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# ILMIY AXBOROTNOMA

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# TERRITORIAL STRUCTURE AND CHANGE DYNAMICS OF IRRIGATED LANDS OF THE ZARAFSHAN REGION

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**Abstract.** The article presents general and regional data on irrigated lands of the Zarafshan economic region. The state of provision of these lands by agricultural land types, the region's share in the country, and territorial differences between them are scientifically analyzed. In addition, the dynamics of changes in irrigated lands within the region and regions are described based on data from the last 25 years. The total irrigated lands, irrigated arable land, forest and pasture areas, territorial differences, and their gradual changes in the Bukhara, Navoi and Samarkand regions are considered separately by districts. The conclusion of the article analyzes the supply of irrigated land resources, the reasons for their change over the years and regions, and the factors affecting it, and provides suggestions and recommendations to prevent the reduction of the area of these lands.

**Keywords:** Zarafshan region, Bukhara, Navoi, Samarkand, land resources, irrigated lands, arable lands, groves, pastures

## Zarafshon mintaqasi sug‘oriladigan yerlarining hududiy tarkibi va o‘zgarish dinamikasi

**Annotatsiya.** Maqolada Zarafshon iqtisodiy rayoni sug‘oriladigan yerlari haqida umumiy va viloyatlar doirasidagi ma’lumotlar keltirilgan. Mazkur yerlarning qishloq xo‘jaligi yer turlari bo‘yicha ta’minlanganlik holati, mintaqaning mamlakat miqyosidagi ulushi, ular o‘rtasidagi hududiy tafovutlar ilmiy tahlil qilingan. Bundan tashqari so‘nggi 25 yillik ma’lumotlar asosida rayon hamda viloyatlar doirasida sug‘oriladigan yerlarning o‘zgarish dinamikasi bayon qilingan. Buxoro, Navoiy va Samarqand viloyatlari umumiy sug‘oriladigan yerlari, sug‘oriladigan ekin yerlar, daraxtzor va yaylovlar maydoni, hududiy tafovutlari, uning tadrijiy o‘zgarishlari tumanlar bo‘yicha alohida ko‘rib chiqilgan. Maqolaning xulosa qismida sug‘oriladigan yer resurslari bilan ta’minlanishi, ularning yillar va hududlar bo‘yicha o‘zgarishi sabablari va unga ta’sir etuvchi omillar tahlil qilinib, ushbu yerlar maydonini qisqarishi oldini olish bo‘yicha taklif va tavsiyalar berilgan.

**Kalit so‘lar:** Zarafshon mintaqasi, Buxoro, Navoiy, Samarqand, yer resurslari, sug‘oriladigan yerlar, ekin yerlar, daraxtzorlar, yaylovlar.

## Территориальная структура и динамика изменения орошаемых земель в Зарафшанском регионе

**Аннотация.** В статье даны общие и региональные сведения об орошаемых землях Зарафшанского экономического района. Научно проанализировано состояние обеспеченности сельскохозяйственными угодьями этих земель по видам, доля региона в республике, а также региональные

различия между ними. Кроме того, описывается динамика изменения орошаемых земель в разрезе областей и регионов на основе данных за последние 25 лет. Отдельно по районам рассмотрены общая площадь орошаемых земель, орошаемых пахотных земель, лесных и пастбищных угодий, территориальные различия и ее постепенные изменения в Бухарской, Навоийской и Самаркандской областях. В заключении статьи анализируется обеспеченность орошаемых земельных ресурсов, причины их изменения по годам и регионам, факторы, на них влияющие, а также даются предложения и рекомендации по предотвращению сокращения площади этих земель.

**Ключевые слова:** Зарафшанский район, Бухарская, Навоийская, Самаркандская области, земельные ресурсы, орошаемые земли, пашни, рощи, пастбища.

**Introduction and problem statement.** The Zarafshan economic region is located in the relatively central part of our country and includes the Bukhara, Navoi and Samarkand regions (Fig 1). Its area is 168.1 thousand sq. km., which is 37.4% of the territory of the republic and in this respect is second only to the Lower Amu Darya economic region in Uzbekistan (Fig. 1). The historical and geographical basis or foundation of this economic region, the forming factor of the region, is the Zarafshan River. True, this hydrographic branch does not currently reach the Bukhara region, but the culture and history of ancient Bukhara were formed precisely under its influence. In turn, the current Bukhara-Karakol oasis also arose on the basis of the ancient flow of the Zarafshan River [7].

The Zarafshan economic region includes the middle and lower reaches of the Zarafshan River, which has a transboundary character. In terms of natural geography, most of it consists of the Kyzylkum desert. Mountainous areas are partly located in the Samarkand region, and oases and valleys are scattered. The territorial structure of the district economy is also formed accordingly. Navoi region stands out in terms of area, and Samarkand region in terms of demographic potential. Bukhara region occupies an average position in this regard.

**Study of the problem.** Irrigated lands are mainly an important object of research in agriculture, economics and geography. A lot of work has been done in this regard within the framework of the directions of geography, and these studies focus on the sectoral (agriculture, in particular farming) and territorial (economic region, region and district) characteristics of irrigated lands. To this end, in many regions of our country, these lands are being studied by several researchers within the framework of the above-mentioned goals.


**Figure 1.** The map scheme of Zarafshan region

In particular, the irrigated lands of the Zarafshan economic region have been studied for agricultural purposes in different years (for example, in the 1960s by Z.M. Akramov). However, the quantity and qualitative characteristics of these lands have not been considered separately, and they have not been studied specifically within the region. In this work, it is these aspects that are given more importance, and irrigated lands are analyzed separately by land type.

**Aim and objectives of research.** The region is moderately endowed with natural and climatic resources, and fertile land and fresh water resources are very unevenly distributed. Due to the somewhat better condition of land resources in this regard and the large area occupied by them, the extensive form of agriculture is widespread. Slope farming is the main occupation of the population, especially in the steppe regions. In this regard, the conditions and opportunities of the Bukhara and Navoi regions are similar. The total land resources of the region are 16.8 million hectares, of which 65% belong to the Navoi (10.9 million ha), 25% to the Bukhara (4.2 million ha) and the remaining 10% to the Samarkand (1.68 million ha) regions. Irrigated lands account for only 4.6% of the total area [10].

**Materials and methods.** The study was conducted on the basis of a systematic and comparative analysis of dissertations on agricultural geography by Uzbek geographers from the 1960s to the present day, with a focus on the classification of relevant research on the topic. The author of the article studied the catalogs of dissertations and abstracts in the Alisher Navoi National Library of Uzbekistan and the library of the Mirzo Ulugbek National University of Uzbekistan. According to their findings, from the 1970s to the present day, about 50 dissertations written for the degree of Candidate of Sciences or Doctor of Philosophy (PhD) in the field of agriculture have been defended in Uzbekistan. Therefore, the analysis, the results of which are presented in the form of an article, was carried out within the framework of more than 40 candidate and doctoral, philosophical (PhD) and doctor of science (DSc) dissertations [4, 12, 16].

**Results and discussion.** In general, the total area of irrigated land in the region is slightly more than 7.8 thousand km$^2$, or 4.7% of the region's land resources. In 2010, it amounted to 777.7 thousand hectares, which has remained almost unchanged over the past 15 years (an increase of 101%). However, since the beginning of the century (7227 km$^2$), the area of this land has increased by 63,000 hectares in the region [8]. Since the beginning of independence, the area of this land has also changed significantly due to water resources. In addition, as a result of other social factors, irrigated land has decreased and some changes are observed in the structure of agriculture. These include the construction of new settlements for the purpose of residential areas, the expansion of household plots, the transfer of irrigated and fertile lands to sectors other than agriculture (Table 1).

Table 1

**Territorial composition and dynamics of irrigated lands of the Zarafshan economic region**

(thousand ha)

| Types of irrigated land | Samarkand | | Bukhara | | Navoi | | Region | |
|---|---|---|---|---|---|---|---|---|
| | 2010 | 2024 | 2010 | 2024 | 2010 | 2024 | 2010 | 2024 |
| Common lands | 379,2 | 379,5 | 275,1 | 280,2 | 123,4 | 126,1 | 777,7 | 785,8 |
| Arable lands | 253,9 | 243,7 | 200,6 | 205,8 | 91,0 | 91,2 | 545,5 | 540,7 |
| Orchards | 56,4 | 66,8 | 20,3 | 21,0 | 10,3 | 9,6 | 87 | 97,4 |
| Fallow lands | - | - | 6,9 | 5,2 | 6,7 | 6,7 | 13,6 | 11,9 |
| Homestead and orchard, vegetable lands | 62,9 | 62,9 | 46,5 | 46,5 | 13,7 | 17,1 | 123,1 | 126,5 |
| Forest lands | 6,0 | 6,0 | 1,8 | 1,7 | 1,7 | 1,5 | 9,5 | 9,2 |

***Source:*** *Prepared by the author based on data from the Cadastral Agency under the Tax Committee.*

The main type of irrigated land in the region is agricultural land. According to 2024 data, the area of this land amounted to almost 650 thousand hectares (17.4% of the country's agricultural land), or an increase of 4 thousand hectares compared to 2010. This type of arable land includes irrigated crops, perennial forest plantations and fallow lands. The area of irrigated crops, which is the main asset of the agricultural sector, and more precisely, agriculture, is about 540 thousand hectares, which is 16.7% of the country's land (3245 thousand hectares). These land resources have decreased by more

than 12 thousand hectares over the past quarter century (in 2000, it was 553 thousand hectares). Gray lands (11,806 ha) and perennial forest plantations (97,398 ha) account for almost the same part of the republic's arable land, i.e. 24.1 and 24.3 percent, respectively. Homestead lands and horticultural vegetable association lands occupy a relatively larger area (126.5 thousand ha). This is because the population in this region has previously lived mainly on irrigated agricultural lands. It should be noted that this is also the main problem in the region, as a large number of highly productive lands are being transferred to other sectors of agriculture. Irrigated forests, like in the republic, occupy a much smaller area (9.3 thousand ha). The above-mentioned heterogeneity is also clearly visible in the distribution of lands by region. The smallest region of the Zarafshan economic region, Samarkand, is very well provided with irrigated lands (379.5 thousand ha). This territory accounts for 8.7 percent of the country's arable land, and almost half of the district (48.3 percent). Irrigated land in the region has remained almost unchanged over the past 15 years, increasing by only 300 hectares. However, by the beginning of the third millennium, these lands had expanded by more than 6,000 hectares by 2010. Irrigated arable land amounted to 253.9 and 243.7 thousand hectares in 2010 and 2024, respectively, or a decrease of 4 percent over this period. This is largely due to changes in the mechanical composition of the soil. The share of these lands in the region and the republic was also 45.1 and 7.5 percent, respectively. Perennial forest stands amounted to 66.8 thousand hectares, which can be observed to have increased by 18.5 percent over the analyzed years (Fig. 2). Homestead lands, horticultural vegetable association lands, and forests have not changed at all (62.9 thousand and 6 thousand hectares) [11].

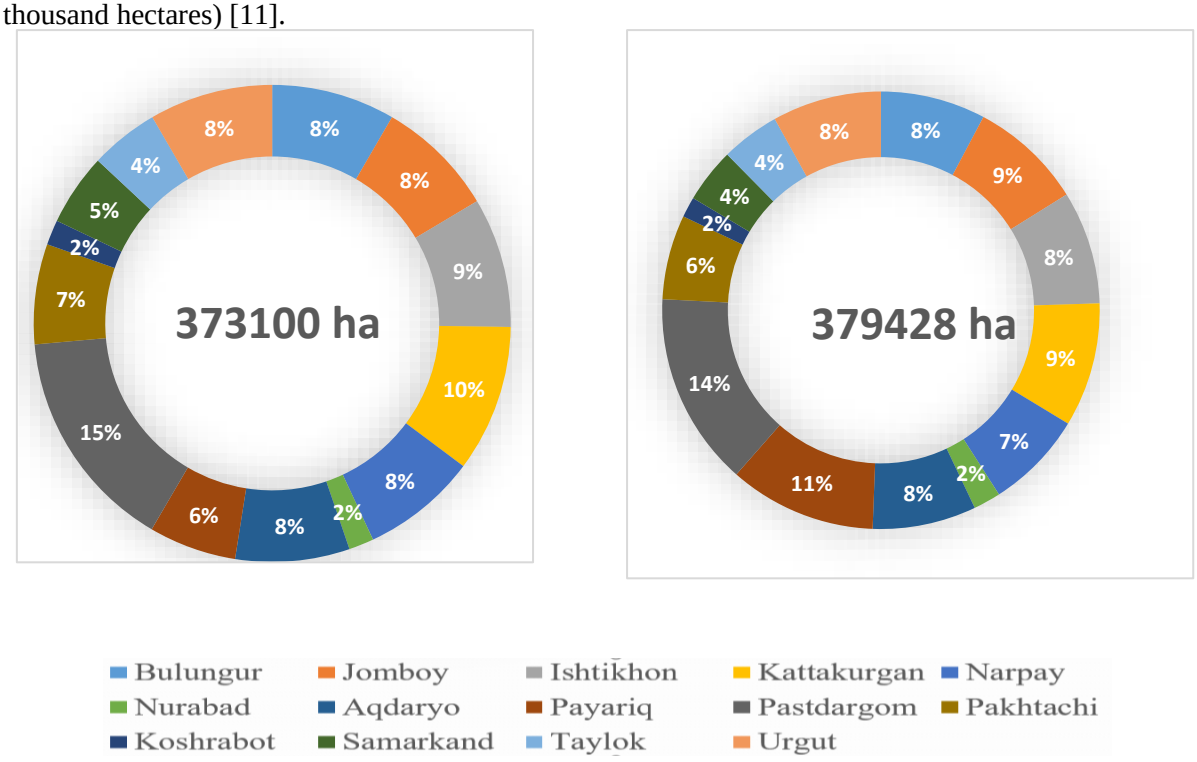


**Figure 2.** Share of irrigated land in Samarkand region districts in 2000-2024
***Source:*** *Prepared by the author based on data from the Cadastral Agency under the Tax Committee.*

When analyzing the share of irrigated land by region, it can be observed that each of the Pastdargam and Payariq districts accounts for more than 10 percent of the land. The share of irrigated arable land is also much higher in these areas (17.2% in Pastdargam, 12.7% in Payariq). Naturally, desert districts such as Nurabad and Qoshrabhat are much poorer in this regard (around 1.5-2%). The share of districts in this regard has not changed much over the past 25 years (the difference was 1-2%). However, increased attention to arable land in the Payariq district led to an increase in its share by 5 percent compared to 2000 (- figure). The area of perennial tree plantations, on the contrary, is much larger in the mountainous districts, including 11.8 thousand ha in Urgut and 8.4 thousand ha in Bulungur. Homestead lands and vegetable gardening associations also occupy the largest area in

Pastdargom (6.8 thousand hectares), that is, 10.7 percent of the region's share. Bulungur, Jamboy and Akdaryo districts are richer in forests compared to other regions. The uneven distribution of irrigated lands in the region depends on their geographical location, including relief and the state of water resources. Bukhara region has an average indicator in terms of irrigated land. As noted above, almost all types of agricultural land here are open-pit lands, and there is no shifting cultivation. The total area of irrigated lands (280 thousand hectares) is slightly more than a third of the Zarafshan economic region (35.7%), 6.5 percent of the republic. These land resources have increased by almost 7,000 hectares over the past quarter century, and irrigated arable land by 6,000 hectares. The area of irrigated arable land is about 205.8 thousand hectares, and its share in the region and the country is similar to the total irrigated land (38.1 and 6.3%). The area of perennial forest stands is small (21 thousand hectares), like other desert regions, and in this respect is also average in the region. Gray lands are larger than in other regions, as can be seen from their share in the region (44%) and in the republic (10.6%). Since the population has long lived mainly on fertile lands, there are also more household plots and vegetable gardens (46.5 thousand hectares). Irrigated forests cover 1,700 hectares, which is a relatively small share in the region (18.4%) and the country (3.2%). Due to the high amount of water used for irrigated lands in the region, its area is decreasing [12].

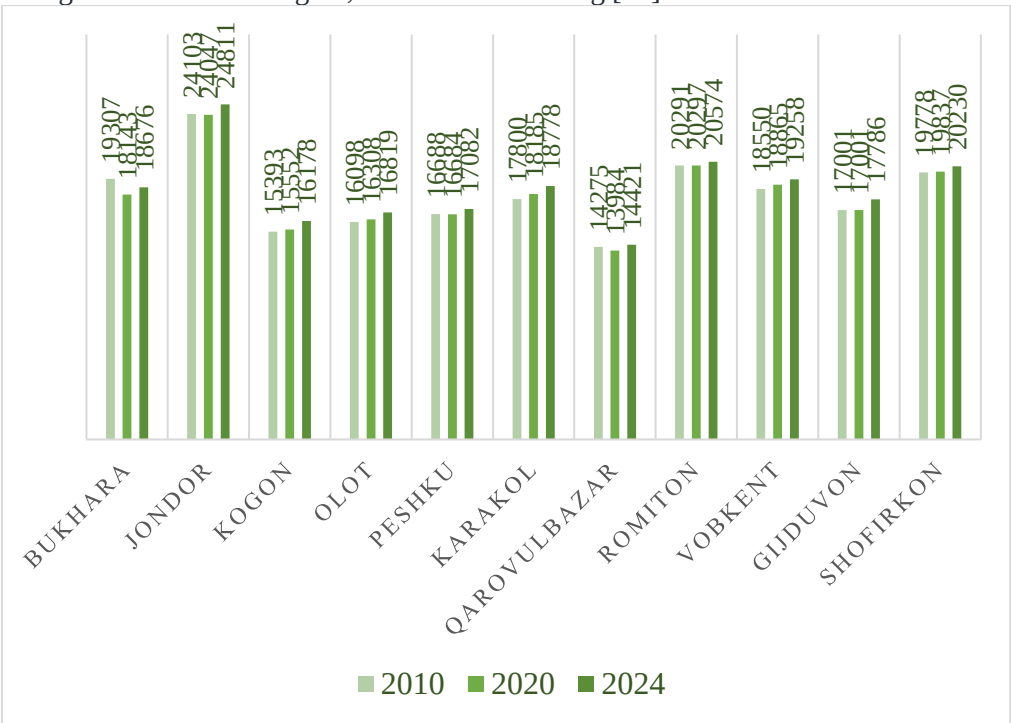


**Figure 3.** Dynamics of change of irrigated arable land in Bukhara region

***Source:*** *Prepared by the author based on data from the Cadastral Agency under the Tax Committee.*

There are a number of differences in the provision of irrigated land in the region, and the factors that cause this include the geographical location of the districts, water supply, etc. In general, there are more of these lands in Jondor, Shofirkon and Bukhara, while the opposite is true in Kogan and Qarovulbazar. Jondor district is also the leader in terms of irrigated arable land (24.8 thousand ha), while Qarovulbazar is in last place (7%) (Fig. 3). The Bukhara district has better irrigated perennial tree plantations (3831 ha), and almost a fifth of the region's irrigated lands are located here. In the Olot and Qarovulbazar districts, their area has decreased due to increased anthropogenic factors. In general, Qarovulbazar has a passive indicator for all types of arable land. Karakul district is the leader in terms of irrigated homestead lands and horticultural vegetable association lands (6730 ha), or 14.5% of the region's land area. The area of irrigated forests is the largest in Shafirkon district (355 ha), and the smallest in Kogon (20 ha). Compared to total land, the share of irrigated lands in arable and fallow lands and perennial tree plantations is almost 100%. Since the region's agriculture is not sufficiently provided with agroclimatic resources for spring farming, all arable lands fall into the category of irrigated lands.

Table 2

**Dynamics of the share of irrigated and arable land in the districts of Navoi region relative to the region**

| № | Territories | Irrigated lands | | | | Irrigated arable lands | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 2010 | 2020 | 2024 | Difference between 2010 and 2024 | 2010 | 2020 | 2024 | Difference between 2010 and 2024 |
| 1 | Karmana | 16,2 | 17,2 | 15,7 | 99,0 | 17,5 | 16,5 | 16,5 | 94,3 |
| 2 | Konimekh | 4,8 | 4,8 | 4,7 | 100,3 | 5,2 | 5,2 | 5,2 | 100,1 |
| 3 | Navbahor | 19,5 | 19,2 | 19,1 | 99,9 | 20,5 | 20,8 | 20,9 | 102,1 |
| 4 | Nurota | 3,7 | 3,7 | 5,5 | 151,9 | 3,5 | 3,6 | 3,6 | 102,1 |
| 5 | Kiziltepa | 26,1 | 25,5 | 25,6 | 100,2 | 24,6 | 24,8 | 24,9 | 101,4 |
| 6 | Tomdi | 0,2 | 0,2 | 0,2 | 100,0 | 0,3 | 0,3 | 0,3 | 100 |
| 7 | Uchkuduk | 0,1 | 0,1 | 0,1 | 100,0 | 0,1 | 0,1 | 0,1 | 100 |
| 8 | Khatirchi | 29,4 | 29,3 | 29,1 | 99,9 | 28,3 | 28,7 | 28,5 | 100 |
| | **Region** | 100 | 100 | 100 | 102,1 | 100 | 100 | 100 | 100,2 |

***Source:*** *Prepared by the author based on data from the Cadastral Agency under the Tax Committee for 2024.*

Navoi region is very poor in agriculture, including irrigated land. These lands account for only 1.8% of the region's agricultural land and 1.1% of the total area. Moreover, the share in the region (16%) and the republic (2.6%) is also much lower. Irrigated arable land accounts for 91.2 thousand hectares, or almost 17% of the region's land. When analyzing the changes in the region's irrigated land since the beginning of the century, not much difference is noticeable. That is, while the total irrigated land has expanded by a little more than 1,500 hectares, irrigated arable land, on the contrary, has decreased slightly (by about 200 hectares). The area of tree plantations is also the smallest in the region (9.9%), but fallow land is the largest (56%), and its share in the country is 13.5%. The share of homestead lands and horticultural vegetable plots (13.5%) and irrigated forests (16.7%) is also not very high. The regional differences in irrigated land in the region are very high, mainly in the southeastern districts. Khatirchi and Kyzyltepa districts account for 54.4% of the total irrigated land and 53.2% of irrigated arable land. Tomdi and Uchkuduk districts, which are the largest not only in the region but also in the republic, account for only 0.3 and 0.4% of these lands, respectively. In addition, since water is very scarce in these regions, there are no other irrigated lands at all. In addition, Navbahor and Karmana districts are also well-supplied with arable land. The share of arable land in the districts in relation to the total land of the region has changed differently over the past 15 years. In particular, irrigated land increased from 3.5% to 5.5% in Nurota district (an increase of 151.9%), while irrigated arable land decreased by almost 6% in Karmana (formerly Navoi) district (- table). The difference in perennial tree plantations, homestead lands and horticultural vegetable association lands is not so high, but 2/3 of irrigated fallow lands and 42.6% of forests belong to Kyzyltepa alone (Table 2). In Navoi region, regional differences are observed not only in agriculture, but also in other sectors of the economy. Therefore, one-sidedness in the agricultural sector, in particular in farming, is clearly visible in this region [8; 11].

**Conclusion.** The area of irrigated land in the region and the level of its use are changing from year to year. In general, the following factors affect the change in these land resources:

**1. Water resource shortage.** The Zarafshan economic region receives its main water from Zarafshan and the Amu Darya. In this regard, the Zarafshan River is considered the main artery of the region, providing Samarkand region with water in full, Navoi region with almost full, and Bukhara with partial water. In addition, the Amu Darya is also the main supplier of the region, supplying the necessary water resources for agriculture and the needs of the population through the Amu-Bukhara and Amu-Karakul canals. In recent years, the area of glaciers, which are the main source of these rivers, has decreased (by 10 - 20%), and the amount of water resources is decreasing. To prevent this, it is better to use modern irrigation technologies (in particular, drip irrigation).

**2. Increased demand.** The population of the region has increased almost 10 times over the past 100 years. As a result, the pressure on irrigated land has increased, which also affects its quality. It is necessary to develop non-agricultural sectors or develop an agro-industrial sector in the region.

**3. Improper use of land in agriculture.** Planting the same crops for a long time and improper irrigation have led to a reduction in the area of these lands and a decrease in their fertility. The solution to this can be the correct implementation of crop rotation.

**4. The use of fertile lands for sectors other than agriculture.** Over the past 20-30 years, the transfer of these lands to other sectors (industry, services and residential areas) has intensified. If this process is not legally regulated, their area may decrease further in the future.

**5. Transboundary and political problems in water use.** The waters of the Amu Darya and Zarafshan rivers originate in the neighboring state of Tajikistan. In addition, in addition to Tajikistan and Uzbekistan, the Amu Darya water is used in agriculture by Turkmenistan and Afghanistan. Therefore, it is necessary to regulate the use of river waters through certain regulatory documents. Regarding the equitable use of water, Uzbekistan is a member of the "Convention on the Protection and Use of Transboundary Watercourses and International Lakes", adopted by the UN Economic Commission for Europe in 1992. According to it, all countries located on the banks of the river have their own limits in using its waters. In addition, in 2002, a declaration was adopted between the two countries in Dushanbe on water use. These documents serve as legal support in resolving political problems in the use of the Zarafshan River. In addition, this issue can be resolved positively by adhering to the basic principles of river water distribution mentioned above.

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