

Environmental situation along the Amudarya River

Mahmud Orziyev^{1,*}, Jamshid Kucharov², and Faxriddin Egamberdiyev^{2,3}

¹Bukhara State University, Bukhara, Uzbekistan

²Karshi State University, Karshi, Uzbekistan

³Bukhara State Pedagogical Institute, Bukhara City, Piridastgir, 2, 200100, Uzbekistan

Abstract. In the article, information on the use of Amudarya waters, the use of the nature along the Amudarya (thickets along the river and their animals), the ecology of the areas crossed by the Amudarya, the prevention of erosion of the river banks, and the transportation of modern boats are analyzed through sources. Keywords: Coastal erosion, soil erosion, thicket, forest, ecology, waterway, stream, "Turkistan Collection", navigable rivers, yellow soil, dead soil, cropping

1 Introduction

The early efforts of the Russian Empire aimed at the conquest of the Turkestan territory began to be carried out as early as the beginning of the 18th century, at the initiative of Peter the Great. After the formation of the Turkestan governorate-general by the Russian Empire, was on the initiative of the first governor-general K.P. Von Kaufman, the "Turkestan collection" was being collected. The pages of this collection covered socio-economic, political and cultural processes in the Turkestan region. It can also be seen that many issues such as Turkestan rivers, water bodies and their study by Russian administrators, the structure, activities of flotillas, the colonization of the land, its importance in economic and political relations, are cited in the "Turkestan collection".

2 Materials and Methods

In the content coverage of the topic, the materials of the "Turkestan collection" were widely used, which were important in the study of the social, economic, political and cultural progress of the Turkestan governorate general between 1867 and 1917. Methods such as comparative analysis, principles of chronological consistency, objectivity, historicism, systematic approach have also been used from a methodological point of view [1].

* Corresponding author: m.z.orziyev@buxdu.uz

3 Results and Discussion

The study of inner waterways in the Turkestan region was initiated by the Russia as early as the beginning of the 18th century, when the Turkestan movement began to establish economic-political relations with the waterways of the Turkestan region and with the countries of the East through them. In the “Turkestan collection” (“Turkestansky sbornik”), a lot of information can be found in this feature. The study of the country’s waterways began as early as the time of Peter I, in an order of February 14, 1716 to Prince Bekovich Cherkassky, the head of the military expedition being sent to Khiva; “let Khan of Khiva to be asked for ships, merchants be transferred to them, and let the roads to India through the Amudarya be studied, Let the paths of water and dryness be explored. Basically let the waterway be learned to go through Amudarya or another river”, and it can be concluded that the main focus is on cheap and qula waterways running through Central Asia to India. The search for waterways to go to India through Central Asia after the death of Peter the Great remained one of the strategic goals of the Empire, although the quest for the new routes remained in practice for more than a hundred years, which became one of the strategical aims of the development of trade with Russia.

The introduction of the waterways were one of the main phases of the acquaintance of the Russian empire into Turkistan in the 19th century. With the construction of the Raim fortification and a number of other forts by Russia, the Aral Sea, Syrdarya and Amudarya, efforts on whether or not they were suitable for shipping were in full swing. In 1848-1849, the first scientific expeditions (military-strategic) began to be externalized. In the same year, an initial expedition was organized to explore the island and the lower part of the Amudarya from the fortress of Fort No. 1 (later called Kazalinsk), which the Russians built. The expedition was accompanied by a phlegel-adjutant G.I. Butakov was in command and the expedition investigated the area of Amudarya from the island sea to the Qung’irat. Also, deltas of Amudarya such as Laudan, Quvonch-Jarma, Karabayli, Ulukun River, Toldiq River have been explored. G.I. Butakov also studied the downstream parts of Amudarya in 1848, 1849, 1858, clarifying the problems of flow rate, permeability, width and depth in the plains of its Delta. However, it was not enough of this information that it was only after the Khiva Khanate was made protectorate to the Russian empire that it was possible to study Amudarya hydrographically in full. While this was the case, research on Amudarya and his suitability for sailing continued almost without interruption. Volume 60 of the “Turkestan collection” in 1858 contains A. F. Mojayskiy checked the distance of 801 wyorst from the part of Amudaryo near Chorjuy to the Qungirat. Of the distance examined, 554 vorst rode on the Hiva boat, 247 vorstini on foot, concluding that Amudario was suitable for navigation. It was also noted that one can see the opinions on Amudaryo’s suitability for navigation whether the were also identified in their research was achieved by Butakov and the English spy A. Burnes [2].

The study of Syrdarya hydrographically, also began to be carried out in 1847 with the beginning of the construction of military fortifications by the Russian Empire in its lower reaches. In this regard, the strategic importance of the river increased, and its study and use for military purposes became the first task. As early as 1847, poruchik Mertvago, who conducted research on a schooner known as “Nicolai”, photographed the two worst distances of Sirdarya’s casting on the island between dikes. Or, in 1848, in the schooner “Nikolai”, the northern coast of the island and the right coast of the Syrdarya were studied from Mazali to Oylbash, in the same year lieutenant Butakov and fleet shturmani praporshik Pospelov studied the island sea. Information about the fact that one of its participants, Lieutenant Colonel Maksheev published the results of this expedition as a separate book, is quoted in the “Turkestan collection”. In addition in the data of this author the topographic study of the Aral Sea by Butakov and Pospelov in 1849-1850, In 1851,

however, it was investigated by topographer Ribin for ancient fortresses in the lower reaches of Syrdarya, and in 1852 Colonel Blaramberg surveyed Syrdarya from its stream Qorauzak to the former Aq-Machite (later Perovsky fort), and in 1853 the steamer “Perovsky”, which had been prepared and brought to the island in one of the factories in the Swesian State, was investigated by Captain-Lieutenant Butakov, and in 1854-1855 the fact that the lower part of the Syrdarya was fully studied, a number of astronomic points were studied, the fact that the river freezes around four months, the observation in between the years 1848-1853 of the glaciation can be considered that the results were brought. We can find the information including: Syrdarya “froze on 26 November 1848, thawed on 29 March 1849, froze again on 21 November that year, thawed again on 10 March 1850, froze on 20 November 1850, thawed on 21 March 1851, froze on 15 November that year, thawed on 25 March 1852, froze on 20 November, and thawed on 22 March 1853, when these lines were written” particulars can be found. In the 70s of the 19th century, a decisive interest in waterways grew. Because, economically, the easy transport of Russian industrial goods to Central Asia was the first priority task, while the established Aral flotilla was considered the second task to be a reliable means of communication between Russian military outposts in the lower reaches of Syrdarya. The flotilla was also instrumental in the development of Central Asia. It serves to justify our opinion that the participation of the island flotilla was important at the time of the military expeditions in the Khanate of Khiva in 1873. The flotilla's steamers including “Samarkand” (70 horse power) and “Perovsky” (40 horse power), as well as its composition of three barges, fought in the White fortress under the Khanate of Khiva and went towards the Ulukun river. However, the khivans stopped in 1858 by colonel (later count) N.P. Ignatev's attempt to reach Khiva by ships in the river was to build a dam and made it difficult for steamers to navigate. The flotilla was forced to go as far as the Qushkhonakul area and turn back [3].

Although the Aral flotilla did not achieve the expected goal during the military campaign to Khiva in 1873, the investigation and geographical study of the Amudarya, which was considered an important waterway of Central Asia, paved a wide way for the further movement and navigation of the state and private ships in this coveted sea. Adjutant General K.P. von Kaufman, after the Khiva campaign, with the rulers of Bukhara and Khiva, ships owned by the state or private individuals belonging to the Russia should sail freely in the Amudarya, the Russian merchants would build their wharves and warehouses on the lands and rivers they wanted, Russian merchants would open their agencies in the cities of Khiva and Bukhara, and their security would be ensured by these rulers. signed an agreement regarding the need to be in charge, opening a wide way for studying and developing the Amudarya. This meant that Russian industrial products could travel by cheap waterway as far as Afghanistan, creating serious competition for English goods. The Russian transformation of the Amudary into its inland body of water, in contrast to the interests of England, was also reflected in the study of the Russian-English raqaboti waterways on the issue of Central Asia. While in English in his brochure named as “Amudarya and Indus”, who saw the face of publication in London in 1869, major Bell's views on the Russian occupation of the waters of Central Asia and the consequent decline in the influence of British in Afghanistan caused widespread discussion in the Russian press as early as 1870, in turn, at a meeting of the Royal Geographical Society in London on March 11, 1869, by Admiral Butakov. In a word, there had been a debate regarding the economic inefficiency of the use of the Amudarya and Syrdarya rivers for military purposes and for navigation of the steamship traffic. The movement of steamships along the Amu Darya and Syr Darya, the destruction of coastal thickets and shrubby vegetation growing on them, in short, no one noticed the deterioration of the ecological situation.

Since the 70s of the 19th century, The importance of the Amudarya has grown. In 1874, an expedition was organized under the command of Colonel Stoletov, and the steamer

“Perovsky” was transferred to the disposal of the expedition in the command of the captain of the 2nd Regiment Bryukhov. With great difficulty, they came through the new water tributary of the Amudarya to Dovqara Lake, The Quvonch-Jarma tributary to Amudarya, and all the way to Petro-Alexandrovsk. The shturman Filippov could prove that the fleet was able to cross the Ulukun river and Eshon tributary to Amudarya, and prevented the expected environmental damage. An attempt to clear the riverbed of reeds and algae had a negative impact on the flora and fauna of this part of the river. By this route, in 1879, the steamer “Samarkand” was able to leave the Aral Sea for Petro-Alexandrovsk. As a result, it was found that the lower reaches of the Syrdarya through Amudarya and the Aral Sea, access to stations by waterway has been shown to be of high economic importance. There were also groups against the establishment of flotilla activities in the Amudarya in the Russian upper offices. The high offices of the Russian Empire also had anti-shipping groups, which concluded that they were economically and technically inefficient, and in Amudarya. Even after the formation of a flotilla for military purposes by the state, materials reflecting dissatisfaction with its too high cost for the treasury can be found in the “Turkestan collection”. A well-known Hungarian scientist H. Vambéry In connection with the fact that first published the opinion that Amudary was not suitable for sailing in the leading press bodies of Europe, Vambéry's opinions were sharply criticized in the Russian press. In particular, Vamberi's comments about the fact that steamers sit on the sandbank as a result of Amudarya's frequent changes in the ores and shores were expressed by the Russian press: “Mr. Vamberi cannot see the successes of Russia in Central Asia”- citing trivial opinions expressed by the Burnes data, a who visited to Bukhara in the 30s of the 19th century, that 150 ships sailed between Urgench and Chorjuy, are in the upper reaches of the river with suitable wooden forests for building ships, while Amudário cited his views that it is more navigable than Don, Dnieper, Volga. However, the emphasis of the time was not on the fact that timber forests would only grow a few tens of metres wide on the river banks, cutting them off and using them as coal would cause future riverbank erosion [3].

The study of the middle and upper reaches of the Amudarya and the examination of its suitability for shipping were also carried out from 1876-1877. In August 1876, the steamer “Samarkand” sailed from Petro-Alexandrovsk for a distance of 230 vyorst. Lacking fuel, it was pushed back on 27 August. In 1877, the steamer “Samarkand” sailed from Petro-Alexandrovsk to Chorzhuy under the command of Captain-Lieutenant Bryukhov. Sailing times were from 22 March to 7 April. This time, fuel reserves were created and prepared in some riverside settlements during the expedition. The reverse took place between 9 and 18 April. With this, it has been proven that in the middle reaches of the Amudary, steamers can swim. The suitability of the distance from Chorjoy, where the upper course of the river was calculated, to Khoja Solor, to be able to sail steamers was determined by Captain-Lieutenant Bryukhov's 1879 test sails again with the steamer “Samarkand” from 23 August to 8 September and the time to turn back from 9 to 18 August. During the period 1876-1877, the expeditions devoted to the study of Amudarya were looking for answers to a number of questions, such as the nature of the river itself and the water level, what volumes of steamers are needed. The article published by Colonel of the military staff Belyavsky gives some conclusions of this research. In particular, continuous observations and conclusions of Captain-Lieutenant Zubov were given, that the rapid flow of water in the navigable part of the Panj River up to Khoja Solor does not cause much difficulty to steamers, the narrow land of the river is convenient for steamboats, the river bed consists mainly of sandy loams, and the stony bed has deeper parts, the process of shallowing of water usually begins in September, the right bank is mainly suitable for building wharves, It was determined that two types of steamers should be built for sailing on the Amudarya, that steamers should draft 2.25 feet when fully loaded on the distance from Petro-Alexandrovsk to Arol, and that steamers sailing upstream from Petro-Alexandrovsk should have a fairway

(water limit) of up to 3.5 feet. it is possible to read opinions about the fact that it was determined as a result of expeditions. And such inspections were carried out after the formation of saksovol reserves on the designated lands of the river, mainly in desert, remote places from settlements. This also had a negative impact on the ecological situation [2].

In investigating the suitability of the middle and upper reaches of the amudaryo for river navigation, the 1879 survey was central. The head of the Amudarya department was A.A. Grotengelm personally led the task, and the expedition was also hired by the Khanate of Khiva boatmen, who knew the lower reaches of the Amudarya river well. This circumstance ensured that the authorities could sail its military steamers as freely as possible on the river. The average speed of steamers on the river was fourteen vorsts, the reason for their so slow movement was due to the need to perfectly compile a hydrographic map of the Amudary. It can be said that up to this time, the records and maps of the researchers of Amudaryo have been found to contain a number of shortcomings and even, errors. In particular, on August 15, the above-mentioned expedition came to the camp called Korovultepa. The river passing was not listed on the cards published in 1878, but, however, is referred to by a different name on the Turkestan Military District cards of 1877. Also, as a result of this expedition, it was also determined how far the range of river passing and important population settlements in the middle and upper reaches of the Amudarya are from Petro-Alexandrovsk. This made it possible to clarify where to collect fuel reserves.

Table 1. Movement schedule of the Amudarya flotilla

Destination point	Distance in versts	Time consumed (day)	Distance between the destination point	average distance/speed per day
Qabaqli	294	16		14
Chorjuj	424	25	130	15
Burdalyq	505	31	81	13
Karki	591	37	86	14
Kelif	692	41	101	25
Termez	795	46	103	20
Up to lower reaches of Kofarnihon river	885	51	90	18
Up to Vakht village in the Panj	920	54	35	11
Up to Qorovultepa river passing	962	59	42	8
Up to the navigable part of the Panj	992	63	30	5
Up to Aq saray village	999	66	7	2

The reason why the steamer moved so slowly was given as the reason for the lack of a suitable steamer for the study and analysis of hydrographic data in different parts of the river, as mentioned above. This expedition proved that it is possible to engage in steamboating on the Amudarya, and came to the conclusions that steamboats can sail 70 or more versts in a day, that it is necessary to divide the river into several sections depending on the depth, width and flow rate, and that it is necessary to hire pilots from fishermen and boatmen of Bukhara and Khiva for these sections. These conclusions were made by expedition member prepared by N.N.Zubov, his thoughts on his participation in this expedition from June 10 to October 4, 1879 were not fully written down. The main reason for this is that the occupying officers were killed by the Turkmen during the Russian military campaign to occupy the Akhal-Teke valley. His researches on the hydrographic study of the Amudarya River, which were not fully written down, the hydrographic maps

he made, some opinions and comments by his associates were given in various articles and memoirs in different parts of the collection. However, most of them are listed in Volume 402 of the “Turkestan Collection”. They also cite Amudarya reeds and algae, factors that cause coastal erosion, and considerations regarding their prevention [1].

During the expedition organized by the head of the Amudarya department Grotengelm, the steamer stopped due to a lack of saxophones at the Qabaqli river passing, which is considered the border of the Bukhara emirate. The steamboat was powered by saxaul – halóxylon wood firewood, because coal deposits had not yet been discovered in the country. The intensified cutting of the saxaul's outbursts, however, caused erosion, caused sandslides, and made it difficult to navigate the river. There is a 500- men garrison of 500 Russia in Qabaqli, and the local governor Abdulkarimbek wants to see the steamer under the pretext of bringing a saxaul – halóxylon. But, while the wood gathered on the first and second of April enabled them to set out on the third of April, the journey was delayed a day when the emir's son, Said Nuriddin Tura, informed him that he wanted to see the steamer. The Prince of Bukhara watched the steamer and gave horses and spears to the officers, and gifts of 20 kopecks to the common soldiers. Gratified by this act of kindness, Grotengelm presented Prince Said Nuriddin Tura with his berdanka rifle. Then the sailing was continued, and this expedition entered Petro-Alexandrovka with great success. Because the commander of the steamer Bryukhov finished photographing the Amudarya valley, the staff-captain Bykov finished photographing the banks of the river, in addition, Lyakhnitsky, who collected valuable information about the flora and fauna of the Amudarya, the translator Khokhryakov studied the roads from Qabaqli to Chorjuy, Marv. So, the expedition came to the conclusion that Amudarya was suitable for steamship navigation. Thus, the expedition collected valuable information about the nature, ecological condition of the forests on the banks of the Amudarya and the River, which came to the conclusion that Amudarya is suitable for steamboat navigation.

Attempts to establish a steamship in audario began in the 70s of the 19th century, and the main expeditions were organized after 1873. The main expeditions were carried out on the ships of the Aral flotilla in 1874 under the leadership of Baron Kaulbars and in 1876 under the leadership of Poruchik Shabashev after the failure of the military campaign in 1873. Starting from 1876, the Amudarya department has been engaged with the fulfillment of these tasks. In 1878-1879, the Amudarya was fully studied hydrographically and hydrometrically as a result of the expeditions organized by the Amudarya department to check the suitability of the Amudarya for steamboat navigation. As a result, the Amudarya was found to be convenient for steamships to sail, and facts were collected that would serve as a basis for the establishment of a flotilla. The theoretical-scientific, economic and military-technical foundations of the creation of the Amudarya flotilla have been formed.

The economic basis for the organization of a flotilla in the amudarya was repeatedly studied, as well as efforts to explore the possibility of connecting through the Amudarya to Orenburg, Caspian and from it to the Volga river with the central regions of Russia. An attempt to connect the Turkestan territory with the central industrial districts of Russia by water began as early as the 1850-60s, when the processes of the conquest of Central Asia began. In the “Turkestan collection”, there is a raccount of count Voynovich who spoke to a Turkmen named Hasanquly and said that Amudarya’s discovery of the old riverbed is mentioned in the article named “O starom rusle Amu-dari” (“The riverbed of Amudaryo”), while in 1869 the Russian trade and industrial society proposed to return Amudaryo to the old riverbed, as a consequence of which a large part of the Khiva Khanate would be desert, but thoughts that if they move to New Lands, and new lands can be tendered and created gardens, and Russians would have a cheap waterway, can be read in the article named “O povorote Reki Amudari po staromu ruslu” (“On returning the Amudary to the riverbed”). From the same period, proposals for turning Amudarya into Caspian and opening a cheap

waterway in different directions began to spread widely in the Russian press. In one article, which does not mention the name and author of the article in the “Turkestan collection”, we can meet the opinion that the Aral Sea was 117 feet above the Caspian Sea, 33 feet above the Black Sea, that in the when the spring water overflows through the old riverbed it was stopped by the Uzbeks from flowing by strengthening its banks (it was actually misinformation), if Amudarya begins to flow through the riverbed, a cheap navigational route would be opened linking the Central Asia with the Caspian Sea, Volga nad Baltic Sea regions. Passionate and scientifically baseless and unsupported thoughts like this can be cited many more. This article does not reveal the extent to which the diversion of Amudarya riverbed would lead to a large-scale environmental disaster.

We can find out from many articles on this issue in the “Turkestan collection” that turning Amudarya through the old riverbed to the Caspian was one of the important topics of the press of the Russia of that time. Even, the entire roof of the collection is filled with information on this property. Since we are limited in our ability to cite detailed information from all of them, we considered it necessary to list some of the main goal tasks, citing them as an example. In particular, we can mention the articles of V.Lakhtin “Reka Amu I yeyo drevneye soyedineniye s Kaspiyskim morem” (“Amudarya and his connection with the Caspian Sea in ancient times“), with the heading Proriv Amudari” (“The rupture of the Amudarya”) related to the activities of the Sariqamish Uzbay expedition (pages 58-62), in the article named “Tiflis”, that engineer Gelman’s on the issue of the turning of Amudarya while coming back from his trip to Khiva in the pp. 66-71), “Noviy Projekt soyedinenie Arala s Kaspiem” (new project on linking amudarya to Caspian) (pp. 79-80, Examples include” O povorote techeniya Amu-dari K Kaspiyskomu moryu” (about diverting the amudarya flow into the Caspian Sea) (pp. 81-82), “Uspeshnoye nachalo rabot po napravleniyu Amudari V staroye ruslo” (The successful beginning of returning of the Amudarya to the old riverbed), etc. in the volume 247, pages 1-48 of the Turkestan collection. In this volume 247 article titled “Povorot Amudari” (“Turning the Amudarya”), the 1879 expedition suggested that the steamer “Samarkand” would sail as far as Khoja Solor, and that the average flow of Amudarya was 160 cubic sajen per year, and that it was enough it to irrigate to 1/8 of the Khiva Khanate, by turning the rest part of it into Caspian, thoughts on creating a navigable riverbed. Only some of these articles present ideas related to the migration of the inhabitants of the Amudarya region to the vicinity of new Ozan. However, there were simply one theories that were not considered a complete solution to this environmental catastrophe and its economic and social problems.

The increase in opinion in the press of the Russia in the case of turning Amudarya into a Caspian was the subject of debate both outside Russia and abroad. On volume 247 of the collection, the German National-Zaitung Press body published an article by the German scientist Coopert, and the opinions on it were analyzed, the scientist's attempts to dig a canal through Sarikamish, Uzbay were not adequately analyzed, Peter I dreamed of going from Russia to Central Asia by water, his opinion that if the canal is dug, one of the richest countries in the world will face a big financial problem, was sharply criticized by the Russian press outlet “Kavkaz”. Although a flotilla was established at amudaryo, in the early period local boats were able to compete with Russian steamers. Opinions about the fact that local residents were skilled swimmers began to appear in documents on the history of Russia in the 40-50s of the 19th century. Among them, Lieutenant Colonel Masheyev’s records in 1856 mentions the following: “the excellent buoyancy of Kazakhs (Kyrgyz in the text) on the Sidarya, their excellent weaving of rafts from reeds, as well as the free movement of their flat boats among reeds that Russian steamers cannot vavigate, many of them being prepared in Khiva, boats were around 4-7 sajens in length, immersion in the amount of waterway 0.75-2 arshins when full load is increased, being able to carry a load of about 125-250 poods”. In the water bodies of the Turkestan region, in shipping activities

the khivans were mainly engaged in and, in part, bukharians. While the Bukharian boatmen mostly sailed upstream from Chorjuy, the Khiva boatmen operated in all possible directions of navigation. It can be said that the fact that the Khiva boaters were literally owners of local waters is cited in the “Turkestan collection”. In the Turkestan region of during 1867-1917, 5/3 of the local raw materials grown in the Department of Khiva and Amudarya were transported by water route, the rest in dry camels. However, the preparation of saxauls and firewood for the passage of parachutes, the cleaning of reeds and algae in parts of the riverbed did not adversely affect the ecological situation either (fig.1).

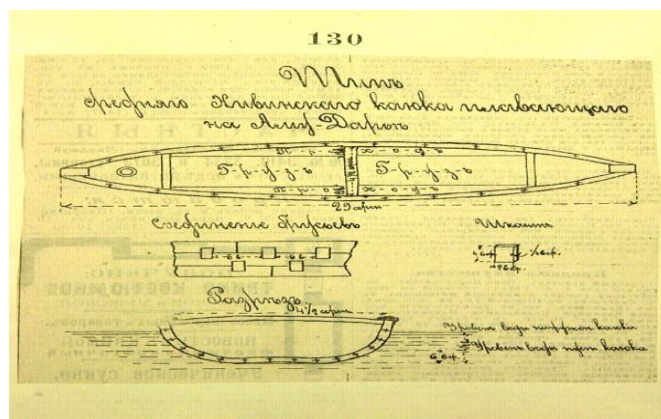


Fig. 1. Construction of local boats

4 Conclusion

In conclusion, it can be said that from the 70s of the 19th century, when there were no railways built in the Turkestan region yet, the study of waterways began, trying to develop economic and social relations through the waterway. However, sailing on steamers in Amudarya, Sirdarya has presented a number of challenges and obstacles. First of all, the frequent changes of the amudarya Oak, the abundance of dunes, coastal errosia were major problems. There have also been efforts to connect Amudarya with Caspian via new riverbed, to have a cheap waterway connecting the central regions of Russia and the Turkestan region. Not enough attention has been paid to the feedback regarding the linking of Amudarya to Caspian via new riverbed as the cause of ecological catastrophe in the region. Because the economic side of the issue interested everyone equally. While the creation of the flotilla was economically oydalı, Amudarya had a somewhat devastating effect on the coastal thickets. Because riparian forests, the cutting of Saxauls caused riverbank errosia, adversely affecting fauna and flora. It also began to adversely affect the growth of dunes on the river and the economic effect of the flotilla.

References

1. Kuldoshev R. et al. //E3S Web of Conferences. 2023. – T. **371**. – C. 05069.
2. Hamroyev A., Jumayeva H. E3S Web of Conferences. 2023. – T. **420**. – C. 10007.
3. Haitov J. //E3S Web of Conferences. 2023. – T. **389**. – C. 03007.