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Nature-Resource Potential of Ukrainian Physic-Geographical Regions: Main Directions, Levels, Types, and Tasks of Cartographic Evaluation

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ABSTRACT

Available experience is generalized and we developed the essence, main directions, levels, types, and tasks of cartographic evaluation for nature-resource potential (NRP) in Ukrainian physic-geographic regions. We also assessed the positive qualities of the NRP of landscapes (of objects) from the perspective of either their rational economic use or of their suitability to be human beings' living area.

1. INTRODUCTION

Complex Evaluation of Nature-Resource Potential (NRP) of Separate Geographic Regions and Countries, being among the major research directions as provided in the Scientific Passport of the course of *Economic and Social Geography*, is, in our opinion, a systemic combination (synthesis) of technological (productive), economic, ecological-economic, and, at last, economic-geographic and cartographic assessments of territorial NRP. We presented in detail generalized concepts of the essence of technological (productive), economic, geographical, ecological-economic and economic-geographical NRP [1, 2]. This is why a thorough attention shall be paid here to our own approach.

2. THEORY AND METHODOLOGY

2.1. Essence of NRP cartographic evaluation

The concept of territory (water territory) NRP economic-geographical evaluation "lies, at first, in a quantitative estimation of the regularities that make the territory differ in the efficiency of its use, protection, and reproduction; in an estimation of its absolute value represented by the productivity of the whole nature-resource complex of the territory" [3, p. 15]. Such value can be only expressed in cost indices that proceed form "effective output" from the so-called "worse" areas of nature resources where the development costs are maximal but ecologically and economically justified since they meet the final economic needs in these or those nature resource products.

In this study, we focus upon a generalization of available experience and development of main directions, levels, types, and tasks of cartographic evaluation of nature-resource potential in Ukrainian physic-geographical (natural) regions.

Mapping is an integral element of the region's NRP valuation system. As authors define in their *Landscape Protection*, a 6-Language Explanatory Dictionary [5, p. 150, 151], "evaluation is an activity, a complex of procedures and methods to know the value. Evaluation bases on cognized objective regularities in

the relationship between the properties of the subject and the evaluated object". According to above-quoted authors, evaluation undergoes the following main stages:

- definition of evaluation goals and tasks, its subject and object;
- substantiation of the list of evaluation indices;
- measurement of present-day and perspective state of the object (e.g. natural resources of geo-systems);
- getting partial estimates of natural resources with the use of corresponding standards and estimation scales;
- setting partial estimates into general integral evaluation of natural resources;
- mapping and summary tabulation as the final and mandatory stage of evaluation [5, p. 151].

According to international scientists' group guided by V. S. Preobrazhenskiy, *"cartographic models (maps)... of (the potential) technological evaluation are of special importance in landscape studies for rational resource use and environmental protection"* [5, p. 85]. T. I. Kozachenko [6, p. 51], Ya. I. Zhupanskyi [7], P. Ya. Baklanov [8], L. A. Bezrukov, Yu. A. Mysyurkeyev [9], etc. are of similar opinion.

Cartographic evaluation represents a relation between the evaluated object (e.g. nature-resource potential of the landscape) and the subject represented by such sphere of human activity as nature use, in the context of the positive qualities of the NRP of landscapes (of objects) from the perspective of either their rational economic use or of their suitability to be human beings' living area. The NRP cartographic evaluation provides spatial-temporal and temporal-spatial regional comparisons of the quantity, quality, structure, and of the productivity (efficiency) of evaluated natural resources.

As witnessed by study results presented by numerous scientists [1; 5, etc.], major levels of regional NRP value cartographic cognition are as follows: essential-analytical, system-functional and organizational-applied (see figure 1).

Conceptual interpretation of the NRP cartographic evaluation and its major directions and tasks are substantiated on the essential-analytical level of its cognition.

System-functional level considers the NRP of the territory (water territory) as an integral, system-organized object developing in the process of interaction of natural and social laws, as well as in the process of realization of natural-social regularities. The organizational-applied level of evaluation supposes introduction of theoretical models of NRP balanced development into the practice of rational nature use which (the practice) is the basis for ecological saving and economic effective functioning of the national economy on the whole.

NRP cartographic evaluation and cognition are specifically successful if present-day geoinformation technologies are applied.

2.2. Geoinformation technologies in mapping regional nature-resource potential

As a concept, geoinformation system (GIS) came from English and appeared in national geographical literature in the mid '70s of the past century. Interpretations and definitions of the concept of GIS were more completely generalized in V. S. Tikunov's Geoinformatics (1993) [10]: According to present-day understanding, GIS is a hardware-software man-computer complex that provides for collection, processing, imaging, and spreading of spatially coordinated data, the data integration and knowledge of the territory for the purpose of their efficient use in solving scientific and applied problems connected with evaluation, analysis, modelling, and prognosticating of processes of interaction between men (society) and environment [10, p. 10]. GIS are classified as global, national, regional and local geoinformation systems. Thematically, GIS are known to be urban and environmental (where land information systems are of specific importance). According to A. I. Lychak and T. V. Bobra, integrated GIS (IGIS) combines GIS functional capacities and those of image digital processing in a single integrated environment [11, p. 8]. They insist that GIS project realization, or GIS development in a broad sense, must undergo the following stages:

1). Feasibility study that would consider users' demands and functional capacity of GIS software;
2). Technical-economic substantiation (costs/benefits estimation);
3). GIS designing;
4). GIS development;
5). GIS test area (a rather small territorial fragment);
6). Prototype development;
7). GIS implementation;
8). GIS implementation and its use [11, p. 8-9].

GIS software tools and a GIS software products, particularly if we speak of ARC/INFO and DRISI, are undoubtedly important.

Present-day development of GIS-based technologies of mapping supposes formation of digital geographical (geo-spatial) data bases. Different Ministries and Departments in Ukraine already possess huge amounts of geospatial data. However, all these significantly lack completion and documentation, as well as suffer of lack of consistent approaches and standards in the course of data processing. This is why, as stated by L. G. Rudenko, A. I. Bochkovska, G. O. Parkhomenko, and V. S. Chabanyuk, the basic concepts of national-scale GIS in this country are not yet realised.

It was only in 2008 that the first serious steps in geoinformation modelling of complex systems were taken in the form of the project of the *National Infrastructure of Geospatial Data Act* which, however, is not expected to quickly pass all parliament formalities [13, p. 8].

3. RESULTS AND DISCUSSION

The National Atlas of Ukraine (NAU) undoubtedly represents a highest ascent of geoinformation modelling in this country and we shall therefore give a brief consideration of its electronic version. As stated by L. G. Rudenko, A. I. Bochkovska, T. I. Kozachenko, and V. P. Razov, the main characteristics of the electronic version are the following:

1). General architecture is defined by the structure of the NAU informational provision.

2). The NAU concept is realized on the basis of Internet technologies with the use of the HTML language.

3). Necessary functionality capabilities and especially the work with cartographic models are possible through special Activex components included into the NAU HTML-documents [14, p. 270].

The language of HTML documents does not require additional programming – everything is reduced to information organization and structuring. There is no need for programs that would process information – the cartographic provision of the Atlas is sufficient.

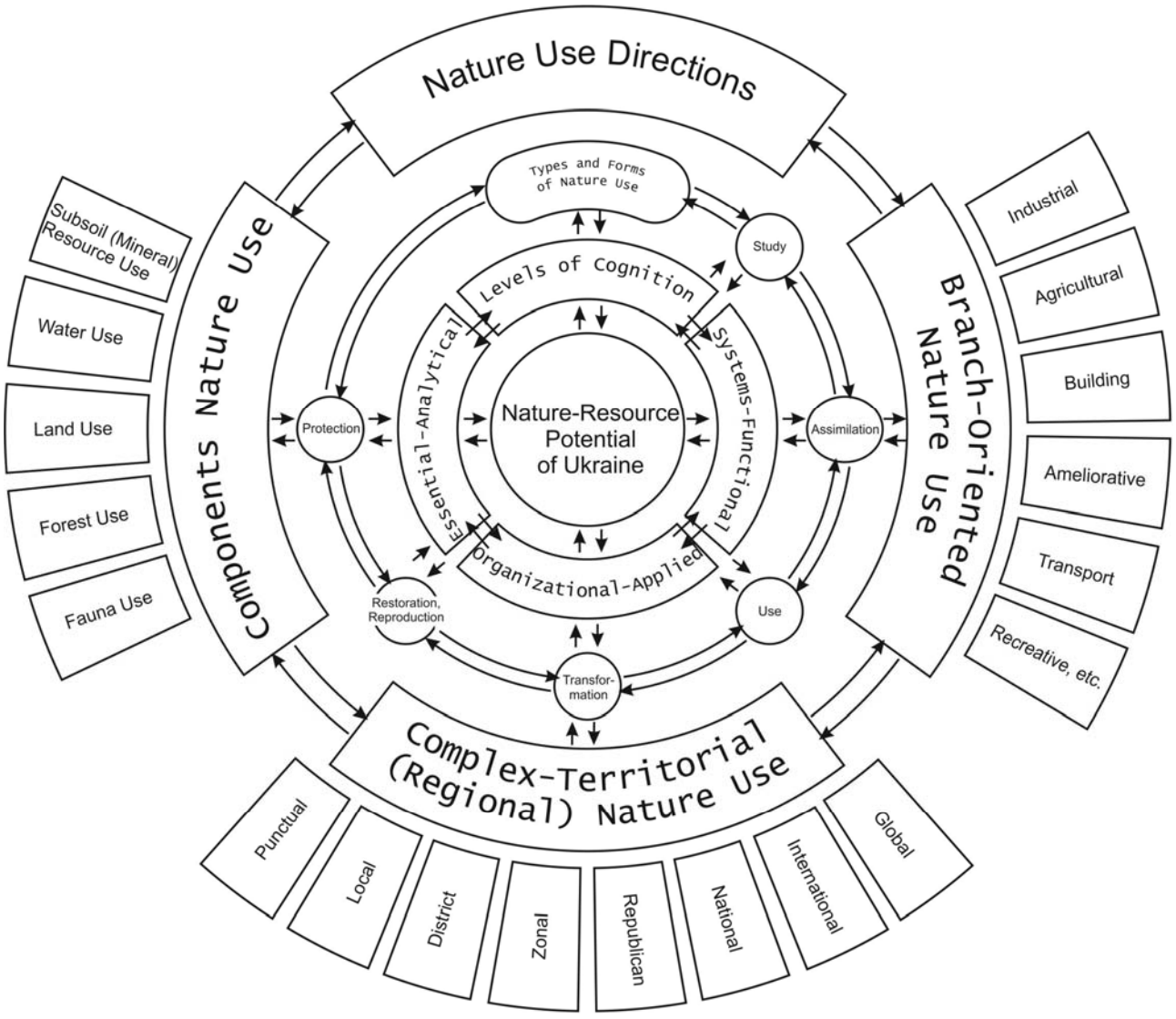

Fig. 1. Directions types/forms, levels of economic-geographical and cartographic study of nature-resource potential of Ukraine *(according to V. P. Rudenko, to O. I. Cherniukh [12], and to S. V. Rudenko).*

The NAU HTML-documents allow for projecting interactive educational complexes, encyclopaedias, as well as for supplementing the Atlas with 3D cartographic models, animations, video images, etc. [15, p. 285]. They do not use raster maps to compensate for display shortages and raise recognition abilities, but reduce maps to vector format. Such format, on the other hand, allows for presentation of

different forms of the same map by changing its scale and thematic interpretation of map models [15, p. 283-284]. Digital cartographic systems, on one hand, allow working with the set of characteristics that exceeds the number of parameters presented on the map, and, on the other hand, the HTML-language allows searching for geographical objects on maps (e.g. search by name). Despite technical limitations for digital cartographic systems, the NAU authors did manage to completely realise their ideas as to the most optimal representation of natural and social phenomena and processes to be mapped [15, p. 285].

Existing examples of already functioning GIS-technologies in Ukraine should obviously force implementation of the same into the process of development of potential evaluation maps for Ukrainian regional nature-resources.

In doing so, it is important to delineate tasks and perspectives for the further development of cognition cartographic methods that would be realized in the thematic atlas for the Ukrainian regional NRP.

3.1. "Ukraine. Nature-resource potential": thematic atlas structure

Nature-resource potential of Ukraine characterizes the country's total wealth including the whole range of available and perspective (potential) nature resources. NRP focuses upon actual present-day or maximally possible (but ecologically justified) output (productivity, efficiency) of the whole territorial combination of natural resources and of nature-resource complex (or system) on the whole.

Since nature resources are represented by extremely different bodies and natural phenomena, their quantitative economic-geographical evaluation supposes the use of cost indices, the so-called "cadastre prices" that originate from maximal (marginal) reduced costs.

NRP is defined as for administrative-territorial division units and social-geographical zoning of Ukraine.

Proceeding from the present-day level and tasks of the country's NRP geographical cognition, the thematic atlas ("Ukraine. Nature-Resource Potential") could have, in our opinion, the following structure:

Contents

Introduction. General Description of Natural Productive Forces of Ukraine.

Part 1. Present-Day NRP of Ukraine

1. Value of Ukrainian Integral (Total) NRP
2. NRP Components Evaluation:
   - Mineral Potential
   - Water Potential
   - Land Potential
   - Forest Potential
   - Fauna Potential
   - Nature-Recreation Potential
3. Structure of Ukrainian NRP
   - NRP Components Structure
   - Functional Structure
   - Territorial Structure
   - Organizational Structure
4. Economic and Territorial Productivity of Integral and Partial (Components) NRP of Ukraine
5. NRP Protection and Reproduction
6. Main Directions of Ukrainian NRP Balanced Development

Part 2. Perspective NRP of Ukraine (Maps are as in Part 1).

Part 3. Levels of NRP Economic Use and Main Directions of its Balanced Development (as for both integral and its separate components, and as for branches of nature use).

Perspective NRP is mapped to reproduce the potential productivity values of nature resources. These are the reserves in this or that region available for the production development which is dependent upon nature. Potential productivity of nature resources characterizes maximally possible efficiency of their use from the point of view of the whole national economy, the efficiency accessible on the present-day stage of the country's productive forces development provided that the actual structure of nature use optimally corresponds to the characteristic features of local historically formed nature-economic conditions. Assessment of nature resources potential productivity as qualification of the territory's perspective NRP allows for defining the objectively substantiated level of economic results.

Thus, the comparison between the perspective and the actual NRP underlines the level of realization of available natural and economic capacities; it contributes to disclose untapped reserves and to identify major directions to increase the efficiency of the market-based economy. The maps of present-day and perspective NRP and the levels of its economic use can be presented either for Ukrainian administrative-territorial units or for Ukrainian natural (physic-geographical) and economic regions. According to our experience [1], each approach may include no less than 300 cartographic NRP models.

4. CONCLUSIONS

Summing up the above, we reached the following conclusions:

1). NRP cartographic evaluation is a relationship between the evaluated object (e.g. nature-resource potential of the landscape) and the subject represented by such sphere of human activity as nature use, in the context of the positive qualities of the NRP of landscapes (of objects) from the perspective of either their rational economic use or of their suitability to be

human beings' living area. The NRP cartographic evaluation provides spatial-temporal and temporal-spatial regional comparisons of the quantity, quality, structure, and of the productivity (efficiency) of evaluated natural resources.

2). Major levels of regional NRP value cartographic cognition are essential-analytical, system-functional, and organizational-applied. Essential-analytical level substantiates conceptual interpretation of the NRP cartographic evaluation and its major directions and tasks. System-functional level considers NRP of the territory (water territory) as an integral, system-organized object developing in the process of interaction between natural and social laws, as well as in the process of realization of natural-social regularities. The organizational-applied level of evaluation supposes introduction of theoretical models of NRP balanced development into the practice of rational nature use of the country.

3). Development of the thematic atlas of Ukrainian nature-resource potential is constrained by the absence of large-scale ecological-economic work on resource-assessment nation wide. It refers to ecological-economic evaluation of major agro-productive groups of agricultural land which was for the last time conducted as far as in the '80s of the past century. Mineral, water, land, forest, and natural recreational potentials of Ukraine require the same assessment.

4). Development and implementation of modern nature-resource (and especially land resource) cadastres will in the nearest future become a significant step in order to realise the thematic atlas "Ukraine. Nature-Resource Potential".

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