Л. Н. Гумилев атындағы Еуразия ұлттық университетінің ХАБАРШЫСЫ.
ISSN: 2616-6771. eISSN: 2617-9962

ГЕОГРАФИЯ СЕРИЯСЫ / GEOGRAPHY SERIES / СЕРИЯ ГЕОГРАФИЯ

IRSTI 39.19.31, 39.03.19, 36.33.27, 39.29.15 *DOI: https://doi.org/10.32523/2616-6771-2024-149-4-79-94*
Scientific article

The landscapes of the Aral physical-geographical region and their zoning experiments

R.A. Ibragimova[1], M.M. Avezov[2]*, A.A. Ibraimova[3]
[1,2,3] National University of Uzbekistan named after Mirzo Ulugbek, Tashkent, Uzbekistan

*(E-mail: [1]r.ibragimova@nuu.uz, *[2]m.avezov@nuu.uz, [3]azizaibraimova983@gmail.com)*

Abstract. In this article, new lands formed in the drainage zone of the Aral Sea and areas where marine deposits are widespread in the Eastern Aral Sea area were identified as a separate physical-geographical unit – the Aral physical-geographical region. The article also describes the landscapes and physical-geographical districts of the Aral physical-geographical region. It has been studied that the units of physical-geographical zoning are classified differently by different researchers, and the units of zoning of the Aral physical-geographical region have been described. A map of the landscapes and physical-geographical zoning of the Aral physical-geographical region with a medium scale (1: 500.000) has been compiled.

Keywords: landscape, Aral Sea, desertification, physical-geographical zoning, physical-geographical district, physical-geographical region, Aral region, relief, soil, vegetation, landscape map, landscape type, physical-geographical zoning map.

Received: 25.11.2024. Accepted: 19.12.2024. Available online: 31.12.2024.
** Corresponding author*

Introduction

An analysis of the works on the physical-geographical zoning of the Aral Sea and the Aral Sea region, which are part of regional studies, showed that the lands released from the water of the Aral Sea due to the decline in the level of the Aral Sea are not zoned physical-geographically. Based on the study and analysis of the physical-geographical conditions of this region, it became known that new unique landscapes began to emerge. These landscapes differ from the landscapes of other regions in their formation and development directions. Therefore, the landscapes of the newly discovered territories' landscapes have been studied scientifically and practically. It was found that they do not resemble the landscape characteristics of neighboring physical-geographical districts, and they were named separate ***Aral physical-geographical region.*** The historical and genetic factor was taken as

the basis for identifying such a physical-geographical unit, and the territories where marine deposits are common were chosen as the boundaries of the region.

In this article, we would like to focus on the landscape map at a scale of 1:500,000 created based on our regional physico-geographical studies of a new territory formed on the Aral Sea and the results of physical-geographical zoning based on it. First of all, we wanted to draw attention to two important points. These are:

1) It is advisable to consider the territory of the Aral Sea coastline, formed before the 1960s, as a unified natural geographical unit based on its orographic structure, genetic origin, and lithological features, and to identify it as a new Aral natural geographical district, alongside natural geographical districts such as Ustyurt, Lower Amu Darya, and Kyzylkum, on the maps of natural geographical zoning of Central Asia;

2) Given that the landscapes that make up the structure of the Aral Sea physico-geographical region are still quite "brittle" in terms of age and relatively "fragile" in terms of stability, great caution is necessary when developing measures for their use in the national economy.

Materials and methods

Since the emergence of the Aral Sea and the Aral Sea region, this area has become an object of research in various directions. A number of scientific works have been carried out aimed at illuminating the natural features of this region. In particular, the geology of the dried-up bottom of the Aral Sea was studied by B.I. Pinhasov (2002, 2006, 2009), the issues of soil formation were studied by T.F. Nekrasova (1990), B. Zhollibekov (1991, 1995, 2002), T.M. Tairov (1993), V.M. Starodubtsev, V.K. Bogdanets (2007), the study of the state of vegetation cover was studied by V.V. Zherbaev (1990), V.V. Zherbaev (19 (2001, 2002, 2006), Kh. Shomurodov and others. (2008), T.T. Rakhimova et al. (2008), S.G. Sherimbetov (2009).

Issues of the formation of natural geographical complexes on the dried-up bottom of the Aral Sea are reflected in the scientific works of N.F. Mojaytseva (1979), M.Sh. Ishankulov (1980), A. Rafikov (1982), G.V. Geldieva, T.I. Budnikova (1987, 1990, 1996), V.A. Popov (1990, 2001), A.K. Kurbaniyazov (2001, 2006, 2008) and P.R.Reimov (2001, 2008, 2009).

The territory of the Aral physical-geographical region is entirely within the desert zone. Here, new landscapes with unique characteristics are emerging, considered the youngest among the landscapes of Central Asia. Their formation, structure, and changes in appearance continue to this day. The difference between these landscapes and the landscapes of neighboring counties lies in the fact that marine morphosculptures have formed and are developing in the region. The current relief can be divided into the Holocene Sea and the primary seafloor plains, which were freed from seawater after 1960. Therefore, the landscapes of the Aral physical-geographical region are divided into ancient and modern marine plains. Modern seafaring plains differ from each other in age, surface area, and greater or lesser fragmentation.

Figure 1. Space image of the Aral Sea region (Source: *https://earth.google.com/web*)

Landscape formation is observed depending on the elevation of the site, initially on relatively high and water-depleted lands. Accordingly, it can be observed that landscapes typically have a longitudinal ribbon shape and are located parallel to the coastline. Over the past 50 years, there has been a gradual formation of landscapes in the Aral physical-geographical region. In this sense, the formation of the territory's landscapes can be divided into 3 stages: 1) the initial stage of formation (1-5 years after drying); 2) Stage in progress (6-20 years); 3) The relatively established stage of landscapes (21-50 years).

Landscapes in the initial stage of formation are very young landscapes located along the dried-up sea, whose structure has not yet formed. In areas 2-4 km wide from the new coastline, in 1-2 years, march salt marshes are formed, groundwater lies at a depth of 30-70 cm, and the soil profile is moist at all depths. After 3-5 years, the transformation of marsh salt marshes into coastal salt marshes is observed [13, 14]. On lands that have been free of sea water for 8-10 years, coastal sandy solonchaks are formed and desalinated to a depth of about 1 m, and it has been established that these landscapes are covered with vegetation in a sparse form up to 10-20%.

Relatively formed landscapes are landscapes with a width close to the bottom shore (eastern shores, Amu Darya and Syr Darya deltas) and a distance of 50-70 km, which develop with the main landscape-forming factors and features characteristic of the sandy deserts of Central Asia. Despite this, these landscapes differ from desert sandy landscapes and are distinguished by their uniqueness, and the landscapes formed in this area can be compared to the landscapes formed as a result of the retreat of the Paleogene Sea in the Kyzylkum and Karakum. One of the pressing issues today is mapping them and developing ways to use them in the economy.

Results and discussion

When studying and mapping landscapes, it is advisable to use a thorough and accurate classification table. Until now, scientists engaged in the theory of natural geography have always been interested in the classification of landscapes. Many geographers were engaged

in classifying landscapes, of whom the experience of N.A. Gvozdetsky [6], A.G. Isachenko [7], and V.A. Nikolaev [9] is particularly noteworthy. Among these scientists, N.A. Gvozdetsky and A.G. Isachenko simultaneously conducted work on the classification of landscapes. Their classification units differ from each other. If N.A.Gvozdetsky's classification scheme is in the form of *"class – type – smaller type – group – child"* then A.G.Isachenko prefers to identify the type first and then divide it into classes. The description of its landscapes was in the form of a *"type – subtype – class – subclass – type – subtype – variant"*. In the classifications performed after N.A. Gvozdetsky and A.G. Isachenko, it can be seen that the works of these scientists were used and similarity or very minor changes were made.

It is well known that the classification of landscapes, which has been developed more thoroughly at present and is widely used in subsequent studies, belongs to V.A. Nikolaev. Its classification scheme is distinguished by its multi-level nature and has the following form: *"section – part – small part – class – small class – group – type – small type – category – subcategory – variety – variant"*. Most of the landscape studies conducted in Uzbekistan (N.A. Kogai, Sh.S. Zakirov, A.A. Rafikov, I.A. Khasanov, A. Zaynutdinov, A.K. Kurbaniyazov, etc.) It was based on the classification recommended by V.A.Nikolaev and yielded good results in the study of landscapes. Because these scientific works are distinguished by the fact that they were carried out on the basis of data on the steppe zone of Asia, its characteristics for arid regions and the fact that small units in the recommended classification are developed fairly perfectly.

Taking this into account, we decided to use the classification unit recommended by the renowned landscape scientist V.A. Nikolaev [9]. This is because it can be seen that this unit of classification has been used in many landscape studies and that the work done has been successful. In particular, A. Rafikov studied the landscapes of the Southern Aral Sea region, I. Khasanov – the Karshi steppe, Sh. Zakirov – the Amu Darya and Syr Darya interfluve, and A. Zaynutdinov – the Chirchik-Akhangaran Valley. However, we have used this classification unit with a minor change. We found it necessary to separate the *group of landscapes* from the *type of landscapes and the subtype*. In this case, the Aral Sea region is entirely within the subtype of landscape of northern deserts. The next classification unit, called the group, is divided into landscape categories, which in turn are divided into landscape types.

When creating a landscape map, the researcher also encounters the method of depicting landscapes in colors. This method is one of the most understudied issues in landscape science. So far, we know that there are only two scientific articles on this issue. These are articles by N.G. Bokachev [4] entitled "Principles of Flower Formation of Medium-Scale Landscape Maps" and Ch.V. Galkov [5] entitled "On the Use of Background Signs in Landscape Maps". Moreover, the colors chosen by N.G. Bokachev and the principle applied by him largely correspond to the classification compiled by F.N. Milkov, and the types of terrain are mainly given by dashed lines, which cannot reveal the main features of the landscapes of our region.

It is difficult to achieve the expected result when using the principle used in Ch.V.Galkov's article, that is, the principle of selecting both colors and signs. Because adding some symbolic symbols to the colors and bars makes it difficult to read the map.

When creating a landscape map of the Aral physical-geographical region, we deemed it necessary to choose a color for landscape types to facilitate its reading. We considered it more important to distinguish landscape groups using dashed lines over colors. Taking into account that landscape groups are automorphic, hydromorphic, and semi-hydromorphic landscapes depending on their moisture content, we decided that a good result can be achieved mainly with the same stroke, but by showing the direction of the lines in three different cases. As a result, all groups of automorphic landscapes are represented by vertical

lines, hydromorphic landscapes by horizontal dashed lines, and semi-hydromorphic landscapes by inclined dashed lines. The dashed lines given in this view can also provide information about the presence of groundwater at depth or on the surface, and the readability of the map is also relatively high.

In addition to the aforementioned methods, factual materials are also important when creating landscape maps. Because without them, it is impossible to create a perfect landscape map. Taking this into account, many scientific and practical materials were collected. In particular, the space images were analyzed year after year. Field research materials and scientific works published in subsequent years were studied. Based on the above, landscapes within the district were identified and mapped based on when the area was released from water masses, plant and soil cover, and geomorphology.

To facilitate the readability of the landscape map of the Aral Sea region, we deemed it necessary to select colors for landscape types. We considered it more important to distinguish landscape groups using dashed lines above the colors. Taking into account that landscape groups are automorphic, hydromorphic, and semi-hydromorphic landscapes, depending on their moisture content characteristics, we decided that a good result can be achieved mainly with the same stroke, but by showing the direction of the lines in three different ways. As a result, all groups of automorphic landscapes are reflected by vertical lines, while hydromorphic landscapes are reflected by horizontal dashed lines, and semi-hydromorphic landscapes are reflected by sloping dashed lines. The dashed lines given in this view can also provide information about the depth or surface of groundwater, and the readability of the map also increases relatively.

In addition to the aforementioned methodological methods, factual materials are also of great importance in creating landscape maps. Because it is impossible to create a landscape map without them. Taking this into account, many scientific and practical materials were collected. In particular, the space images were analyzed year after year. Field research materials and scientific works published in recent years were considered. Using the above, landscapes within the region were identified and mapped based on the area's water availability, vegetation and soil cover, and geomorphology.

At the initial stage of landscape identification and separation, over 400 contours were identified. As a result of re-analysis and generalization, similar contours of landscape features were added to each other. As a result, more than 100 contours were formed and they were combined into 33 landscape types (Figures 2 and 2a). These landscape types were numbered in arabic numerals. The identified landscapes are typological units. In addition to landscape types, landscape categories, groups, subspecies, types, and classes are distinguished on the landscape map, which is well reflected in its legend. Therefore, it has been established that all existing landscapes belong to the same class *(plains)*, one species *(deserts)*, and one subspecies *(northern deserts)*. The landscapes of the district are also divided into automorphic, semi-hydromorphic, and hydromorphic groups. Automorphic landscapes have lost contact with the influence of groundwater, and their formation and development largely depend on atmospheric precipitation. Landscapes in the semi-hydromorphic group depend on atmospheric precipitation and at certain times on groundwater. In areas where groundwater and atmospheric precipitation occur year-round, landscapes are formed under hydromorphic conditions. From this perspective, 57.5% of the territory's landscapes (by number) are automorphic, 12% are semi-hydromorphic, and the remaining 30.5% are hydromorphic. Identifying landscape groups has both scientific and practical significance. For example, recognizing the possibility of landscapes transitioning from one group to another or a third group during their development, and studying this

process allows one to determine the directions of landscape development and thereby predict their future state.

The next unit in the classification is the category of landscapes, the main criterion for their identification is the lithological composition and geological history of geological deposits. For example, ancient marine plain landscapes (landscapes No. 1, 2, 3, 4, 5, 6) include landscapes formed on Holocene deposits. In doing so, an attempt was made to rely on the data found in existing paleogeographic works [10, 18, 12].

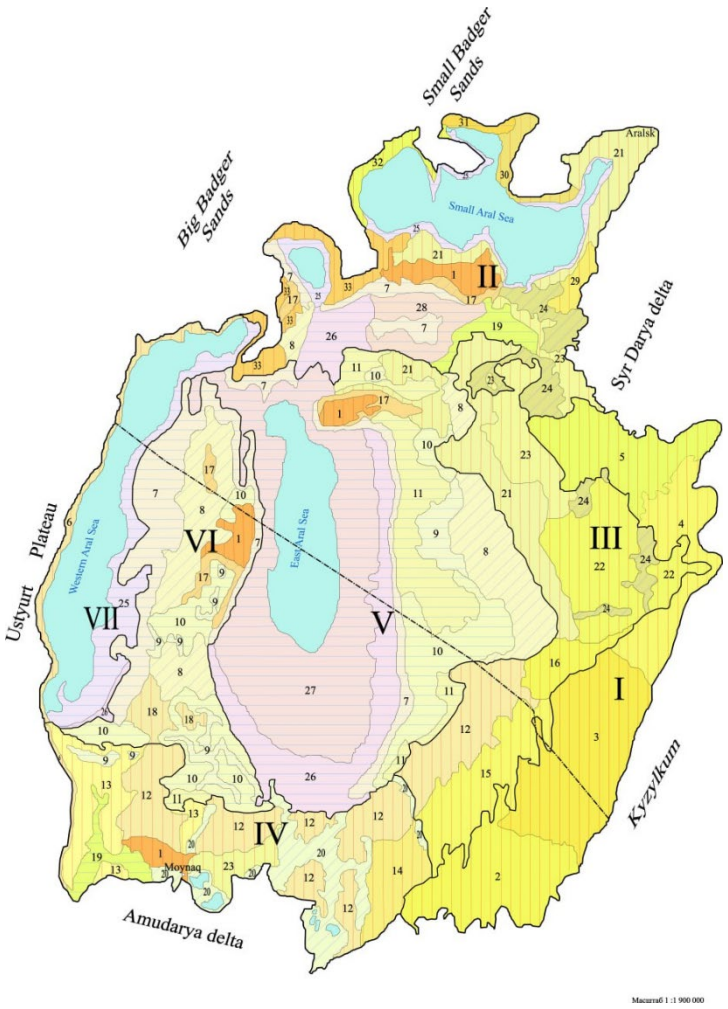

Figure 2. Map landscape and physical-geographical zoning of the Aral physical-geographical region (compiled by the author's in Uzbek)

PLAINS

Desert landscapes
Northern desert landscapes
Seaplanes

I. Ancient Seaplanes

1. Structural-denudation plains with sandy desert soils of kandym *(Calligonum aralense)* and black saxaul *(Haloxylon aphyllum)*

2. Sandy-steppe and sandy slopes with cherkez *(Saisola richteri)*, kandym *(Calligonum aralense)*, black saxaul *(Haloxylon aphyllum)*

3. The slopes with sandy desert soils, where kandym *(Calligonum aralense)*, cherkez *(Saisola richteri)*, white saxaul *(Haloxylon persicum)* and black saxaul *(Haloxylon aphyllum)*

grow, and the lowlands with black saxaul *(Halostachys belangeriana)* around the residual solonchaks

4. Wave-shaped plains with sandy and sandy desert soils, where cherkez *(Saisola richteri)*, boyalich *(Salsola arbuscula Pall)*, black saxaul *(Haloxylon aphyllum)*, and common saltwort *(Halocnemum strobilaceum (Pall))* grow

5. Accumulative plains with sandy desert soils with the growth of kandym *(Calligonum aralense)*, cherkez *(Saisola richteri)*, black saxaul *(Haloxylon aphyllum)*

6. Gravel-gray-brown-soil and fine-stone slopes (chink landscapes) with wormwood *(Artemisia diffusa)*, buyrgan *(Anabasis salsa)*

II. Modern Plains

7. Seaside solonchaks and marshes with sparse solonchaks *(Atriplex fominii, Salsola foliosia, Climacoptera aralensis)*

8. Inclined plains with coniferous salt marshes, where halophytes grow, and takyr-like soils, where alfalfa *(Calligonum aralense)* and sarsazan *(Halocnemum strobilaceum (Pall))* grow

9. Humid lowlands with simple salt marshes without vegetation cover

10. Sea salt marshes with salt marshes, where there are red salt marshes *(Salicornia europaea)* and black salt marshes *(Salicornia herbacea L)*, sarsazan *(Halocnemum strobilaceum (Pall)*

11. Moist salt marshes without vegetation

12. Sandy slopes with sparse black saxaul *(Haloxylon aphyllum)* and willow *(Tamarix hispida)*

13. Wavy surface sandy plains with sparse black saxaul *(Haloxylon aphyllum)*, alfalfa *(Calligonum aralense)*, wormwood *(Tamarix hispida)* and salt marshes with salt marshes *(Atriplex fominii, Climacoptera aralensis)*

14. Rare shrubs, wormwood *(Artemisia diffusa)*, and selenium *(Stipagrostis pennata)* growing in fine hilly sandy wavy plains

15. Cherkez *(Saisola richteri)*, kandym *(Calligonum aralense)* and psammofit bushes, sandy desert-soil and fine hilly sandy wave-like plains

16. Desert-sandy sandy plains with the growth of the common bollworm *(Salsola arbuscula Pall)*, astragalus *(Astragalus)*, alfalfa *(Calligonum aralense)* and black saxaul *(Haloxylon aphyllum)*, as well as small hilly sandy plains with the growth of the common bollworm *(Halostachys belangeriana)* and the common sarsazan *(Halocnemum strobilaceum (Pall))*

17. Inclined plains of inter-sandy salt marshes with halophytes and takyr-like soils with the growth of sarsazan *(Halocnemum strobilaceum (Pall)* and willow *(Tamarix hispida)*

18. Wave-shaped plains of sandy desert soils with nests and dunes, where annual halophytes grow

19. Accumulative plains with meadow soils with the growth of wormwood *(Halostachys belangeriana)*, wormwood *(Tamarix hispida)* and salt marshes with annual halophytes

20. Accumulative plains with cane *(Phragmites australis)*, wormwood *(Tamarix hispida)*, sarsazan *(Halocnemum strobilaceum (Pall))*, saline takyr-like meadow soil and desert sandy soil

21. Plains with a slightly fragmented surface, with a common salt marsh and sandy soils, where black marshes *(Halostachys belangeriana)* grow

22. Concave sandy and barren plains with wormwood *(Artemisia diffusa)*, black saxaul *(Haloxylon aphyllum)* and selenium *(Stipagrostis pennata)*

23. Inclined plains with heavily saline desert sandy soils with the growth of safflower *(Halocnemum strobilaceum (Pall))*, wormwood *(Tamarix hispida)*, black saxaul *(Haloxylon aphyllum)*

24. Lowland lowlands with saline takyr-like and sandy desert soils with the growth of Halostachys belangeriana, sarsazan *(Halocnemum strobilaceum (Pall))*, wormwood *(Tamarix hispida)*

25. Beaches that are under the active influence of seawater

26. Inclined coastal salt marshes with sparse halophytes

26. Inclined coastal salt marshes with sparse halophytes

27. Sea-affected coastlines and wet salt marshes without vegetation

28. Salt marshes *(Salicornia herbacea, Salsola foliosia, Climacoptera aralensis)* are common salt marshes and salt marshes without vegetation

29. Accumulative plains with sandy desert soils, where sparse salt marshes *(Atriplex fominii, Salsola foliosia, Climacoptera aralensis)*, wormwood *(Artemisia diffusa)*, alfalfa *(Calligonum aralense)* grow

30. Rare salt marshes *(Atriplex fominii, Salsola foliosia, Climacoptera aralensis, Salicornia herbacea)*, grey-brown and plain salt marshes

31. The alluvial plains with salt marshes *(Atriplex fominii, Salsola foliosia, Climacoptera aralensis, Salicornia herbacea)* and grey-brown soils with wormwood *(Artemisia diffusa)*, rainbow trout *(Salsola arbuscula Pall)*

32. Sea-influenced coastlines and inter-sandy coastal salt marshes with halophytes and sloping plains with grey-brown soils with sparse wormwood *(Artemisia diffusa)*

33. Inclined inter-sandy plains with coniferous salt marshes and buyrgun *(Anabasis salsa)*, boyalich *(Salsola arbuscula Pall)*, grey-brown soils with wormwood *(Artemisia diffusa)*

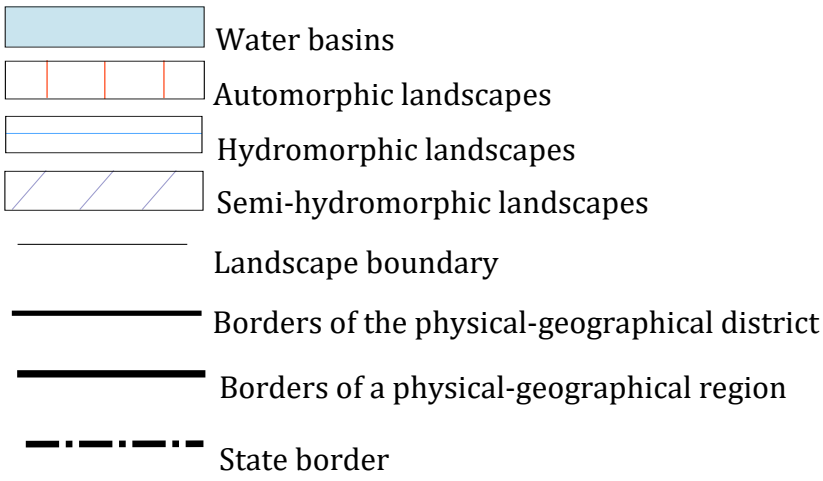

Figure 2a. Legend of the Map landscape and physical-geographical zoning of the Aral physical-geographical region

Variety is the smallest unit of classification of landscapes. The main feature that serves as the basis for their identification and mapping is the characteristics of their soil and vegetation. A total of 33 landscape types have been identified. Most of them belong to the automorphic group and to the category of modern marine plains. The stated ideas can also be identified from landscape names.

Analysis of this landscape map shows that the combination of other characteristics, in addition to these classification units, motivates the physical-geographical zoning of this territory. In other words, the landscape allows for the identification of regional units based on the analysis of typological units. Such units, which we have identified, are reflected on the landscape map.

As discussed above, we adopted the area under study as the ***Aral physical-geographical region.*** A county is a division between a province and a physical geographical region. Physical-geographical regions are large territories within a province, with unique connections and characteristic features between the components of the geosystem, which are not repeated in adjacent territories [1, 2, 3]. The Aral physical-geographical district belongs to a small province of the plain and is a unique physical-geographical complex with its geographical location, relief features, rock composition and character, hydrogeological and climatic conditions, soil and vegetation groups.

The 1960 maritime boundary line was adopted as the boundary of the Aral physical - geographical region, and the areas of eastern marine deposits were also added. This can also be considered an orographic boundary. The county occupies an area of more than 75,000 square kilometers and is structurally heterogeneous. There are differences in the nature of the northern, southern, western, central, and eastern parts. These differences are manifested in the gypsometry, fragmentation, and slope of the surface, as well as in age, the analysis of which necessitates the identification of a number of physical-geographical districts. A physical- geographical district is a part of an county that differs in geomorphological or climatic features.

Landscapes formed on the dried-up bottom of the Aral Sea differ from landscapes of other regions in terms of time, age, formation, and development directions. Based on the analysis of the landscape map compiled taking this into account, within the Aral physical-geographical district, the Kyzylkum, the Northern Syr Darya delta, the Eastern Aralkum, the Southern Amu Darya delta, the Central Aralkum, the Western Aralkum, and the Ustyurt region were identified. On the landscape map, they were displayed in roman numerals. Below we will give a detailed description of them.

I. The physical-geographical district Beside of Kyzylkum borders the Kyzylkum district to the east, the Eastern Aralkum district to the west, the Beside of South Amu Darya delta district to the southwest, the Beside of North Syr Darya delta district to the northwest, and the Beside of Syr Darya delta to the northeast. The district occupies 12.5% of the county's area. The territory of the district consists of ancient sea-sandy plains, primarily composed of pleiocene-holocene rocks, with an absolute elevation of up to 85 meters at the site of islands older than 50 meters. The thickness of the deposits is not very large, up to 5-6 meters. The surface is sloping, mainly composed of eolian forms – sand hills and dunes (height 2-8-10 m), while in low places there are numerous salt marshes (Figure 3).

Figure 3. Takyr salt marshes in the Aral region (author's photo)

The district includes 4 landscape types, which are formed in an automorphic group. The overall surface of these landscapes slopes westward, and in their appearance, psammophytic plants predominate.

The former Akpetki archipelago, consisting of more than 300 islands, and many bays with a depth of 7-8 meters, are located within this region (landscape 2, figures 2 and 2a). The islands in the archipelago were not separated because they were at the level of facies and urochishe, and they were classified as ancient sea plains landscape. The physical-geographical districts of the Kyzylkum districts differ from other regions in that the structure of the landscapes formed here has already been formed, and all of them belong to the category of ancient sea plains.

II. The physical-geographical district Beside of the North Syr Darya delta is bordered by the Syr Darya delta to the east, the Aral Sea and the Great and Small Bursuq sands to the north and northeast, the Beside of Ustyurt district to the southwest, the Central and Eastern Aral Sea district to the south, and the Beside of Kyzylkum district to the southeast. The area within this boundary constitutes 17% of the county's area. The Small Aral Sea is located within the district. This lake accounts for 25.5% of the area of the district. The land surface of the district is mainly brought by the Syr Darya River and is composed of marine deposits. The surface of the district is sloping towards the Small Aral Sea and its absolute elevation is around 40-160 meters. The district has 16 landscape types. Most of these landscapes belong to the category of modern marine plains and are divided into 3 groups – automorphic, hydromorphic and semi-hydromorphic. Near the Small Aral Sea, hydromorphic (groundwater levels up to 1-3 meters) landscapes were formed, and as they moved away from it, semi-hydromorphic (3-5 meters) and automorphic (5 meters and deeper) landscapes were formed.

Figure 4. Carduim edule L seashells in the Aralkum (author's photo)

III. The Eastern Aralkum physical-geographical district borders the Kyzylkum district to the east and south, the Beside of North Syr Darya Delta district to the north, the Central Aralkum district (Figure 4) to the west, and the Beside of South Amu Darya delta district to the southwest, constituting 13% of the district's area. The area of the raion encompasses areas that became dryland between 1960 and 1984 and has an absolute elevation of 42-53 m. The surface is composed of sandy, loamy clay rocks and sandy loams. Most of the district consists of landscapes of the automorphic group. One landscape (24-landscape, figure 2 and 2a) has semi-hydromorphic conditions. In the vicinity of the Beside of Kyzylkum side district of the Eastern Aralkum district, numerous sand dunes and hills exceeding 3-5 meters in height can be found. They are getting thinner and thinner to the west. The area is dominated by a landscape (22 landscape, figure 2 and 2a) of hilly sandy and barren plains with the growth of wormwood, black saxaul, and selenium. The general appearance of the physical-geographical region is characterized by halopsammoid and psammophytic plants. One of the landscapes within the district belongs to the category of ancient marine plains, while the rest belong to the category of modern marine plains.

IV. The physical-geographical district of the Beside of Southern Amu Darya delta is located in the northern part of the Amu Darya delta. The district includes the dried-up southern parts of the Aral Sea. The region borders the Beside of Kyzylkum and Eastern Aralkum districts to the east, the Central and Western Aralkum and Beside of Ustyurt districts to the north, the Ustyurt Plateau to the west, and the modern Amu Darya delta to the south. This boundary constitutes 12% of the county's area. The land surface of the district is mainly composed of sand, sand, clay, and aleurite rocks brought by the Amu Darya River, and the slope decreases towards the north. In the south of the physical-geographical district, near the Amu Darya delta, the groundwater level in 1991 was 5 meters, and in 2002 it was 10-15 meters deep. By 2005, the groundwater level had risen to 5-6 meters due to the influx of river water into the Saribas Bay.

This area has been well studied by scientists. In 2001, A. Kurbaniyazov [8] identified 40 physical-geographical complexes in this area. By 2007, botanists [15] had identified 9 physical-geographic complexes. We have identified 8 types of landscapes in the physical-

geographical district. Most of these landscapes belong to the category of landscapes of modern marine plains, the formation of which is associated with the retreat of the sea.

V. The Central Aralkum physical-geographical district is located in the center of the region. The district borders the Eastern Aralkum district to the east, the Beside of North Syr Darya delta district to the north, the Western Aralkum district to the west, and the Beside of South Amudarya delta district to the south. This district occupies the largest area of the physical-geographical region (27%). The territory of the district includes lands freed from the water of the Eastern Aral Sea. From 1984 to the present day, the process of land conversion is accelerating here. The sea was shallow and rapidly turning into land. As a result, hydromorphic landscapes were formed on large areas. The Eastern Aral Sea, located in the center of the physical-geographical district, currently occupies 13% of the area. Hydromorphic landscapes predominate in the district. The main difference between this district and other districts is that there are many areas without vegetation, and 99% of them belong to modern marine plains.

Many of the landscapes of this physical-geographical district have not yet formed and continue to develop.

VI. The Western Aral Sea physical-geographical district is located between the Western and Eastern Aral Seas. This district borders the Central Aralkum district to the east, the Beside of North Syr Darya delta district to the north, the Beside of Ustyurt district to the west, and the Beside of South Amu Darya delta district to the south, and its area constitutes 11% of the district's area. The Arkhangelsk uplift, which passes through the Muynak and Kulandy peninsulas, and the previous Vozrojdeniye, Lazarev islands are within the district. The district includes 8 landscape types.

Figure 5. Landscape of the Western Aral Sea physical-geographical district (author's photo)

VII. The Beside of Ustyurt physical-geographical district is bordered by the Western Aralkum district to the east, the Beside of North Syr Darya delta district to the northeast, the Ustyurt Plateau to the west, and the Beside of South Amu Darya delta district to the south. The Western Aral Sea, the deepest part of the Aral Sea, occupies the smallest (7.5%) area among the physical and geographical regions of the district. The lake occupies 61% of the

area of the district. Much of the area of the district consists of hydromorphic landscapes that have become dryland after 2000.

Conclusion

As a result of our research, the first landscape-typological units of the Aral physical-geographical region and a map of its physical-geographical zoning were created. It has been established that 33 landscape varieties identified within the district belong to 1 class, 1 type, 1 subtype, 3 groups, and 2 categories. Due to the peculiarities of the landscape structure, 7 physico-geographical districts were identified (the Beside of Kyzylkum, the Beside of North Syr Darya delta, the Eastern Aralkum, the Beside of Southern Amu Darya delta, the Central Aralkum, the Western Aralkum, and the Beside of Ustyurt).

The landscapes of the Aral physical-geographical region, based on a certain pattern, formed landscapes extending from west to east in the southern and northern regions, and conversely, from north to south in the western and eastern regions. The use of these territories in the economy has not yet been established. When establishing the use of landscapes in the economy, it is important to be aware of the nature of the Aral physical-geographical region, the prospects for using its natural resources, and the problems of nature conservation.

Funding: There is no source of funding.

Conflict of interests: no conflict of interest.

Author's contributions: Data collection and photography of objects using field studies for the article; **Rana Ibragimova** carried out a critical review of the article's content; Project of the concept of the work, the analysis of the results of the article and the writing of the text, the approval of the final form of the article was carried out by **Mukhriddin Avezov**; Creation of the physical-geographical zoning map presented in the article and the development of its legend were carried out by **Aziza Ibraimova**.

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Ибрагимова Р.А.[1], Авезов М.М.[2], Ибраимова А.А.[3]
[1,2,3]Мирзо Улугбек атындағы Өзбекстан ұлттық университеті, Ташкент, Өзбекстан

Арал физикалық-географиялық ауданының ландшафттары және оларды аудандастыру тәжірибесі

Аңдатпа: Мақалада Арал теңізінің құрғату аймағында пайда болған жаңа жерлер мен Шығыс Арал өңірінде теңіз шөгінділері кең таралған аймақтар жеке физикалық-географиялық бірлік – Арал физикалық-географиялық округі болып белгіленді. Мақалада Арал физикалық-географиялық округінің ландшафттары мен физикалық-географиялық аудандары да сипатталған. Физикалық-географиялық аудандастыру бірліктерін әр түрлі зерттеушілер әртүрлі жіктейтіні зерттеліп, Арал теңізінің физикалық-географиялық аймағының аудандастыру бірліктеріне сипаттама берілді. Орта масштабтағы (1: 500 000) Арал физикалық-географиялық округінің ландшафттары мен физикалық-географиялық аудандастыру картасы жасалды.

Түйін сөздер: ландшафт, Арал теңізі, шөлейттену, физикалық-географиялық аудандастыру, физикалық-географиялық аудан, физикалық-географиялық округ, Арал округі, рельеф, топырақ, өсімдік жамылғысы, ландшафттық карта, ландшафт түрі, физикалық-географиялық аудандастыру картасы.

Ибрагимова Р.А.[1], Авезов М.М.[2], Ибраимова А.А.[3]
[1,2,3]Национальный университет Узбекистана имени Мирзо Улугбека, Ташкент, Узбекистан

Ландшафты Аральского физико-географического округа и опыты их районирования

Аннотация. В данной статье в качестве отдельной физико-географической единицы – Аральского физико-географического округа были выделены новые земли, образованные в зоне дренажа Аральского моря и районы, где морские отложения широко распространены в районе Восточного Арала. В статье также описываются ландшафты и физико-географические районы Аральского физико-географического округа. Было изучено, что единицы физико-географического районирования классифицируются по-разному различными исследователями, описаны единицы районирования физико-географического района Аральского моря. Составлена карта ландшафтов и физико-географического районирования Аральского физико-географического округа среднего масштаба (1: 500 000).

Ключевые слова: ландшафт, Аральское море, опустынивание, физико-географическое районирование, физико-географический район, физико-географический округ, Аральский округ, рельеф, почва, растительность, ландшафтная карта, тип ландшафта, карта физико-географического районирования.

Information about the authors:

Ibragimova R.A. **–** Candidate of Geographical Sciences, Associate Professor of the Department of Physical Geography, Faculty of Geography and Geoinformation Systems of the National University of Uzbekistan named after Mirzo Ulugbek, University st., 4, 100174, Tashkent, Uzbekistan.

ORCID *https://orcid.org/0009-0005-0787-4370*

Avezov M.M. **–** Doctor of Philosophy (PhD) in Geographical Sciences, Associate Professor of the Department of Physical Geography, Faculty of Geography and Geoinformation Systems of the

National University of Uzbekistan named after Mirzo Ulugbek, University st., 4, 100174, Tashkent, Uzbekistan.

ORCID *https://orcid.org/0009-0002-7918-3921*

Ibraimova A.A. **–** Candidate of Geographical Sciences, Associate Professor of the Department of Cartography, Faculty of Geography and Geoinformation Systems of the National University of Uzbekistan named after Mirzo Ulugbek, University st., 4, 100174, Tashkent, Uzbekistan.

ORCID *https://orcid.org/0009-0002-4275-0574*

Ибрагимова Р.А. – география ғылымдарының кандидаты, Мирзо Улугбек атындағы Өзбекстан Ұлттық университетінің география және геоақпараттық жүйелер факультеті «Физикалық география» кафедрасының доценті, Университетская көш., 4, 100174, Ташкент, Өзбекстан.

ORCID *https://orcid.org/0009-0005-0787-4370*

Әвезов М.М. – география ғылымдарының философия докторы (PhD), Мирзо Улугбек атындағы Өзбекстан Ұлттық университетінің география және геоақпараттық жүйелер факультеті «Физикалық география» кафедрасының доценті, Университетская көш., 4, 100174, Ташкент, Өзбекстан.

ORCID *https://orcid.org/0009-0002-7918-3921*

Ибраимова А.А. **–** география ғылымдарының кандидаты, Мирзо Улугбек атындағы Өзбекстан Ұлттық университетінің география және геоақпараттық жүйелер факультеті «Картография» кафедрасының доценті, Университетская көш., 4, 100174, Ташкент, Өзбекстан.

ORCID *https://orcid.org/0009-0002-4275-0574*