-natural-resource, applied to the natural unit (a landscape, a natural complex) of a territory, a region, and even an administrative-territorial unit, can be attributed to ecological-geographical assessments. As for the sustainability potential, it is identified solely in relation to natural entities. The criteria and indicators of the assessment are developed, for example, for the cluster "Ecological potential", the biomedical, recreational, balneological and medical-geographical assessments of the local potential are defined. The environmental and hydrothermal factors, the ecological features of the biota, the biochemical conditions, the natural disasters, the climatic conditions, the hypsometric factor are identified as the assessment criteria [3].

An important step in the development of the environmental-geographical assessment methods was the works by B.I. Kochurov, who considered the interaction and interdependence of four clusters: the antropogenic impact, the nature itself (the natural environment), the changes in the nature, the consequences of the economic development [4]. In the cluster "Nature", the specific components of the natural environment are considered as criteria. In the cluster "Antropogenic impact", quantitative indicators characterize different types of economic activities in regard to demographic characteristics. The cluster "Changes in the nature" assesses the consequences of the antropogenic load on the natural complexes, their pollution, depletion and degradation.

On the basis of this approach, A.V. Antipova proposed the algorithm (the logical formula) of the ecological analysis (the eco-diagnostics) of the territory with the allocation of the main objects of the study: "the natural-landscape differentiation of the territory, the spatial structure of the land use, the distribution of the population density" [5]. The main operational spatial units, to which all environmental indicators are bound are called the natural-antropogenic systems, for each of them a set of specific indicators for the changed natural features is determined, which, in comparison to the

environmental quality standards, characterize the ecological condition of the given territory in accordance with 32 parameters [5]

A. V. Shakirov deals with the issues close to ecological-geographical estimates of the region and, in particular, ecological-geographical zoning. According to the approaches, his academic works are resonant to those by B. I. Kochurov, since the natural and anthropogenic factors of differentiation for this type of zoning, as well as the impact of the technogenesis are taken into account and the degree of the territory's development is considered [6].

## METHODS OF RESEARCH

On the basis of the ecological analysis method (the ecological diagnostics of the territory) a new trend of the ecological-geographical analysis, i.e. behavioral geoecology, has been formed. It is based on a comparative study of the results of the territory's comprehensive environmental analysis and the assessment of the perception of the state of the environment by the local population. The algorithm of the comparative analysis of the geoecological situation and the assessment of the population's view on the state of the environment is based on the integration of the results of the territory's ecological-geographical analysis through the correlation of the maps of the territory's ecological diagnostics (the result of the ecological analysis of the territory according to the statistics and the results of field observations) and the mental map of the environmental problems. The mental maps are made in accordance with the questionnaire data on the basis of the subjective personal views that reflect the average spatial knowledge and understanding of the reality by a group of people in terms of the environmental issues and the assessment of their severity. This approach makes an integrated ecological-geographical study adequate to the geographical reality [7].

It should be noted, that at determining the criteria for the environmental-geographical assessments, the researchers rarely consider the time parameters related to the age (duration) of the development. The category of time is relevant in the integral scientific trends, in particular, in the landscape studies it is used to define the age of the particular components and the landscape at large. The landscape is related to time as it is an objectively real form of its existence and the existence of the whole environment, surrounding it. According to H. L. Beruchashvili [8] the age of the landscape is the time that has passed since its formation. The study of the temporal characteristics of the particular components of the nature and the landscape as a whole is at the heart of a systemic vision of the objective reality.

The study of the history of the development and settlement of the region is interdisciplinary. When considering the process of the territory's development, V. S. Zhekulin focuses on the historical-geographical aspect, highlighting three stages of the development: "the geographical discovery and exploration of the territory; the settlement of the people in the area, the formation of national groups (ethnoses); the development of the economic structure, social relations, the settlement system" [9, P. 16]. In the study of the process of the territory's economic development within the time, the historical-geographical periodization, i.e. the formulation and development of the issue of historicism in the territorial organization of society and environment, is created in historical geography.

The time category is applied in the temporal analysis of the ecological situations, which includes the analysis of time series of social and natural indicators and their combinations, representative for a particular territory and allowing the researchers to reveal the tendencies of aggravation, stabilization or improvement of a situation, as well as the rates of their changes.

The natural landscape, which is characterized by a certain ecological and resource potential (ERP), forms a relatively stable natural framework for the retrospective analysis of the anthropogenic changes in the subsystem "society-economy". The assessment of the ecological component of the territory's potential is carried out due to such properties as the comfort of living, the presence or absence of natural hazards and the factors limiting human activities. It is important to take into account the development and the human impact on the territory, depending on the stages of its development and the development of human society.

For example, the transformation of society in the process of the transition to a producing economy (the Neolithic revolution) manifested itself in the interdependence of the technology and social structure [10]. The technology of the stone use is characterized by the following stages: the extraction of raw materials, the manufacture of tools, the acceptance or rejection of their use. The degree of dependence of man on the environment was the highest. Of significance were the ecological adaptation and the model of behavior depending on the mobility of groups [11]. Each stage of the development passes three main phases: formation, flourishing and decline. The transition from one stage to another takes place due to the change in the prevailing tendencies of the economic activity. As a rule, one tendency prevails at the stage of flourishing, two or more trends are typical for the stages of the formation and decline. Thus, the stage of flourishing can be called a period of sustainable development, when the main tendency of the economic activity and the type of the environmental management dominate over others.

We can regard the evaluation of the development of the region as one of the alternative variants of the ecological-geographical assessment. According to our concept, for this purpose, it is necessary to undertake detailed historical and geographical research. In particular, carrying out the regional historical-geographical analysis and synthesis including historical-geographical periodization with the allocation of temporary units (periods, epochs, stages) and historical-geographical zoning with the identification of spatial historical-geographical units (regions, provinces, districts, etc.).

The evaluation criteria should be selected for the implementation of the assessment of development. The list of criteria, in our opinion, may include: the duration of the process of the region's development in time at large and each time unit (period, epoch, stage) in particular, the nature of this process (continuous or periodic), the "age" of its development, marking the time of the anthropogenic factor formation, the development intensity, characterizing the degree of the landscape resources involvement in the economic turnover.

The development "age" refers to the whole chrono-interval (time slot) since the emergence of man in the territory, the formation of ethnic groups, the way of life, the system of settling. This criterion explains the specificities of the anthropogenic landscape structure, the pattern of the settlement network, the peculiarities of the species composition of plant associations (exotic, segetal and ruderal species). The development

"age" is represented in the maps of historical and geographical zoning of the region by the allocation of space-time units, for example, the areas of early and new development, etc.

For the evaluation of the development intensity within a chrono-interval, a lot of historical-geographical data are important: the population size and density, the number of settlements, population density, the proportion of the land in use, the economy pattern defined by the set of the types of nature management, that found their development in the studied chrono-taxon. Throughout the history of the region's development, some types of nature management are replaced by others, the scope of the area involved in a particular use (land development ratio) changed.

The anthropogenic changes that take place in natural complexes depend on the duration and intensity of their development, which altogether show the economic development of the landscapes of a region both within a separate time interval, and during the whole period of its development.

The researcher obtains the detailed information about these criteria from the historical-geographical periodization created by the means of the method of the analysis. When assessing the duration of the development, it is important to take into account such a characteristic as continuity. The change of chrono-intervals is characterized by the emergence of the new forms of land use. The more types of nature management are developed in the region, the more complex the considered economy pattern can be, it is a favorable factor for the people and negative for the environment, because with the increase in the number of types of nature management, an increasing number of natural resources are involved in the economic turnover and the degree of anthropization of the natural complexes increases.

In historical and geographical studies, the important research milestones are: the creation of the information base by means of a set of specific and general scientific methods; the creation of historical-geographical periodization by means of the method of the analysis and carrying out historical-geographical zoning by the means of the method of synthesis [12].

## DISCUSSIONS

Conducting historical-geographical research provides a parallel study of the changes in the natural features, landscapes, natural resources, population, economy, political structure, ethnic groups. Along with it, the reconstruction of the area of study at each stage of the historical process of its development is being carried out. Historical-geographical studies help to reconstruct the stages of the historical process of the development and settlement of various territories, i.e. to assess the impact of these changes on shaping and functioning of natural-ethnic-economic systems.

The historical-geographical basis, represented by the historical-geographical information base as well as the periodization and zoning, contains the required information for the implementation of the landscapes ecological and geographical research, taking into account the spatial and temporal bases [12]. The ecological and geographical assessment of the landscapes of the region can be a practical result of such an integrated space-time study.

As an example of ecological-geographical assessment of the landscapes, let us consider the criteria for assessing the degree of the development of a region. In our opinion, this list of criteria should include:

1) the "duration" of the process of the region's development in time for each time unit (period, epoch, stage). It is important to characterize the "continuity of the development": whether there were periods of "rest and recovery" in the landscape, if nature management was continuous throughout the period; whether there were conditions for the formation of a cultural landscape. The duration of the development process is estimated during the periodization and is referred to in tens and thousands of years, depending on the time of human involvement of natural resources of the region in economic circulation. The duration of the development for different epochs varies significantly, it creates certain difficulties in calculations [13].

Based on the value of the development duration, we introduce a new quantitative indicator – the ratio of "age" of the time unit or the "age" of development. It is important to know how long ago the use of natural resources (environmental management) stopped, because when a certain amount of time passed after the end of the use of landscapes, the traces of the impact are almost "not detected", the natural systems restore. Setting this indicator is important not only for determining the landscapes changes or studying the invariant, but also for assessing the landscape potential [13].

3) the "intensity" of the development depends on the level of technological and productive forces development and characterizes the degree of anthropogenic variability of natural complexes. This feature can correlate with the change in the energy balance of the landscape due to the anthropogenic load, and it will eventually lead to a change in its bio-productivity.

The calculation of the intensity of the development is carried out by establishing the number of types of environmental management in a given time unit. It is important to set the "load" of each type of the environmental management on specific landscapes. It is recommended, that the following indicators be used:

- the share of the area used in the economy in the total area of the historical-geographical taxon (local or total logging, plowing, etc.), which take a form of the share of the used area which has received quantitative representation in percentage, at different time units;
- the number of types of environmental management developed at different time units. The more types of environmental management are developed in the region, the more "complex" the economy is, these are favorable conditions for the people and a negative factor for the natural environment;
- the total load on the landscape from each type of the environmental management, not just the sum, but taking into account the multiplier effect, when one component of the landscape is under the impact of several types of the environmental management.

The intensity of the development shows the ability of man to control the changes in the landscape per time unit, it is characterized by the level of the productive forces and the degree of the involvement of the landscape resources in the economic turnover. The degree of the landscape disturbance directly depends on the intensity of the development.

The historical and geographical study of the environmental situations includes the analysis of time series of indicators which are representative for a certain territory and allow us to reveal the tendencies of aggravation, stabilization or improvement of a situation, and also the rates of the changes. The focus should be on both social and natural drivers of change and their combinations.

## RESULTS

In the study of the particular regions within the framework of the main sections of the ecological-geographical assessment – the natural and landscape differentiation, the spatial structure of land management and the distribution of population density within the study area – a historical course of the development, taking into account various events that influenced the formation of the environmental situation should be analyzed. For a retrospective analysis of the mobile changes of the subsystem "society-nature", the landscape structure of the region forms a relatively stable natural frame. As the territorial basis of historical and geo-ecological studies of large regions, N. N. Alexeeva [14] recommends that a grid of landscape zoning with setting aside the areas of different taxonomic ranks be used.

At the present stage of the study of the geosystems anthropogenization, it should be stated that it is essential to take into account the historical and geographical approach to the ecological and geographical assessment of the landscapes.

## CONCLUSIONS

The proposed research methodology is carried out through a retrospective analysis of the relationships within the tri-unity of "landscape – ethnos – nature management", and turns the researcher to the study of the past eras: the identification of trends in the development of nature, the anthropogenesis of the geosystems, the detection of "the genetic code" of the landscapes within the units of historical and geographical zoning.

The objectives of environmental-geographical assessments may be aimed at solving specific regional issues related to forecasting or development prospects of a particular industry or of the environmental management system in general. All the research should be carried out taking into account the historical and geographical grounds of the region including the periodization of the history of the territory's development, the degree of the economic impact on the landscapes and its ecological consequences. The results of the assessments are shown in the maps of ecological-geographical zoning of the studied regions.

The ecological and geographical assessment of the territory should be approached in a differentiated manner, individually to each region, taking into account all factors of the anthropogenic impact: the assessment of the natural resource potential, the time and the intensity of the development, the landscape resistance to anthropogenic impacts.

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