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GEOECOLOGICAL PECULIARITIES OF GEOSYSTEMS OF TENIZ-KORGALZHYN CAVITY

Abstract. The research focuses on ecological, hydrological and climate peculiarities of the region, tendencies of vegetation cover and soil depending on geomorphological peculiarities of river pools and the impact of anthropogenous factor. The description of contemporary geoecological state of geosystems is exemplified. Within the region under investigation two subgeosystems are defined.

Key terms: geosystemic approach, geosystem, river basin.

Introduction. Teniz-Korgalzhyn wetlands lying on the main migration routes of waterfowl are one of the most important in Kazakhstan. Basin geosystems have been exposed by humans for a long time.

In 1968, the Government of the Kazakh SSR established the Korgalzhyn State Reserve on the territory of these lakes (Resolution № 214 of the Council of Ministers of the Kazakh SSR dated April 16, 1968). In 1974, the Teniz-Korgalzhyn wetlands were included in the Ramsar list. In 2002, Teniz Lake, the first and so far the only one in Kazakhstan, was included in the Living Lakes international network, which includes the most unique lakes in the world. At present, the territory of the Korgalzhyn State Reserve has been proposed for inclusion in the UNESCO list of natural heritage including areas of particular importance for the conservation of wetland birds. The territory of the Teniz-Korgalzhyn cavity, chosen for research, including the Teniz-Korgalzhyn lake system, lies on the main migration routes of waterfowl, which, along with the important national one, determines the key global importance of this territory in maintaining a large number of migratory species, primarily globally threatened.

Objects and methods of research. Generally accepted methods in landscape science and physical geography were used in this publication. As a result of the analysis of thematic maps, statistical data, informational analytical material, specialized literature, Landsat 8 space imageries, thematic maps of the researched region were developed.

The concept of the geosystem approach was developed in the writings of V.N. Solntsev [1], V.B. Sochava [2]., K.M. Dzhanaleyeva [3] and others. The basin approach to the study of geosystems reflects both the current state of the natural environment and its dynamics, as well as the processes of evolution in time. By K.M.Dzhanaleyeva geosystem is a natural and anthropogenic formation, revealed taking into account the interaction of the dominant natural components and factors of the biogenic and technogenic transformation of the environment [3]. The object of research is the geosystems of the Teniz-Korgalzhyn cavity (Fig. 1).

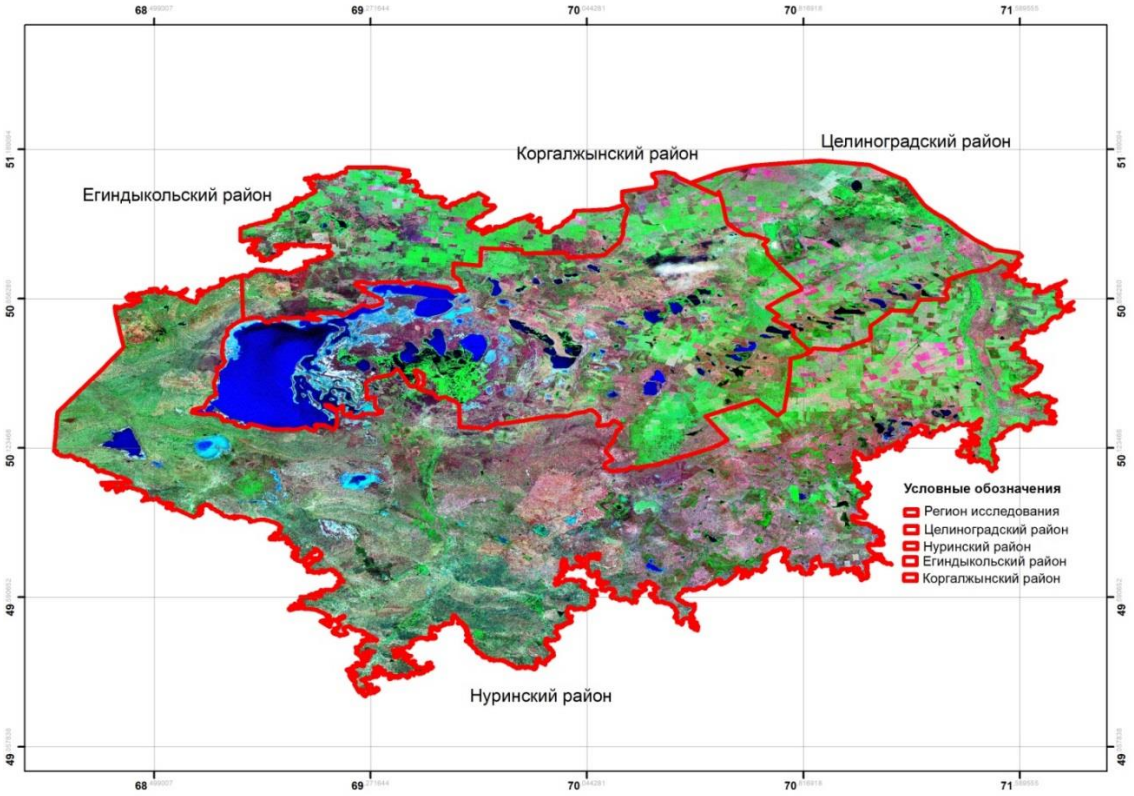

Fig 1 - Teniz-Korgalzhyn cavity

Егиндыкольский район – Yegindykol district
Коржалынский район – Korgalzhyn district
Целиноградский район – Tselinograd district
Нуринский район – Nurinsk district

Legend:
- Area of research
- Tselinograd district
- Nurinsk district
- Yegindykol district
- Korgalzhyn district

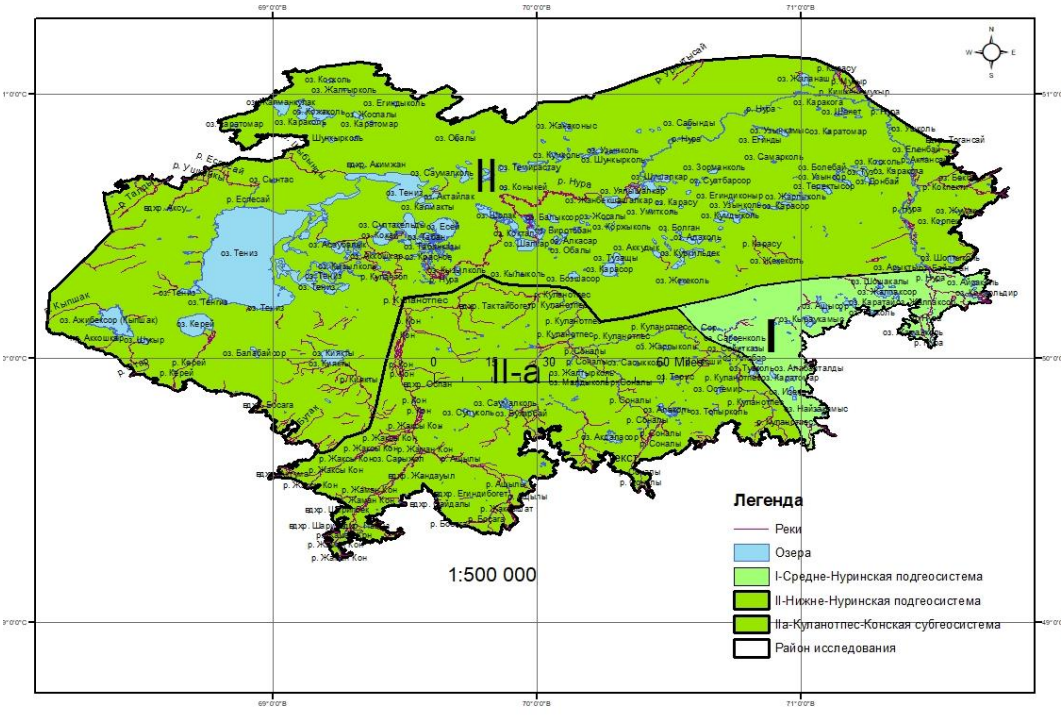

Figure 2 - Map of geosystems of the Teniz-Korgalzhyn cavity

When researching the Teniz-Korgalzhyn cavity, we identified 2 sub-geosystems: the Middle-Nurinsk sub-geosystem and the Lower-Nurinsk sub-geosystem, the development of which is confined to the outflow of the Nura River inside the basin, where the spatio-temporal connections of channel-forming processes from source to mouth are dominated. In the relief, 2 layers are clearly traced: plain and shallow. Each layer corresponds to a combination of certain morphogenetic relief types and a complex of prevailing relief formation processes [1] (Fig. 2).

The Nura River originates from the confluence of springs on the northwestern slopes of the low mountains of Khankashty and Konyrtas. The catchment area is 40 thousand km². Up to 70% of runoff reaches the Teniz-Korgalzhyn lake-flowing systems. The annual water flow in the river is 19.2 m³/sec. The average annual runoff layer in the central parts is 10 mm, in the eastern outskirts, up to 2 mm. The coefficient of variation of annual runoff varies from 0.75 - 1.0 in the central parts and on the western and eastern periphery reaches 1.25 - 1.5. The chemical composition of the water is chloride, from hydrocarbonate-calcium to sodium chloride. The average dates of the passage of the peak of the flood are April 15-20. The average annual water supply with runoff is 10-15 thousand m³ / km² [4].

The total area of the water table in the central and eastern regions is 0.5-1% of the total area of the Teniz-Nurinsk macrogeosystem up to 2-4% on the western outskirts. The large lakes Kumkol, Saumalkol, Katynkol, Balykshykol are replenished by melt and groundwater, and precipitation. Amplitudes of fluctuation of levels are 0.7-1 m. Lakeside terraces are often plowed up [5].

Soil and climatic conditions are diverse, ranging from moderately arid in the east to dry in the west and southwest. The scoring points in the mountainous territories are 80–100, in the central parts 60–80, in the west and south-west 40–60. The complexity of the soil and vegetation cover, the spatial distribution of which is subordinated to the latitudinal-zonal patterns, also appears. Only in mountain ranges manifests altitudinal zonation. Floodplain territories as well as geosystems of runoff dispersion zones in the Teniz-Korgalzhyn lake-flowing system have the greatest diversity of biota and high productivity [1] (Figure 3).

Korgalzhyn Nature Reserve is one of the unique natural formations. The natural potential decreases due to the negative influence of technogenic factors. The reserve regime weakly contributes to the conservation of relict avifauna and endemic flora.

The density of the rural population varies from 10-20 people / km² near industrial centers, along highways and decreases to 0.1 people / km² in the southwestern anhydrous areas of the macrogeosystem.

In the Teniz-Nurinsk macrogeosystem, the Verkhne-Nurinskaya, Sredne-Nurinskaya, and Nizhne-Nurinskaya sub-systems were distinguished, as well as the Kulanotpes-Konskaya, Kipshak-Kereyskaya subgeosystems [1].

The territory of our research is occupied by the Sredne-Nurinskaya and Nizhne-Nurinskaya sub-geosystems.

The Middle Nurinsk sub-geosystem is represented by geosystems of basins of the right-bank tributaries - Ashagandy, Zhailmin, Ulkenkunduzdy, and left-bank - Yesen and Sherubaynury.

The geosystem of the right bank functions in the conditions of hilly-bumpy small hills and a denudation-hilly plain of moderately dry steppe soil and vegetation cover. The left bank is characterized by a more desiccated dry-steppe biota, which forms on the lake-alluvial Kalpaksor and stratum Tassuat plains

Natural complexes of the Middle Nurinsk sub-geosystem are represented by paragenetic complexes of floodplains and floodplain terraces. Valley geosystems are formed on three floodplain terraces, cut by ravines and composed of alluvial sand and pebble deposits, as well as covered with loams of heavy and average mechanical composition.

The dominant sparse meadow-steppe vegetation is formed on meadow-chestnut soils, chestnut for characteristic grasses of upland surfaces are characterized by chestnut, to the south - light chestnut

The development of geosystems formed in the recharge zones of the Samarkand, Intumak, Samara reservoirs and water releases through the Irtysh-Karaganda canal occurs under the influence of technogenic factors that change the conditions of their natural self-regulation. Particularly high manmade loads of the geosystem in the areas of wastewater dilution of the Temirtau mining and processing enterprise The excess of MPC in rivers on polluting ingredients averages: for mercury and copper - 4 MPC, oil products - 10 MPC, phenolam-9 MPC, ammonia nitrogen - 15 MPC, nitrites up to 16 MPC.

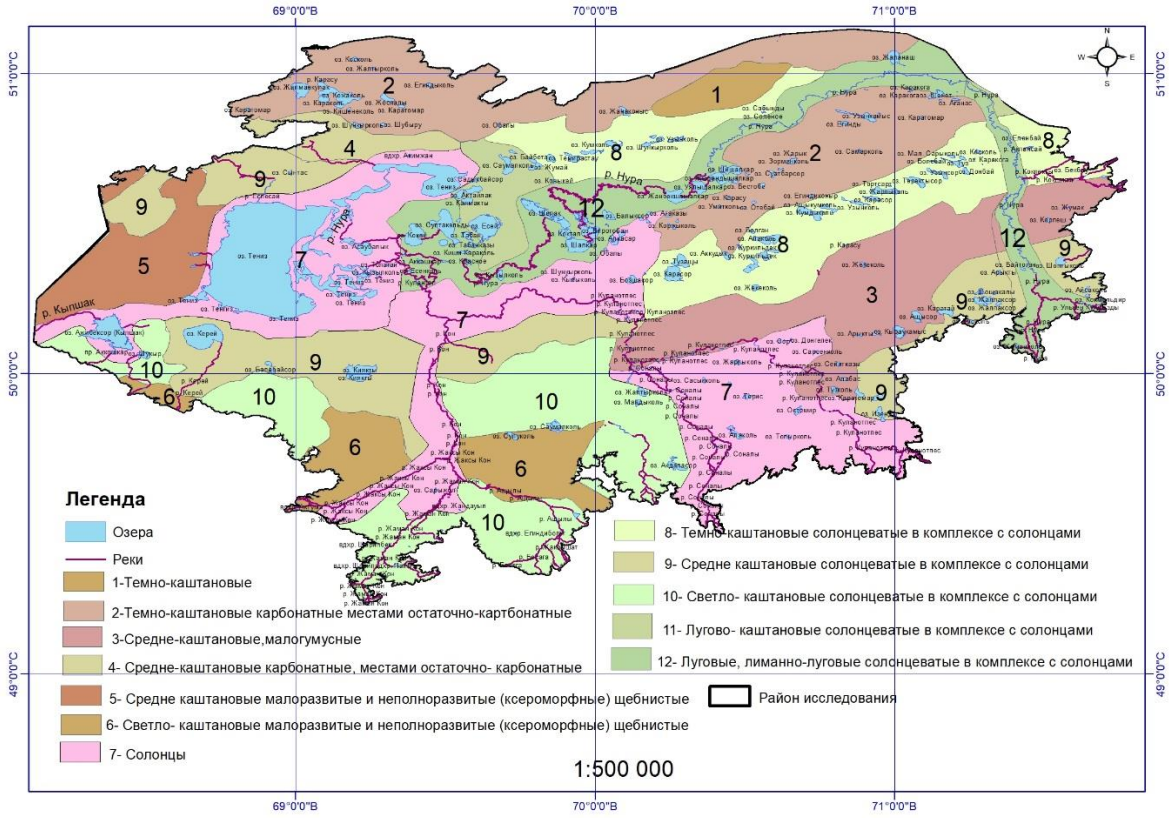

Figure 3 – Soil map

Озера – Lakes
Реки – Rivers
Темно-каштановые – Dark chestnut
Темно-каштановые карбонатные местами остаточно-карбонатные - Dark chestnut carbonate in places residual carbonate
Средне-каштановые малогумусные - Medium chestnut low humus
Средне-каштановые карбонатные местами остаточно-карбонатные - Medium chestnut carbonate in places residual carbonate
Средне-каштановые малоразвитые и неполноразвитые (ксероморфные) щебнистые - Medium-chestnut underdeveloped and underdeveloped (xeromorphic) gravelly
Светло-каштановые малоразвитые и неполноразвитые (ксероморфные) щебнистые- Light-chestnut underdeveloped and underdeveloped (xeromorphic) gravelly
Солонцы - white alkali
Dark chestnut solonetzic in combination with white alkali – Среднекаштановые солонцеватые в комплексе с солонцами – Medium-chestnut solonetzic in combination with white alkali
Светло-каштановые солонцеватые в комплексе с солонцами – Light-chestnut solonetzic in combination with white alkali
Лугово-каштановые солонцеватые в комплексе с солонцами – Meadow-chestnut solonetzic in combination with white alkali
Луговые, лиманно-луговые солонцеватые в комплексе с солонцами - Meadow, estuarine-meadow solonetzic in combination with white alkali
Район исследования – Area of research

Aquatic geosystems also contain a high percentage of salts of mercury, cadmium and other pollutants. The capacity of industrial sludge is 2-3.5 m. The mercury content in them reaches 560 mg/kg (with a background of 0.08 mg/kg). A significant part of the mercury is in active form, available for assimilation by biota. This explains the increase of mercury in surface runoff during floods, discharge of water from reservoirs and drainage systems. In this case, mercury comes from bottom sediments and is a source of secondary technogenic pollution of the environment [5].

In general, as a result of prolonged exposure to technogenesis factors, the natural potential of the Middle Nurinsk sub-system is insignificant, many geosystems have impaired self-regulation processes, and transformation signs of biota are characterized by clear signs of desertification. Significant territories used by the mining industry require phytomelioration and other reclamation works [1].

The Nizhne-Nurinsk subgeosystem occupies territories within the Teniz-Korgalzhyn cavity, below the confluence of the Ulkenkunduzdy tributaries into the Nura River. This is a lake-alluvial drainage hollow with moderately dry-steppe conditions. Upper Devonian metamorphic rocks, overlapped by a thick sequence of Neogene-Quaternary sediments, take part in the lithogenesis of geosystems.

Numerous lake-flowing systems, closed depression, and saline lakes are widespread. Lakeside geosystems function in conditions of swamps and solonchaks. The channel of the Nura River runs through the Besshalkar group of lakes: Shiymalkar, Zhandyshalkar, Uyalyshalkar, Birtaban, Sholak and others. Further to the east, the fresh lake Kurgalzhyno is connected by a system of reaches and Asaubalyk lakes to the river Teniz.

Teniz Lake is declared the final zone of accumulation of suspended particles brought with the runoff of Nura, Kulanotpeas, Kon and other small rivers. The salt lake of Teniz is connected with the fresh lake Korgalzhyno by a system of lakes and tributaries - Isey, Sultankeldy, Kokai, Tabankazy, Bolshoi and Maly Karakol [1].

The structure of aquatic geosystems is complicated by reaches, shallow waters, bays.

The geosystem developing in the recharge zone of these lakes is unstable in relation to the hydrogeological regime and water flow in the channels. At present, geosystems that have lost their natural potential due to a decrease in groundwater levels and a decrease in water flow in rivers, an increase in mineralization, are in an unstable state.

The geosystems of the first lake floodplain terrace are more dynamic due to their greater moisture content and proximity to groundwater. Sandy coastal shafts are deflated. The geosystems of the second and third floodplain terraces are more stable in spatio-temporal terms and have a more stable mechanism of self-regulation.

The soils of the dominant lush-saltwort vegetation of the high terraces that form on meadow white-alkalies are composed of fine-grained, loamy-sand and silt sediments with a thickness of up to 10 m.The degree of intensity and the nature of the functioning of geosystems depends on the water-salt balance of these lake-flowing systems. The associated processes of the hydrochemical and hydrogeological regimes are closely interconnected with the anthropogenic halophytization of biota, which reduce its productivity. In recent years, factors of technogenesis began to play a dominant role in the total mass-energy exchange of substance [6].

The dominant ossotiations are fescue-feather-grass-tyrse with dark-chestnut alkaline soils. Significant areas of lowlands are occupied by sedge-reed beds.

On paragenetic complexes of the feeding zone of lakes composed of sandy-clay strata, there are developed grassland, bonfire, and pointed solonchakous meadows on meadow white alkoli. Mosaic and complex geosystems of a lower order are also determined by small sand mounds.

In 1968, the Korgaldzhyn State Reserve was established as a wetland of international importance, mainly as a habitat for waterfowl.

The modern use of natural complexes of the remaining territories of the sub-geosystem is associated with agricultural production (rainfed farming, grazing). Significant areas are represented by hayfields with high productivity (20-40 c/ha) and spaces with crops of forage grasses.

The Kulanotpes-Konskaya subgeosystem is a territory bordering the basins of the Kulanotpes river with a tributary of Kon. Besides of this, this includes the basin of the Kipshak and Kerey rivers, which often dry up and do not have constant surface runoff. Some of these rivers have their sources in the low-mountain massif Zhelyadir. Suspended substances accumulate in the lakes of the same name. The main surface runoff is formed on denudation hilly-steep small hills of the Kazakh plateau, foothill loops with a thin gravelly cover. The influence of surface stocks on the function of geosystems is not very noticeable. Groundwater levels are independent of surface. Dominant geosystems of lower order geosystems function in the conditions of basement hilly plains with xeromorphic forbs of semi-desert character. Halophytization of biota is enhanced by saline drainless hollows and depressions, where saltwort-sagebrush plant communities appear [9]. The valley geosystems of the Kulanotpes and Kon rivers have dry-steppe communities.

The lower reaches of the Kulanotpes river merge with the terraced lake Tennis-Korgalzhyn depression.

As a result of the analysis of the data obtained, the following **conclusions** were made:

To maintain the ecological balance of these geosystems and provide the necessary wetlands, the implementation of scientifically-based environmental protection measures is required, with water consumption and protection of the region's water resources. In general, the Teniz-Nurinsk mega-geosystem is one of the interesting physical and geographical objects represented by the Nura River basin and the Teniz-Korgalzhyno lake system. Man-made impacts on the environment significantly reduced the natural potential of natural complexes unique in their set of flora and fauna.

У.Сагатбаев, О.Мазбаев

ГЕОЭКОЛОГИЧЕСКИЕ ОСОБЕННОСТИ ГЕОСИСТЕМ ТЕНИЗ-КОРГАЛЖЫНСКОЙ ВПАДИНЫ

Аннотация. Исследование посвящено экологическим, гидрологическим и климатическим особенностям региона, тенденциям растительного покрова и почвы в зависимости от геоморфологических особенностей речных бассейнов и влияния антропогенного фактора. Приведено описание современного геоэкологического состояния геосистем. В пределах исследуемого региона определены две субгеосистемы.

Ключевые слова: геосистемный подход, геосистема, речной бассейн.

У.Сағатбаев, О. Мазбаев

ТЕҢІЗ-ҚОРҒАЛЖЫН ОЙСЫНЫҢ ГЕОСИСТЕМАСНЫҢ ГЕОЭКОЛОГИЯЛЫҚ ТҮРЛЕРІ

Аннотация. Зерттеу аймақтың экологиялық, гидрологиялық және климаттық ерекшеліктеріне, өзендер бассейіндерінің геоморфологиялық ерекшеліктеріне және антропогендік фактордың әсеріне байланысты өсімдіктер мен топырақтың беталысына арналған. Геожүйелердің қазіргі геоэкологиялық жағдайына сипаттама берілген. Зерттелетін аймақтың ішінде екі ішкі жүйе анықталған.

Түйін сөздер: геожүйелік тәсіл, геожүйе, өзен бассейні.

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