ISSUES OF IRRIGATION WATER USE: WORLD AND ARMENIA

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Water is vital for life. It plays an important role in ensuring the integrity of the ecosystem and receiving a variety of products and services from it. Along with population growth, the demand for fresh water for agricultural and industrial purposes, as well as in order to meet the needs of the urban economy, is growing at an unprecedented rate. At the same time, especially with the impact of global climate change, water resources are significantly reduced. Therefore, the rational consumption of water through the introduction of water-saving technologies becomes a major problem. About a third of the world's freshwater is used in agriculture, so it is especially important to reduce losses in irrigation systems and save water available to plants. This article analyzes the international experience of irrigation water use and the possibilities of introducing modern water-saving technologies, assesses the state of irrigation water use in Armenia and presents organizational and economic measures for improvement.

Fresh water is considered a vital natural resource, the volume of which is limited, and the sources of recovery are endangered. In some water basins, these restrictions are not severe or seasonal, and in water-scarce areas, rational water use and storage are persistent problems. Moreover, water storage capacity is limited by geographical location, terrain, seismicity, groundwater resources, melting point and overall external flow.

The total volume of water in the world is about 1.386 billion cubic kilometers. However, 97.5% of this vast volume

is the salt water of the seas and oceans, which is almost unusable without desalination. Freshwater, on the other hand, accounts for only 2.5 percent of total water resources, most of which, 68.7 percent, are in the form of ice at the Earth's poles and natural glaciers. Thus, despite the fact that most of the planet is covered by water, only a small part of it is usable by humans, and these limitations must be taken into account when planning water use.

Glaciers and snow cover 1/10 of the land, which accounts for about 70% of fresh water. Unfortunately, most of this quantity is far from the settlements and is difficult to access for use. There is a large amount of fresh water in the lakes of the world. However, their uneven distribution and inconvenience of use create serious difficulties. For example, Canada is home to about 50% of the world's freshwater lakes. In addition, many freshwater lakes are located in arid regions, and as a result of intensive evaporation, the salt content exceeds the allowable limit. For example, the Caspian Sea and the Dead Sea, whose waters are very salty, have such a fate.

So, the volumetric distribution of fresh water on the planet is quite heterogeneous. The spatial and temporal distribution of water is also irregular and does not meet the water distribution requirements of the population and human society. If the average European drinks a glass of water or juice a day (0.2 liters of water), brushes his teeth (1 liter), uses the toilet (8 liters), takes a shower for five minutes (100 liters), eats porridge for breakfast (1 liter), drinks tea or coffee (1.5 liters for a teapot), washes the dishes (100 liters), turns on the washing machine (100 liters), etc., and consumes a total of 600 liters of water per day, then, in the poorest countries in Africa, the daily water consumption per capita ranges from 3-8 liters, which is equal to the use of toilet water once in Europe. The average in China is 100 liters, in Russia - up to 400 liters, the average American consumes 700-800 liters of water per capita per day[1].

Given the growth rates of the country's population and the growing trends in water demand in various sectors, it is inevitable to increase the amount of water consumption in urban and rural areas. Water plays a key role in the country's economic, social and cultural processes. Increasing agricultural production and food security, urban and rural development, and raising the living standards of the population require making the necessary investments and using water-saving technologies to balance water supply and demand as much as possible.

By 2050, India's population is projected to grow by another 563 million, while China's population by 187 million. Egypt, Mexico and the Islamic Republic of Iran are also facing population growth. If the main steps and the implementation of appropriate actions for the optimal use of limited water resources are not included in the agenda, the world will surely face serious difficulties on the way to sustainable development. It is no coincidence that the UN Sustainable Development Goal 6 proclaims "Clean Water and Sanitation", with sub-goals 6.4 and 6.5: «6.4. By 2030, significantly increase water use efficiency in all areas and ensure sustainable fresh water intake and water supply to address the problem of water scarcity and significantly reduce the number of people suffering from water scarcity, 6.5. Until 2030 to implement comprehensive water resources management at all levels, including, where appropriate, through cross-border cooperation".[2]

Israel is a classic example of prudent water management in the world. Here, as a rule, the water pumped to the field and greenhouses by closed, drip system is a multifunctional factor. That is, the irrigation system performs both irrigation and fertilization and disease control functions. The pre-defined volume of water is mixed with the required amounts of fertilizers and disease prevention agents and served as a complex mixture to both the root and surface systems of plants. By the way, this saves water,

[1] Paruyr Abrahamyan, Global Water Scarcity and Its Implications for Armenia; https://evnreport.com/magazine-issues/global-water-scarcity-and-its-implications-for-armenia

[2] https://armenia.un.org/hy/sdgs/6

TABLE 1

Israel's population and water use[3]

Year	Population	Water use				Water consumption in household
		Total	Household	Industry	Agrarian sector	
	Thousand, people	Million m³/year	Million m³/year	Million m³/year	Million m³/year	Liter (person/daily)
1960	2200	1338	197	54	1087	245
1970	3100	1659	254	86	1319	224
1980	3950	1679	368	100	1212	255
1990	4900	1779	558	108	1113	312
2000	6300	2018	756	124	1138	329
2010	7610	2227	886	117	1189	325
2020	8941	2590	1049	116	1392	333

as well as working time and space. Saving space is an important resource, especially in modern greenhouses. In addition to the fact that the plants grow mainly at the expense of height, they are also placed on movable tables and no permanent corridors are left for the movement of workers. The data in Table 1 show that over the last 60 years, Israel's population has more than quadrupled, total water use has increased 1.9 times, and the amount of water used in the agricultural sector has increased almost 1.3 times. It is interesting that the use of domestic water per capita in 2020 was only 333 liters and in 1960 increased by only 88 liters or 36% compared to last year.

Irrigation is an important precondition for the development of high-tech agriculture in areas with relatively low atmospheric precipitation. It is no coincidence that in assessing the potential of farming in Central Asia, the advantage is given not so much to the size of the land as to the availability of irrigation water. Figuratively speaking, the villager is not asked first, "How much land do you have?", but "How much water do you have?" And in Israel, the yield of agricultural crops is calculated not only by the unit of land, but also by the amount of irrigation water consumed.

In arid regions such as the Middle East, Central Asia, the western United States, agriculture is difficult to imagine without irrigation systems. And in the countries of Southeast Asia and Latin America, the cultivation of agricultural crops, especially rice, is directly related to the diverse use of irrigation water.

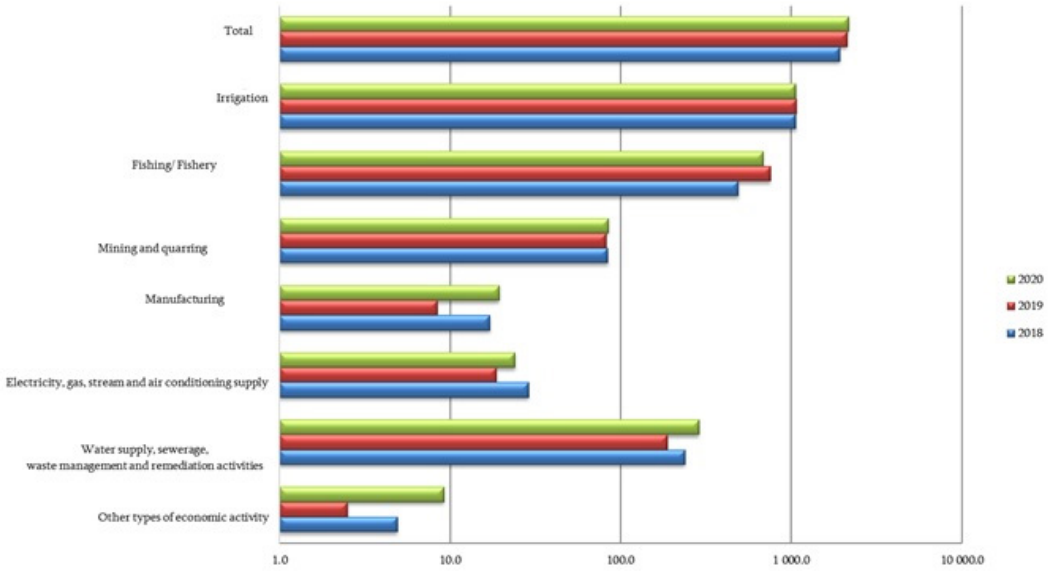
Due to different factors, different amounts of irrigation water are used to obtain the same product unit in different geographical areas of the world. For example, to produce 1 ton of wheat, 849 cubic meters of water are needed in the United States, 690 cubic meters in China, 1,654 cubic meters in India, 2,375 cubic meters in Russia, 3,177 cubic meters in Mexico, and the world average is 1,334 cubic meters. Moreover, sometimes water-scarce countries (for example, Israel) carry out consistent work on the introduction of water-saving technologies, desalination of seawater, and in some cases simply limit the area under relatively high water demand crops.

According to the Food and Agriculture Organization (FAO), water resources in Uzbekistan and Turkmenistan are extremely high. In those countries, 169% and 144% of water is consumed, respectively, compared to its own water resources. This indicator is average in Tajikistan (62%), Armenia (56%) and Azerbaijan (54%). The use of fresh water in Kyrgyzstan and Kazakhstan also exceeds the world level and is 50% and 33%, respectively. Russia and Georgia use 4% of their own fresh water, Moldova - 12% and Ukraine - 14%.

Not so long ago, in 1988, the area of irrigated lands in Armenia in all types of farms was 315.9 thousand hectares[4]. Agricultural water use 2432 million cubic meters c.m. was or 68.6% of the total water

[3] The chart was created by the author https://guide-israel.ru/country/161-vodnye-resursy-izrailya/ and from other internet resources

[4] Народное хозяйство Армянской ССР в 1988 году: Статистический ежегодник, Ер., Айастан, 1989, стр 197.



GRAPH 1

Volume of water use by the main types of economic activities (by NACE REV.2), 2018-2020, mln. m³

use.[5] As a result of the liquidation of state, collective and inter-economic organizations and the privatization of land, the use of fresh water for irrigation and agricultural water supply decreased by 3.3 times in 1995 and amounted to only 742 million. m. c. or 50% of total water use.[6]

The main reason for such a sharp decline was the liquidation of large economies and structural changes in agriculture. About 862 former agricultural enterprises were liquidated in the early 90s of the last century and as a result of mass land privatization, about 320 thousand hectares were created in small farms. The centralized system of state logistics and state procurement of products underwent significant changes. The transition to market principles, or rather the elimination of existing infrastructure and economic relations without creating new ones, especially in the early years, led to sharp declines in production and economic indicators. As we have noticed, irrigated agriculture was no exception. A decade later, in 2001, the number of farms reached about 345,000, but the use of fresh water for irrigation and agricultural water supply was only 808 million cubic meters.[7] Over the next two decades, irrigation systems were rehabilitated and developed, especially with loans and grants from the World Bank, the International Fund for Agricultural Development, and the Asian Bank. Probably due to the implementation of these programs, water use in Armenia has increased dramatically in the last decade. Thus, if the water intake in 2000 was 1.8 billion cubic meters, then it is now approaching 3 billion cubic meters per year. However, studies show that transit losses are still high. More specifically, we lose about 1 billion cubic meters of water per year on the roads, which is too much. If no serious investments are made in the water transportation system in the next decade, the water problem in Armenia will intensify. At present, more than 80% of water intake is spent on agriculture, 49% of which is on irrigation and 31.4% on

[5] Ibid. p. 107.
[6] Statistical Year Book of Armenia. Yerevan, Zangak-97, 1998, p. 111.
[7] Statistical Year Book of Armenia. Yerevan, Zangak-97, 2002, p. 217.

fish farming (Graph 1).

According to the RA State Committee for Water Economy, the cadastral irrigated area is 194796 hectares, 151 thousand hectares of which are in the service area of water companies. In 2020, 85,000 hectares were actually irrigated. By the way, for various reasons, a significant part of the land is not irrigated. First, about 27,000 hectares of irrigated land are not irrigated due to the absence of the owner. There are lands where water is available 3-4 times during the vegetation period, while 6-7 times irrigation is required. Water scarcity often leads to inefficient agriculture, so landowners simply do not cultivate the land. There is an opinion that it is necessary to change the mechanisms of state support. For example, it is proposed to subsidize the result, not the use of water, that is, to subsidize the crop. The same goes for switching to overnight irrigation. If the price of night light is cheaper, the same can be said for water and a boost for night use. The idea of building reservoirs is also an interesting option. That is, to store the unused water at night and supply it to the water users during the day.[8]

In any case, the construction of reservoirs remains a priority for Armenia. The 29 million cubic meter Vedi Reservoir is currently under construction. The construction of the 25 million cubic meter Kaps reservoir will start soon, which may reach 60 million cubic meters as a result of further negotiations. The plan to build another 16 reservoirs is on the agenda. At the same time, the reduction of water losses remains a major issue, one of the important means of which is the establishment of a closed system of water pipes and a drip system for in-house water use. In other words, the modernization of the irrigation system has been on the agenda, and it remains, due to which, especially in the conditions of global climate change risks, the more economical use of water resources must be ensured.

[8] Ihttps://www.ecolur.org/hy/news/sevan/13118/

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Սամվել ԱՎԵՏԻՍՅԱՆ
«Ամբերդ» հետազոտական կենտրոնի ավագ փորձագետ, ՀՊՏՀ, տնտեսագիտության դոկտոր, պրոֆեսոր

ԱԳՐԱՐԱՅԻՆ ՔԱՂԱՔԱԿԱՆՈՒԹՅՈՒՆ

ՈՌՈԳՄԱՆ ՋՐԻ ՕԳՏԱԳՈՐԾՄԱՆ ՀԻՄՆԱԽՆԴԻՐՆԵՐԸ. ԱՇԽԱՐՀ ԵՎ ՀԱՅԱՍՏԱՆ

Ջուրը կենսական նշանակության ռեսուրս է, որը կարևոր դեր է կատարում ոչ միայն էկոհամակարգի ամբողջականության պահպանման, այլև բազմազան ապրանքների ու ծառայությունների ապահովման համար: Բնակչության աճին զուգընթաց, ինչպես գյուղատնտեսական և արդյունաբերական, այնպես էլ քաղաքային տնտեսության կարիքները բավարարելու նպատակով աննախադեպ ծավալով ավելանում է քաղցրահամ ջրի պահանջարկը: Դրա հետ մեկտեղ, հատկապես՝ կլիմայի գլոբալ փոփոխության ազդեցությամբ, նկատելիորեն կրճատվում են ջրային ռեսուրսները: Ուստի օրախնդիր է դառնում ջրի խելամիտ սպառումը ջրախնայողական տեխնոլոգիաների ներդրմամբ: Աշխարհում մատչելի քաղցրահամ ջրի շուրջ մեկ երրորդն օգտագործվում է գյուղատնտեսական արտադրության ոլորտում, հետևաբար՝ առանձնահատուկ կարևորություն ունեն հատկապես ոռոգման համակարգերում կորուստների կրճատումն ու բույսին հասանելի ջրի խնայողությունը: Վերլուծելով ոռոգման ջրի օգտագործման միջազգային փորձը և ջրախնայողական ժամանակակից տեխնոլոգիաների ներդրման հնարավորությունները՝ հոդվածում գնահատվում է Հայաստանում ոռոգման ջրի վիճակը, ինչպես նաև ներկայացվում են կազմակերպչական ու տնտեսական մի շարք միջոցառումներ այդ գործընթացի բարելավման նպատակով:

Հիմնաբառեր. *գյուղատնտեսություն, ոռոգում, ջրախնայողական տեխնոլոգիաներ, կորուստներ, գլոբալ տաքացում*

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АГРАРНАЯ ПОЛИТИКА

ПРОБЛЕМЫ ИСПОЛЬЗОВАНИЯ ВОДЫ ДЛЯ ОРОШЕНИЯ: МИР И АРМЕНИЯ

Вода играет важную роль в обеспечении целостности экосистемы и получении от них разнообразных продуктов и услуг. Наряду с ростом населения беспрецедентными темпами растет потребность в пресной воде для сельскохозяйственных и промышленных целей, а также для бытового потребления населения. В то же время, особенно из-за воздействия глобального изменения климата, водные ресурсы значительно сокращаются. Поэтому рациональное потребление воды за счет внедрения водосберегающих технологий становится большой проблемой. Около трети доступной пресной воды в мире используется в сельском хозяйстве, поэтому сокращение потерь, особенно в ирригационных системах, и использование воды, доступной для растений, имеют особое значение. В статье анализируется международный опыт использования оросительной воды, возможности внедрения современных водосберегающих технологий, оценивается состояние использования оросительной воды в Армении, а также представлены организационные и экономические меры по его улучшению.

Ключевые слова: *сельское хозяйство, орошение, водосберегающие технологии, потери, глобальное потепление*