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Water Resources of Azerbaijan and Biosecurity

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Abstract

In the presented work summarizes information about the water resources of Azerbaijan based on literature data, and it is justified that the efficient use of water resources, both in the world and in Azerbaijan, which is part of it, is a problem that needs to be solved, but is still waiting to be solved. Thus, the problems faced by the world's population today include water, primarily freshwater scarcity, and today this issue has a global character. As a part of the world, this problem has a more serious impact in the Republic of Azerbaijan, due to the fact that a certain territory of the country has been under occupation for nearly 30 years, 70% of water resources are formed by transboundary rivers, and some of the states to which these rivers belong have not joined the "Convention on the Protection and Use of Transboundary Watercourses and International Lakes", and the lack of an advanced mechanism (including biosafety) that reflects the efficient use of river waters. The main task in eliminating these is to find a balance between social, ecological, and economic relations.

Keywords: water resources, transboundary rivers, biosecurity, international conventions

Introduction

One of the characteristic features of our increasingly globalized world is the creation of new approaches and the improvement of existing ones in line with the requirements of the modern era regarding the efficient use and security of natural

resources, primarily water, of this or that country, as well as of individual regions[11]. In this regard, comprehensive assurance of biological security (BS) in a particular country and in the world is one of these, so that currently BS is considered one of the main and most important components of the security system that ensures the stable development of the state [5, 23]. Biologically active material(living or various metabolites derived from them) that has shaken the world and is even more terrifying than weapons of mass destruction can sometimes be used as a tool that can disrupt stability in local, regional and global space, create social tension and cause other negative situations. Although advances in world politics and scientific research have a positive impact on the problem of biosecurity, they have not been directed at a fundamental solution to this issue. For this reason, it should be considered a realistic approach to characterize BS as an issue that concerns everyone today, from ordinary citizens to those at the highest levels of government. If we add to this the fact that the achievements of biotechnology are of a "dual" nature[9], then no additional argument is needed to confirm the great importance of this issue.

Biosecurity in modern times is expressed as follows: [8, 24]:

- It is a strategic and integrated approach that combines political and regulatory aspects (instruments and activities) to analyze and manage food safety, human, animal and plant health, and the environmental risks associated with them.
- It reflects the concepts and management of pests and diseases of humans, animals and plants, the control of the creation and release of genetically modified organisms (GMOs), as well as the production of products based on them, and invasive species and genotypes.
- It is a concept aimed at protecting the environment, including biodiversity, which is directly dependent on the sustainability of food security in agriculture.

It is also clear from the definitions given about BS that biosecurity (BS) is not only a concept that reflects the fight against bioterrorism, but also reflects the methods and approaches that allow the prevention of the mass death of people and the emergence of serious social and economic problems due to the deliberate and spontaneous spread of infectious diseases in the world [2]. From this idea, it becomes clear that the creation of new technologies to ensure biosafety, the preparation and adoption of seriously substantiated programs in the field of biosafety within the country necessitate the active implementation of international relations.

As is known, there is a serious problem of freshwater scarcity in the world, especially in arid and semiarid regions, and this problem is getting worse. It would be appropriate to say just one fact: currently, more than 40% of the world's population is faced with the problem of drinking water more precisely, the shortage of water, primarily fresh water, which was once characterized as an inexhaustible resource, has become a global problem. Even the most optimistic forecasts suggest that this figure will be 57% in 2050[10] It is no coincidence that

achieving water safety, primarily in biological aspects, is a reality accepted by everyone in the world in terms of sustainable development of society[21].

Materials and Methods

Studies show that the problem of water scarcity arises from the following:

1. In line with the increasing world population within a fixed area, the demand for water by the population, industry and agriculture has increased in modern times;

2. The observed trend of decreasing world water resources against the backdrop of global climate change;

3. Globalization of problems arising from the increase in anthropogenic impact on the environment;

4. Changes the people's lifestyle and food rations;

5. The increase in the amount of water used in production processes, including energy production, and the failure to use water resources in accordance with the principles of sustainable development;

6. Excessive use of groundwater, reduction in the self-purification capacity of water reservoirs as a result of severe pollution, etc.

It should be noted that situations leading to water scarcity are also caused by the uneven distribution of water resources across countries. It is known that the world's water resources are 1390 million km^3, of which 97.5% is salt water and 2.5% is fresh water which is formed by sources such as rivers, lakes, canals, reservoirs, seas and oceans, groundwater, soil moisture, mountain and polar glaciers, and atmospheric water vapor[30, 32]. Although Brazil ranks first among the top ten countries in terms of total water resources, Canada[13] ranks first in terms of water per capita (tab. 1). As can be seen, the situation in the Republic of Azerbaijan is not very encouraging in terms of both the total amount of water resources and the amount of water per capita although 1 sea, 8,359 rivers, 153 reservoirs, 47 canals and 450 lakes participate in the formation of Azerbaijan's water resources. In addition, the annual amount of water required to meet the water needs of the country's population is estimated to be 894 million m^3, while the amount of water currently supplied and actually used is 662 and 478.3 million m^3, respectively [12]. This, in turn, allows us to confidently state that the attitude towards water resources and ensuring their safety is a more important issue in Azerbaijan.

In general, it is worth noting that water scarcity is the most serious problem affecting the socio-economic and human development as a whole. Because water

problems can lead to the degradation of ecosystems, the deterioration of the health of living beings, and the destruction of the means necessary for survival[19, 31].

Table 1.

Water resources and per capita water availability in some countries of the world [13]

Countries	Total water supply, km^3	Water per capita, thousand m^3
Brazil	6950	43,0
Rusiya	4500	30,5
Canada	2900	98,5
China	2800	2,3
Indonesia	2530	12,2
USA	2480	2,4
Bangladesh	2360	19,6
India	2085	2,2
Venezuela	1320	60,3
Burma	1080	23,3
Azerbaijan	26,2	1,3

Currently, in world practice, a comprehensive scientific approach that must be implemented to eliminate the factors that cause the reduction of fresh water reserves, assess its quality, and use it effectively consists of the following elements[16, 27]:

- Identification of factors related to the physical, geographical, and hydrological characteristics of a water basin as a natural or water management object.
- Determination of controlled indicators of the composition and characteristics of the aquatic environment that allow for the formal assessment of water quality and compliance with relevant standards
- Comprehensive assessment of the structural-functional organization of water hydrobiont communities and the specificity of the development dynamics of aquatic biocenoses, solving existing problems and predicting potential problems and finding solutions.

The quality of water in the world is determined by various criteria, one of which, and the most important, is related to biotic factors[3, 20, 25]. This indicator is a matter of special concern because it is felt by all living things on Earth. Although the determination of water quality indicators depends on humans, every year, extremely large groups of living beings, including humans, become ill and even lose their lives due to the pollution of water used for drinking, irrigation, and other purposes [6, 28].

Research conducted in the field of aquatic biology worldwide to ensure the safety of waters related to biotic factors (biological safety) includes the following [2, 7, 26, 29]:

- Control of water biota (bacterial, virus, fungal, phytoplankton, zooplankton, benthic organisms, ichthyofauna, etc.);
- Development of principles of biological safety of waters;
- Expanding biological approaches to the reuse of polluted waters.

Based on the analysis of literature data, it can be noted that biosafety and the criteria used to ensure it are as follows:

First, there must naturally be a legal basis for ensuring biosafety, and this must be confirmed in the current Constitution of the Republic of Azerbaijan and the international conventions it has joined as a state, the treaties it has signed, the laws it has adopted, and other documents. It is no coincidence that many countries around the world (Russia, China, USA, Kazakhstan, Belarus, etc.) have adopted new BS laws in this direction, and some countries are preparing draft laws in this direction. It should only be noted that the recent decisions on biosafety differ significantly from the Cartagena Convention, which included a more comprehensive approach to this issue and entered into force on 11.09.2003, and reveal new views on the essence of biosafety. For this reason, it is important to prepare and adopt an appropriate law on biosafety in the Republic of Azerbaijan. The law to be prepared should be based on the basic principles of biosafety, primarily human health and its protection, as well as the reconciliation of the interests and responsibilities of individuals, society, and the state in the field of biosafety. More specifically, the law to be drafted should take into account a balanced balance of social, economic and environmental relations, and this approach should be adopted not only for Azerbaijan, but also throughout the world.

Secondly, it is the timely identification of diseases caused by biological agents, the functionally active substances they synthesize, and the preparation of measures aimed at preventing complications that may occur from their effects. If we approach this criterion from the perspective of the current situation in Azerbaijan, it becomes clear that this field should be strongly developed, and a large-scale research program should be prepared to identify diseases and their causative agents, especially infectious diseases, to develop scientific and practical foundations for preventive measures aimed at treating diseases, as well as to develop methods and approaches that allow for the identification of metabolites produced by living organisms as a result of their vital activity that cause various pathologies in humans. This program can be more successfully implemented as a result of the joint activities of various fields of exact and natural sciences (molecular biology, microbiology, biotechnology, genetic engineering, biochemistry, bioinformatics, toxicology, biophysics, etc.).

Third, approaches that allow the use of bioresources in accordance with the principles of safe and sustainable development[22]. Extensive research is being conducted in this field around the world, and Azerbaijan is no exception. In the

century we live in, certain research in this field has been conducted and is currently ongoing in the Institutes under the Ministry of Science and Education of the Republic of Azerbaijan, the Ministries of Agriculture and Health of the Republic of Azerbaijan, and the Food Safety Agency and its Scientific Research Institute.

Based on the above criteria, it is important to ensure the safety of almost all natural resources, including rivers. As rivers are the main sources of fresh water, they are usually used as the most common source of drinking water. According to the World Health Organization (WHO), water is considered suitable and safe for human consumption if it does not have any adverse health effects during use and meets the principles guided by WHO in terms of its biological, chemical and physical properties. The formation of these indicators is influenced by primary sources, materials entering the river from the areas it passes through, as well as the natural climatic and soil conditions of the area. This, in turn, makes it relevant to focus on studying freshwater sources, including rivers, from biological, chemical, and physical aspects.

As is known, starting from the late 80s of the last century, the territory of the Republic of Azerbaijan began to be occupied by Armenia, and 20% of our territory was occupied and remained under occupation for almost 30 years, and our natural resources there were literally subjected to ecological terrorism. As a result of the Patriotic War, which began on September 27, 2020 and lasted 44 days, those lands were returned to their original and eternal owner. After that, assessing the current ecological state of the resources of those territories, primarily their waters, became one of the most important tasks to be solved[4, 18]. It is more important to determine the biosecurity of water resources, primarily transboundary rivers. Thus, up to 70% of Azerbaijan's water basin is formed[14-15, 33.] by transboundary waters, and some of the states located in the territories through which these waters flow (Georgia and Armenia) have not joined the "Convention on the Protection and Use of Transboundary Watercourses and International Lakes" adopted by the UN on March 17, 1992. The largest rivers of Azerbaijan, the Kura and the Araz, are transboundary rivers. Although the Kura River does not pass through the occupied territories, not only the Araz River itself, but also some of its tributaries (Oksuchay, Bargushad, Basitchay, Arpachay, etc.) have characteristics typical of transboundary rivers, in that the Araz and Okchuchay, Bargushadchay and Basitchay are located precisely in the territories liberated from occupation, and these rivers enter Azerbaijan from the territory of Armenia, which makes the issue of the security of the use of these rivers extremely important[15, 17]. The importance of Azerbaijan's aquatic ecosystem and the importance of ensuring its biosecurity are clearly demonstrated in the information provided about these rivers.

The Araz River flows through the territories of Turkey, Iran, Azerbaijan, and Armenia, and originates in the Erzurum Mountains in Turkey. It joins the Kura River in the Sugovushan village of the Sabirabad district of Azerbaijan and flows into the Caspian Sea. The length of the Araz River is 1072 km, and the basin area is 101.9 thousand square kilometers. After the Akhura branch joins the river from Turkey, the Araz forms the state border of Armenia and Azerbaijan with Turkey and Iran for a distance of approximately 600 km to the vicinity of the Bahramtepe

water junction. It is the second largest river in the South Caucasus in terms of water volume.

The Okchuchay River, flowing through the Zangilan district of Azerbaijan, which is part of the East Zangezur economic region, is one of the transit rivers that has been polluted in Armenia. The total length of the river is 85 km, 40 km of which passes through the territory of Azerbaijan and flows into the Araz River in the settlement of Minjivan.

The Basitchay River is a left tributary of the Araz River and originates in the Republic of Armenia. The length of the river is 44 km (17 km of which falls on the territory of Azerbaijan) and the catchment area is 354 km² (156 km² of which falls on the territory of Azerbaijan).

The Bargushadchay River originates from Lake Zalkha, located on the northern slope of the Zangezur Range at an altitude of 3,040 m. After passing through Armenia, it enters the territory of the Gubadli district and, after merging with the Hakarichay near the village of Garalar, flows into the Araz River in the territory of the Zangilan district. The length of the river is 178 km.

The mentioned rivers are very rich in terms of water resources, and adding these rivers to the total water resources of Azerbaijan is of great importance in irrigating the areas through which the rivers flow, as well as the agricultural fields in the neighboring regions of Jabrayil, Aghdam, and Fuzuli, as well as in providing drinking water to the population of the newly built cities of Aghdam, Fuzuli, and Jabrayil. In addition, approximately 20% of the water resources formed in Azerbaijan fall precisely on the territories liberated from occupation.

Thus, it was clear from the research that among the problems faced by the world's population today is the scarcity of water, first of all fresh water, and in this matter today it has a global character. As a part of the world, this problem has a more serious impact in the Republic of Azerbaijan. Among the reasons for this are the fact that 70% of the country's water resources are formed by transboundary rivers, and some of the states to which these rivers belong do not join the "Convention on the Protection and Use of Transboundary Watercourses and International Lakes", and the lack of an advanced mechanism (including biosafety) that reflects the efficient use of river waters. The main task in eliminating these should be a more logical approach, finding a balance between social, ecological, and economic relations.

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