Kdz Uni Int J Islam Stud and Soc Sci 2025;2(3)356-364DOI: https://doi.org/10.71082/rp11q731 KUIJIS

Open Access

Study of the Factors Contributing to Freshwater Reduction and Its Consequences

Wahdat Wahidi [1*]; Tora Ghiasy [1]

[1]*Department of Geography, Faculty of Education, Baghlan University, Afghanistan*

[*]*Corresponding Email: wahdatwahidi123@gmail.com, Phone Number: +93 775959332*

Article History:
Received: 05. 08.2025
Accepted: 14. 08.2025
Online First: 20.09.2025

Citation:
Wahidi, W. & ***Ghiasy***, T. (2025). Study of the Factors Contributing to Freshwater Reduction and Its Consequences. *Kdz Uni Int J Islam Stud and Soc Sci*;2(2):356-364

e-ISSN: 3078-3895

Abstract

In a world where urbanization, industrialization, and agriculture are rapidly expanding, the protection of natural water resources seems nearly impossible, and the issues of water pollution and salinity have become increasingly severe. Natural resources are among the blessings that must be used wisely to protect and improve human living standards. The aim of this article is to identify the causes of freshwater reduction, promote optimal and rational use of water resources, and examine the amount of available water on Earth, the limitations of water resources, and the negative impacts on the economy, culture, and social issues. The research method used in this study is qualitative, with data collected through a library-based approach and analyzed descriptively. The results show that water holds a special place among natural resources, as it is neither degradable nor renewable. Moreover, water is a vital resource for human societies and plays a crucial role in the economies of countries. The results also indicate that water consumption in agriculture is significantly higher than in industrial and urban sectors.

Keywords: Freshwater, Reduction, Resources, Shortage, Supply, Water.

Introduction

This scientific article, titled "Study of the Factors Contributing to Freshwater Reduction and Its Consequences", has been conducted with both scientific and practical significance. Today, the issue of freshwater reduction is a very serious and widely discussed topic. Therefore, the aim of writing this article, alongside examining the role of water within natural resources to address the value and role of human societies in the reduction of freshwater as well. To the best of the author's knowledge, no fundamental research has been conducted specifically on this title so far. However, some researchers in various sources have expressed opinions related to this topic. The shortage of freshwater in the world is one of the most critical challenges of the present century. It has been warned that dry regions of the world face the risk of becoming even drier. It has also been noted that

the sharp increase in water demand for industry in recent decades has pushed humanity into a water crisis. If the current trend continues, it is expected that by the year 2030, demand will exceed available resources by 40%. Climate change is a serious challenge or water resources. The quantity and quality of groundwater resources are at risk due to various climatic, human, and geological factors. The groundwater table in the basin has decreased as a result of reduced precipitation (successive droughts), rising temperatures, lower river discharge, and over-extraction of groundwater resources (Fijani, 2020). Only 14% of all the water on Earth is fresh and easily accessible. However, 86% of the remaining water is saline, and access to the rest, just under 3% is difficult. On a global scale, and from a technical standpoint, there is enough freshwater available. However, due to the unequal distribution of water, which has been intensified by climate change, some regions have become extremely wet while others have become very dry (Madani & Sirus, 2006).The Earth's hydrological system-we must avoid any incorrect interference or actions without scientific standards. Otherwise, we may face consequences that are irreversible. Only through a precise understanding of hydrological and geographical laws can long-term decisions about water usage be made. Without such understanding, we risk rapid sedimentation in reservoirs, salinization and desertification of land, decreased freshwater availability, and the escalation of environmental issues or damage to infrastructure caused by floods.Therefore, low rainfall, as well as temporal and spatial imbalance in precipitation, is among the main water issues in arid regions. Even in some humid areas, irrigation is needed during summer. In most of these regions, water is available, but it is saline. In many others, there is no water at all (Kordvani, 1992).

Material and Method

The research method which has been used in this article is qualitative, with data collected through a library-based approach and analyzed descriptively.

Freshwater Reduction

Due to the excessive drilling of deep and semi-deep wells, many Qanats (traditional underground water channels) or groundwater passages have dried up. The overexploitation of groundwater has also led to a significant drop in the water table. Therefore, there is a risk of the complete depletion of aquifers, and on the other hand, water is being extracted from the lower, saline layers of these aquifers. Planet Earth has an area of over 500 million square kilometers, and nearly three-quarters of it is covered by water. Therefore, we should expect to see water everywhere. However, water is not always available where and when we need it, or its quality may not be satisfactory.

The population explosion and development in the 1960s served as a warning to people about water pollution, highlighting how vulnerable water is and how limited its distribution can be. On the other hand, people must have access to water, as they need large quantities for personal, industrial, and agricultural use. In any case, humanity's growing demand for water necessitates important considerations in water management. Water travels great distances due to gravity before it reaches the Earth's surface. The use of underground canals (Qanats) helps meet water needs at ground level. Groundwater makes up approximately 25 times the amount of water found in all the lakes and rivers combined, and it accounts for nearly 25% of the freshwater used globally.

Totally, the area covered by freshwater equals approximately 147,800,000 square kilometers, which corresponds to about 35,029,210 million cubic kilometers, making up 2.53% of the world's total water. Most of this freshwater can be found in fresh groundwater, glaciers, permanent snow surfaces, and in Antarctic and Greenland. In smaller amounts, it also exists as soil moisture, water in Arctic islands, mountain regions, permanently frozen lands (permafrost), freshwater lakes, wetlands, rivers, and even streams(Jeddari Avazi, 2005).

However, only 20% of all freshwater exists in liquid form that is accessible for human use. Groundwater consumption is especially high in arid regions, where people heavily depend on it. Nevertheless, the quantity of available freshwater is not sufficient to meet human demand reasonably, as surface runoff and rivers tend to flow into seas and eventually oceans, reducing accessible supplies . Water-related problems have an international dimension and have been encountered throughout history. The Middle East is one such region where water issues are persistent. Water conflicts have long existed between countries such as Israel, Jordan, Syria, Turkey, Iraq, Egypt, and others. Although water is naturally scarce in these arid regions, the situation has worsened due to population growth and increased water demand (Asadian,20003).

Many countries have resorted to drilling deep and semi-deep wells to extract groundwater. This has led to several major problems:

1) Declining groundwater levels, as nature is not given enough time to recharge aquifers. For example, Israel, the Gaza Strip, and Jordan face an annual water deficit of about 300 million cubic meters.

2) Excessive extraction causes saline water to become accessible, and its use, use-especially in irrigation-leads to desertification.

3) In coastal areas, falling groundwater levels cause seawater intrusion, where salty seawater penetrates inland. The shores of the Persian Gulf and the Sea of Oman face this serious issue.

4) Water use in agriculture, industry, and urban sectors has led to heavy pollution of surface and groundwater in many regions(Fijani,2020).

Accessibility and Use of Water

Clean and fresh water plays a crucial role in the location and activities of human settlements worldwide. One reason why 60% of the world’s population lives in Asia may be the high accessibility of water, especially for agriculture. Iceland is the richest country in the world in terms of per capita water production, with an annual renewable water volume of 670,000 cubic meters. In contrast, countries like Kuwait and Bahrain have no renewable water resources.

They either desalinate the salty water of the Persian Gulf or import water into their countries. In Egypt, except for the flow of the Nile River, which originates from tropical regions, particularly through Sudan, the annual renewable water volume reaches only 30 cubic meters per capita, which is just one two-thousandth of Iceland’s renewable water resources (Alijani, 2005).

Another factor relates to the variability of rainfall over different years. In some regions, such as the coastal areas of Africa, annual rainfall can be high in some years but severe droughts occur in others. Therefore, this issue has led many places around the world, even

thousands of years ago, to take appropriate measures to control, store, and transfer water so that it remains available during dry seasons or years.

At the same time, on every continent, there are areas where rainfall is low due to topographic effects and wind patterns. Additionally, the alternating cycles of wet and dry years cause temporary droughts.

Water scarcity has a significant impact on semi-arid regions, as access to moisture is a key factor in determining and sustaining the distribution of plants and animals.

Of course, some natural ecosystems may suffer less damage from drought, but agriculture and livestock face significant losses. Therefore, the problem of water reduction or scarcity in many regions of the world has forced farmers to abandon their fields and migrate to cities. Consequently, there is concern that greenhouse gases may cause major climate changes, leading to more frequent and severe droughts than before (Kordvani, 1992).

Various Uses of Water

Unlike energy resources that are depleted after use, water has the potential to be used multiple times. In this regard, different types of water usage can be briefly mentioned. We withdraw water from lakes, rivers, groundwater aquifers, and other sources for various purposes. Water use refers to the portion of withdrawn water that is either absorbed into the soil, infiltrates into groundwater aquifers, evaporates, or undergoes chemical changes. As a result, human use removes water from its beneficial state. Changes in water quality due to pollution or salinization are other reasons for water degradation (Madani, 2006).

While the quantity of water available may remain constant after various uses its quality changes. Therefore, the water no longer holds the same value it had initially. At the global level, humans withdraw about 10% of the total runoff and nearly 25% of the stable runoff. Consumption and depletion amount to almost half of the withdrawn water in most industrial societies. The other half of the water withdrawn can still be valuable for organic uses, provided that it is protected from pollution and salinization and supplied properly to consumers.

Water consumption has doubled from the 19th to the 20th century. While water use in industrial countries has remained stable, demand is increasing in developing countries where water supply is available. For example, in countries like Canada, Brazil, and Congo, less than 1% of annual runoff is withdrawn. In contrast, countries such as Libya and Israel, where water is a valuable environmental resource, withdraw groundwater and surface water at rates over 100 times their renewable supply (Moheddanesh, 1994).

Water use can be analyzed in three main sectors: domestic (urban and rural), industrial, and agricultural. Globally, 69% of total water is consumed in agriculture. In India, this figure reaches 93%, while in Kuwait it accounts for only 4% of total water use. Farms in Canada, benefiting from natural rainfall, are well irrigated, and only 12% of the country's water is used for agriculture.

A quarter of the world's available water is used in the industrial sector. Fortunately, in many industries, wastewater can be recycled for other purposes. However, in some industries, water becomes highly polluted and contaminates surface and groundwater after discharge, such as in leather manufacturing plants. In developing countries, 10% of available water is used in industry, but this consumption is increasing with industrial development. Depending on a country's level of progress or underdevelopment, the importance of water can be comparable to that of energy (Hashem, 2002)

Freshwater Shortages

Water is a major limiting factor for biological systems and human societies in the environment. The world, alongside rapid spatial growth, has always depended on natural freshwater resources. With increased water consumption over wide areas, we are facing water shortages caused by:

1) Increasing demand,
2) Unequal distribution of usable freshwater,
3) Rising pollution and salinity of available water.

Kalinin, a Russian hydrologist, predicted that by the year 2000, humans would use nearly half of all renewable water on Earth. At least one billion people, about 20% of the world's population, face a shortage of safe or adequate drinking water. The World Health Organization considers 2,000 cubic meters (53,000 gallons) of safe water per person annually as the minimum standard for a healthy life. In 40 countries, water availability is below this standard. Countries with the greatest water shortages are either island nations or located in the Middle East. For example, in Mali, 88% and in Ethiopia, 94% of the populations are face to the shortages of safe water (Haj Rasouliha, 1985).

Rural populations generally have less access to safe water compared to urban populations; even in urban areas, only 60% of people use safe water. The causes of water shortages are numerous. In some cases, shortages arise from natural forces: low rainfall and scorching winds dry up water reservoirs and create conditions for dry seasons, alter river courses, and force rural people to leave their villages.

Other causes of water shortages are human-made: many people need water, urbanization, overgrazing, and improper agricultural practices cause water to become unusable before it is use. Without investments, polluted and salty water cannot be accessed by people through wells, pipelines, or other infrastructure (Mahdavi, 2002).

Pure water is available in many countries, but mainly for those who can afford to pay for it. Today, many people suffer from the shortage of this essential resource. In many cities, such as those in Pakistan, there is no piped drinking water system, and people have to buy bottled water at high prices. Meanwhile, the water used at home is often not suitable even for bathing and other washing needs (Farajzadeh, 1996).

In many dry and semi-dry countries, over 80% of water resources come from groundwater. Even in the United States, nearly 40% of freshwater used for agriculture and personal consumption is supplied by groundwater. About half of all Americans and nearly 95% of the rural population rely on groundwater for drinking and other household uses. Excessive use of this water has caused problems such as drying up wells, the disappearance of natural springs, and the loss of surface waters like wetlands, lakes, and rivers.

Many unconfined aquifers, which slowly recharge over thousands of years, have formed over millennia. However, humans rapidly deplete them all at once. Most of the groundwater aquifers we know likely originated during ice ages thousands of years ago. This water is called fossil water. When we extract water from such aquifers, we must acknowledge that in our era, they will never recharge again. In other words, we are exploiting non-renewable water resources. Fossil water in the United States, especially in Texas, has been completely depleted. Currently, countries like Libya, Algeria, and even Saudi Arabia are heavily tapping into fossil water, as if these water resources belong only to the current generation.

Extracting large amounts of groundwater affects soil structure and causes land subsidence. This issue is seen in many coastal cities where buildings are constructed on river deltas or other loose sedimentary areas. Some inland regions also experience land subsidence. Mexico City is one of the worst examples of this phenomenon. It is built on the bed of an abandoned lake. It is likely that the Aztecs also experienced land subsidence (Alizadeh, 1989).

In recent years, the increasing population and urbanization have caused severe depletion of groundwater aquifers. Some urban areas have subsided as much as 8.5 meters. When the roof of an underground canal or cave collapses, a large sinkhole is formed. Extraction of groundwater and unconfined aquifers accelerates the process of land subsidence. Suddenly, large sinkholes appear, swallowing roads, houses, and trees within hundreds of meters wide. When underground parts collapse or the pores between rocky sections disappear, water is displaced. After the depletion of unconfined aquifers, salty water flows in. Along long coastlines and in areas with saline deposits from ancient ocean layers, seawater retreats inland. However, excessive use of freshwater reserves in agriculture and urban areas often allows salty water to invade these unconfined aquifers (Mahdavi, 2006).

Arab countries around the Persian Gulf and the Sea of Oman, due to overuse of groundwater, will soon be devoid of fresh water. Their vast groundwater sources have been depleted, and seawater has intruded up to ten kilometers inland into unconfined aquifers! It is estimated that by 2007, groundwater in the Arabian Peninsula will no longer be potable.

Finding solutions to prevent groundwater over-extraction is neither easy nor cheap. Gulf Arab countries and those around the Sea of Oman are resorting to seawater desalination (Khaledi, 1997).

Increasing Water Supply

There are several methods to increase the local water supply:

1. Cloud seeding with dry ice or silver iodide can be done for clouds that contain sufficient moisture.
2. Transporting icebergs from the North or South Poles, as icebergs contain large amounts of fresh water. However, transporting them requires a lot of energy, and this method is not recommended because it disrupts the natural balance of polar environments.
3. Desalination of salty water, including ocean water, is useful for increasing the supply of fresh water. By the late 1980s, the global capacity for desalination was about 13.3 million cubic meters per day. However, the cost of desalination is 3 to 4 times higher than other fresh water sources. Currently, 60% of the 4,000 desalination plants are located in Saudi Arabia and other Gulf countries. This method removes salts from seawater primarily through evaporation and distillation. Oman and Bahrain, with very limited fresh water resources, sustain their water needs using this method.
4. The construction of new dams, reservoirs (canals, water transfer systems), underground pipelines, use of qanats, springs from groundwater, artificial recharge of aquifers by various methods, and controlling surface runoff are effective ways to meet the water needs of people in dry regions.
5. Water conservation and promoting a culture of saving water, educating farmers about drip irrigation and other efficient methods.

6. Establishing and strengthening vegetation cover and preventing the destruction of forests and pastures.
7. Supplying two types of water and creating separate water supply facilities for them in cities (Khaledi, 1995).

The Problem of Water Supply in the Future

With declining rainfall and limited water resources, restrictions become evident. How can we satisfy the increasing demand for water? The amount of water available per person is decreasing due to population growth, and economic development further increases personal demand. As a result, since 1970, the global water supply per capita has dropped to one-third. Moreover, pollution limits water resources, so even before quantity becomes critical, water quality issues restrict health and development in a region.

The future of water on Earth is truly complex. Right now, nearly all of the world's renewable water is being consumed. Half a billion people rely solely on the polluted Ganges River. The World Bank has estimated that in 2010, a $600 billion investment was needed to increase available freshwater resources (Vahabsadeh, 2004).

Climate change has made water supply conditions more critical in many regions. Around 200 major river basins worldwide face similar issues. These rivers flow into oceans, seas, or lakes. Among them, 148 rivers are shared between two countries, and 52 rivers belong to three countries. The 1966 Helsinki rules on international rivers consider not only legal issues but also economic, political, geomorphological, hydrological, engineering, industrial, and cultural aspects (Madani, 2006).

Findings

The findings of this research indicate that fresh water is one of the most essential natural resources for the survival of living beings and the sustainable development of human societies. However, in recent decades, due to population growth, climate change, water pollution, unsustainable agriculture, and overexploitation, freshwater resources have significantly declined. It is possible that in the coming years, a large portion of the world's population will face freshwater shortages.

The reduction of freshwater resources also has widespread consequences, including threats to food security, increased social and political tensions, forced migrations, declines in public health, and damage to natural ecosystems. Additionally, water scarcity can lead to reduced agricultural and industrial production, directly negatively impacting the economies of communities. However, there are also solutions for sustainable management of water resources and reducing its negative effects, which can be somewhat effective. Important measures such as cloud seeding, desalination of salty water, dam construction, water conservation, saving, and strengthening vegetation cover are among the key strategies that can help enhance water supply.

Conclusion

Water holds a special place among natural resources. Unfortunately, the value of freshwater is often overlooked, and it is wasted carelessly. Due to excessive water extraction-especially the depletion of surface water, groundwater sources are also at risk of decline, pollution, and salinization. Meanwhile, humans are also exploiting fossil water

reserves. Water consumption is highest in agriculture, followed by industry, but excessive urban water use is one of the major challenges. The reduction of freshwater resources makes it difficult to meet conventional water demand. Water scarcity is also caused by drought, lack of rainfall, and pollution. In 2019, the World Economic Forum identified water scarcity as one of the greatest global risks due to its potential impact in the coming decade. Causes of water scarcity include partial or complete failure to meet demand, economic competition over water quantity and quality, conflicts among users, irreversible depletion of groundwater, and negative environmental effects. About two-thirds of the world's population (4 billion people) experience severe water scarcity for at least one month each year. Around 500 million people face severe water scarcity year-round. Half of the world's largest cities suffer from water shortages.

Acknowledgment

The authors also thank the anonymous reviewers for their helpful comments and suggestions.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

Asadian, Khadijeh. (2003). Geology for Geography, Tehran: Organization for Research and Compilation of University Humanities Books. P, 277

Alizadeh, Amin. (1989). Principles of Applied Hydrology, Mashhad: Astan Quds. P, 96

Alijani, Dr. Bahlol. (2005). Fundamentals of Climatology, Tehran: Organization for Research and Compilation of University Humanities Books. P, 138

Farajzadeh, Manouchehr. (1996). Drought and Methods of Its Study, Scientific, Social, Economic Quarterly of Forest and Rangeland, Issue 32.

Fijani, Elham. (2020). Study of Groundwater Factors' Affecting Reduction, Scientific Journal, University of Tehran. P, 177

Hashem Golpayegani, Akbar. (2002). Industrial Society and Information Society, Letter of the Quarterly of Culture, p. 44.

Haj Rasouliha, Shapour. (1985). Water Quality for Agriculture, Academic Publishing Center, Tehran. P, 155

Jeddari Avazi, Jamshid. (2005). Geography of Waters, Tehran: University of Tehran. P, 44

Khaledi, Shahryar. (1997). Meteorology and Hydrology: For Hydrologists and Water Resources Engineers, Tehran. P, 86

Khaledi, Shahryar. (1995). Applied Meteorology, Tehran: Qums. P, 48

Kordvani, Parviz. (1992). Water Resources and Issues in Iran, Tehran: University of Tehran. P, 231

Mahdavi, Mohammad. (2002). Applied Hydrology, Tehran: University of Tehran. P, 125

Mahdavi, Mohammad. (2006). General Hydrology,Tehran: Elm va Adab Publishing. P, 165

Vahabzadeh, Abdolhossein. (2004). Fundamentals of Environmental Science, Mashhad: Jihad Daneshgahi Publications, Mashhad. P, 132

Madani, Hassan & Shafighi, Sirous. (2006). General Geology, Tehran: Amir Kabir University of Technology. P, 67

Moheddanesh, Ali Asghar. (1994). Hydrology of Iran's Surface Waters, Tehran: SAMT Publications. P, 95