Transboundary waters and their impact on the socio–economic development of the border areas of the Batken region of Kyrgyzstan with Uzbekistan (using the example of the Kadamzhai district)

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Abstract. The study examines the border rivers, which is one of the main features and prerequisites for the integration of the efforts of the Central Asian countries as the basis for the ecologically balanced use of water and land resources in the region. For the countries of the region, the problem of water use in the basins of transboundary rivers has much in common, however, there are differences due to the climatic, economic, economic, and political conditions of each country. Environmental security and the economy of the Central Asian countries are closely linked to the nature of the use of water resources and coordinated actions for the joint management of transboundary rivers. A noticeable decrease in their water resource potential as a result of the increasing struggle for water, pollution of water sources are considered as serious obstacles to the sustainable development of the region. Keywords: border rivers, transboundary rivers, water crisis, water resources, sustainable development

1 Introduction

The study examined indicators such as the rapid growth of the world's population, neglect of water resources management and predatory consumption of water resources by the population during economic activity have led to the fact that water resources have become even more scarce and polluted. It is known that by 2030, the demand for water resources will exceed 40% of their supply, and half of the world's population will live in areas with water scarcity.

Water resources in Central Asia are on the verge of depletion, and the ongoing decline of the Aral Sea is a prime example. Due to the lack of attention and neglect of management,

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the water resources of Central Asia are used for irrigation. Due to its geographical location, most of the cultivated lands in Central Asia require artificial irrigation.

According to statistics, 75% of the arable lands of Kyrgyzstan need artificial irrigation. This is the reason for the large losses of water resources, since more than half of the irrigation water evaporates and enters the water circulation system without entering the fields. In the Aral Sea basin, the annual loss of water resources caused by this is estimated to reach 30–40 cubic kilometers.

More than half of the Central Asian population lives in rural areas. The rural populations of Kazakhstan and Turkmenistan account for about half of the total population, the rural populations of Tajikistan and Kyrgyzstan account for about two thirds, and almost half of the Central Asian workforce is employed in agriculture. Glaciers play an important role in the water cycle in Central Asia. However, due to climate change, the mass and area of glaciers are significantly decreasing. Since water plays an important role in the transition to energy, a shortage of water resources can prevent achieving zero carbon dioxide emissions.

2 Materials and methods of research

Traditional methods of geographical research were used as the basis for the collection and analysis of materials. The solution of the study was based on the application of comparative geographical, cartographic, expeditionary and other methods of studying the dynamics of water resources.

3 Discussions

Water is a major natural resource and a strategic economic resource. Maintaining a healthy aquatic environment, guaranteeing national water security and supporting sustainable economic and social development through the sustainable use of water resources are important issues related to the national economy and the livelihood of the population. Any country needs to be persistent in managing its water resources. The countries have a vast territory and a complex topography. Most of them are in monsoon climates. Consequently, the spatial distribution of most of the river flow is seriously uneven, and the natural evolution of the water systems of rivers and lakes is relatively dramatic. Combined with the large population and high intensity of development, the task of managing water resources has been very difficult since ancient times.

Kyrgyzstan is one of the countries with the richest water resources in Central Asia, and many large transboundary rivers originate on its territory. However, due to the dominant features of the mountainous terrain of Kyrgyzstan, most of its freshwater resources are represented by Alpine glaciers, lakes and deep groundwater, the development of which is more difficult, and river runoff accounts for a relatively small proportion of all water resources.

From the point of view of the spatial distribution of water resources, the size of river runoff is positively correlated with altitude; lakes are mainly distributed in high–altitude areas; the distribution of glaciers is mainly manifested in the form of spatial imbalances.

The Ak–Suu River is an international river that crosses China and Kyrgyzstan. If Kyrgyzstan increases the use of water resources in the upper reaches of the Ak–Suu River basin, this will lead to a decrease in the amount of water entering the Ak–Suu River. This will inevitably have a significant impact on the economic and social development and environmental protection of the Ak–Suu River basin and the main course of the Tarim

River. The main attention is paid to the Ak–Suu River basin and the Tarim River drying zone (Figure 1).

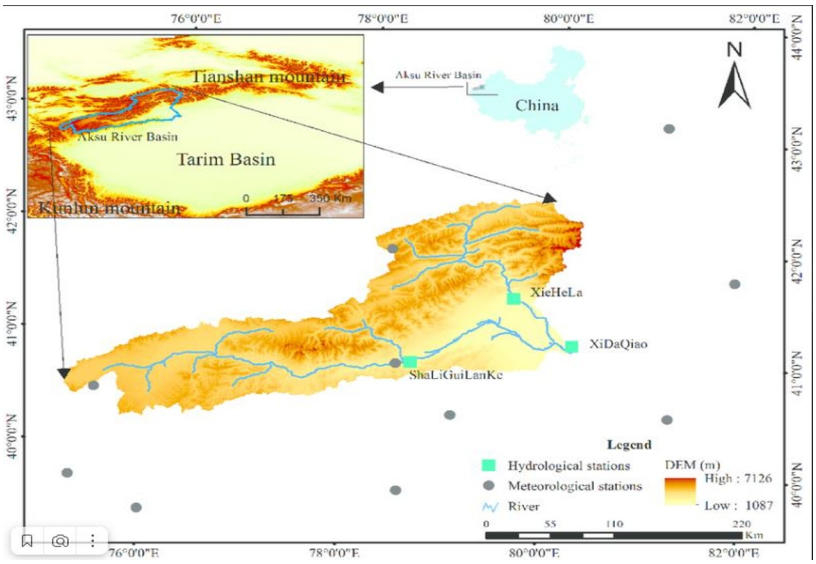

Fig. 1. Aksu River Basin. Source: compiled by the authors

The Shakhimardan River (Figure 2) originates in the territory of the Shakhimardan exclave of Uzbekistan at the confluence of the Ak–Suu and Koksu rivers, which originate on the northern slopes of the Alai and Turkestan ranges.

The basin of the Shakhimardansai River, into which the Koksu River flows, is transboundary and is located on the territories of Kyrgyzstan and Uzbekistan (the Shokhimardon enclave). It is formed as a result of the confluence of the Ak–Suu and Koksu rivers. Most of the basin is covered by high mountains. The length of the river is 112 km, the basin area is 1300 sq.km.

Fig. 2. Kyrgyzstan Shahamardan River. Note: compiled by the authors according to the data

Bakhtiyor Karimov noted in his research that the Shakhimardan River upstream from Kyrgyz and Uzbek water intake structures represents an important habitat for adult marinka in spring. The exact extent to which they also migrate to tributaries (the Koksu and Ak–Suu rivers) still needs to be clarified. However, based on the current state of the population of these tributaries, especially the density of juveniles and mature fish, it is likely that adults migrate upstream to spawn, which underlines the importance of longitudinal connectivity of habitats in tributaries.

The Kyrgyz Republic is constantly working on improving legislation. Thus, the main task of the law "On granting a special status to the Batken region" was to ensure the socio–economic development of the region with the creation of new jobs and solving urgent problems, including the construction of necessary social and infrastructure facilities, providing residents with clean drinking and irrigation water, and attracting investments. The management plans to achieve real positive changes in the life of every family living in the Batken region. The population should live in comfortable and safe conditions.

Next, we present the statistics of the Batken region for a number of years on the protection and rational use of water resources in table 1.

Table 1 – Protection and rational use of water resources *(million m^3)*

Items	2013	2016	2019	2022
Water abstraction from natural water sources	8 326,8	7 333,7	8 068,7	8 741,9
From underground water	107,9	208,7	254,8	258,4
Water consumption	5 114,0	4 668,7	5 211,1	5 844,0
For production needs	39,7	67,2	84,3	79,1
For irrigation and agricultural water supply	4 543,6	4 435,3	4 920,7	5 515,6
Waste water	113,5	100,0	99,3	132,2
Purified according to standards water	103,3	93,5	94,3	128,2
Waste water discharfe (without treatment or not enough treated)	4,9	2,1	1,9	1,7

Note: compiled by the authors according to the data https://docs.yandex.ru/docs/view?url=ya–browser%3A%2F%2F4DT1uXEPRrJRXlUFoewruPfPeOo872tcrfjtper3CWvTh1TVlJsjjOT5ZFpgSfcAneCES0JTw__tNzTwbUM6tqT7aO28fKt3eKVPw_5AG1S9D6pgPwdQLKAjas9RuchtlgQbJ8Lf6E24NUEuWbanWQ%3D%3D%3Fsign%3DAru74fpIwtd0VYbJu9GBZlxYk4IM08m7m_fr790cXXc%3D&name=2e48b8c1–aa74–4c30–910e–9d1873384fe8.xls&nosw=1

Water consumption (figure 3).

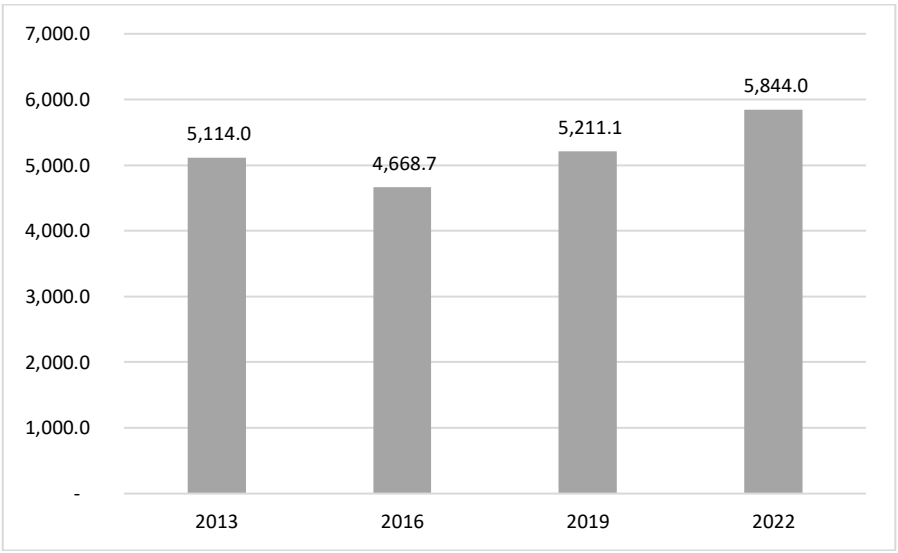

Fig. 3. Water consumption 2013–2022 Source: https://docs.yandex.ru/docs/view?url=ya–browser%3A%2F%2F4DT1uXEPRrJRXlUFoewruPfPeOo872tcrfjtper3CWvTh1TVlJsjjOT5ZFpgSfcAneCES0JTw__tNzTwbUM6tqT7aO28fKt3eKVPw_5AG1S9D6pgPwdQLKAjas9RuchtlgQbJ8Lf6E24NUEuWbanWQ%3D%3D%3Fsign%3DAru74fpIwtd0VYbJu9GBZlxYk4IM08m7m_fr790cXXc%3D&name=2e48b8c1–aa74–4c30–910e–9d1873384fe8.xls&nosw=1

The Earth's climate and the Earth's water cycle have a very close and complex relationship, so the dynamics of climate change will affect water resources. For example, a lack of rainfall will reduce soil moisture, river runoff, and groundwater recharge, but the magnitude of the overflow effect will depend on local conditions such as soil properties, geology, vegetation, and water use members [1–14].

Agricultural water use is an important link between the natural environment and socio–economic development. Continuous monitoring of spatial and temporal changes in the vulnerability of agricultural water resources is of great importance for identifying sustainable development and use of water resources, ensuring the safety of water resources and combating floods and droughts in Batken region.

The permanent population of Kadamzhai district is shown in table 2.

Table 2 –The number of permanent residents of Kadamzhai district

The name of the aiyl aimag and the settlement	**The number of permanent residents**
Batken region	**570 898**
Kadamzhai district	**204 815**
sity Aydarken	**10 998**
sity Kadamjai (including villages)	**15 213**
Ayyly (villages) in the city of Kadamzhai	6 391
Ak–Turpak Aimag	17 722
Alginsky Aimag	10 059
Birlik Aiyl Aimag	14 672

Absamat masalievsky aiyl Aimag	15 600
Translation Aimag	11 155
Maidan Aiyl Aimag	15 137
Orozbek aiyl aimag	14 187
Uch–Korgon aiyl Aimag	37 471
Kyrgyz–Kyshtak Aiyl Aimag	9 876
The Soviet Aiyl Aimag	1 552
Chauvai aiyl aimag	1 655
of Kyzyl–Kiya (village)	**61 144**
A village (selo) within the city of Kyzyl–Kiya	17 090

*Source: compiled by the authors according to official data of the National Statistical Committee of the Kyrgyz Republic.

The Nurgaziev main canal is located under the Shakhimardan irrigation and drainage system, located in Kadamzhaysky district of Batken region, three associations of water users are suspended according to the WUAs database for 2020. Below is Table 3 with the names of WUAs, irrigation area, service areas with data on WUAs members [15–20].

Table 3 – WUAs Service area

The name of the WUAs	**The size of the irrigation area (ha)**	**Number of zones**	**The area planned for irrigation**		**Actually watered area**	
			Size ((ua)	**% of irrigation area**	**Size ((ua)**	**% of irrigation area**
Ak–Suu Halmion	3 080	77	3 080	100	2 880	94
Alga–Zharkoton	750	18	750	100	750	100
The soul is the land of Pulgon	–	–	–	–	–	–

Source: compiled by the authors according to official data of the National Statistical Committee of the Kyrgyz Republic

A network of irrigation channels, hydraulic structures, reservoirs, pumping stations, etc. has been built on the territory under consideration. About 45 % of the irrigation channels in the basin under consideration are in satisfactory condition, the rest require major and routine repairs [21–25].

The level of sustainable access of the republic's population to safe drinking water has reached 92 %, but the same indicator in the Batken region is only 77 % on average over the past five years. In rural areas, due to the lack of water supply networks, open water and water management facilities are used for drinking, which are not disinfected, which leads to a high level of gastrointestinal diseases, hepatitis C. The percentage of housing stock

equipped with plumbing in the Batken region remains one of the lowest in the republic. The level of samples that do not meet the requirements of the Law of the Kyrgyz Republic "Technical Regulations on the safety of drinking water" in the Batken region is high – 6 %. The share of the population with sustainable access to sewerage is only 0.5 – 9.1 %, which is 3.5–63 times lower than the national figure. We have revealed that the volume of wastewater passing through the sewerage system is very low, there has been a decrease in the Batken region in recent years [26–33].

4 Conclusion

Thus, with the rehabilitation of on–farm canals, not only the availability of irrigated land for the local population will increase, but it will become a point of growth and the basis for the creation of regional agricultural and irrigation clusters in border areas and contribute to increasing their export potential. The development of such growth points will require the following:

– firstly, conducting research and determining the directions of economic growth based on its results;

– secondly, the establishment of the necessary amounts of financial resources and their sources;

– thirdly, the direct financing of the research.

Conducting research to study the socio–economic condition of the regions of the basin of the small Shakhimardan and Ak–Suu rivers will allow to identify potential risks and threats to these areas, develop effective plans for their development, taking into account the specifics of the region, and rationally use available resources for further growth.

Solving socio–economic issues of border rivers and sustainable water resources management helps to increase environmental sustainability, strengthen human health, protect nature, help people adapt to climate change, ensure national security, follow the laws of nature, focus on the problem, rational thinking, commitment to reform and innovation, as well as the pursuit of science and technology.

Effective water resources management and proper public health will alleviate the problem of climate change, protect ecosystems and reduce carbon dioxide emissions.

Water is a valuable non–renewable resource. It is connected with normal production and people's lives. It is an indispensable resource for human survival and development. Especially in areas where water resources are scarce, water has even become an important factor affecting relations between the countries of the region. The factor. Since the rivers flowing through Central Asia are mainly transboundary rivers, although the total amount of water resources is very large, the uneven distribution caused by geographical reasons has shaped the specifics of water resources in Central Asia. In addition to a series of disputes over the allocation of water resources between the five Central Asian countries, many contradictions have also arisen due to the long–term unjustified development, pollution and waste of water resources by various countries. To this end, the Central Asian countries have signed a number of bilateral and multilateral agreements aimed at trying to solve the problem of transboundary water resources.

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