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GLOBAL IQLIM O'ZGARISHI DAVRIDA O'RTA ZARAFSHON HAVZASIDAGI SUV OMBORLARINING ATROF-MUHITGA TA'SIRI

ВОЗДЕЙСТВИЕ ВОДОХРАНИЛИЩ НА ОКРУЖАЮЩУЮ СРЕДУ В БАССЕЙНЕ СРЕДНЕГО ЗАРАФШАНА В ЭПОХУ ГЛОБАЛЬНОГО ИЗМЕНЕНИЯ КЛИМАТА

ENVIRONMENTAL IMPACT OF WATER RESERVOS IN THE MIDDLE ZARAFSHAN BASIN IN THE ERA OF GLOBAL CLIMATE CHANGE

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Annotatsiya

Global iqlim o'zgarishi yer yuzi bo'ylab suv va suv resurslariga sezilarli darajada ta'sir ko'rsatib, bu suvning mavjudligi, sifati va taqsimotida o'z ifodasini topmoqda. O'zgaruvchan iqlim shakllari ya'ni, yog'ingarchilikning o'zgarishi, haroratning ko'tarilishi hamda ekstremal ob-havo hodisalari gidrologik siklni buzadi va suv resurslarini boshqarishda bir qancha qiyinchiliklar tug'dirmoqda. Bu ta'sirlar keng qamrovli va xilma-xil hisoblanib asosan ekotizimlarga, qishloq xo'jaligiga, inson salomatligiga va iqtisodiy rivojlanishga ta'sir qiladi. Ushbu o'zgarishlarga moslashish va suv resurslarini barqaror boshqarishni ta'minlash va suv tanqisligi xavfini yumshatish maqsadida O'rta Zarafshon havzasida bir qancha suv omborlari qurilgan. Ularning eng asosiylari Kattaqo'rg'on va Oqdaryo suv omborlari hisoblanadi. Tusinsoy, Qoratepa, Sobirsoy kabi kichik suv omborlar va Omondara, Muminobod kabi past bosimli suv omborlari mavjud. O'rta Zarafshon havzasidagi bu suv omborlarining xalq xo'jaligidagi ahamiyati benihoya katta hisoblanadi. Ushbu maqolada havzada joylashgan suv omborlarining atrof-muhitga ta'siri, suv bosgan va zax bosgan maydonlarning hosil bo'lishi, suv ombori ta'sirida bo'lgan aholi va xalq xo'jaligi obyektlariga ta'siri keng yoritilgan. Shuningdek, Kattaqo'rg'on va Oqdaryo suv omborlarining ko'p yillik suv sarfi va kirimi tahlil qilingan.

Аннотация

Глобальное изменение климата оказывает существенное влияние на воду и водные ресурсы по всему миру, что отражается на доступности, качестве и распределении этой воды. Изменение климата, т. е. изменение количества осадков, повышение температуры и экстремальные погодные явления, нарушают гидрологический цикл и создают ряд проблем в управлении водными ресурсами. Эти воздействия считаются широкомасштабными и разнообразными, в основном затрагивающими экосистемы, сельское хозяйство, здоровье человека и экономическое развитие. Чтобы адаптироваться к этим изменениям, обеспечить устойчивое управление водными ресурсами и снизить риск дефицита воды, в бассейне Среднего Зарафшана было построено несколько водохранилищ. Наиболее важными из них являются Каттакурганское и Акдарьинское водохранилища. Имеются небольшие водохранилища, такие как Тусинсай, Коратепа и Собирсай, а также водохранилища с низким давлением, такие как Омондара и Муминабад. Значение этих водохранилищ в бассейне Среднего Зарафшана в народном хозяйстве считается исключительно большим. В статье подробно рассматриваются вопросы воздействия водохранилищ, расположенных в бассейне, на окружающую среду, формирование затопленных и подтопленных территорий, а также воздействие на население и хозяйственные объекты, находящиеся под воздействием водохранилища. Также был проведен анализ многолетнего водопотребления и притока Каттакурганского и Акдарьинского водохранилищ.

Abstract

Global climate change is having a significant impact on water and water resources across the globe, manifesting itself in the availability, quality and distribution of this water. Changing climate patterns, i.e. changes in precipitation, temperature increases and extreme weather events, disrupt the hydrological cycle and pose a number of challenges to water resource management. These impacts are wide-ranging and diverse, affecting ecosystems, agriculture, human health and economic development. In order to adapt to these changes and ensure sustainable water resource management and mitigate the risk of water scarcity, several reservoirs have been built in the Middle Zarafshan Basin. The most important of them are the Kattakurgan and Akdarya reservoirs. There are small reservoirs such as Tusinsay, Koratepa, Sobirsay and low-pressure reservoirs such as Omondara and Muminabad. The importance of these reservoirs in the Middle Zarafshan basin in the national economy is considered to be very great. This article extensively covers the impact of the reservoirs located in the basin on the environment, the formation of flooded and inundated areas, the impact on the population and national economy objects affected by the reservoir. Also, the long-term water consumption and inflow of the Kattakurgan and Akdarya reservoirs are analyzed.

Kalit so'zlar: *Iqlim, harorat, Zarafshon daryosi, suv ombori, tahlil, Kattaqo'rg'on, Oqdaryo suv omborlari, qishloq xo'jaligi.*

Ключевые слова: *Климат, температура, река Зарафшан, водохранилище, анализ, Каттакурганское, Акдарьинское водохранилища, сельское хозяйство.*

Key words: *Climate, temperature, Zarafshan River, reservoir, analysis, Kattakurgan, Akdarya reservoirs, agriculture.*

INTRODUCTION

Global climate change is having a significant impact on water resources worldwide. The impact of climate change on water availability, quality and distribution is becoming increasingly evident. Changes in precipitation patterns, rising temperatures and extreme weather events are altering the hydrological cycle, posing serious challenges to water resource management. The impacts of climate change on water resources are diverse and widespread, affecting ecosystems, agriculture, human health and economic development.

Addressing the impacts of climate change on water resources requires a comprehensive and integrated approach that integrates mitigation, adaptation and sustainable water management strategies. Promoting water conservation practices and improving water use efficiency can help reduce demand for water and minimize stress on water resources, especially at a time when water scarcity is increasing due to climate change.

Today, in our country, where the arid climate prevails, the effective use of water and water resources is considered very important. The amount of water in rivers and streams in Central Asia is so unevenly distributed throughout the year that as a result, a lot of water is wasted. During the spring floods, the overflowing of rivers and streams often causes great damage. In order to prevent such problems and meet the water needs of agriculture in our country, reservoirs are built. In addition, reservoirs are created to regulate river flow and are mainly used for energy, irrigation, water transport, water supply and flood prevention. To achieve this, reservoirs accumulate water during certain periods of the year and deliver the accumulated water to consumers at other times . Other as in other words, water collect, from it in the future effective use opportunity giver construction task will do.

LITERATURE REVIEW AND METHODOLOGY

It is no secret that reservoirs are necessary for the socio-economic development of society, for meeting its needs for water, food, energy, recreation, and other sectors. The negative impact of reservoirs is that they cause damage to various aspects of the economy, including food and agriculture, in river valleys upstream and downstream of the dam.

It is no secret that the achievements in the field of hydrology and irrigation in Central Asia began to be implemented in other countries. The famous Uzbek scientist Al-Farghani created a simple and reliable device, which he called a nilometer. This device was a deep well installed on the river bank, with a column in the middle and level lines marking the water level. The well was connected to the Nile River by an underwater channel, and when the river water rose, the water in the well rose, and vice versa, changes in the level were measured in the nilometer.

At the end of the old era and the beginning of the new era, according to historical data, small reservoirs and ponds were built in the territory of the Central Asian states. By the 10th-12th centuries, a much larger Khanbandi reservoir was built. In addition, in the 16th century, the Abdullakhanbandi reservoir was created near the village of Oqchob in the Samarkand region. The Abdullakhanbandi reservoir was built in the narrowest place in the Pasttog gorge in the Forish district of the Jizzakh region, its height was 15 meters and it could hold more than 1.5 million m^3 of water. Archaeological scientific research conducted on these reservoirs shows that both reservoirs were built on the basis of special projects prepared in advance with precise calculations. In addition, many reservoirs have been built around the world, the largest in the world being Owen Falls (Victoria) on the Victoria-Nile River, Bratsk (Angara River), Krasnoyarsk (Yenesey River), Kuibyshev (Volga), and Bukhtarma (Irtysh) reservoirs located in Russia.

In our country, in the first half of the 20th century, reservoirs were built on the Kosonsoy River (Kosonsoy Reservoir) and the Syrdarya River (Farkhod Reservoir). By the 1950s, irrigated agriculture had developed in our country, and thousands of hectares of barren and protected lands had been developed. This with one in line large industry centers (Angren, Chirchik, Navoi) cities construction This was done . as a result and to the water was demand and need further exceed gone .

This because of Uzbekistan in the rivers further many water warehouses build work began. In 1952 water with a capacity of 845 million m^3 Zarafshan on the river Kattakurgan water warehouse built .

In solving not only scientific, but also practical issues of designing, creating and operating reservoirs, the organization and systematization of a huge amount of various data and information about them is of particular importance. Classification and typification of reservoirs requires taking into account simultaneously natural, technical, ecological and social aspects and the specificity of their natural, economic and social conditions for different regions. Therefore, the necessary initial stage of universal systematization of reservoirs is characterized by the development of private (according to individual criteria, parameters and characteristics) classifications and typifications.

As we know, after the construction of reservoirs, each of them has its own unique water level, temperature, hydrochemical, hydrophysical and hydrobiological regimes. At the same time, the discharges and water masses flowing into the reservoirs through rivers and canals differ from each other in that the shape and size of the reservoir bowl change due to the movement of the water under the influence of the wind, the formation of waves, and the erosion of the banks under their influence.

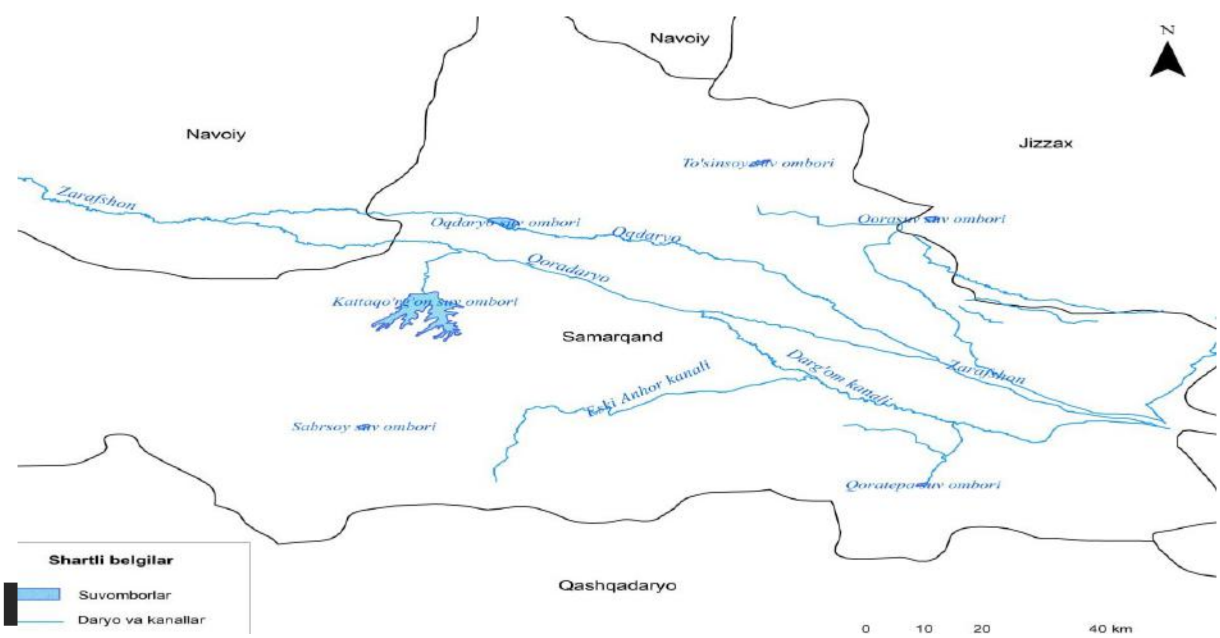
The flow of turbidity from rivers into reservoirs is of particular importance, because rapid turbidity can quickly render the reservoir unusable. This problem is very common in reservoirs in mountainous areas and is fundamentally different from reservoirs in the plains.

For example, the water entering the Kattakurgan reservoir through the canal carries 22 kg of sediment per second, or an average of 0.847 million cubic meters per year. As a result, the reservoir's volume is reduced by 0.1 percent per year.

RESULT AND DISCUSSION

The Zarafshan River, located in the central part of Samarkand region, is bordered by the Nurota Mountain in the north and stretches from east to west, while the Zarafshan Range runs in the south in the same direction. The Zarafshan Valley forms the gap between the Nurota and Zarafshan ranges. The Zarafshan River flows from east to west along the valley. The water level of the rivers in the Middle Zarafshan Basin varies daily and monthly, from winter to summer, and over the years. Currently, a number of irrigation facilities have been built to regulate the flow regime of the Zarafshan River, and several reservoirs have been built in the basin.

The Middle Zarafshan Basin contains low-pressure reservoirs such as the Akdaryo, Koratepa, Tosinsoy, Sobirsay reservoirs, Omondara, and Mominabad. The reservoirs in the Middle Zarafshan Basin are shown on the map. The largest of them are the Kattakurgan and Akdarya reservoirs. (Figure 1)

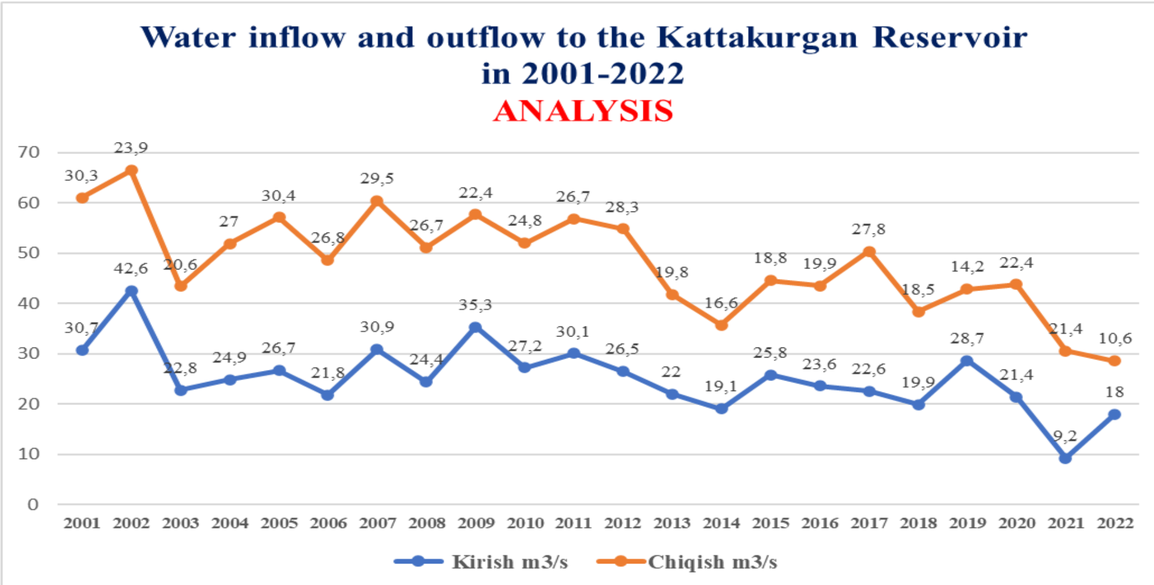


Map of water reservoirs built on the Zarafshan River (figure 1)

Kattakurgan space image of the reservoir (figure 2)

The Kattakurgan reservoir is a hydraulic structure, the first reservoir built in Uzbekistan, built in a natural depression near the city of Kattakurgan. The Kattakurgan Reservoir supplies water to the cultivated areas of the Zarafshan Valley and regulates the water regime of the Zarafshan (Qaradarya) River, storing flood and flood waters. The main structure of this reservoir, which was built and put into operation in 1940-1952, consists of a dam with a water outlet, water supply and water outflow channels. In 1941, a 4 km long , 28 m high earthen dam was built. dam rose (later of the dam height 31.5 m delivered). Water warehouse size year after year increasing went and in 1952 in the project shown quantity 845 million m^3 to delivered . (Picture 2)

The length of the water supply canal is 28 km, the water flow is 65 m^3/s, and the length of the water outlet canal is 15.2 km, the water flow is 125 m^3/s· water is discharged. In 1956, the water supply canal was reconstructed, and its water capacity was increased to 100 m^3 /s, the channel was straightened, expanded, and a concrete bed was laid on the channel. As a result, the length of the channel reached 21.2 km. The capacity of the Kattakurgan reservoir is 845 million m^3 of which the useful capacity is 834 million. m^3 The water surface area is 84.5 km^2 . Length 17 km, maximum width 8 km, average width 5 km, maximum depth 26.3 m, average depth 10.0 m. The water of the Kattakurgan reservoir is used to irrigate 94 thousand hectares of land in the Samarkand and Bukhara regions, and the water supply of 150 thousand hectares of land has been improved. Kattakurgan water warehouse water channel with To the Black Sea Water is poured . in the warehouse fishing fast developing , per year middle estimated 240-250 tons fish is hunted .



Big water warehouse characteristic years water levels vibration graph. (Figure 3)

In general, in order to study the interannual changes in the water level observed in the Kattakurgan Reservoir, data were collected on 22 years of water levels observed during the period 2001-2022. This information based on Big water warehouse characteristic years water levels vibration graph drawn . (Figure 3)

This on the graph visible it is so Kattakurgan water to the warehouse the most many water income was 42.6 million m^3 in 2022 organization did if the most less water consumption in 2022 is 10.6 million m^3 see possible .

From this outside water 24.9 million m^3 were stored in the warehouse in 2004 water poured if so , then 27 million m^3 of water per year released . Most pitiful and 9.2 million m^3 in 2021 water poured , that 21.4 million m^3 of water per year released.

Analyses this shows that global climate change under the circumstances water warehouses importance and from them reasonable use very important is considered .

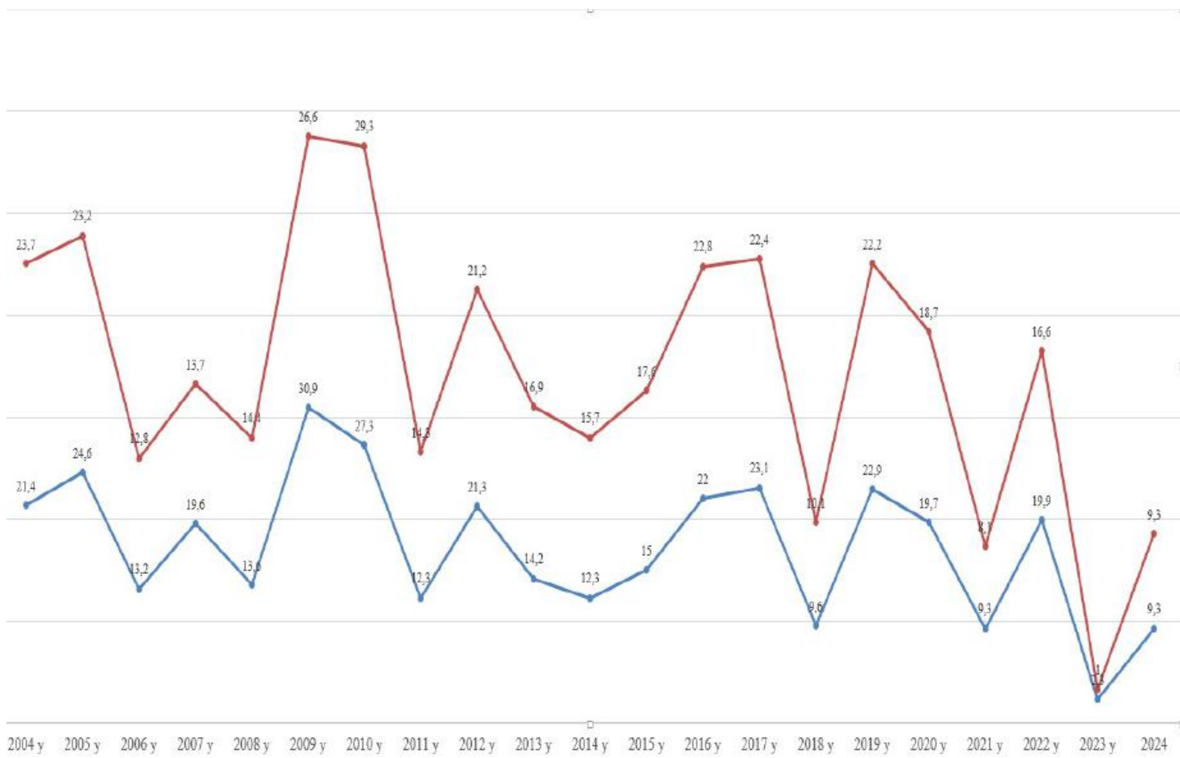
The expansion of deserts, desertification and land degradation, the increasing amount of household and industrial waste, atmospheric pollution, pollution and scarcity of water resources, and the reduction of forests and biodiversity have become extremely urgent global environmental problems for humanity. Given the specificity of these problems for our country, extensive work is being carried out in our country to protect the ecology and environment, and ensure ecological sustainability.

The Akdarya reservoir is located in the north-west of the Samarkand region, administratively covering the territory of the Ishtikhan and partly Kattakurgan districts of the region **(Figure 4).** Before the construction of the reservoir, the water of the Zarafshan River was mainly used to irrigate agricultural crops in the summer, and in the winter, the Akdarya and Karadarya waters were not used for irrigation and were wasted in the desert sands of the Navoi region. In order to eliminate this problem, the

Space image of the Akdarya reservoir (figure 4)

Akdarya reservoir, located in the Akdarya riverbed, was commissioned in 1989, its earthquake resistance is up to 7 points. The total volume of the reservoir is 120 million m^3 , of which the useful water volume is 113 million. m^3 , and the dead water volume is 1.4 million. m^3 . Today, climate change and the onset of drought are also significantly affecting reservoirs.

When analyzing the Akdaryo reservoir for the period from 2004 to 2024, we can see that the water inflow is decreasing over the years, that is, the years with the lowest water inflow were 13.6 m^3/s in 2008, 12.3 m^3/s in 2014, 9.6 m^3/s in 2018, 9.3 m^3/s in 2021, and 2.3 m^3/s in 2003. In addition, if we analyze the years with the lowest water outflow, we can see that it was 2.8 m^3/s in 2006, 8.1 m^3/s in 2021 , and 1.0 m3 /s in 2023. (Figure 5)



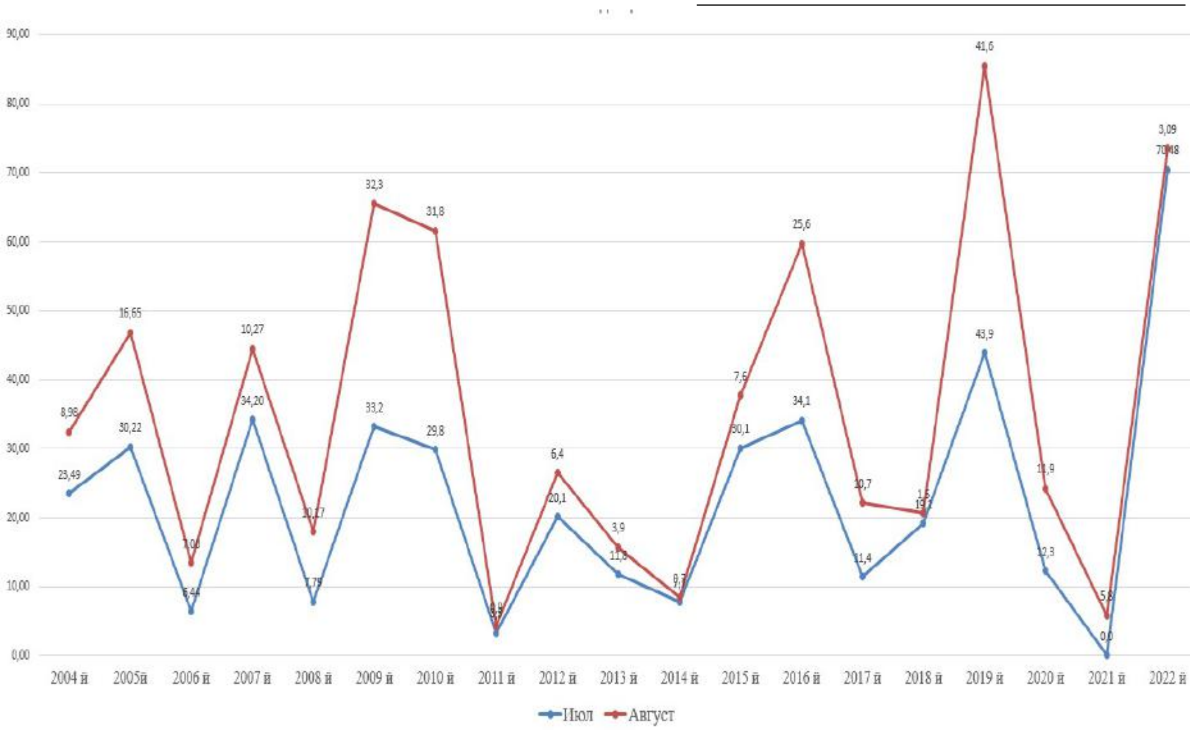
Water inflow and outflow to the Akdarya reservoir from 2004 to 2024 by year (figure 5)

contained 89.67 million m^3 of water, of which 11.50 m^3/s of water was inflow (*shown in blue on the graph*), while 30.00 m^3/s of water was consumed that year. As a result of climate change and the drought of the year, we can see that these indicators recorded the most sad and low figures in 2023, that is, the reservoir contained a total of 0.81 million m^3 of water this year, of which 2.27 m^3/ s of water was inflow, while 1.00 m^3/s of water was consumed. The main reason for this is that the weather was very hot this year and as a result of the drought of the year, there was the least water in the reservoir.

In addition, when conducting scientific analyses of water inflow or outflow into the reservoir from 2004 to 2022, the average annual data shows that the minimum water inflow was 8.98 m^3/ s in August 2004 (*shown in red in the graph)* , while the maximum inflow in July 2022 was 70.48 m^3 /s. (Figure 6)

Analysis of water inflow to the Akdaryo reservoir in July-August 2004-2022 (figure 6)

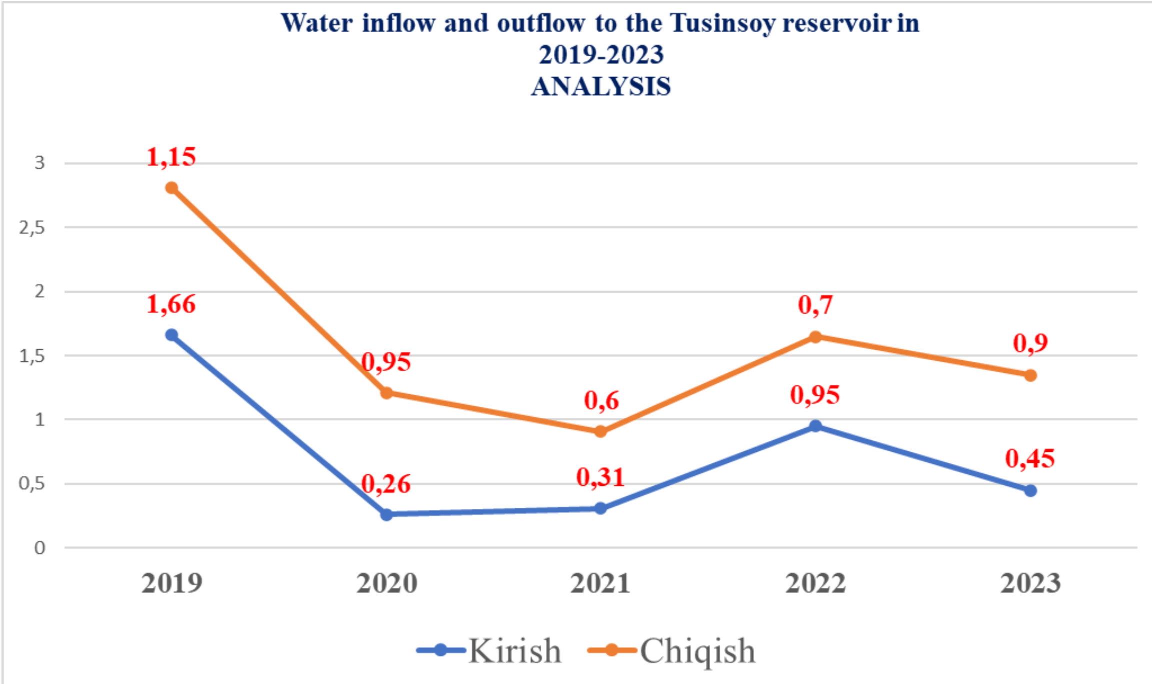
When the Akdaryo Reservoir was designed, its maximum depth was 23.4 m; currently, due to the accumulation of turbidity, the depth of the reservoir is 18.1 m.As a result of the construction of reservoirs, the flora, ecology and landscape of many river valleys have changed, and the processes here affect not only the reservoir itself, but also the natural conditions located tens of kilometers away from it. As a result of the analyzes and scientific research conducted on the Akdarya reservoir, the moisture coefficient in the air and soil has increased after the construction of the Akdarya reservoir. In particular, the groundwater level has risen on 60-70 hectares of land around the reservoir, and the soil condition has deteriorated. In the coastal zone 50-100 m around the reservoir, the soil The groundwater level is rising . cases is observed . This situation reduces the possibility of growing agricultural crops, worsens the land reclamation condition. Due to the high level of humidity in the lower part of the reservoir, even in residential areas, we can see cases of flooding of houses. Currently, in order to reduce these negative consequences, a collector-drainage system has been built around the reservoir. In addition, 50 thousand willow and poplar bushes have been planted in the coastal areas around the reservoir, these trees are water-loving trees that absorb excess



Space image of the Tusinsay reservoir (figure 7)

moisture in the soil. At the same time, fruit orchards have also been established around the reservoir. This expands the possibility of growing additional food products. Until 1994, the main attention was paid only to filling the reservoir with water and how to use it, but since 1994, a snake farm has been established on land unsuitable for cultivation near the reservoir (15-20 ha) in order to rationally use the reservoir area. The snakes here were used to extract snake venom, which is necessary for medicine. However, for some reasons, this activity was discontinued by 1996, and by 2009, fish farms were established here. The reservoir is home to 10-15 species of fish, including large-headed bream, bream, herring, flounder, eel, eider and bream, wild geese, ducks, and seagulls from fishing birds.

Before the construction of the Tusinsoy reservoir, the flow of the streams there was unevenly distributed throughout the year by season, that is, in the spring months the stream waters overflowed, sometimes causing floods, and in the summer months the flow volume decreased slightly, which caused various inconveniences to the population living along the stream in their agricultural activities. The development of new lands in the steppe and forest zones led to an increase in the demand for water. For this reason, the Tusinsoy reservoir was designed (1980), completed in 1985 and began to be filled with water, and put into operation in 1988. The design of the reservoir has a water capacity of 42 million. m^3 , and a usable volume of 5.5 million. $m^{3.}$ When filled with water, the surface of the reservoir occupies an area of 2 km^2 . The height of the reservoir dam is 41 m, and its length is 405 m. Dam wall The width of the lower part is 125 m, and the upper part is 25 m. Its depth is 52-55 m. The water transfer capacity of the structure is 40 m^3/sec. (144 m 3 /sec. during full flow). **(Figure 7)**In general, in order to study the interannual changes in the water level observed in the Tusinsoy reservoir, data on water levels observed during 2019-2023 were collected. This information based on Tosinsay water warehouse characteristic years water levels vibration graph drawn **(figure 8).**



Tosinsay water warehouse characteristic years water levels vibration graph. (figure 8)

This on the graph visible it is so Tosinsay water in the warehouse 2019-2023 during water levels change 2019 many water, 2000-2021 the most less water, 2022 year of the rat juicy and even less in 2023 juicy per year correct that he came our vision possible .

Water warehouse water balance elements analysis results based on many water in 2019 to the warehouse with an average volume of 1.66 million m ^{3} water poured and that one 1.15 million m^{3} of water per year released . Low water in 2020 , and 0.26 million m^{3} of water poured and that one 0.95 million m^{3} of water was released in 2021. 0.31 million m ^{3} water poured if so , then 0.6 million m^{3} of water per year released . Average and in 2022, water water 0.95 million m^{3} per warehouse in volume water poured and that one 0.7 million m^{3} of water per year being released was determined.

CONCLUSION

Received to the results based on, we climate change under the circumstances water resources management according to adaptation measures working exit and done increase the necessity our emphasis This water is possible. from resources effective use for infrastructure improvement, water planning strategies working exit and of the region climate to change weakness reduce measures own inside Research results Tosinsay water warehouse and other this such as in the regions water resources stable management and variable climate to the conditions adaptation policy working exit for basis become service Makes changes . more precisely prophecy to do and in the future water resources stability and preservation provide according to decisions acceptance to do monitoring for and research continue to hold important importance has is considered.

In short, the impact of a reservoir on the ecological system is multifaceted and complex. It is important to predict it only by carefully studying the geoecological conditions of the area where they will be built and determining the causes of the processes that may occur. Depending on the geographical location of mountain and foothill reservoirs located in the Middle Zarafshan, their characteristics, climate and fauna differ from each other. Reservoirs should be considered as natural-technical systems, a complex consisting of natural and technical subsystems that are in dialectical contact with each other. Taking into account this interaction can significantly increase the possibilities of rational and comprehensive use of reservoirs, while ignoring it can lead to significant losses. By managing the technical subsystem of reservoirs, a person can cause the development of such processes, phenomena and effects in the natural subsystem, which he is not yet able to prevent, or overcoming them requires the expenditure of large amounts of labor and material resources. Therefore, reservoirs can be considered only partially managed objects. Man only directly and completely controls the water reserves and partially and indirectly manages the ecosystem and geosystem of the reservoir.

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