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The problem of water supply of population and farms in Aghdam and Fuzuli regions

Abstract: In modern times, the provision of water resources is one of the main factors affecting the sustainable settlement of the population and its employment. In the context of global warming and climate changes, efficient use of limited water resources is very important. Providing water to the population is considered one of the important factors of improving the quality of life. This issue is of special importance for the liberated territories of Azerbaijan. In the long-term perspective, the level of provision of water resources in rural areas plays an exceptional role in ensuring the sustainability of settlement. The article is dedicated to the possibilities of using water sources and improving drinking water supply in Agdam and Fuzuli administrative regions, which are included in the Karabakh economic-geographical region. The possibilities of providing water sources to the population, especially rural communities, were analyzed and economically-geographically evaluated. The article examines the role that access to existing water sources can play in the employment of the population in those administrative regions. For each of Agdam and Fuzuli regions, the possibilities and prospects of providing the population with water resources were investigated separately. Proposals and recommendations for improving water supply have been made.
Keywords: Sustainable, population, water supply, settlement, employment.

Összefoglalás: A modern időkben a vízkészlet biztosítása az egyik fő tényező, amely befolyásolja a lakosság fenntartható letelepedését és foglalkoztatását. A globális felmelegedéssel és az éghajlatváltozással összefüggésben nagyon fontos a korlátozott vízkészletek hatékony felhasználása. A lakosság vízellátását az életminőség javításának egyik fontos tényezőjének tekintik. Ez a kérdés különösen fontos Azerbajdzsán felszabadított területei számára. Hosszú távon a vidéki térségek vízkészlet-ellátottsága ki-

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emelkedő szerepet játszik a település fenntarthatóságának biztosításában. A jelen tanulmány a vízforrások felhasználásának és az ivóvízellátás javításának lehetőségeivel foglalkozik a karabahi gazdaságföldrajzi régióhoz tartozó Agdam és Fuzuli közigazgatási régiókban. Elemezték és gazdaságföldrajzilag értékelték a lakosság, különösen a vidéki közösségek vízellátásának lehetőségeit. A kutatás annak vizsgálatára irányul, hogy a meglévő vízforrásokhoz való hozzáférés milyen szerepet játszhat az adott közigazgatási régiók lakosságának foglalkoztatásában. Agdam és Fuzuli régiók mindegyikében külön-külön felmérték a lakosság vízkészlettel való ellátásának lehetőségeit és kilátásait. Ennek eredményeként javaslatok és ajánlások születtek a vízellátás javítására.
Kulcsszavak: Fenntarthatóság, népesség, vízellátás, település, foglalkoztatás.

Introduction

After the liberation of the Karabakh and East Zangezur territories of Azerbaijan, which had been under occupation for nearly 30 years, in 2020, there was a need to restore the infrastructure that had been destroyed and devastated. One of the areas that suffered damage and needed restoration and efficient development is water resources management. During the occupation, river beds were neglected, polluted, and reservoirs and artificial reservoirs were seriously damaged. Ensuring the provision of water resources and accessibility to water sources is an important issue in terms of the population returning to their homelands and living prosperously, and the settlement of the population in the territories liberated from occupation. In order to consistently and sustainably solve the problem of water resource use, "Azerbaijan 2030: National Priorities for Socio-Economic Development" was approved. Based on these priorities, the "Socio-Economic Development Strategy of the Republic of Azerbaijan for 2022–2026" was developed. The importance of ensuring the implementation of the National Priority "Great Return to the Liberated Territories" is reflected in the "State Program on the Great Return to the Liberated Territories of the Republic of Azerbaijan". One of the items mentioned in the program is the implementation of measures related to the construction, reconstruction, restoration of water management facilities, drinking water and irrigation water supply, as well as rainwater management in order to effectively use the water resources of the liberated territories [1].

[1] *I State Program on the Great Return to the liberated territories of the Republic of Azerbaijan*. Baku, 2022.

Azerbaijan is less well-supplied with water resources compared to other South Caucasus countries. In 2010–2023, the volume of water withdrawn from natural sources increased by 10.7 percent, and water consumption by 26.7 percent [2].

Taking into account the current situation and future risks, an order was signed on October 10, 2024 to approve the "National Strategy for the Effective Use of Water Resources".

[2] *Decree of the President of the Republic of Azerbaijan on the allocation of the "National Strategy for the Use of Water Resources".* Baku.

The purpose of the study

To analyze and assess the accessibility of the population to existing water sources in the territory of the Aghdam and Fuzuli regions, which are part of the Karabakh economic region, and to investigate the possibilities of improving water supply. The article also examines the role that accessibility to existing water sources in the Aghdam and Fuzuli regions can play in the employment of the population. For this purpose, the tasks set were to analyze the existing water sources in these regions from an economic and geographical perspective, identify the villages through which the main rivers that play an important role in water supply pass, as well as analyze multi-year statistical indicators on water use.

Methodology

During the study, data expressing quantitative indicators of the population were compared based on population census data of the last two years (2009 and 2019). The data obtained through the Google Earth program made it possible to monitor and analyze the geographical location of settlements in the study area and their proximity to water bodies. The research also used the indicators of the State Statistical Committee of the Republic of Azerbaijan on water resources and related scientific literature. Based on the comparative analyses conducted, certain conclusions were drawn and relevant recommendations were made.

Analysis and discussion

The administrative regions of Aghdam and Fuzuli are located in the eastern part of the Karabakh economic region, and both are distinguished by the vastness of their plains and high demographic potential. The territory of these administrative regions, dominated by a plain relief and semi-desert landscape, is characterized by low rainfall (400–500 mm per year) and a relatively low density of the river network. The territory of both regions is characterized by fertile soils that allow the development of irrigated crop production. Aghdam and Fuzuli regions together have 205 settlements [3], which is 34.2% of all settlements in the region.

Part of the Aghdam region was occupied from the early 1990s to 2020. The Gargarchay and Khachinchay rivers and the reservoirs of the same name located on the Khachinchay are of great importance in the water supply of the Aghdam region, which has an area of 1,150 km^2. Approximately 92% of the administrative region's lands are suitable for cultivation [4]. During the occupation of Aghdam, water sources in its territory were deliberately blocked during the summer months, which seriously damaged the economy. During the rainy season, the removal of these barriers led to floods. There are fertile conditions for the development of grain growing and other agricultural sectors.

The Aghdam administrative region ranks first in terms of population in the Karabakh economic region. Its population is 178.4 thousand people [5], which is 1.8% of the country's population and 24.2% of the economic region's population.

Rapid reconstruction and reconstruction work is being carried out in the Aghdam region, especially in the villages of Kangarli, Khi-dirli, Sarijali and Bash Garvand [6]. The first migration to the city of Aghdam is planned for 2025. During the resettlement of the population, the issue of water supply is of great importance in terms of ensuring employment, household use and cultural recreation. The presence of agricultural lands (29%) [7] in the district and the fact that agriculture is the traditional occupation of the population are factors that necessitate the efficient use of water resources. The main statistical indicators related to water use in the administrative district are given in *Table 1.*

[3] Census of the district of the Republic of Azerbaijan (2019): *ARDSK. Statistical collection, I c. Population size, sex-age repeat.* Baku.

[4] Mammadov, C. H. (2024): Hydrological characteristics of rivers of Aghdam region, Water problems: Science and technology. *International Peer-Reviewed Scientific Journal,* 1., (23.).

[5] Among Azerbaijan (2023): *Statistical bulletin.* Baku.

[6] https://president.az/az/articles/view/66857

[7] Geography of Karabakh and Eastern Zangezur (2021): *Natural-geographic conditions and socio-economic development potential.* Baku.

Table 1. Some indicators of water use in Aghdam region

Actions	2015	2018	2019	2020	2021	2022
Water consumption, mln. cubic m.	241.7	267.7	299.9	261.3	274.9	289.9
Use of water for domestic drinking purposes, mln. cubic m.	5.4	1.9	1.5	1.3	1,2	1,2
Water supply for irrigation and agriculture, mln. cubic m.	236.3	265.8	298.4	260.0	273.6	288.8
Disposal of waste water, mln. cubic m.	5,6	1.7	0.03	0.0	0.0	0.04
Water loss, mln. cubic m.	36.2	61.8	59.5	85.1	68.9	79.2

Source: Regions of Azerbaijan, ARDSK, 2023, p. 864.

As can be seen from *Table 1*, although water consumption in the region has increased, water use for domestic and drinking purposes has decreased. The main reason for this is that water is mainly used for irrigation in agriculture. In 2022, water consumption in the Aghdam region accounted for 15.8% of the total consumption in the Karabakh economic region (1828.0 million m3) [8]. Water used for irrigation and agricultural water supply is 15.8% of the total indicator in the economic region (1820.4 million m^3) [8].

Water loss indicators reached their maximum in 2020. Although water consumption in 2020, as well as irrigation and agricultural water supply indicators, decreased compared to 2019, water loss reached its highest level in that year. Water loss in Aghdam district in 2022 accounts for 14.6% of the total water loss in the economic region in 2022 (541.9 million m3). The main reason for water loss is non-compliance with norms and rules during irrigation, non-application of "smart irrigation systems", and lack of concrete lining of ditches and canals. Since 2021, an increase in water consumption and water supply to agriculture has been observed. When analyzing the table, it is also noticeable that the wastewater discharge indicator decreased in 2015–2022, and slightly increased in 2022.

[8] Environment in Azerbaijan (2024): *Statistical compilaion.* Baku: DSK.

The Khachinchay River, which plays an important role in the water supply of the Aghdam region, flows through the villages of Aliagali, Alimadetli, Khachindarbetli, Mollalar, Magsudlu, Talishlar, Kosalar, Abdynli, Goytepe, Shirvanli, Shukuragali, Sarijali, Uchoglan, and Orta Qishlag of the region and is an indispensable source of drinking water for the population. Since these areas have favorable conditions for the development of agriculture, it is possible to ensure the employment of the residents of the mentioned villages, who will be resettled in the coming years, in income-generating agricultural fields to a large extent through the efficient use of the water of this river.

The Khachinchay reservoir, located 6 km east of the Aliagali village of the Aghdam region, in the Khachindarbetli village, has not been used for a long time due to its occupation. The reservoir has the potential to meet the water needs of the population of the villages of Khachindarbetli, Aliagali and Mollalar in particular. The Khachinchay reservoir allowed for the irrigation of more than 10 thousand hectares of land before the occupation.

According to expert estimates, the Khachinchay reservoir can irrigate an area of 20,000 ha or 200 km^2 [9]. The effectiveness of measures to be taken to improve the well-being of rural communities in the mentioned settlements can be largely determined by improving water supply. The Gargarchay River, formed by the confluence of the Khalfali River and the Zarisli River, flows through the territory of Aghdam district and at a shorter distance to Khachincha. This river passes through or near the villages of Poladli, Garadagli, Shikhbabali, Saybali, Ajarli, Novruzlu and Yusifjanli. It should be noted that the main purpose of the construction of the Agdamkend water reservoir, which was built in Gargarchay in 1963, was the irrigation of agricultural lands.

Aghdam's water supply uses water from the kahriz, canal and subartesian wells. A. According to Guliyev, there were 105 kahriz in the territory of Agdam region in 1938 [10]. 202 researchers are deployed in 48 unoccupied areas of the region [11].

It seems that water resources will be widely used not only in agriculture and household resources, but also in industry, with the possibility of the industrial park in Aghdam, and the use of water resources and reserve resources in the region. A factory for the production of electrical distribution equipment, electrical sockets and concrete substations in Aghdam Industrial Park; ventilation, fire-fighting equipment and metal products production plant, wall paper production plant and started operating. For now, the food industry is being developed in the region.

[9] Mammadov, C. H. (2024): Hydrological characteristics of rivers of Aghdam region, Water problems: Science and technology. *International Peer-Reviewed Scientific Journal,* 1., (23.).

[10] Guliyev A. G. (2019): *Kahrizlari of Azerbaijan.* Baku.

[11] http://azkahriz.az

There is a large demand for industrial products in the country, but the growth of local production is possible. In Aghdam, there was a bakery, a canning factory, an initial winery and a number of industrial enterprises in the vineyard state farm named after "Ali Bayramov" [12]. It is possible to obtain the main sources of water for the location and operation of all these and other industrial enterprises.

It was kept in the area near the 30th part of Fuzuli district, which is another research area. The district is located on the left bank of the Araz river. The territory of Fuzuli region with an area of 1386 km 2 is mainly lowland and plain. Its population is 130,000 people [13], making up 1.3% of the country and 17.6% of the economic region. 822 families or 3132 people have been settled in the city of Fuzuli since the end of the war until now, i.e. until the third quarter of 2024. The important role of the flowing Kondalanchay, Guruchay, Gozluchay and other small rivers, the reservoirs of the same name built in Kondalanchay, and the Araz river and the Mil-Mugan hydrojunction play an important role in providing water to the region. Some indicators of water use in Fuzuli region are given in *Table 2.*

Table 2. Some indicators of water use in Fuzuli district

Actions	2015	2018	2019	2020	2021	2022
Water consumption, mln. cubic m.	156.9	164.4	159.2	163.8	148.9	160.6
Use of water for domestic drinking purposes, mln. cubic m.	6.0	1.3	1,2	1,2	1,2	1.3
Water supply for irrigation and agriculture, mln. cubic m.	150.8	163.1	158.0	162.6	147.7	159.3
Disposal of waste water, mln. cubic m.	0.2	0.0	0.0	0.0	0.1	0.1
Water loss, mln. cubic m.	197.6	169.9	168.5	137.4	124.8	144.4

Source: Regions of Azerbaijan, ARDSK, 2023, p. 864.

[12] Geography of Karabakh and Eastern Zangezur (2021): *Natural-geographic conditions and socio-economic development potential.* Baku.

[13] Among Azerbaijan (2023): *Statistical bulletin.* Baku.

As can be seen from *Table 2*, water consumption by the population reached 164.4 million m^3 in 2018, which was the highest indicator. This indicator accounts for 10.3% of the water consumption in the Karabakh economic region (1595.5 million m^3) [14] in that year. It is also noteworthy that water supply for irrigation and agriculture reached its highest level in the same year *(Table 2)*. This indicator accounts for 10.3% of the indicators for irrigation and agriculture water supply in the Karabakh economic region (1586.4 million m^3) [14]. The low use of water for domestic and drinking purposes in that year is due to the greater use of water for agricultural purposes. The increase in water consumption indicators in 2022 is due to the start of migration to the Fuzuli region, the return of the population and its settlement.

It flows through the villages of Upper Yaglivand, Devletyarli, Mirzajamalli, Seyidmahmudlu, Merdinli, Karakhanbeyli, Alkhanli, Upper Kurdmahmudli, Ashaghi Kurdmahmudlu, Ahmadbeyli, near Bala Bahmanli village of Araz, which is 102 km long. Playing an important role in the economy of the villages through which the river passes, there is a need for great assistance in settling and engaging the population in profitable economic activities.

More energy consumption of irrigation activities was built after the Yagli, Yarli and Mirzajamalli villages of Kondalanchay and the reservoirs of Kondalanchay-1 (1962), Kondalanchay-2 (1964) and Ashaghi Kondalanchay (1981). These three reservoirs built in Kondalanchay serve to irrigate 6.7 thousand ha of cropland [15]. There is a settlement of the Mil-Mugan water junction built near Horadiz settlement of Fuzuli district in the region's water supply. In Fuzuli, Beylagan, Aghjabedi and Khojavend regions, the water of this hydrojunction is used for irrigation of crops, and these possibilities are at a high level. In the process of putting this hydrojunction into operation, two areas of 200,000 ha in each of the Islamic Republics of Azerbaijan and Iran were provided with irrigation water. Two areas of Fuzuli, Beylagan, Aghjabedi, Imishli and Aghdam regions are supplied with irrigation water through the Bash Mil, Yukhari Mil and Yeni Khangizi canals starting from the hydrojunction. Hasanliarkh and Maralarkh rivers, which take their source from Araz river, cause irrigation disease in Fuzuli and Jabrayil regions. The use of groundwater and subartesian wells also plays an important role in water supply in the region. According to A. Guliyev, there were 71 kahriz in Fuzuli district in 1938 [16].

[14] Environment in Azerbaijan (2024): *Statistical compilation.* Baku: DSK.

[15] Geography of Karabakh and Eastern Zangezur (2021): *Natural-geographic conditions and socio-economic development potential.* Baku.

[16] Guliyev A. G. (2019): *Kahrizlari of Azerbaijan.* Baku.

[17] http://azkahriz.az

In 2021, for research in the residential areas of the district, the Guruchay estuary in the Shukurbeyli settlement and the Ahmadalilary estuary in the Ahmadalilary settlement were investigated [17].

[17] http://azkahriz.az

Conclusion and suggestions

- After 2020, water consumption and agricultural energy in both regions will work with the energy of the water used. The reason for this is the increase in the opportunities to engage in farming and animal husbandry under the same conditions in Agdam and Fuzuli regions, and at the same time, migration to Fuzuli region has begun.
- It is important to ensure the return of the population to the territories freed from occupation, first of all, to establish workplaces and improve housing and communal conditions, build the necessary infrastructure, and ensure the use of additional water at the appropriate level. We believe that in Agdam and Fuzuli regions, the population is engaged in some areas of agriculture, the improvement of water works in these areas, the restoration of destroyed reservoirs, canals and other hydrological objects.
- It is necessary to constantly focus on the possibility of actions related to food security due to warming, drought and limitation of water resources. It is necessary to take into account the dangers mentioned in the Aghdam Fuzuli valleys.
- It is possible to engage in agriculture based on the population in the research regions. Irrigation devices should be based on the latest technology to prevent water wastage.
- In the research areas, the use of water purification devices is mandatory for providing the population with household solutions and clean water. At the same time, special attention should be paid to concrete lining of ditches and channels.
- Implementation of education, implementation of water use stimulation mechanisms, correct application of water use fees in practice and other measures can be useful for the formation of social responsibility of people.

