UDC 911.6 IRSTI 87.29.37

LANDSCAPE FACTORS FORMING THE STEPPE ZONE OF THE ZHAYIK RIVER BASIN OF THE WEST KAZAKHSTAN REGION

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This article examines the influence of various natural factors on the formation of landscape and soil complexes in the Zhaiyk River basin. The key components considered in the study include soil types, topography, and natural landscapes. The analysis reveals that the soils of the region range from chestnut and chernozem to sod-podzolic and solonetz soils, which determine the characteristics of vegetation and agricultural potential. Soil complexes are largely shaped by topography, water regime, and climatic conditions. Based on cartographic data obtained from satellite imagery and digital terrain models, an analysis was conducted to assess the distribution of soils and their relationship with vegetation types, water bodies, and other natural features. The results of the study reveal important patterns in the distribution of soil types and assess their role in the region's ecosystems, providing practical insights for land resource management, agriculture, and environmental conservation in the Zhaiyk River basin. Topography, in turn, affects water exchange and erosion processes, which significantly influence soil types and their distribution. Special attention is given to identifying the interrelationships between soils, topography, and vegetation, as well as the role of these factors in the formation of sustainable ecosystems. The findings confirm that the complex interaction of topographical and soil features influences the distribution of landscape zones, which is crucial for planning agricultural activities and nature conservation.

Keywords: steppe zone, landscape, landscape map, West Kazakhstan region, anthropogenic factors, natural factors, steppe landscapes.

Accepted: 24.05.2024 y.
DOI: 10.54668/2789-6323-2024-115-4-75-90

INTRODUCTION

The basin of the Zhaiyk River flows through the territories of the Russian Federation and the Republic of Kazakhstan. On the territory of Russia, the river basin is located within the Chelyabinsk and Orenburg regions, as well as the Republic of Bashkortostan. On the territory of Kazakhstan, the Zhaiyk River basin is located within the Atyrau, West Kazakhstan and partially Aktobe regions. The total length of the river is 2,534 km, the catchment area is 231,000 km^2 (Petrenko et al., 2001, Ramazanov, 2009).

On the territory of the Russian Federation, its length is 1450 km, its catchment area is 121900 km^2 (52,8 %), and on the territory of Kazakhstan, respectively, 1084 and 109100 km^2 (47,2 %). The Zhaiyk River originates on the eastern slope of Uraltau and flows into the Caspian Sea. The river basin can be divided into the following natural provinces: The General Syrt, the Mugalzhar Mountains, the Sub-Ural (Poduralski) Plateau, the Caspian Lowland. The common Syrt serves as a watershed of the Volga and Zhaiyk river basins. Its surface is slightly wavy, with low (up to 200...360 m) outliers. Along the southern spurs of the Syrt there is a vast pre-Syrt plain, the width of which reaches 60 km near the city of Uralsk. Intersected by numerous valleys of small rivers, it retains a rocky character and only in the south breaks off with a steep ledge to the Caspian lowland. The Mugalzhar Mountains are an extension of the Southern Urals. This uplift consists of the northern and southern parts, separated from each other by a wide intermountain depression. The northern Mugalzhar occupy the space between Ilek and Irgiz with a width of up to 200 km and are mainly hilly and rocky hills. The Northern Mugalzhar are divided into western and eastern wings by the Oryu River. The western wing of the Northern Mugojars (Or-Ilek interfluve) has the

appearance of a plateau lying on the continuation of the southern spurs of the Ural Mountains. To the west of the watershed, the plateau is strongly indented by watercourses and represents a shallow sandstone, and to the east of it passes into a slightly framed plain, dissected by a network of left tributaries of the Or River. The southern Mugalzhar have a mountainous terrain and their main western chain, the Mugalzhar ridge proper, rises sharply (by 200...300 m) above the adjacent the Sub-Ural (Poduralski) Plateau. The Sub-Ural (Poduralski) Plateau adjoins the Caspian lowland from the east and is a steep-hilly plain dissected by the valleys of the Zhaiyk River and its left tributaries Ilek and Utva (Ramazanov, 1998, Ramazanov, 2003, Ramazanova et al., 2019).

The relief of the Sub-Ural (Poduralski) Plateau indicates intensive denudation and erosion processes, the main agents of which are water and wind. The Caspian lowland frames the northern part of the Caspian Sea. It is a dried-up bottom of the retreating Caspian Sea and is characterized by a leveled surface with traces of coastlines and coastal ramparts. The surface of the lowland is dotted with a variety of different-sized rock depressions, lakes and shallow channels, which belong to certain coastlines associated with different levels of the Caspian Sea. The Chizhinsko-Durinsko-Balika depression has the largest dimensions. This is a huge lowland stretching from the southern border of the Common Syrt almost to the Volga-Ural sands. Its surface is covered with vast expanses of estuarine meadows, among which individual remnant massifs with a length of 2 to 30 km rise in places (Yegorova & Motrich, 2010, Vilesov et al., 2009, Akiyanova & Vasilchenko, 2015, Salesa & Cerdà, 2020).

To understand the surrounding world with the modern relationship between man and nature, with human impact in the environment, one of the solutions is to study the territory using landscape analysis. Thus, the steppe zone in the West Kazakhstan region of the Zhaiyk river basin has been studied since ancient times, but it is now that the study has become more detailed and detailed.

Landscape analysis of the steppe zone is very important, because the steppe zone is one of the most favorable zones for human settlement. Therefore, timely landscape analysis of the steppe zone is very relevant today. The need to study the landscape analysis of the steppe zone of the Zhaiyk River basin arose due to the anthropogenic impact on the landscapes of the steppe zone and pollution in Zhaiyk.

The factors shaping the landscape and its components are closely related. Any component of the natural environment that forms within the landscape is a landscape-forming factor. In this regard, landscape-forming factors include: lithogenicity factors with geological and relief characteristics, then hydrological and climatic factors with water and climatic characteristics, the following soil factors and biogenic factors. Also, in parallel, special attention should be paid to anthropogenic factors, since at present there is almost no type of landscape without contact with human activity. Landscape factors also have external and internal types of influence, including such external natural phenomena as: movements in tectonics, relief-forming factors, solar radiation, atmospheric circulation. And of an internal nature as a violation of the energy and material balance in the system, which subsequently leads to a change in any components of the natural environment (Amelchenko et al., 2006, Chibilev, 2008).

Therefore, the study of landscape factors in the formation of certain territories is a very important and relevant type of study of the structure of the landscape and its principle of resilience to external anthropogenic influences. The study of the steppe zone is also significant, since the steppe zone is a very fertile and densely populated area of human settlement, and is of social importance. As a result, the subject of the study was “Landscape formation factors”, and the object of study was the steppe zone of the Zhaiyk river basin in the West Kazakhstan region (Darbayeva et al., 2020).

The purpose of the study was to study the landscape factors forming the steppe zone of the Zhaiyk river basin in the West Kazakhstan region.

In order to achieve these goals, the following tasks were set:

– study of statistical, literary, cartographic data on the object of research;

– determination of the steppe zone of the Zhaiyka River basin on the territory of the West Kazakhstan region;

– characteristics of the landscapes of the steppe zone of the Zhaiyka river basin;

– compilation of relief, climatic, geological, soil, plant, hydrographic maps using the ArcGIS program;

– preparation of a series of maps;

– analysis of landscape factors forming the steppe zone of the Zhaiyk river basin in the West Kazakhstan region.

MATERIALS AND METHODS

The article used methods of geographic information mapping and comparative geographic analysis, cartography and statistics, computer science tools, in particular methods of geographic information systems and technologies.

Also used: statistical method (processing of quantitative parameters); graphical methods (graphical representation of data in the form of tables, diagrams, graphs); cartographic method (compilation of a series of maps), namely landscape mapping and systematics of landscapes and the method of landscape classification is used.

Landscape mapping and landscape systematics are in close logical connection. They relate to each other as a way of modeling the landscape structure of the territory, mutually complementing each other and stimulating development. If the systematics shows a structural and genetic model of the landscape structure of the region, then the landscape map shows a spatial model.

Before you start working in the ArcGIS program with digital terrain models, you need to download a DEB file from the Internet, where you select your object and upload it to your computer (laptop). Next, it is unzipped and saved on the desktop or local disk C (D) in a specific folder. After that, work begins in the ArcGIS program. DEM files (DEM) are loaded into the ArcMap program. For further work with DEM files, you should use the tools of the 3D Analyst, conversion and Spatial Analyst «Hydrology» group. These tools are used to simulate the flow of water over the surface.

Digital relief models SRTM were used as research material to highlight the Zhaiyk River basin, cartographic material for the study area according to landscape parameters.

The algorithm for processing the digital relief model for highlighting the river basin is shown in Figure 1.

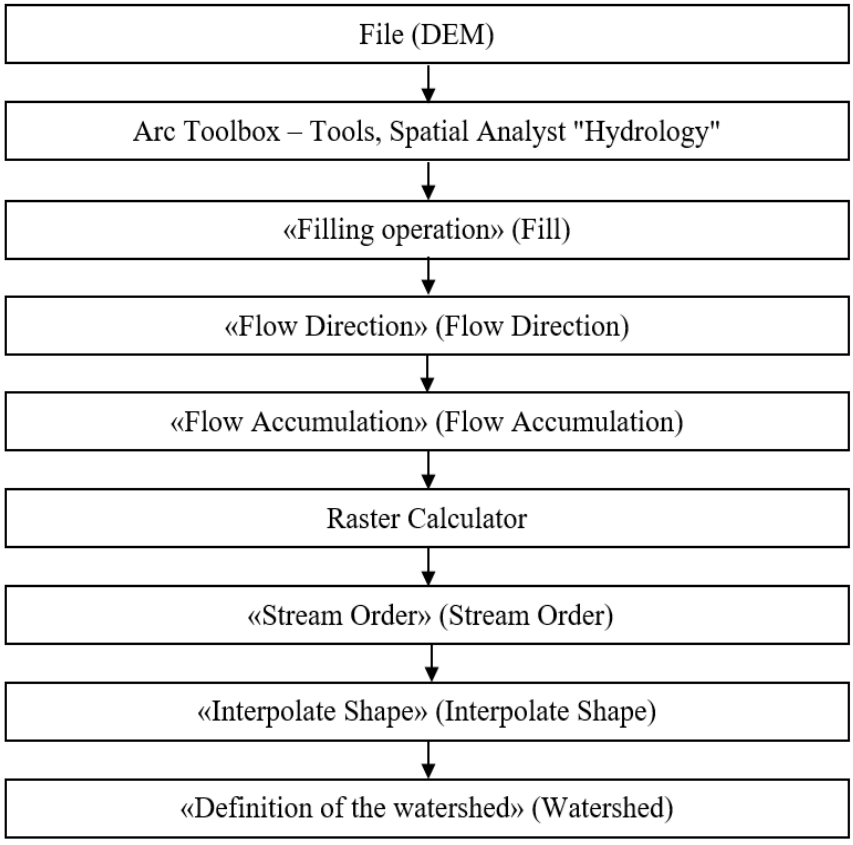

Fig. 1. *An algorithm for processing a digital relief model for highlighting a river basin*

To identify the basin area, digital elevation models (DEMs) were used, modern methods using DEMs using 3D Analysis tools, conversion and spatial analysis tools of the ArcGIS 10.8 program.

Modern methods for determining the structure of landscapes were also used, based on compiling a landscape map, mapping methods and using the functions of the ArcGIS 10.8 program to determine the structure.

Using the functionality of the ArcGIS 10.8 program, SRTM satellite images were processed, a digital relief model was obtained, the boundaries

of the Zhaiyk River basin were identified, then the territory of the steppe zone was digitized and layers of natural environment components were created using the method of overlaying layers and interpolation. As a result, steppe landscapes of the West Kazakhstan region were identified.

The processing algorithm consisted of several steps, including such types of work as collecting and systematizing data on the research object by natural components, data composition, processing of cartographic material and creating a landscape map using ArcGIS 10.8 program tools.

The source data and sources for the geoinformation system are the basis of their information support, which are extremely time-consuming, due to the large mass of sources based on analog data (maps on paper, tables, reports, text, etc.), and digital forms and data processed by it are needed to work in the digital environment of GIS existence. As a result, at the moment they are gradually moving from the analog database to digital, which serves as progress in the field of GIS technologies.

When working in GIS with the analysis and evaluation of various sources of information, it is necessary to take into account common properties in the form of metadata.

When mapping the river basin, statistical and cartographic data of the river basin are used, such as: relief, quaternary sediments, soil cover, plant resources, geomorphological and tectonic maps, landscape changes, etc.

To study the steppe zone of the river basin, cartographic data sources are used, namely general geographic survey maps (soil, vegetation, relief, hydrography, geomorphology, etc.), thematic maps, namely maps of nature (geological, landscape, physico-geographical).

Currently, in hydrological, geographical and environmental studies, geoinformation computer technologies are more often replacing desk and field studies. It is very common to use and process a digital terrain model through certain functions and operations in a GIS program. So, using operations through hydrological functions, it is possible to divide the provided territory in the form of a digital relief model into a river basin.

Digital terrain models today are modern digital images from space depicting any territory of the world. With the help of the ArcGIS program, you can identify any object in a certain area.

Various methods are used to determine the river basin. One of the modern methods is the definition of a river basin based on a digital relief model using 3D Analyst tools, conversion and Spatial Analyst Tools of the ArcGIS program, which is the most accurate for determining the river basin, since digital relief models (satellite images) are used.

Next, a series of steps were taken to create a landscape map, for this purpose, a landscape classification technique was applied, including 4 consecutive interdependent stages, shown in Figure 2.

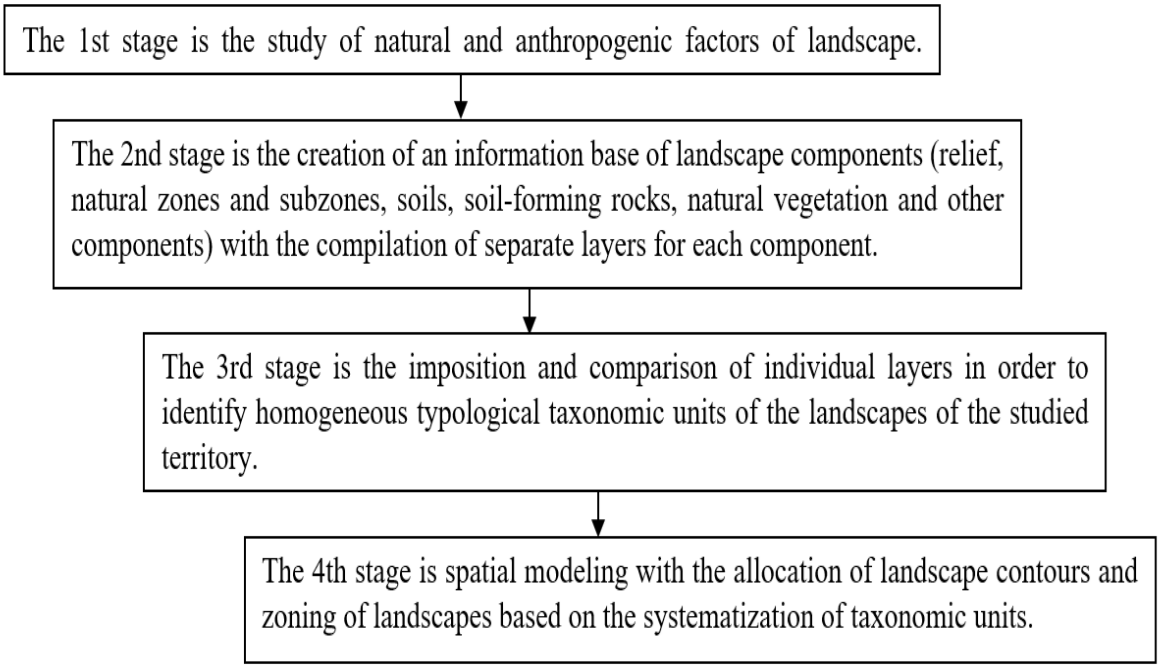

Fig. 2. *The algorithm of the method of classification of landscapes*

RESULTS AND DISCUSSION

The steppe zone of the Zhaiyk River basin is located in some part on the territory of the West Kazakhstan region. The territory lies deep in the Eurasian continent and is remote from the Atlantic Ocean and its seas with a distance of 2.5 thousand kilometers. The Arctic Ocean is also far away. This location influences the formation of a sharply continental climate with a ratio of heat and humidity, which has developed in the territory determines the features of soil cover, vegetation development and the formation of natural complexes.

The territory is not accompanied by bright, pronounced borders and runs along the Caspian lowland, along the Saratov and Samara regions of the Russian Federation along the Common Syrt, between the Aktobe region of Kazakhstan the administrative borders coincide with the western border of the Emben plateau, and between the Atyrau region of the Republic of Kazakhstan runs along that part of the Caspian lowland where the Ryn Sands (Naryn) were formed. A distinctive feature is the flat nature of its territory (Figure 3).

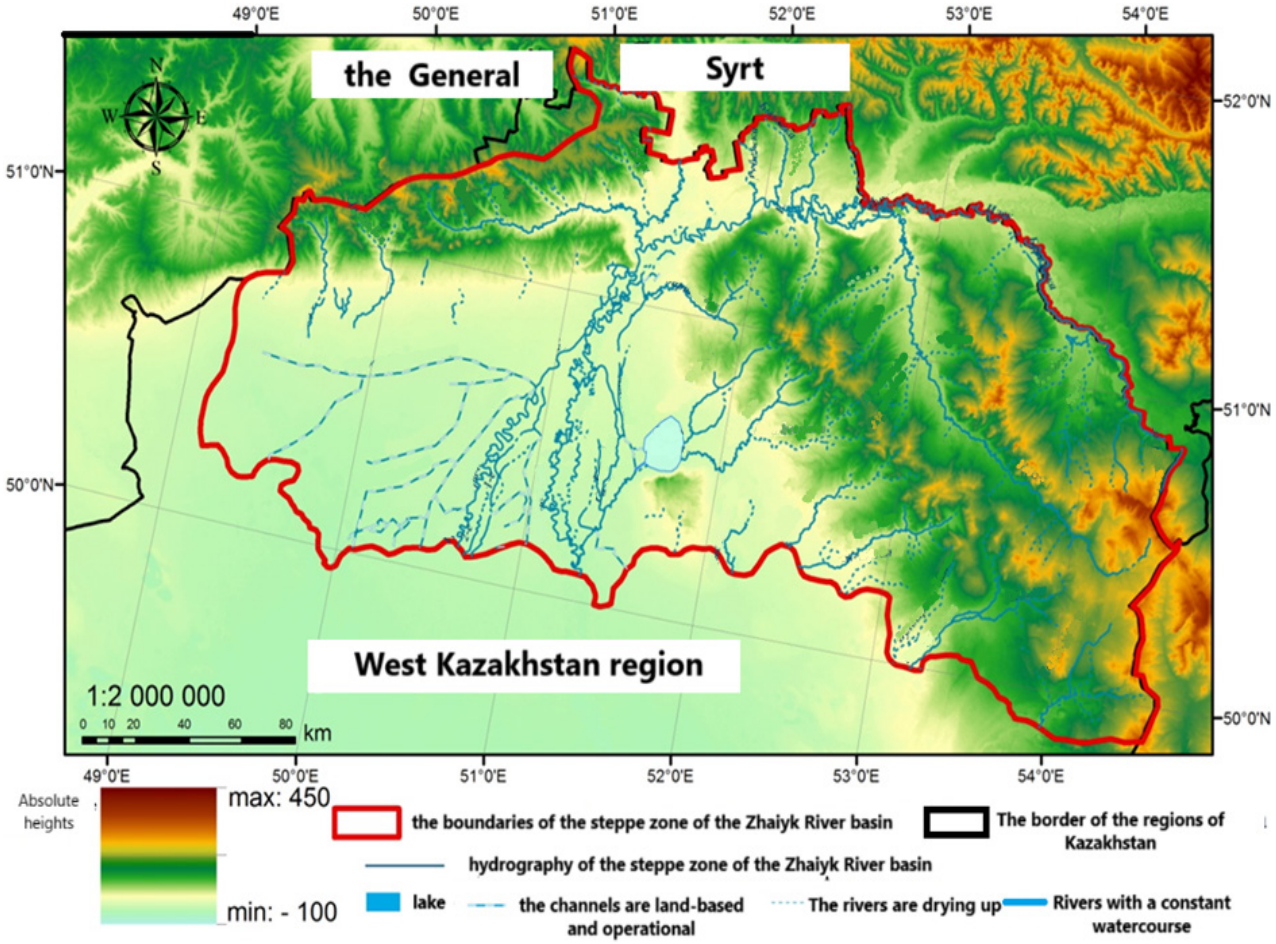

Fig. 3. *Physical and geographical map of the steppe zone of the Zhaiyk River basin*

The Zhaiyk River basin is located in the West Kazakhstan region, and is located in the deep part of the Eurasian continent. This territory is characterized by plains.

The general scheme of the created landscape map with the structure of the steppe zone of the Zhaiyk River basin included the implementation of certain actions.

The first action was to compile an electronic geological map of the genesis of sediments in the steppe zone of the Zhaiyk River basin. The map was made using the vectorization method of scanned geological and scanned geomorphological maps. Information on the genesis of sedimentation in the steppe zone of the Zhaiyk River basin was entered into the attribute data of the table (Figure 4).

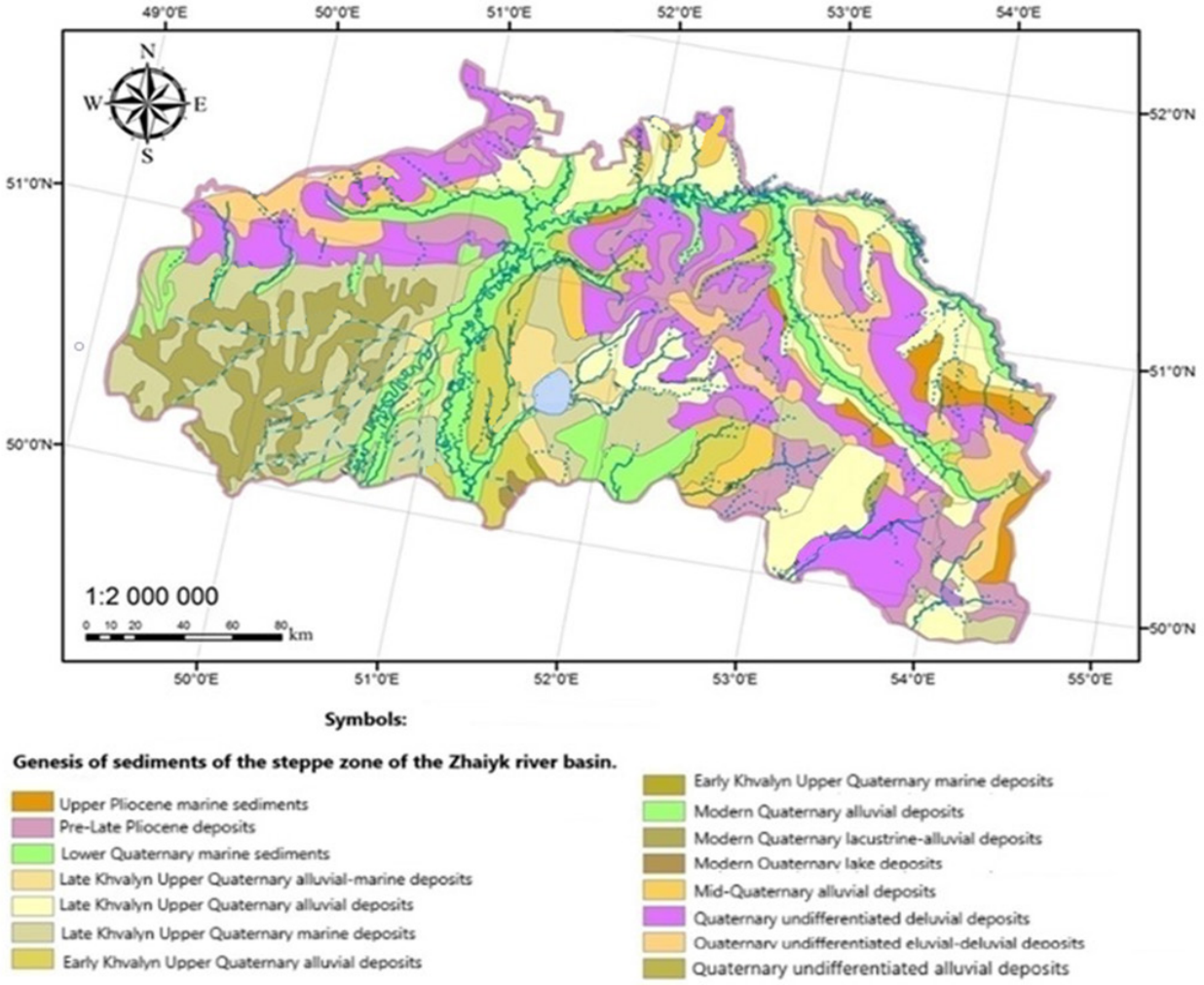

Fig. 4. *Map of quaternary sediments of the steppe zone of the Zhaiyk River basin*

As a second step, a map of the basin landscape-territorial structure of relief structures was compiled. Using a step-by-step determination algorithm in the ArcGIS software package in the branch of hydrology functions in the automated synthesis of maps of drainage areas of the river basin, which was described above in the subsection using and processing a digital elevation model, after processing the digital elevation model, we obtained the territory of the Zhaiyk River basin and the relief of the study area (Figure 5).

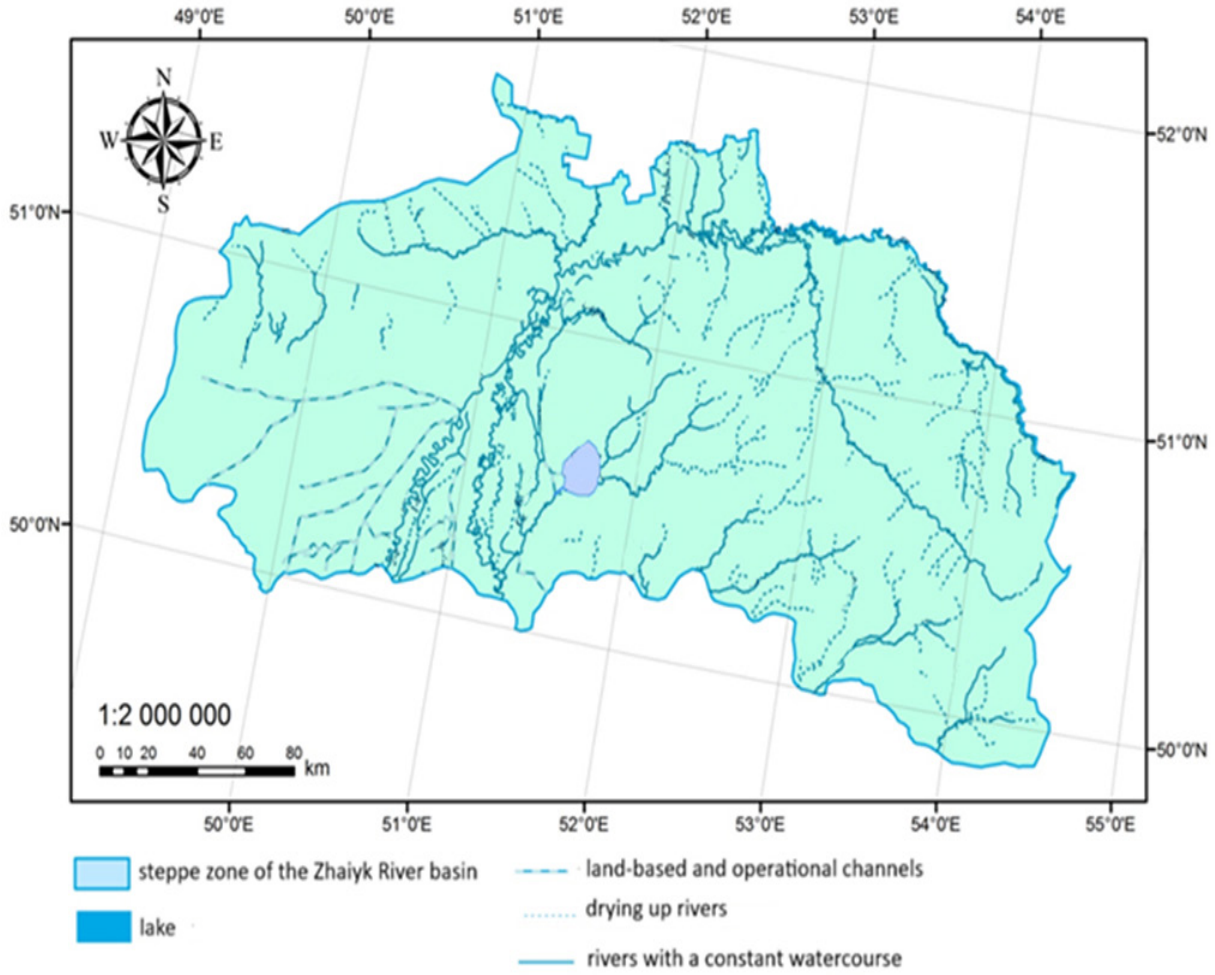

Fig. 5. *Map of the hydrographic network of the steppe zone of the Zhaiyk River basin*

The third step was to create a soil map of the steppe zone of the Zhaiyk River basin in digital form by vectorizing a scanned soil map within the West Kazakhstan region. Using the ArcCatalog program, a shapefile was created and the name of the shapefile of the «soil» of the steppe zone of the Zhaiyk River basin was set, then the type and coordinate system were set. When creating a digitized map, first, the shapefile was copied into the ArcGis program and using the Editor function, the soils of the steppe zone of the Zhaiyk River basin were digitized. Information on soil type, numbers from the digitized map, numbers of soil type, steppe zone of the Zhaiyk River basin were entered into the table of attribute data of the digitized soil map of the steppe zone of the Zhaiyk River basin to create a soil map legend (Figure 6).

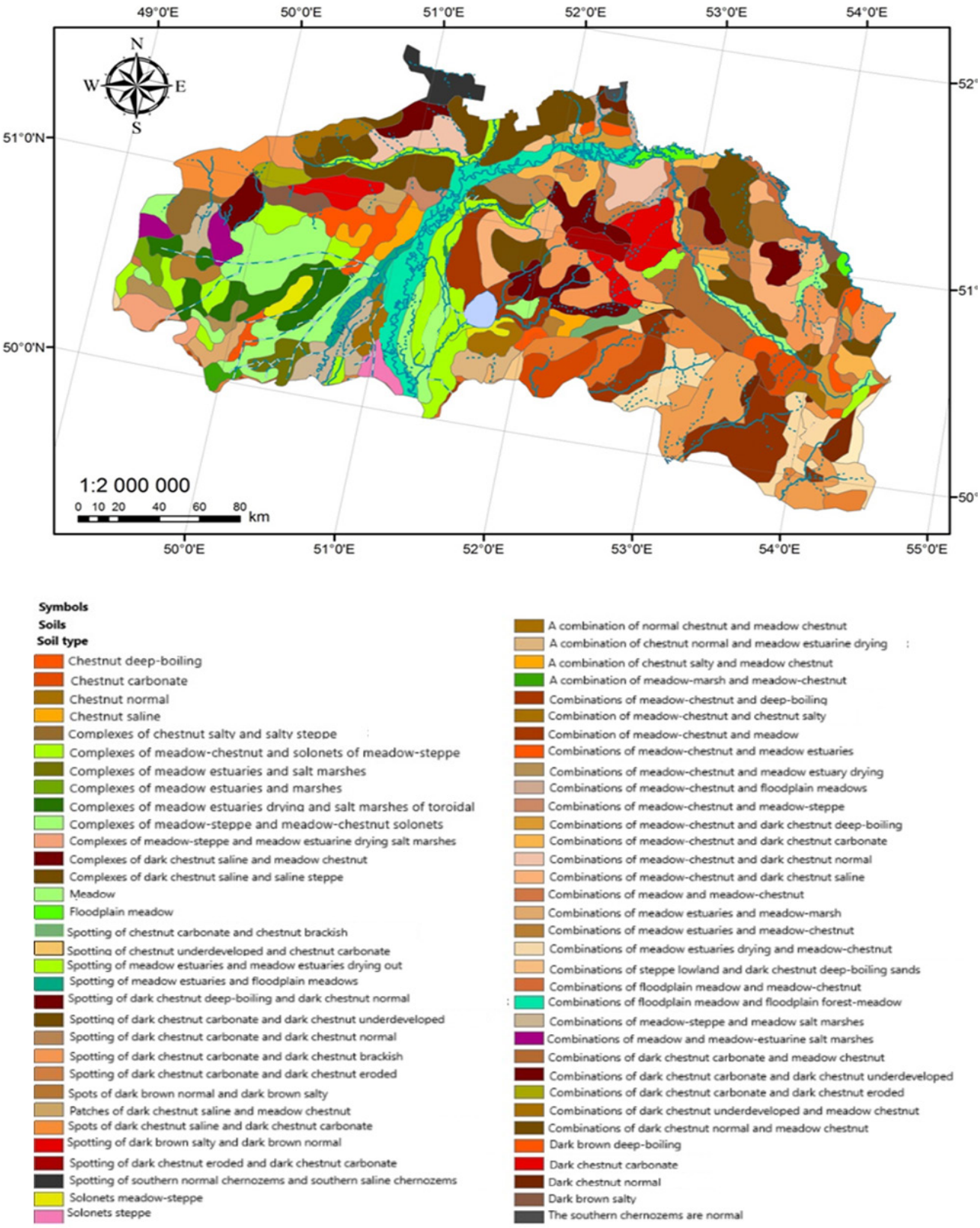

Fig. 6. *Soil map of the steppe zone of the Zhaiyk river basin*

In the same way, as in the third action, the fourth action was to compile a vegetation map based on an already existing paper map (the paper vegetation map of the West Kazakhstan region was made by scientists from the Department of Botany of the West Kazakhstan University named after M. Utemisov) in digital form by vectorizing the scanned plant map of the West Kazakhstan region (Figure 7).

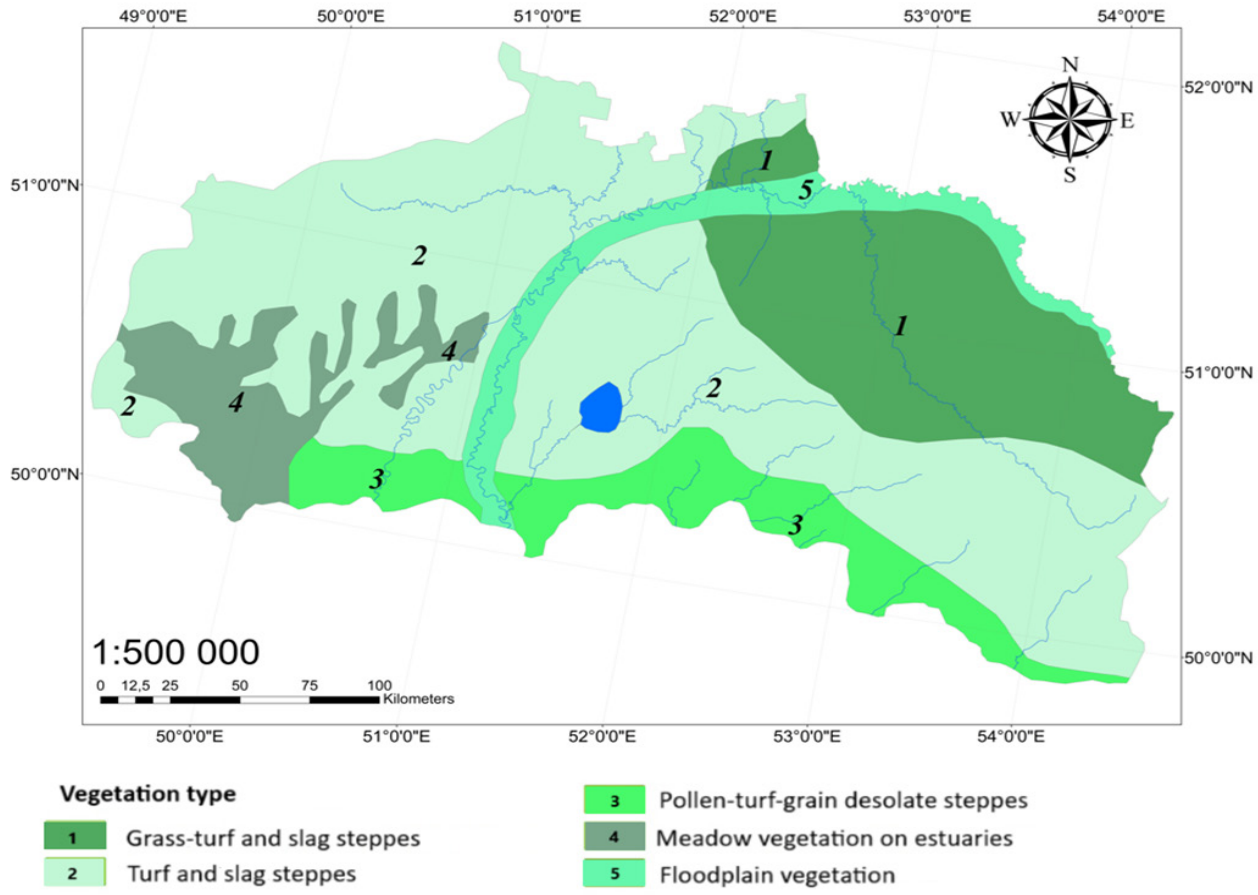

Fig. 7. *Plant resources of the steppe zone of the Zhaiyk River basin*

Then, using methods of analytical operations of the ArcGis overlay program, the structure of the landscapes of the steppe zone of the Zhaiyk River basin was determined, the already created polygonal classes of spatial objects (Quaternary deposits, relief, soils, vegetation) were subjected to an overlay using the Analysis Tools function of the Overlay branch of the Intersect tool with preservation of attribute data. Next, the "Merge" procedure (from the ArcToolbox Data Management Tools set) was performed for the resulting class to remove boundaries between objects with the same descriptions.

At the final stage of the action, the map was designed, unique numbers of landscape stripes and legends of the landscape map of the steppe zone of the Zhaiyk River basin were created.

When studying the steppe zone of the Zhaiyk River basin, 14 landscapes were identified: 12 plain landscapes and 2 valley landscapes. Plain landscapes were classified as steppe type, of which 5 are denudation plains and 7 are accumulative plains. Below is a map of landscapes with a legend of the steppe zone of the Zhaiyk River basin (Figure 8 and note to Figure 8).

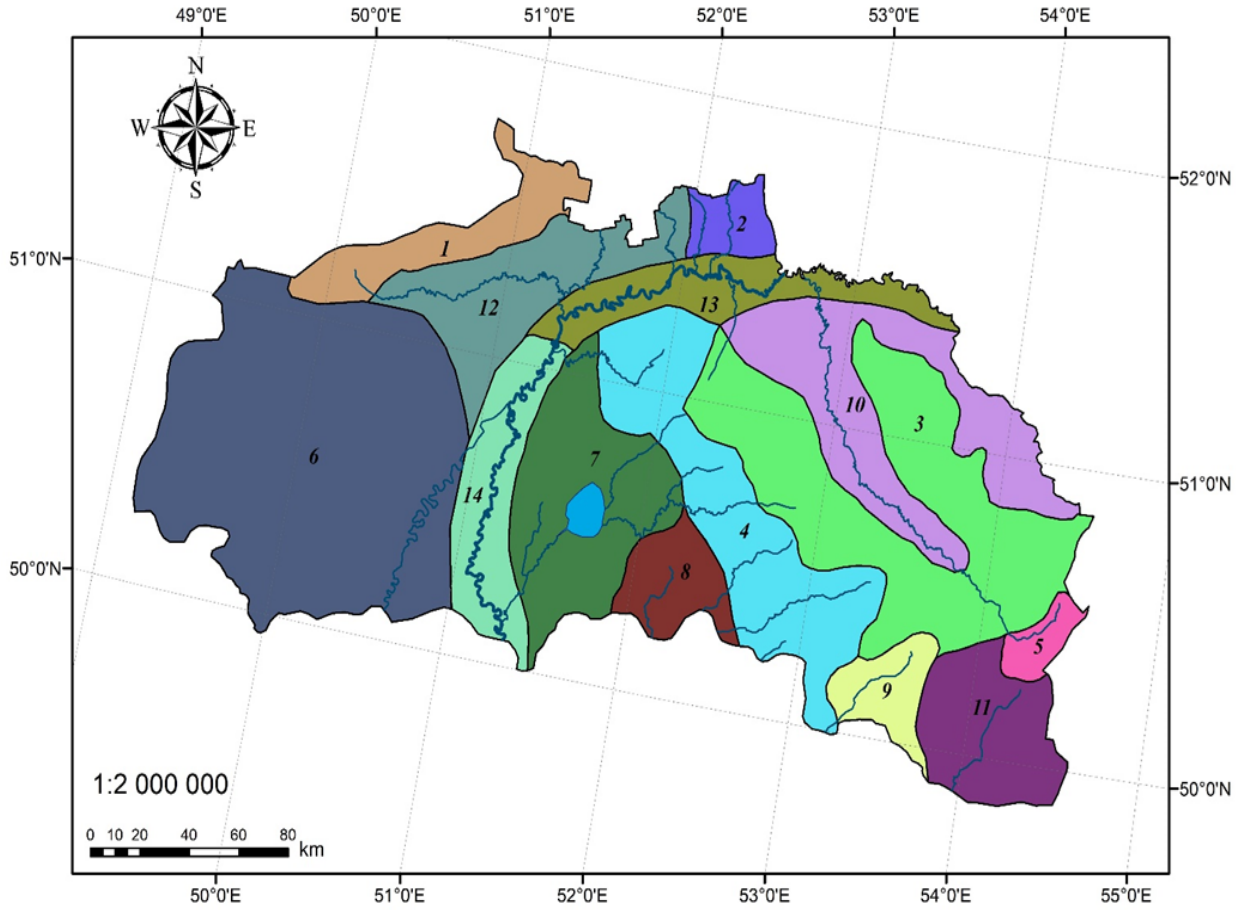

Fig. 8. *Landscape map of the steppe zone of the Zhaiyk river basin*

Note to Figure 8

Plain landscapes

Steppe

Denudation plains

1. Structural dissected plateau, composed of clays, loess, loam, sandy loam with fescue-feather grass vegetation on southern chernozems, in combination with wormwood-white wormwood vegetation on dark chestnut soil;

2. Stratified-basement gently undulating plain, composed of sands, clays, sandstones, limestones with forb-pinnate feather grass vegetation on southern solonetzic chernozems with solonetzes and meadow-bog soils;

3. Stratified, intensely dissected plain, composed of clays, loess-like loams with fescue-feather grass vegetation on dark chestnut normal soil;

4. Layered ridge plain composed of clays, loess-like loams with fescue-feather grass vegetation on chestnut soils;

5. Stratified, intensely dissected plain, composed of clays, sandstones, limestones with fescue and forb-erkek vegetation on chestnut normal and incompletely developed soils.

Accumulative plains

6. Marine plain, composed of clays, loams, sands with forb-grass-meadow and fescue vegetation on light chestnut and meadow soils;

7. Marine weakly dissected plain, composed of clays, loams, sandy loams with fescue-feather grass steppes on meadow-chestnut and meadow soil;

8. Sea hilly plain, composed of clays, loams, sands with cereal-dwarf wormwood vegetation on normal light chestnut and meadow-chestnut soils with solonetzes;

9. Alluvial hilly plain composed of sands, loams with forb-erek vegetation on meadow, chestnut meadow soils and sands;

10. Alluvial weakly dissected plain, composed of loams, sandy loams, sands with white wormwood-fescue and wheatgrass vegetation on chestnut meadow soils with solonetzes;

11. Alluvial-proluvial plain, composed of

loams, clays, sands with forb-herb vegetation on meadow-chestnut and light chestnut soils;

12. Deluvial-proluvial dissected plain, composed of gravelly loams, clays with fescue-feather grass vegetation on dark chestnut carbonate-solonetzic soil.

Valley landscapes

13. Floodplain composed of loams, sands, gravel and pebbles with forb-grass meadows and small-leaved forests on floodplain-meadow soils;

14. The floodplain is highly dissected, composed of loams, sandy loams, sands with trees, shrubs and wheatgrass and forbs on meadow-alluvial and meadow-bog soils.

The right bank part of the Zhaiyk River basin belongs to the Aralsorko-Uzensky district, and the left bank to the Kushumo-Uralsky district. Only the extreme southeastern part of the small area is included in the Uilsky district, Uilo-Embensky district. In the south, a small territory is occupied by the South Caspian region, which in turn is part of the Guryev province. The southern part belongs to the Ryn-Khakinsky district, the southwestern part of this district is included within the Khakinsky district, and the rest belongs to the Ryn-Sands district. The southern part of the left bank of the Zhaiyk River, in a small area, is occupied by the Dossor-Koschagyl district, which is part of the Ural-Embensky district.

The entire territory of the study object belongs to the class of flat landscapes, which in turn are divided into two subclasses: relatively lowered plains and elevated plains, the border between them runs along the 50-meter line.

The steppe zone of the Zhaiyk River basin, according to Isachenko's classification, is represented by a subboreal semiarid (steppe) zonal type of landscape.

The border with the subboreal semiarid (steppe) zonal type of landscape runs in the north along the southern spurs of General Syrt, in the northeast along the Podural plateau of the Ilek River valley, in the south approximately along the line of the villages of Borsy, Bogatyrevo, Taldykuduk, Chapaevo-Dzhambeyta-Egindikul.

Within the West Kazakhstan region, steppe landscapes are represented by two subtypes: the northern part is moderate-dry steppe, the southern part is dry-steppe.

The humidification coefficient is approximately 0,5. Solar radiation is 110...120 kcal/cm^2, the sum of daily temperatures is above 10 °C and amounts to 28 °C.

The landscape map of the steppe zone of the Zhaiyk river basin on a scale of 1: 2,000,000 shows the following types of landscape.

Subtype: Moderate-dry steppe.

Class: Flat

Subclass: Raised Plains

1. Type of landscape: A structural dissected plateau composed of clays, loess, loam, sandy loam.

This type of landscape occupies the northern part of the Zhaiyk River basin. The relief is represented by hills, gullies, hollows, ravines and valleys of small rivers. The soil and vegetation cover is represented by typical grass-grass phytocenoses on southern chernozems, in combination with wormwood-white-wormwood associations on the solonets srednestolbchaty. The syrtic uplands are composed of certain clays and are occupied by tipchak-kovyl communities on dark-shtan carbonate-saline soils. In the hollows, vegetation and soil cover are mainly represented by wheatgrass on meadow rejuvenated soil, and in ravines and gullies, due to additional moistening of surface waters, shrub-tree plantations grow on meadow and meadow-chernozem soil (Amelchenko et al., 2006; Chibilev, 2008).

2. Type of landscape: A stratum-basement gently undulating plain composed of sands, clays, sandstones, limestones.

It occupies the northeastern part of the right bank of the Zhaiyk River. The uvalisto-wavy, uvalisto-flat terrain has a noticeable slope to the south, towards the valley of the Zhaiyk River. The soil-forming rocks are represented by loams, sands and sandy loams, as well as sandy deposits. The soil and vegetation cover consist of mixed grass-pinnacular communities on the southern saline chernozems with saline and meadow-marsh soils.

Subtype: Dry Steppe

Class: Flat

Subclass: Landscapes of elevated plains

3. Type of landscape: A stratified intensively dissected plain composed of clays, loess-like loams.

The entire territory of the landscape occupies the Poduralsky plateau within the Utva-

watershed. The relief is represented by a steep-undulating plain with absolute heights of 110...260 meters, dissected by a system of fairly wide river valleys. Flat areas are characterized by microrelief depressions and elevations. Salt dome tectonics and erosion processes are well developed. Erosion processes complicated their slopes with ravines, gullies and river valleys, which dissected the resulting elevated stratified plain.

4. View of the landscape: A flat, rocky plain, composed of clays, loess-like loams.

The territory of the landscape is located within the Precourt ledge. The terrain is flat, poorly dissected. The valleys of small rivers are oriented almost strictly from north to south, the territory is divided into a number of watershed sections. It has a slight general slope to the southwest. The soil-forming rocks are heavy loamy deposits.

5. Landscape type: An intensely dissected stratified plain composed of clays, sandstones, and limestones.

The landscape is located in the far east, occupies a small area of the Poduralsky plateau. The relief is characterized by wavy and flat elevations of the salt dome type. The surface is dissected by the valleys of the sources of the Utva River. Soil-forming rocks: heavy loams, sandy alluvial deposits, as well as Cretaceous deposits. The soil and vegetation cover is dominated by typical and mixed-grass - coastal vegetation on chestnut normal and partially developed soils.

Class: Plain

Subclass: Relative to the lowered plains

6. Type of landscape: A sea plain composed of clays, loams, and sands.

It occupies the territory between the valley of the Zhaiyk River, the Chizhinsky-Durinsky and Balyktinsky floods, and in the north, it borders the southern slopes of the southern spur of the Common Syrt. The terrain of the territory is a relatively elevated accumulative marine loamy watershed plain, elevated by local tectonic movements. It has a slope to the south. Depressions of various shapes and origins are quite common here, such as padinas, estuaries, hollows, meso-micro-depressions, as well as micro-elevations in the form of gophers. The soil-forming rocks in the northern part are represented by medium-saline heavy loams of marine and ancient alluvial origin. In the south, they consist of medium-loamy layered sediments.

Subtype: Dry Steppe

Class: Flat

Subclass: Relative to the lowered plains

7. Type of landscape: A marine poorly divided plain composed of clays, loams, sandy loams.

The surface of the landscape has a flat appearance with slight slopes to the southwest. There is a large lake basin Shalkar on the territory, on the outskirts of which the salt dome concepts of Santas and Sasai rise. This territory receives an additional amount of surface and ground moisture coming here from the Podural plateau and the Pre-Salt ledge.

Class: Plain

Subclass: Relative to the lowered plains

8. Type of landscape: A marine hilly plain composed of clays, loams, and sands.

The landscape is located in the south in the Barguzin depression. In the northeast, it is bordered by the hills of the Pre-Syrtov ledge, and in the north by the Shalkar uplift. In the western part of the Zhaiyk River basin, the landscape approaches the lower reaches of the Olenty, Buldyrty and Kaldygaity rivers. In the southern part of the district there are many depressions and depressions on a flat plain. The northeastern part of the landscape has a slope to the southwest, this is reflected in the direction of the rivers that flow into the Caspian lowland from the Poduralsky plateau.

9. Type of landscape: Alluvial hilly plain, composed of sands, loams.

The territory of the landscape is met by islands, located in a narrow strip of the meridional direction. The landscape occupies sandy massifs in the southern part of the Pre-Syrtic ledge, as well as small sandy massifs of the lower reaches of the Kaldygaity River. There is a well-defined orientation from northeast to southwest in the relief. Here, various depressions alternate with elongated increases. Sandy massifs are represented by bumpy sands. The soil-forming rocks are represented by sandy loams and sands of alluvial origin. The groundwater lies at a depth of 2...5 meters.

Subtype: Dry Steppe

Class: Plain

Subclass: Relative to the lowered plains

10. Type of landscape: An alluvial poorly divided plain composed of loams, sandy loams, and sands.

The landscape is represented by narrow strips of valleys of the Utva and Ilek rivers. The relief is dominated by valley plains with low altitudes. The northern part is more elevated. In the Utva River valley, chalk deposits often come to the surface, and alluvial sediment cover is widely developed in river valleys. There are ravines and gullies that are occupied by various grass and shrub vegetation on meadow and chestnut-meadow soils.

11. Type of landscape: Alluvial-proluvial plain, composed of loams, clays, sands.

The territory is located in the south-east of the region and occupies the south-western slope of the Predsyrtovy ledge. The relief is dominated by river-like depressions with elongated elevations, as well as dunes and deep sandy basins, gullies. The soil-forming rocks are represented by sandy loams and sands of alluvial origin. Groundwater lies at a depth of 2...5 meters. The soil and vegetation cover is dominated by a mixed grass-erk vegetation on meadow chestnut and light chestnut soils.

12. Type of landscape: Devual-proluvial dissected plain, composed of gravelly loams, clays.

The landscape occupies the southern slope of the southern spur of the Common Syrt. The relief is flat and undulating, has a noticeable slope to the south and is rather densely dissected by hollows having a meridian direction. The territory of the landscape is crossed in the latitudinal direction by the valley of the Derkul River. The average absolute height is 50...70 meters. Soil-forming rocks are most often represented by clays and heavy loams. The soil and vegetation cover is mainly represented by typical grass-grass vegetation on dark chestnut saline and meadow-chestnut soils. The southern part of the landscape is plowed, and has dark chestnut, normal, combined with dark brown carbonate-brackish soil.

13. Type of landscape: Floodplains composed of loam, sand, gravel and pebbles.

This landscape of the floodplain of the Zhaiyk River occupies a segment from the mouth of the Ileka River to the Chalk Mountains located south of the city of Uralsk. Here the river valley coincides with the Caspian trough. The floodplain is from 12 to 20 kilometers wide and has a lake-like character. The height of the floodplain above the boundary is on average 6...7 meters, it is characterized by a flat-maned relief, against which a network of flowing lowlands, lakes and old trees develops. Soil-forming rocks: easily loamy, loamy and clayey alluvial deposits.

14. Type of landscape: The floodplain is strongly dissected, composed of loams, sandy loams, and sands.

This section of the river valley runs from the Chalk Mountains to the village of Antonovo. Here, the river valley is characterized by a wide floodplain (from 2...3 to 8...10 kilometers), bordered by narrow (1...3 kilometers) flat above-floodplain terraces that rise 8...11 meters above the inter-level. Sometimes the higher second and third terraces come close to the river.

Here, deep hollows alternate with high crescent-shaped manes, and a coarse-grained sandy relief is also widely developing. The soil-forming rocks are composed of young Lower Khvalyn sedimentary deposits of the Kushum paleodelt, rich in lime carbonate, chloride and sulfuric acid salts. In this regard, the salinity of floodplain soils is increasing here.

In conclusion, it can be said that the following key types of soils are found in the steppe zone of the Zhaiyk River basin:

Chernozem soils occupy about 30...35 % of the territory, mainly on the plains and in the lowlands, where water accumulates, providing high fertility. These soils support various types of vegetation, including meadow and steppe grasses.

Chestnut soils are common in 25...30 % of the territory, typical for slopes and slightly elevated areas. They have a good structure and provide good drainage.

Sod-podzolic soils occupy about 15...20 % of the territory, they are found in wetter areas close to reservoirs.

Brackish soils – about 10...15 % of the territory, are common in places with high salinity, especially in low-lying areas and in areas with difficult drainage.

Quantitative characteristics of the landscapes of the steppe zone of the Zhaiyk River basin indicate a significant variety of natural conditions that affect the distribution of soil types, vegetation and water resources. These data play a key role in environmental monitoring and planning for the sustainable use of land resources, agriculture and nature conservation in the region.

CONCLUSION

An important new understanding of the complex interaction between natural and anthropogenic forces came from studying the landscape features affecting the steppe zone of the Zhaiyk River basin in Western Kazakhstan. We have carefully studied and demonstrated several factors influencing the unique landscape architecture of this area using Geographic Information System (GIS) technologies.

The results show that although human activity is gradually changing the terrain, geological and climatic elements are needed to determine it. Comprehensive cartographic data combined with digital terrain models made it possible to fully understand the interaction and changes of various elements over time.

The discovery of fourteen separate landscapes of the steppe zone highlights the biological richness of this area.

Since geomorphologically the territory is part of the Caspian basin, with the features of the elevated plain and tectonic uplifts and depressions, which is expressed in the relief (for example, the Janybek-Urda uplift, the Ashiozek depression) and the territory is located deep in a temperate climatic zone with a continental climate, pronounced seasons and its characteristic warmth, low-snow winters and lack of precipitation. Thus, the landscape analysis used in this study allows us to give a modern description of the landscapes of the steppe zone of the Zhaiyk river basin and show the landscape features of the object of study.

It is necessary to implement sustainable management strategies that prioritize environmental integrity along with human development. This work highlights the need for continuous monitoring of terrain changes caused by human activity and serves as a fundamental tool for subsequent research.

An improved understanding of the landscape dynamics of the Zhaiyk River basin will help more successful conservation projects and promote harmonious coexistence between human activities and natural ecosystems.

This study highlights the need for landscape analysis to solve environmental problems and clarify complex relationships within ecosystems. Our ongoing research of the Zhaiyk River basin highpoints the need to preserve its unique landscape to ensure a sustainable future for its people and natural resources.

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БАТЫС ҚАЗАҚСТАН ОБЛЫСЫ ЖАЙЫҚ ӨЗЕНІ АЛАБЫНЫҢ ДАЛАЛЫҚ БЕЛДЕУІН ҚАЛЫПТАСТЫРАТЫН ЛАНДШАФТТЫҚ ФАКТОРЛАР

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Бұл мақалада Жайық өзенінің алабында ландшафттық және топырақтық кешендердің қалыптасуына әртүрлі табиғи факторлардың әсері қарастырылады. Зерттеу барысында талданған негізгі компоненттер — топырақ түрлері, рельеф және табиғи ландшафттар. Талдау нәтижелері аймақтағы топырақтардың каштанды, қара топырақты, дерново-подзолисті және сорлы топырақтардан тұратынын көрсетеді, олар өсімдіктердің түрлері мен ауылшаруашылық әлеуетін анықтайды. Топырақ кешендері рельеф, су режимі және климаттық жағдайлардың әсерінен айтарлықтай қалыптасады. Спутниктік суреттер мен сандық рельеф модельдерін пайдаланып алынған картографиялық деректер негізінде топырақтардың таралуы мен олардың өсімдіктер типтері, су айдындары және басқа табиғи ерекшеліктермен байланысы бағаланды. Зерттеу нәтижелері топырақ түрлерінің таралуындағы маңызды заңдылықтарды анықтап, олардың аймақтың экожүйелеріндегі рөлін бағалайды, бұл Жайық өзенінің алабындағы жер ресурстарын басқару, ауылшаруашылық қызметі және қоршаған ортаны қорғау үшін практикалық ақпарат береді. Рельеф, өз кезегінде, су алмасуына және эрозия процестеріне әсер етеді, бұл топырақтардың түрлері мен олардың таралуына айтарлықтай ықпал етеді. Топырақтар, рельеф пен өсімдіктер арасындағы байланыстарды анықтауға ерекше назар аударылған, сондай-ақ осы факторлардың тұрақты экожүйелердің қалыптасуындағы рөлі қарастырылған. Алынған нәтижелер топографиялық және топырақтық ерекшеліктердің күрделі өзара әрекеттесуінің ландшафттық аймақтардың таралуына әсер ететінін және бұл ауылшаруашылық қызметін жоспарлау мен табиғатты қорғауда маңызды рөл атқаратынын растады.

Түйін сөздер: дала зонасы, ландшафт, ландшафт картасы, Батыс Қазақстан облысы, антропогендік факторлар, табиғи факторлар, дала ландшафттары.

ЛАНДШАФТНЫЕ ФАКТОРЫ, ФОРМИРУЮЩИЕ СТЕПНУЮ ЗОНУ БАССЕЙНА РЕКИ ЖАЙЫК ЗАПАДНО-КАЗАХСТАНСКОЙ ОБЛАСТИ

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В данной статье рассматривается влияние различных природных факторов на формирование ландшафтных и почвенных комплексов в бассейне реки Жайык. Ключевыми компонентами, рассмотренными в исследовании, являются типы почв, рельеф и природные ландшафты. Анализ показывает, что почвы региона варьируются от каштановых и черноземных до дерново-подзолистых и солонцовых, которые определяют характеристики растительности и сельскохозяйственный потенциал. Почвенные комплексы в значительной степени формируются под влиянием рельефа, водного режима и климатических условий. На основе картографических данных, полученных с помощью спутниковых снимков и цифровых моделей рельефа, был проведен анализ для оценки распределения почв и их взаимосвязи с типами растительности, водоемами и другими природными особенностями. Результаты исследования выявляют важные закономерности в распределении типов почв и оценивают их роль в экосистемах региона, предоставляя практическую

информацию для управления земельными ресурсами, ведения сельского хозяйства и охраны окружающей среды в бассейне реки Жайык. Рельеф, в свою очередь, влияет на водообмен и процессы эрозии, которые существенно влияют на типы почв и их распределение. Особое внимание уделяется выявлению взаимосвязей между почвами, рельефом и растительностью, а также роли этих факторов в формировании устойчивых экосистем. Полученные результаты подтверждают, что сложное взаимодействие топографических и почвенных особенностей влияет на распределение ландшафтных зон, что имеет решающее значение для планирования сельскохозяйственной деятельности и охраны природы.

Ключевые слова: степная зона, ландшафт, ландшафтная карта, Западно-Казахстанская область, антропогенные факторы, природные факторы, степные ландшафты.

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