UDC: 551.432(575.141)

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METHODOLOGICAL BASIS FOR USING THE RELIEF PLASTIC METHOD IN STUDYING NATURAL AND ECONOMIC SYSTEMS OF RESERVOIR BASINS

Abstract. *For the first time, the article examines the reservoirs of irrigated areas as a whole - a "natural-economic system." The main stages of the application of the method of relief plasticity of the watershed concept in the study of natural and economic systems in the reservoir watersheds are given. At the same time, the goals and objectives of the research to be carried out at each stage are considered, and they form a single cognitive system that interacts. Each economic system is inextricably linked with the internal structure of the reservoir, creating a unique object. The main focus is on highlighting the natural and economic-geographical foundations of sustainable development of natural systems.*

Key words: *natural-economic system, watershed concept of nature use, collector watershed, relief plasticity, watershed mapping, sustainable development.*

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МЕТОДИЧЕСКИЕ ОСНОВЫ ИСПОЛЬЗОВАНИЯ МЕТОДА ПЛАСТИКИ РЕЛЬЕФА ПРИ ИЗУЧЕНИИ ПРИРОДНО-ХОЗЯЙСТВЕННЫХ СИСТЕМ БАССЕЙНОВ КОЛЛЕКТОРОВ

Аннотация. *В статье впервые рассматриваются бассейны коллекторов как целостные природно-хозяйственные системы. Приведены основные этапы применения метода пластики рельефа в рамках бассейновой концепции при изучении природно-хозяйственных систем бассейнов коллекторов. При этом отмечается необходимость учёта цели и задачи каждого этапа исследования. Бассейны коллекторов являются функционально целостными объектами научного познания, их природно-хозяйственные системы имеют своеобразную внутреннюю структуру, придающую им черты уникальных геосистем. Большое внимание авторами уделяется природных и социально-экономическим аспектам устойчивого развития характеризуемых природно-хозяйственных систем.*

Ключевые слова: *природно-хозяйственная система, бассейновая концепция природопользования, бассейн коллектора, пластика рельефа, бассейновое картографирование, устойчивое развитие.*

Introduction and problem statement. In order to rationally use the natural resources of river basins, the basin concept is widely used. As a result, river basins are considered as a single "natural-economic system". A look at the collector basins of irrigated territories as a natural geographic geosystem is well covered in the scientific work of A.K.Urazbaev [13]. However, recent studies show that one of the main tasks of socio-economic geography is to consider reservoir basins not only as a natural geographic geosystem, but also as a natural and economic system that forms a single whole. That is why, considering the natural and economic system of collector basins as a whole, we considered it necessary to use the basin mapping method, i.e., relief plasticity, based on the concept of a basin, with the rational use of its natural resources**.**

Study of the problem. In many areas of economic geography, including agrogeography, special attention was paid to the study of natural conditions and resources of objects. Yu.G.Saushkin, one of the founders of economic geography, in his famous work

emphasized the special role of nature in the agricultural activities of the population, concluding that "nature is always in connection with each element of the economic system" [10; p.45]. In other words, the development of agriculture at each site is directly related to the resources of the natural conditions of this site.

Deltas play a special role in the development of irrigated agriculture. The well-known geologist Ya.G.Gulomov notes that the development of irrigated agriculture in the deltas, including the Sarikamysh delta in the Khorezm oasis, is associated with fertile soils and waters of the Amudarya region [3]. As a result, science and culture are highly developed in this oasis, along with irrigated agriculture. In his study, V.N.Fedorko geographically analyzes all the conical branches and deltas in which irrigated agriculture is developed in Central Asia, and considers the interaction of natural and economic elements in the territorial economic system. According to the author, the geocomplex approach was first used in the study of oases located at the confluence of rivers [2]. It should be noted that our previous research also analyzed the characteristics of the development of farms within the natural-economic systems, with great emphasis on the natural geographical conditions of the place [8, p.106].

The aim and objectives of the work. The purpose of the study is to demonstrate the methodological basis for the application of the method of basin cartography - relief plasticity based on the theory of the basin concept in the study of natural and economic systems of irrigated areas of the modern Amudarya delta. With this in mind, the task of scientific and practical substantiation of changes occurring in water bodies of natural and economic systems is set.

Materials and methods. In this research process, a systematic approach, basin mapping, geographical comparison, experiment, field-expedition, complex methods were used.

Main part. A special role in the study of river basins as a geosystem is played by the scientific work of L.M.Korytny. In recent years, the scientist continued his scientific ideas and developed the basin concept of nature management. In other words, he considers river basins as an integral natural and economic system. According to the author, based on the concept of the basin in nature management, each economic system is in contact with the river basin and, on this basis, develops steadily [4].

In his study A.K.Urazbaev was the first to consider the reservoir basins in the modern delta of the Amudarya as a geosystem, and, in the author's opinion, the natural reclamation conditions are directly related to the internal structure of the reservoir basins.

In our opinion, the natural and economic system is formed and develops in the collector basins in connection with the natural and reclamation conditions. When studying natural and economic systems in irrigated areas, we used relief plasticity, which is a method for mapping basins, and divided it into several stages (Figure 1).

At the same time, we relied on the theory of the basin concept of nature management. It should be noted here that the sum of heights and depressions on a relief plastic card forms a pelvis of one size or another. In other words, the relief plasticity theory, which is a basin mapping method, is directly consistent with the concept of basins in nature management.

The basin concept in nature management is based on rivers, lakes, sea basins, and there will be collector basins in the irrigated areas that are the object of our study. In the modern delta of the Amudarya, the sum of small deltas forms certain collector basins, the natural boundary of which runs along the uplands of the river or along the channels located at these heights. Therefore, the concept of "pool" occupies a special place in the concept of a basin in nature management. Basins are not only a hydrological system, but also a geomorphological system. This, in turn, provides a basis for considering reservoirs in terms f hydrology and geomorphology. The layering of the ditches of the collector basins is directly affected by the structure of the relief.

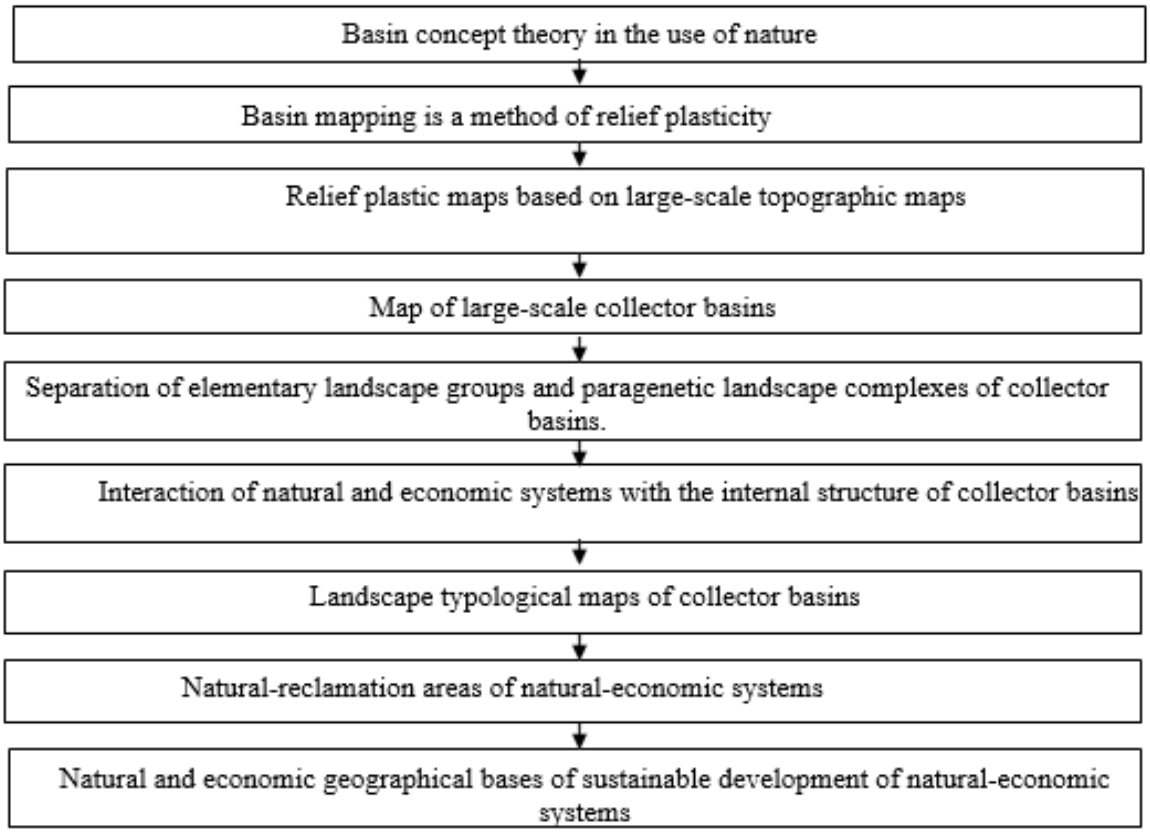

Figure 1. The main stages of application of the basin relief plastic method in the study of natural and economic systems of collector basins

The concept of a basin also occupies a special place in the science of landscape geochemistry. That is why the founder of the science of landscape geochemistry, B.B.Polynov, writes: “All geochemical studies should be carried out only on the basis of basins” [7; p.56]. Surface water flows, which form a system that connects the elements of the basin (highs and lows), affect the natural reclamation conditions of landscapes. According to A.K.Urazbaev, natural and reclamation conditions in reservoir basins are associated with the "tree-like" form of small deltas, which change in the order of the area occupied by the basin. The orderly change of natural components and natural resources in the collector basins, in turn, forms the basis for the application of the basin concept in nature management at the site. Collector basins provide a natural basis for the basin concept of nature management. This, in turn, is the basis for considering the collector basins as an integral natural and economic system [14].

The method of basin mapping also occupies a special place in the concept of basin nature management. Relief plasticity, which is a method of mapping basins, is not limited to depicting elevations and depressions on topographic maps, but also represents reservoirs, which are the basis for studying the natural and economic system of irrigated areas.

On this occasion, I.N.Stepanov writes: “Relief plastics, which is a method of mapping basins, not only shows basins on maps, but also clearly shows surface water flows that affect the natural reclamation conditions of landscapes” [11; p.32]. The relief plasticity method provides both a scientific and practical basis for studying the significance of surface water runoff, which directly affects the natural and economic system of irrigated areas.

We are based on the "Theory of basic concepts in the use of nature" of the concept of cognition shown in the first figure. L.M.Korytny writes: “When using natural resources in river basins, based on the concept of a basin, a special place is given to changing the “natural-economic system” located in this geosystem in accordance with the law”. In other words, the natural and economic system of river basins will be inextricably linked with the internal structure of the river basins that form the geosystem. Continuing his opinion, L.M.Korytny

writes: “In basin mapping of river geosystems, the connection of river networks with relief slopes based on system-forming flows should form the methodological basis of the basin concept” [4; p.7]. That is why basin cartography plays a special role in the rational use of natural resources. River basins are located in a wide variety of areas, from regional units to local units. River basins form a geosystem with natural boundaries in all areas. Relief plastic was used, which is a method of mapping reservoir geosystems in irrigated areas. I.N.Stepanov, the founder of the theory of relief plasticity, writes: “The elevations and depressions present in the relief are interconnected, forming rivers and reservoirs of different sizes. These basins must be objective and must be the main object of study in the geosciences [11; p.88]. Continuing the idea of his teacher I.N.Stepanov, A.K.Urazbaev wrote: “Basin mapping is the basis for the rational use of natural resources based on the basin concept.” In other words, relief plasticity, which is the basic method of mapping, depicts on the basis of topographic maps all water bodies, consisting of depressions and elevations of the earth's surface [13; p.25].

Topographic maps form the basis of all studies by the method of relief plastics. That is why, when creating relief plastic maps, topographic maps are the first source, and space photographs are the second. In other words, the dynamics of all water bodies, created on the basis of topographic maps, is supplemented on the basis of satellite images. Therefore, in his studies, V.V.Dokuchaev, paying great attention to the depressions and elevations of the earth's surface, writes: "The relief plays a special role in the diversity of soils, including landscapes". Complementing the opinion of the scientist on the basis of the doctrine of geotism, one can say: “Eluvial, transeluvial, superaquatic and aquatic groups of elementary landscapes are interconnected, forming rivers and road basins of different sizes [1; p.28]. These basins should play a key role in the study of the "natural-economic system".

The scale of topographic maps plays a major role in the creation of relief plastic maps. Topographic maps with a scale of M. 1: 50 000 or M. 1: 100 000 play a key role in the creation of relief plastic maps of mountainous areas. However, due to the gradual change of relief slope in delta geosystems, it is not possible to create relief plasticity maps based on topographic maps with a scale of M. 1: 50 000 or M. 1: 100 000. Therefore, topographic maps with a scale of M. 1: 25000 are used in the creation of relief plastic maps of the current delta of the Amudarya. The following scientific discoveries were made on the basis of the formed relief plastic maps: 1. For the first time in the current delta of the Amudarya 9 small deltas were separated. 2. For the first time in the current delta of the Amudarya 6 collector basins were allocated.

Relief plastic maps, created on the basis of large topographic maps, became the basis for a complete change in our opinion about the modern Amudarya delta. G.V.Lopatin divided the relief of the modern Amudarya delta into two parts: 1. The “living” part of the modern Amudarya delta, i.e. landscapes of the hydromorphic regime existed in this area. 2. In this region, the southern part of the modern delta of the Amudarya prevailed, i.e., semi-hydromorphic and autotrophic landscapes. In contrast to these relief maps, in the modern delta of the Amudarya, we have identified "tree-like" landscape complexes. "Tree-like" landscape complexes are united in irrigated areas, forming collector basins. In other words, plastic relief maps, created on the basis of large topographic maps, provide the basis for the analysis of irrigated areas based on basin mapping [5].

On the basis of large-scale relief plastic maps, a map of the collector basins of the irrigated territories of the modern Amudarya delta was created. The scientific novelty of studying reservoir basins as geotism is:

Large-scale relief plastic maps served as the basis for identifying collector basins, since they displayed all the ups and downs of the deltaic geosystem, which means that the irrigated areas of Central Asia had not been divided into collector basins until that time [6].

Each separate collector basin is fundamentally different from the second collector basin in its internal structure, i.e. the relationship and ratio of depressions and increases in each collector basin is never the same as in the second collector basin. Thus, the map of large collector basins created for the first time made it possible to divide irrigated areas into

elementary basins. Each collector basin is a separate entity found in nature, forming a geotism with a unique internal structure. Collector basins, like river basins, are an objective area that exists in nature, i.e. all depressions and elevations in it serve as a natural basis for the construction of collector networks.

The current state and future prospects of the natural and economic system in reservoir basins are directly related to the migration of chemical elements. The founder of the science of landscape geochemistry, B.B.Polinov distinguishes elementary landscape groups for studying the migration of chemical elements. Based on this description, we also divided the elementary landscape groups of reservoir basins into: eluvial, transeluvial, superaqueous and aquatic. Elementary landscape groups combine to form a geochemical landscape [7]. The geochemical status of isolated elementary landscape groups differs sharply from each other and directly affects the natural and economic system. For example, the current state of the natural-economic system, in which eluvial elementary landscapes are located, is fundamentally different from the above-water elemental landscape. That is why it is important, first of all, to study the influence of elementary landscape groups of collector basins on the natural and economic system [12].

We know that there are several small deltas in collector basins. First of all, it is necessary to distinguish the elementary landscape groups in these small deltas. The current state and dynamics of elementary landscape groups depend on the surface water currents that make up the system. Therefore, in the alluvial elementary landscape in the collector basins there are always or in most cases autorphoric landscapes. In the Superakval elementary landscape, hydromorphic landscapes predominate. In other words, considering the collector basins as a geosystem, the separation of elementary landscape groups in them gives positive results in practice.

The internal structure of reservoir basins directly affects natural and economic systems. We tried to investigate this interaction using the example of the collector system of a bell. The bell collector system is fundamentally different from other collector basins, i.e. in this collector basin there is a rapid exchange of elementary landscape groups at short distances from each other. These metabolic processes affect the natural economic system. The internal structure of the Kungrad collector system consists of the Uldarya subdelta, the lower part of the Kiyatjargan subdelta, the middle and lower parts of the Raushan subdelta and the uplands along the Amu Darya River. The Kungrad collector system includes all parts of the Uldarya subdelta, i.e. top, middle and bottom. With the exception of the Amudarya region of the Uldarya subdelta, cotton, alfalfa and melons are grown in the upper and middle parts. The farms engaged in these crops give abundant harvests, especially in the upper part of the small delta, i.e. in these areas, the depth of groundwater is 3-5 meters. The farms in the middle part produce less than the farms in the upper part. Thus, the level of complexity of natural and reclamation conditions affects the economics of natural and economic systems. In other words, natural and economic systems are closely related to the natural components of the upper and middle parts of the small delta of the Uldarya, i.e., the depth of groundwater, the ameliorative state of soils, the structure of the relief, and the methodological composition of nano. Rice is grown in the middle and lower parts of the small delta of the Uldarya. Sowing rice in this area is primarily due to natural and reclamation conditions, i.e. the depth of groundwater is 1-2 meters, as the site is located in a small delta of the Uldarya. Behind the rice-growing areas, the lowlands around Lake Sudochye begin. Sowing crops on large areas does not give positive results, since the process of salinization is always actively going on in the soils of this region. The lower parts of the small deltas Kiyatjargan, Uldarya and Raushan meet around Lake Sudochye; the relief is dominated by depressions in relation to the uplands. At the same time, surface water currents in this area constantly bring and precipitate harmful salts from the upper parts. Thus, the natural farming system in each collector basin will be linked to the internal structure of the facility. Its positive development or lag in development is closely related to the structure of small deltas that make up this reservoir basin.

If we analyze the natural and economic complexes located in the reservoir-1 basin on

the right bank of the modern Amudarya delta, then their territorial position correlates, albeit partially, with natural and reclamation conditions. The upper parts of the collector basin are occupied by tugai forests, the protection of which is given great attention. Irrigated agriculture is developed in the upper and middle parts of the collector basin. After the Kuskanatau ridge, the lower part of the collector basin is occupied by grazing due to lack of water resources. Salinization did not occur in this area due to the predominance of landscapes of the automorphic group in the lower part of the reservoir basin. We know that the sewer discharge-1 pours its waters into the lake Dzhiltirbas. Lake Dzhiltirbas, in turn, is located in the tidal lowland, and the water in the lake is still available due to collector water. So, since the lake is located in a lowland, there are all opportunities for the development of fishing in this area. The analysis of natural-economic systems located in the basin of the discharge collector-1 shows that the functional integrity of the collector basin is taken into account in the territorial location of existing farms.

The categories of "integrity" or "integrity" occupy a special place in the concept of each economic-geographical region. Based on these categories, the collector pools form a functional whole. With the rational use of natural resources of natural and economic systems based on the basin concept, it is important to consider the reservoir basin as an integral geosystem, i.e., to consider each reservoir basin as a separate economic and geographical area in full. in accordance with the doctrine of geosystems.

Due to the fact that the collector basins have a natural boundary, all natural and geographical processes in this area change according to a certain pattern. In accordance with these natural-geographical processes, the natural-economic system develops. The natural and economic system of this collector basin is formed on the basis of its inseparable connection with natural and reclamation conditions. Consideration of each collector basin as a natural reclamation zone gives positive results in the reclamation landscape. In our opinion, consideration of each collector basin as a separate economic and geographical area should also give positive results, i.e., the territorial location of natural and economic complexes should correspond to natural and reclamation conditions. At the same time, each economic-geographical region, in turn, is divided into regions. The fact that the upper, middle and lower parts of the reservoir basin are economically and geographically distinct allows them to be considered as separate zones. It should be noted that the basis of the economic-geographical regions is the functional integrity of the reservoir basins. Thus, the fact that on the basis of the functional integrity of the collector basins on the basis of each economic-geographical region, in turn, creates a methodological basis for applying the basin concept in the rational use of natural resources.

At present, in order to ensure the full-fledged sustainable development of natural and economic systems, it is necessary to take into account natural and economic and geographical conditions in the territorial distribution of economic sectors on the basis of geosystem doctrine. In other words, the factors that ensure functional integrity must be taken into account on the basis of the geosystem doctrine. According to A.Yu.Reteyumu, the tract of the geosystem corresponds to the boundary of surface water flows. Therefore, the naturally occurring regional or local dimensions of watersheds ensure the functional integrity of each watershed [9; p.94]. With this in mind, the collector basins of rivers, lakes or irrigated areas will be a natural basis for ensuring the sustainable development of natural and economic systems. It should be noted that the functional integrity of each object serves as the basis for natural and economic and geographical factors that ensure the sustainable development of natural and economic systems. The natural stratification of natural and geographical conditions in the functional integrity of water bodies creates the economic and geographical basis for the sustainable development of natural and economic systems.

Conclusion. 1. Water bodies of any land: rivers, lakes and reservoirs form a certain functional integrity and are analyzed as a "natural and economic system". This, in turn, will become the basis for the rational use of natural resources based on the basin concept.

2. A special role in the rational use of natural resources based on the basin concept is played by relief plasticity, which is a method of basin cartography. Any elevations and depressions of a regional and local scale are combined into depressions of various sizes.

3. To analyze natural and economic systems in deltaic geosystems, plastic relief maps based on large-scale topographic maps are needed. The created relief plastic maps for the first time made it possible to identify several "tree-like" small deltas in the modern Amudarya delta. The created large-scale relief plastics completely changed our understanding of the relief of the modern Amudarya delta, and it has been scientifically and practically proven that it consists of small deltas of different ages.

4. For the first time in the plane of the delta, it was possible to divide the reservoir basins, since large-scale relief plastic maps show all the heights and depressions of the object. The large-scale map of the reservoir basins that was compiled served as the basis for the analysis of each reservoir basin as a geosystem.

5. Identification of elementary landscape groups in reservoir basins is the basis for studying the migration of chemical elements. The study of the migration of chemical elements, in turn, provides a scientific basis for the analysis of natural reclamation conditions. Objective beings are paragenetic landscape complexes or elementary landscape groups in river basins.

6. The internal structure of collector basins consists of several small deltas. The natural-ameliorative system of each small delta should be located according to the natural-ameliorative conditions, i.e. the natural-ameliorative conditions in the small deltas have a direct impact on the natural-ameliorative systems. The surface water currents that make up the system play a special role in this connection.

7. Systematically changing natural-ameliorative conditions in collector basins have a direct positive or negative impact on the natural-economic systems located in this basin. All natural-economic systems located in the Kungrad collector system or in the collector discharge-1 basin are developing to one degree or another as they are related to the natural-ameliorative conditions of these objects.

8. Since collector basins have their own functional integrity, their analysis as a geosystem or economic-geographical area allows the implementation of new innovative ideas. The fact that the natural and economic systems of the reservoir basins, in turn, are associated with natural and reclamation conditions, provides a scientific basis for considering this object as a separate economic and geographical area.

9. For the sustainable development of natural and economic systems in the reservoir basins, first of all, it is necessary to follow the basin concept of rational use of natural resources. The formation of each basin of its own water bodies and the lawful change of natural resources in them, in turn, creates a natural and economic-geographical basis for the sustainable development of natural-economic systems. The functional integrity of water bodies is of scientific and practical importance in the rational use of natural resources on the basis of the basin concept.

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For citation

Urazbaev A.K., Rajabov F.T., Ibroimov Sh.I. (2022), Methodological basis for using the relief plastic method in studying natural and economic systems of reservoir basins, *Central Asian journal of the geographical researches*, No 1-2, pp. 29-36.

Для цитирования:

Уразбаев А.К., Ражабов Ф.Т., Иброимов Ш.И. Методические основы использования метода пластики рельефа при изучении природно-хозяйственных систем бассейнов коллекторов // Центральноазиатский журнал географических исследований. 2022. № 1-2. С. 29-36.