Environmental Substantiation of the Creation of Artificially Regulated Water Bodies on the Drained Bottom of the Aral Sea And in the Amudarya Delta

V.A.Rafikov , N.A.Rafikova , A.A.Ibraimova , A.I.Akhmadjonov , F.N.Kuziev

Institute of Seismology of the Academy of Sciences of the Republic of Uzbekistan,

Tashkent, Uzbekistan

Article Info
Page Number: 8756-8768
Publication Issue:
Vol. 71 No. 4 (2022)

Abstract: In the past, the Aral Sea, located in the desert zone of Central Asia on the territory of Kazakhstan and Uzbekistan, was the second largest continental drainless salt water body after the Caspian Sea. Only two rivers flow into the Aral - the Syr Darya and the Amudarya, which serve as its main source of water. Since 1960, the drying of the Aral Sea began. This was due to a sharp reduction in river flow as a result of increased water intake for irrigation. The resulting deficit in the water balance led to a rapid drop in sea level, a reduction in its area and an increase in salinity. In the foreseeable future, the return of Aralak to its original state is extremely unlikely. Even if the average annual river flow is increased to the previous level, the complete restoration of the lake will take about 100 years. However, partial preservation of residual water bodies is possible. It is supposed to continue the restoration of the Small Aral. There is a plan to raise the water level in one of its parts - Bolshoy Sarycheganak Bay . To do this, it is necessary to build a dam in the throat of the bay and lay a channel for water supply from the Syr Darya. An alternative to this option may be the reconstruction of the Kokaral dam. If it is possible to increase the flow of the Amu Darya and redirect it to the Western Big Aral, then this reservoir may still be preserved.

Article History
Article Received: 15 September 2022
Revised: 25 October 2022
Accepted: 14 November 2022
Publication: 21 December 2022

Keywords: Aral Sea, Aralkum, desertification, drought, degradation, destruction, landscape, geosystem, ecosystem.

Introduction

The dried part of the bottom of the Aral Sea, which is a vast desert sandy-saline geosystem, has a significant impact on the natural environment of the Aral Sea region, especially the lower reaches of the Amu Darya and Syr Darya. The impact on the Amudarya delta is expressed in the form of increased northern and northeastern winds and the removal of salts, salt dust and sand to inland areas, a decrease in relative air humidity, activation of (turbulent) wind movements, accompanied by the removal of a large amount of dust, sand particles and other substances up (tornadoes). This shows that the drying zone becomes a large-scale object of wind processes. In conditions of weak (and almost complete absence in a vast part) soil fixation, the influence of the dried bottom of the Aral in this regard is very dangerous for the surrounding spaces. The noted process is also facilitated by the annual expansion of the sea drying area. All this necessitates the development of certain measures on the dried seabed to prevent its negative impact on the environment in a timely manner.

Methodology and objects of research

Justification of the creation of reservoirs and their impact on improving the environmental situation. In ecologically critical situations of the Southern Aral Sea and the intensification of desertification processes in the region, the creation of reservoirs of various parameters will help mitigate the created environmental tension. It has been established that in the arid zone, the water space, depending on its size, usually creates favorable natural and ecological conditions within the radius of its influence.

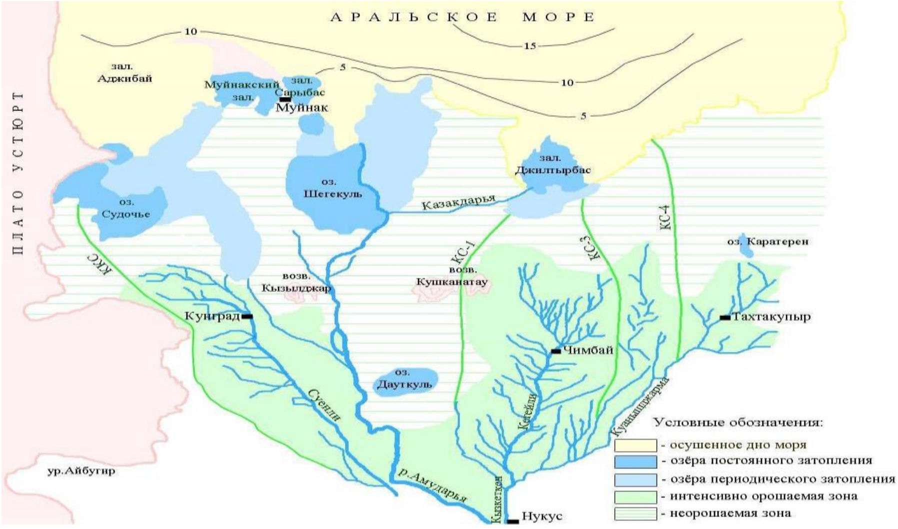
Water bodies not only create a kind of microclimate, but also form certain ecological conditions for the formation and development of the corresponding biocenoses on their periphery. In general, those ecosystems will arise here that were not previously characteristic of the desertifying territory. With a certain quality of water, reservoirs can be successfully used for breeding fish, muskrats and other valuable aquatic fauna, as well as for recreational and sports purposes.

A significant disadvantage of shallow reservoirs in desert conditions is the consumption of a large volume of water for total evaporation. After all, shallow water and the presence of hygrophytes (reed, reed, cattail, etc.) will contribute to the expenditure of moisture in a significant amount for evaporation. According to Kes A.S. [1], the evapotranspiration loss from the reed beds of the delta is 1500 mm/year.

However, nevertheless, the efficiency of water bodies will be effective to a certain extent. This has been proven in practice. For example, the lake-bog complex, formed on the drained bottom of the Dzhiltyrbas Bay and existing since the beginning of the 70s of the last century, due to the discharge of runoff from the Kazakhdarya channel, collectors KS-1 and KS-3 (collector network), has a beneficial effect on the surrounding plain. In its water area, there is no outflow of salts and sand to the periphery. A lake-marsh ecosystem is developing, which is distinguished by rich fauna, and reed beds are used in places by the local population. In high-water years (1987, 1988), the entire area of the bay turns into a lake, where a large number of fish are caught.

Reservoirs built on the drained parts of the Rybatsky and Muynaksky bays for fish farming, although their parameters are not larger, their ecological significance is well known: they not only alleviate environmental tension on the periphery, but are also a kind of subaquatic and superaquatic biocenoses, where, under favorable environmental conditions, it receives development of rich flora and fauna of reservoirs, and their periphery differ sharply from neighboring ecosystems.

Taking into account the effectiveness of the hydroecological features of the existing reservoirs in the Amudarya delta and on the dry bottom of the bays of the southern coast of the Aral Sea, it seems to create a number of reservoirs: in the Muynak Bay within the isobaths of 52.5-49.5 m in the Rybatsky Bay within the limits of the existing reservoir with a FSL of 52.5 m; in the Dzhiltyrbas Bay within the existing lake and marsh complex with a FSL of 52.0 m (see figure).



Picture. Schematic map of the main water flows in the Amudarya delta

The purpose of creating reservoirs is to minimize the area of salt-bearing areas subject to blowing, to create water-environmental barriers against the onset of dust- salt- sand drift from the drying zone and to form a subaquatic transition zone that helps reduce environmental tension in the contact zone between the Amudarya delta and the dried bottom of the Aral Sea.

The location of reservoirs from the point of view of the ecological efficiency of their impact on the environment seems to us to be chosen correctly; former bays are suitable for the design of these water bodies. We consider it expedient to create one more reservoir near the mouth of KS-4.

Muynak reservoir. By its location, it completely covers the bay of the same name of the sea. Its ecological significance for this part of the dried sea bottom and the Amudarya delta is great. This is due to the fact that here in the southern and southwestern parts of the Muynak Peninsula there are a number of large settlements (Muynak city, Uchsay settlement, Tokmak, etc.). In this regard, the creation of this reservoir is considered very necessary to improve the unfavorable environmental situation. At present, there is a small body of water here, watered by the runoff of the Glavmyaso canal. In low-water (1982, 1986, 1989, 2000, 2001, 2008) years, its water area decreases to a minimum, and in high-water years (1987, 1988, 1992, 2009, 2010) it expands significantly.

The existence of the reservoir since the beginning of the 80s of the last century, even with different water areas, is justified, since, together with the overgrowth of a significant area around it with reed thickets, this causes a significant reduction in the volume of salt removal to the periphery; wind activity here is very limited due to the hydromorphism of ecosystems. In the full-flowing state of the reservoir, the relative humidity of the air increases, the number of “hot” winds from the sea drying zone decreases, and a more favorable ecological situation develops in its coast.

However, the greatest ecological effect can be achieved under conditions of constant fullness of the reservoir, which will lead to a decrease in acute tension in the area by creating a kind of microclimate, and maybe even a local climate, since the reservoir covers about 98 km^2 of the bay area. This will help stop the removal of salts and salt dust to the periphery, especially towards the settlements of the Muynak Peninsula. An increase in the relative humidity of the air in the area of the reservoir, especially on the southern periphery, will lead to a significant overgrowth of moisture-loving plants, mainly reeds, azhrik, etc., due to the removal of northern and northeastern winds of vaporous moisture that forms over its water area. Approximately, within a radius of up to 2-3 km from the water's edge, air humidity will be the highest.

Raising the water line of the reservoir to the level of 52.5 m abs. (absolute height above the level of the Baltic Sea) will contribute to the flooding of the strip along the primary coast of the sea, and especially the areas adjacent to the settlements from Uchsay to Muynak, which at present are a combination of typical salt marshes with finely hilly sands. This will lead not only to the fixation of sandy massifs, but also to the appearance of a dense cover of reeds in shallow water, which is food for cattle, horses, etc. In other words, the improvement of the ecological situation in the region will also contribute to the development of animal husbandry. As a result of an increase in air humidity, one should expect an increase in the productivity of pastures at the foot of the hill located on the Muynak Peninsula. In addition, during strong storms that affect the surge phenomena, a significant part of the coast will be flooded due to the waters of the reservoir, which will cause the development of various plant communities along the coast.

The creation of favorable aquatic ecological biotopes over a large area will contribute to the mass reproduction and development of various waterfowl, semi-aquatic and terrestrial animals. In general, as a result of the creation of a reservoir, a peculiar ecosystem will form here and, on its periphery, which differs sharply from the surrounding decertifying biocenoses.

Fishing pond. It covers the now drained bottom of the bay of the same name. Now there is a body of water here, filled with the waters of the Amu Darya. However, its water area, like the Muynak reservoir, is unstable and directly depends on water supply from water sources. Regular maintenance of the water table at around 52.5 m abs. will contribute to improving the ecological efficiency of the reservoir in this area of the delta.

The creation of a reservoir on a new design basis provides for the mitigation of environmental tension in the south of the Muynak Peninsula, in the coastal strip of the sea of the 60s of the last century in the bay area and on a certain part of the dried bottom of the Aral Sea to the north-west of the reservoir. However, in all likelihood, the positive impact of the reservoir will apparently be greater than the above milestones, since it will not be protected by a special engineering dam. Therefore, during a wave in a reservoir, a certain part of the coast can be flooded, thereby creating conditions for the development of herbaceous, tugai and woody-shrub plants. This will lead to the formation of a special green vegetation belt along the reservoir, its width will depend on the availability of soil moisture and the degree of salinity. In all likelihood, the northeastern and southeastern, as well as the western coast, due to the wide distribution of deposits of light mechanical composition, will not lead to widespread development of salinization; aeration. Here, mainly tree-shrub tugai (turanga, willow, comb, dereza, licorice, etc.) will widely develop, from grassy - reed, yantak , parnolistik , akbash , etc. At the same time, in the southern direction, the width of the belt will reach its greatest value, because in this direction not only the relief becomes gentle, but also a large amount of vaporous moisture is carried away by the wind with northeast and north winds.

In connection with the shallow water of the reservoir, especially in its southeastern half, reed thickets, cattails and other hygrophytes will develop widely. This will not only contribute to the emergence of favorable environmental conditions for the reproduction of muskrats and other water-loving fur-bearing animals, fish, birds, but also for individual ungulate hunting and commercial animals, the number of which, due to desertification and drying up of water bodies, has been sharply decreasing in recent years. Consequently, the reservoir will turn into one of the dynamic and very necessary hydrobiocomplexes for the development of many species of animals in the delta.

The creation of a reservoir near the city of Muynak and other settlements located on its periphery should have a beneficial effect on optimizing the conflict situation that has arisen here as a result of desertification. An increase in the relative humidity of the air on the coast and the removal of moisture from the reservoir in the southwest direction will lead to the overgrowth of the sandy massif located southeast of Muynak (former beach). The fixation of moving sands by psammophytes will help to stop the removal of sand to the city by the wind. It is possible that as a result of moisture from the reservoir, the air condition within the city and on its periphery will improve, since the atmospheric air in the city is unfavorable for the life of the population due to the dryness of the climate and the presence of dust.

Dzhiltyrbas reservoir. It is advisable to design within the contour of the currently existing lake-bog complex in the bay of the same name with a FSL of 52.0 m. At present, a kind of ecological subaquatic complex has been formed here, which in high-water years becomes a large lake, and in low-water years it turns into a reed swamp with separate habitats not deep lakes and thus is a powerful moisture evaporator. Here, apart from the settlement of Kazakhdarya , there are no any large settlements, and often there are absolutely no permanent settlements around it.

The significance of the projected reservoir is determined by the creation of a large artificially regulated water-ecological complex on the dried bottom of the sea bay in order to stop the removal of salts and sand to the periphery by the wind, reduce critical environmental tension in the area of the reservoir functioning and on the plains surrounding it by increasing the hydromorphism of the territory and increasing air humidity. In high-water years, the lake floods cover a significant area due to the flooding of the western, southern, and eastern coasts, and communication with the sea is carried out through a narrow strait in the northern part of the bay. With the construction of an engineering-type dam, communication with the sea, except for collectors, will be terminated. In the years of flooding, the positive influence of the reservoir on the surrounding plains is undeniably great, a dense cover of reed thickets formed around it, followed by a strip of combs and other plant species, where many waterfowl and semiaquatic animals found shelter, various species of fish live in the reservoir itself.

As a result of flooding of a significant area around the reservoir, the groundwater level rises everywhere to 0-1 and 1-2 m or more, which favors the development of predominantly halophytic (annual saltwort, karabarak , comb, kermek), forb and herbaceous plant communities. Provided that the level of the water table is constantly maintained at around 52.0 m abs ., which is possible after the construction of the dam in the northeastern and eastern parts, the flood area will be relatively large and stable. This explains the fixation of sandy massifs in the southeast and north of the reservoir, the overgrowth of solonchak soils in the south, west and east of this natural complex. All this will contribute to preventing the development of adverse phenomena and processes (blowing of sand, salt and salt dust, etc.), restoring the environmental conditions that were typical before the desertification of this area of the delta.

Justifying the ecological significance of the reservoir, it should be noted that while maintaining the water surface at the level of 52.0 m abs . the underground runoff of groundwater on the southern periphery of the reservoir, flowing from south to north, will slightly worsen; from the side of irrigated lands (farms "Karakalpak", " Kuralpa ", etc.) to the reservoir. In those years when the water level in the reservoir was low, it served as an area for unloading the groundwater flow, and in high-water years, on the contrary, as an area for their feeding. Therefore, in conditions of high water, one should expect some rise in the level of groundwater near the lake complex, but the width of this zone, obviously, will not be wide, since moisture will be intensively spent on total evaporation, on the other hand, irrigation rates for crops are now not only stabilizing, but also decreasing compared with previous years, therefore, the flow of water to replenish groundwater reserves will be less, and this in turn will lead to a decrease in the ground moisture table.

In general, the creation of a reservoir on the drained bottom of the Dzhiltyrbas Bay will be effective from the point of view of ecology and improvement of the environment in this area of the Amudarya delta and the drained seabed. Compared to other reservoirs projected on the dry bottom of the Aral Sea, it enters relatively deeper into the inner parts of the delta, thus its beneficial effect on the environment will be relatively large.

The construction of reservoirs near the Amudarya delta on the drained seabed will largely prevent the development of negative phenomena developing on sandy-saline geosystems, which contribute to the intensification of desertification processes in the South Prearalie. In order to reduce the scope of these negative phenomena, it is proposed to create polder complexes, which should encircle the above water bodies along certain former isobaths.

Mezhdurechensky reservoir. Created between the channel of the Kipchakdarya and the Akdarya river , in the center of the northern part of the Amudarya delta. According to the conditions of the relief, the place of construction is undoubtedly correct, because here is one of the largest lower sections of the delta created by nature itself; riverbanks of Kipchakdarya and Akdarya rise above the bottom of depressions by 2-3 m or more, if they are increased by another 1.5-2 m, then the capacity of the reservoir will increase by several million m^3 . In ecological terms, the positive impact of the reservoir on the environment will undoubtedly be even greater than that created on the dry part of the seabed, since it is surrounded by desertifying natural complexes, which primarily need life-giving moisture. These complexes, when applying certain reclamation measures, are quite suitable for economic use.

In high-water years, the northern part of this depression is filled with water for the purpose of watering hayfields, pastures and fish breeding, and in low-water years, water is provided only by Shege Lake and the extreme northern sections of the depression along the Kipchakdarya channel . Observations carried out in 1977, 1984, 1988, 1993, 2010, 2013 show that under high water conditions in the northern part of the depression, the condition of the vegetation cover is quite satisfactory, reed, comb and various herbs grow everywhere. In tree and shrub tugai along the channels of the Kipchakdarya and Taldykdarya , due to the presence of water in the channels, the state of vegetation is quite satisfactory. This is due not only to the presence of water in the channels, but also to an increased moisture content in the air due to evaporation from the water surface of the depressions. Consequently, in high-water years, the vegetation growth conditions on the surrounding plains are most favorable, obviously, this is due to the increased moisture content in the air, otherwise tree tugai (turanga, dzhida) could not develop at a remote distance from the channels: the groundwater level here is often lower 3-4 m from the surface.

The creation of a reservoir with a permanent mirror at a certain height will contribute to the guaranteed sustainable growth of tree and shrub tugai along the channels and the Akdarya River, shrub and herbaceous plants behind the tugai belt and reed and comb communities occupying the southern half of the interfluve. This will not only lead to the creation of favorable environmental conditions for the vegetation of plant formations, but will also increase the productivity of pastures and hayfields. Improving the water supply of ecosystems will simultaneously intensify the reproduction and population of the animal world.

The discussion of the results

Possibilities of using water bodies for economic and other purposes. The reservoirs created on the dry part of the bottom of the southern coast of the Aral Sea should be used for economic, recreational and sports purposes. It will depend on the parameters, water quality and condition.

The Muynak reservoir should be filled with river water. However, due to the mineralization of river water, especially in dry years, the degree of salinity here will most likely fluctuate from 1.2 to 1.5 g/l or more, and in high-water years from 0.7 to 1.0 g/l and more. The relatively high quality of water (with a low content of pesticides) will allow for the widespread development of fish farming; however, the shallow water of the reservoir will determine the development of reed and underwater thickets in a significant part of the water area. All this determines the regular cleaning of the bottom of the reservoir from underwater and reed thickets, in addition, overgrowing and siltation require deepening work. In general, the creation of a reservoir based on the clean river water of the Amudarya will provide the former fish processing plant in Muynak with a certain number of fish products.

Transparent and clean water of the reservoir will contribute to the development of recreation - the creation of rest houses, boarding houses. In the summer, favorable for swimming, sunbathing, hiking and cycling, excursions, sports games, it is advisable to use the northern coast, where the steep hillside on the Muynak Peninsula is located. Here, from the side of the peninsula, a beautiful landscape opens up.

The Rybachye reservoir, as well as the Muynak reservoir, will be provided with river water, which contributes to the development of fish farming, recreation, and reed beds should be used as feed. Compared to the Muynak reservoir, its depth at the dam will be 5.5 m, which is more favorable for fish breeding, the use of motor boats and other means of catching fish and transporting it to the port.

Preservation of the reservoir surface at a height of 52.5 m abs. will allow the construction of rest houses in the former recreational zone of the Muynak Peninsula again, here, due to the presence of a deep section of the reservoir, it is convenient to build a small port for receiving fish products.

The Dzhiltyrbas reservoir will be shallow, the depth at the dam is about 2 m, so its overgrowth is inevitable, which determines the ongoing cleaning of algae and reed beds. At the same time, it is advisable to develop here those types of fish (white carp, etc.) that eat reeds and other water-loving plants. The reservoir will be fed by discharges of collectors KS-1 and KS-3, as well as the Kazakhdarya channel. Consequently, the qualitative state of water masses in a reservoir will be determined by the chemical composition of drainage waters. The insignificant depth of the reservoir, obviously, will not allow the widespread development of fish farming, and the remoteness from settlements (except for the village of Kazakh Darya) will not contribute to the use of the reservoir for recreational purposes.

The Mezhdurechensky reservoir with a depth of up to 4 m and a water volume of 0.175 km^3 is effective in increasing the water supply of the surrounding pastures and tugai ecosystems. Due to the constant presence of water in it, the water supply of the Kipchakdarya channel will be guaranteed, which explains the improvement in the vegetation of degraded tugai. The reservoir will provide a guaranteed distribution of water along the channels of peripheral pastures and irrigated areas not only within the interfluve, but also on the right bank of the Akdarya (Maypost massif).

The reservoir, due to its provision with river water, will be favorable for fish breeding, especially since it should be designed relatively deep. However, the deep part will be confined mainly to its northern half, and in the southern part, a significant water area of the reservoir will be occupied by shallow water, where reeds form a dense cover. The deeper part of the reservoir along the northern bend of the Kipchakdarya is quite suitable for recreational use. There are many settlements here, there is a highway, which favors the use of the reservoir for swimming, sports, etc.

Within the boundaries of the former water area of the Sarishiganak Bay (Small Sea), Kazakh specialists propose the creation of an artificial reservoir in order to improve the living conditions of the population of Aralsk, reduce dust and salt carryover, revive ecosystems and partially resume fishing. The structure of the facilities for the creation of a reservoir (volume 7.46 km ^{3} , area 875 km ^{2} , at the FSL mark 59 m abs .) includes: a water intake on the Syrdarya River with a water-lifting dam 2 m and a length of 90 km, feeding a canal with a length of 76 km with a flow rate 100 m ^{3} /s, a dam-dam blocking the bay, 17.5 km long and up to 15 m high, as well as a number of water management, fisheries and transport facilities.

The initial filling of the reservoir provides for the supply of water in the amount of 2 km ^{3} per year. To maintain the level of the reservoir and its flow, which ensures the calculated mineralization, it is necessary to subsequently supply 1.5 km ^{3} annually water [5].

Issues of flooding natural meadows and hayfields of the Syrdarya delta.

A sharp decrease in runoff in the lower reaches of the Syrdarya due to the complete regulation of its hydro regime, as well as frequent low water since the 60s of the last century, contributed to the desertification of ecosystems in the lower reaches of the river. According to the data of Kazakh soil scientists, the total fund of hydromorphic soils in the lower reaches of the Syr Darya was estimated at 1.5 million hectares (including 0.7 million hectares of meadow and 0.8 million hectares of swamps), by 2008, 260 thousand hectares, 107 thousand hectares were used for irrigation. Of the 846 thousand hectares of marsh soils, 564 thousand hectares have dried up and become deserted, 63 thousand hectares have been developed for irrigation. Salinization of hydromorphic soils led to an increase in the area of solonchaks by 110 thousand hectares. Until the 1980s, 3.6 million tons of hay grew annually on marsh soils, which was used for roughage and winter grazing. At the end of the 90s, the forage stock of these lands decreased to 0.8 million tons. along with this, degradation of the herbaceous cover of tree and shrub tugai is observed, the replacement of tree species by tamarisks and other drought-resistant communities.

All these negative environmental consequences dictate the implementation of large-scale radical measures to combat anthropogenic desertification in the Aral Sea region. The priority urgent practical measures in the lower reaches of the Syrdarya to preserve and increase the productivity of ecosystems and, in general, address environmental issues in the region are regular watering of meadows and haylands, dry channels, the coastal strips of which are occupied by tree and shrub tugai of varying degrees of desertification and a number of large lakes.

Some work is currently being carried out in this direction. In recent years, in order to partially compensate for the damage, artificially flooded hayfields have been created here with mechanical water supply using low-pressure dams and stationary pumps. However, although these measures are necessary in the current situation, due to their implementation on a small scale (the area of irrigated land is 60-80 thousand hectares), it does not allow fighting throughout the desertification region.

In order to achieve more effective results and optimize the natural environment throughout the lower reaches of the Syr Darya, water resources should be used in a significant amount, since only regular watering of ecosystems can change the unfavorable state of farmland into a favorable one. According to the calculated data of Kazakhstani specialists, the maximum flooding of deltas in the lower reaches of the Syrdarya, excluding runoff into the sea, to create conditions close to the formation of the previous undisturbed landscapes (until 1961), requires water supply in the amount of 13 km ^{3} per year, with a minimum - 8.7 km$^{3.}$

Subject to the use of a minimum volume of water, it is possible to water swamp and meadow soils on an area of 330 thousand hectares and to carry out water supply for irrigation of 144 thousand hectares [2]., since until 1961 the total area of hydromorphic soils was 1.5 million hectares. But if, first of all, at least this area (330 thousand ha) is watered, it is possible to achieve some success in combating ecosystem degradation, and subsequently, in conditions of an increase in the amount of river water runoff, it will be possible to water the rest of the massifs.

Dry channels of the modern (Kazalinsky) delta of the Syr Darya, now almost dried up or occasionally flooded, are subject to regular watering. It is advisable to supply a certain amount of water at least once a year in order to provide moisture for tree and shrub tugai and grass cover, and if there is a sufficient volume of water, to supply 2-3 times during the growing season. The watering of the channels will allow the vegetation of not only tree species, but also increase the moisture content of the soil, which will affect the rise in the groundwater level. Of course, this, on the other hand, can lead to salinization of soils, especially in low relief areas and slopes of river banks and inter -channel depressions. However, the presence of reeds and other moisture-loving plants will promote intensive moisture transpiration, preventing waterlogging and strong salt accumulation in soils.

At present, the total area of irrigated land in the lower reaches of the Syr Darya is about 300 thousand hectares, of which 240 thousand hectares are in the ancient delta and 30 thousand hectares in the modern delta, and the rest is in the delta. Of the total area of irrigated land, about 106 thousand hectares are occupied by rice fields. However, due to the shortage of irrigation water, the area of rice fields is shrinking; in 1995, rice fields occupied over 100,000 hectares.

The rice crop ultimately uses a large amount of irrigation water, reaching 25-30 thousand m ^{3} /ha, and sometimes more. However, on the other hand, risovniki are good natural ameliorants to improve the condition of saline soils. Therefore, the development of rice growing in the conditions of the lower reaches of the Syr Darya, despite the shortage of irrigation water, is expedient. Waste water in rice fields must be directed to water meadows and hayfields or tree tugai.

At the same time, it is advisable to combine rice with alfalfa, corn and other fodder crops. We consider it expedient, in the presence of a certain volume of water, to develop the near-channel shafts or lands located on their periphery. Of course, the absence of wood tugai should be taken into account. The riverbanks and their peripheral strips are distinguished by satisfactory ameliorative conditions, in particular, the availability of soil drainage. On these lands it is possible to grow both food (vegetables, melons, fruits) and fodder crops, and flat plains and inter -channel depressions can be allotted for the development of forage production, mainly the cultivation of reeds, perennial grasses, etc.

In order to reduce the rate of irrigation and water used to flush saline soils, recently the Institute of Soil Science of the Academy of Sciences of the Republic of Kazakhstan, together with the Kazgiprovodkhoz Institute, has developed a new technology for growing rice on highly saline alkaline soils with a planned yield in the year of development. When heavily saline soils and solonchaks are used for development, preliminary long-term washing of soils to remove excess toxic salts is not carried out. The development of saline soils is carried out without the ameliorative leaching period, and irrigation water is saved due to the use of a shortened irrigation regime. The technology involves the use of a low-volume zinc ameliorant to neutralize the action of highly toxic boron compounds in soils, high soil alkalinity, and soil microorganisms pathogenic for rice. The shortened regime of soil flooding with this technology also provides a more normal oxygen regime in the initial phases of rice development. In 2013, production tests of a new rice cultivation technology were carried out in the conditions of the Kazaly irrigation array on highly saline soils of farms on an area of 240 hectares using zinc ameliorant, nitrogen and phosphorus fertilizers. The site was continuously flooded with waste water throughout the growing season. This made it possible to obtain a rice yield of 30 to 47 q/ha. The increase in yield, compared with the control variant, was 3.2-8.3 c/ha [2].

In the conditions of shortage of water resources in the Aral Sea basin, in order to find additional water resources for watering pastures and hayfields of the Syrdarya delta, the engineering and technical improvement of rice systems in the Kyzylorla region is of great importance. According to Zavyalov P.O. [3], the general technical level of irrigation systems here remains rather low. The efficiency factor (coefficient of performance) of many of them does not exceed 0.5-0.6, which means that half of the water taken from the irrigation source is spent on filtration and evaporation during its transportation through the canals. So, on average for 1981-1985. losses amounted to 2.19 km ^{3} of irrigation water, of which 1.47 km ^{3} (67%) falls on the on-farm network. Consequently, the reconstruction of the irrigation network in the region should be carried out in the near future, and the saved water should be used for watering desertifying ecosystems.

Of certain importance is the use of waste water from the Kyzylkum and Toguskent irrigation massifs for watering the Zhanadarya channel to preserve unique saxaul forests on takyr-like soils, where saxaul forests die from lack of water on an area of over 300 thousand hectares. Previously, from time to time, water was sent along the channel of the Zhanadarya , but now its supply has practically ceased. At the same time, waste water from the Kyzylorda irrigation array should be sent to the Aksai - Kuvadarya system to preserve and increase the productivity of natural fodder.

Conclusion

At present, most of the territory of the dried bottom of the Aral Sea is represented by a saline desert with extremely poor biocenoses in terms of species composition. The vegetation of the young marine plain is mainly limited to halophytes: single bushes of bristly-hairy tamarisk and annual saltworts. Occasionally there are clumps of oppressed reeds. From the side of the Amudarya delta and the northwestern Kyzylkum, reptiles penetrate here: the Central Asian tortoise, fast foot-and-mouth disease; mammals: eared hedgehog, roofing hare, small jerboa, tarbagan, upland jerboa, house mouse, tamarix , midday and red-tailed gerbils, wolf, fox; birds: gray lark, black crow.

At the same time, there are prerequisites for improving the ecological situation here on the dried-up bottom of the sea. Experimental work carried out by the Uzbek Research and Production Center for Ornamental Horticulture and Forestry in the southern part of the sea plain shows the promise of forest reclamation activities in this region [4]. The highest survival rate on the moving sands of the dried sea bottom is the Richter 's Circassian, and on the saline sandy loamy plains - the black saxaul. On certain sands, the kandym head of Medusa develops well. Over time, artificial plantations will form a lower tier of ephemera and halophilic grasses.

The overgrowth of the Aral Sea bottom, the formation of sod, the accumulation of litter and other plant debris will become an additional factor in the accumulation of snow and atmospheric moisture in the forest belts and the retention of surface runoff, which in turn will improve the water regime and microclimate in areas occupied by artificial plantations, increase their resistance to adverse environmental influences. This will contribute to the self-development of such peculiar agro-ecosystems, which are artificial plantations.

The prospects for carrying out phytomeliorative measures are based on the forecasts of the Scientific Research Hydrometeorological Institute Uzhydromet, according to which the decrease in precipitation that has already begun in the desert zone of Central Asia will continue in the future.

Improving the fodder base of artificial plantations will attract new species of animals here. The most likely inhabitants of artificial plantations, in addition to the above animals, will be reptiles: sand roundhead, steppe agama, arrow-snake, large gerbil, mole voles, fine-toed ground squirrel, piebald putorak; birds: Caspian plover, white-tailed pigalitsa, small plover, dun finch, saxaul jay, desert warbler, water -dancer, desert raven, long-legged buzzard.

In addition to improving the ecological situation in the degrading region, artificial plantations will help protect soil from wind erosion and fix moving sands. In addition, artificial plantations will also perform a protective function, which consists in the fact that, becoming a barrier to northern winds, they will help to reduce the transfer of fine earth particles and salts by air masses towards the Amudarya delta. The experience of melioration of desert territories by creating artificial plantations shows that good results are achieved here with preliminary cutting of moisture-accumulating and sand-accumulating furrows. In our opinion, successful phytomelioration of the dried bottom of the Aral Sea will be facilitated by preliminary cutting of moisture-accumulating and sand-accumulating furrows in the reclaimed areas, which should be located horizontally (former isobaths). In the moisture-accumulative furrows in the autumn-winter-spring period, precipitation and surface runoff will accumulate. The presence of moisture-accumulating, and in areas with clay soils and sand-accumulating furrows will change for the better the physical properties of the soils of the reclaimed massifs and create favorable conditions for the natural overgrowth of the marine plain [5].

The need to improve the methods of phytomelioration requires the creation of a test site on the dried bottom of the Aral Sea to test the method of irrigation of reclaimed areas with limited volumes of waste water. To do this, from the existing and planned main waste collectors (Kokdarya, KS-3, GLC (Main left-bank collector), etc.) it is possible to draw supply ditches to the moisture-accumulating furrows, through which the minimum norms can be passed by machine 2-3 times during the summer period water. At one site in the test site, seafloor leaching techniques can be tested to desalinize soils for subsequent phytomelioration .

In order to prevent salinization of areas reclaimed in this way with mineralized waters, it is necessary to provide for the removal of saline groundwater by a system of drains and collectors. The latter do not have to reach the sea area. Local natural depressions can serve as salt receivers [5].

On massifs desalinated in this way, one can expect an increase in the productivity of vegetation, which will make it possible to use them in pasture animal husbandry in the future.

An example of the positive impact of depressions in the relief on the productivity of ecosystems is the area of the relic Akpetka archipelago, where the natural dissection of the sea plain, along with the predominance of sandy material in the soil, contributes to a good overgrowth of the dried bottom of the Aral Sea.

List of sources used

1. Kes A.S. Forecast of salt-forming processes on the drying bottom of the Aral Sea. - Tashkent: Fan, 1999. - 190 p.
2. Isachenko A.G. Methods of applied landscape research. - L.: Nauka, 1998. - 222 p.
3. Zavyalov P.O. Modern hydrological state and variability of the water mass of the Great Aral Sea. –M.: Nauka, 2012.– 167 p.
4. Shamsutdinov Z.Sh. Actual problems of scientific research in the field of arid fodder production. In the book: "Biological resources of deserts and their rational use". - Ashgabat: Ylym . 1994. - No. 6. - S. 322-342.
5. Rafikov V., Rafikova N., Mamadganova G. Forecasting and the forecast of changes of arid geosystems in the conditions of proceeding ecological destabilization in Aral Sea region // Editorial office for Journal of Geodesy and Geodynamics. – China, 2014. – vol. 5, N 2. - pp.16-23.