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# WATER AND WATER PROBLEMS FOR OUR FUTURE

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**ABSTRACT**

Water is a miracle liquid that covers about 2/3 of our world and our body. Although it is used as if it is unlimited, the water resources in the world are unfortunately limited. Water resources that can be used safely for domestic, agricultural, and industrial purposes are only a small part of the total water resources in the world, such as 2.5%. Since water resources are not equally distributed for all people and countries in the world, the importance of water in our lives has started to make itself felt even more with domestic, agricultural, and industrial activities and climate changes. Recently, with the effect of technology, microplastics in water and food have started to come to the fore. This situation reveals that access to clean and healthy water and efficient and effective use of water is important and that necessary precautions should be taken as soon as possible. For this reason, the protection of existing water resources, the development of alternative water resources, the use of technologies compatible with the ecological environment, and their dissemination can be counted among the measures that can be taken.

## 1. Introduction

Water, $H_2O$; is a Miraculous liquid that makes up about 50-70% of the human body (in children: 70-75 in adults: 60) and 2/3 of the world (Watson et al. 1980, Perlman, 2016). Water is an indispensable element of human life, quality water is needed for many vital



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activities such as digestion of food, removal of wastes in metabolism, control of body temperature, regulation of intestinal flora, and proper functioning of the immune system and brain functions. Dehydration and depletion of carbohydrate stores that occur in the body during long-term activities are two important factors. Especially in the summer months when the air temperature is high, people are faced with the possibility of high-water loss (Toğrul & Hayoğlu, 2020). This is especially more important in hot regions and in children of developmental age. In order to meet the daily water, needs of the body, a normal person should drink 6-8 glasses of water a day. In case the water lost in the human body cannot be replaced, the damages that may occur due to water loss are given in Table.1 depending on the body weight (Naghii, 2000; Sawka et al., 2005).

**Table 1.** The Damages That May Occur Due to Water Loss

| Water Loss Rate | Possible Impact |
|---|---|
| 2-3 % | Increased temperature, increased thirst, Deterioration of body temperature |
| 4-6 % | Headache, fatigue, Weakness, Decreased physical performance |
| 7-10 % | hallucinations, convulsions, fainting |
| 10< % | unconsciousness, death |

## 2. Water, Its Importance and Its Place in Agricultural Activities

Water is essential for our daily life. We mostly use water with our food. According to UN and FAO data, approximately 3 000 – 5 000 liters of water are needed to meet the daily food requirement of a person (FAO, 2022; FAOaquastat, 2022). In addition, water is an indispensable component of agricultural production. As agricultural production cannot be possible without water, water insecurity means food insecurity. It is obvious that adequate and healthy water consumption is of great importance in a balanced and healthy diet. Sufficient quantities of quality water are needed to produce some of the healthy foods we need, especially fruits and vegetables. Recently, an increasing amount of agricultural land has started to suffer from chronic water shortage. As a result of increasing drought periods, intense storms or flood events due to climate change, losses in agricultural production have begun to occur. In addition, in many regions, water quality deteriorates due to increased urban population density, increased polluting activities due to increased water demand in the energy and industrial sectors, salinization caused by rising sea levels, and water resource changes caused by climate change. A sustainable approach to water resources management is essential, as the balance between water demand and water availability has reached critical levels in many parts of the world and demand for water and food production is likely to increase in the future (Mishra et al, 2021). The concept of sustainable water management refers to all practices that increase crop yields and minimize water losses (Mancuso et al. 2015). Sustainability in food production cannot be achieved unless the water is properly managed. 70% of the fresh water in the world and 74% in Türkiye are used in agricultural activities (OECD, 2020; FAOaquastat, 2022). Agricultural activities also continue to be a major source of water pollution. It is stated that approximately 20-50% of Türkiye's surface waters are polluted with nitrogen (OECD,

2019). Therefore, improving water management is crucial for a sustainable and productive agricultural and food sector.

### 3. The Water Crisis and Its Impacts

World Meteorological Organization (WMO, 2022), Global Water Partnership (GWP, 2022), Worldwide Fund for Nature (WWF, 2022), CDP Global Water Report (CDP, 2020), UN (UN, 2022) and other institutions and organizations According to current data on climate and water, the water crisis appears to be a major problem for many societies around the world.

In the Global Risks Report of the World Economic Forum, water crises are stated as the third most important global risk in terms of impact on humanity after weapons of mass destruction and extreme weather events (WEF, 2021). In accordance with studies, Today, one in four people live in countries affected by water stress. It is estimated that more than 5 billion people will be affected by water scarcity by 2050, which will affect approximately 45% of the world economy (Unwater, 2022; Openacces, 2022; Boretti & Rosa 2019). Among the reasons for this, the uncontrolled use of water, climate change (melting of glaciers, salinization of groundwater, and increased evaporation-sweating), reduction of freshwater resources, mismanagement of environmental resources, and although water is considered an economic tool, it is not understood that it is very important for environmental health. In the last 20 years, floods have increased by 134% and droughts by 29%. However, the effects of water scarcity and disasters are not evenly distributed around the world (Openacces, 2022). These water problems are expected to strongly affect agriculture, which is a highly water-dependent sector and particularly affect the productivity of rain-irrigated crops and livestock activities in certain countries and regions. These changes will subsequently affect markets, trade and food safety, and food assurance.

The total amount of water in the world is about 1.4 billion $km^3$. About 97.5% of this water consists of salt water in the oceans and seas. 2.5% consists of fresh water, which is found in rivers, lakes, and underground and is necessary for life. Approximately 68.7% of fresh water is in the form of ice and glaciers, and 30.1% is in the form of groundwater (Figure 1). Just over 1.2% of all freshwater is in the form of surface water, which meets most of the needs of life. Most of this water is in the form of ice, and 20.9% is found in lakes. Rivers make up 0.49% of surface freshwater. Although the rivers have a very small proportion, people get most of their water from here. The amount of water suitable for meeting the needs is only 0.25% of the total amount of water in the world. (Shiklomanov, 1993; Hotloś, 2008; Teksoy et al., 2017; CSB 2020; Water Science School, 2019,).

Approximately 500,000 $km^3$ of the total water on the planet we live in evaporates and falls back to the earth as precipitation within the annual water cycle. The average annual precipitation around the world is approximately 110,000 $km^3$. 40,000 $km^3$ of it reaches the seas and lakes via rivers, of which approximately 9,000 $km^3$ is usable technically and economically (Hekimoğlu & Altındeğer, 2008). Since the lack of a balanced distribution of usable water, approximately 1/3 of the world's population does not have adequate and healthy water resources and is stricken by water scarcity. Worldwide, approximately 8% of the population lives in North America and

6% in South America, while 15% and 26% of usable water resources are located in these areas, respectively (Uitto, 2001; Atçı, 2019; UN, 1997). On the other hand, 60% of the world's population lives in Asia and the rate of water resources is 36% (Figure 2). Moreover, the approximate population ratios of Europe, Africa, and Australia are 13%, 13%, and 1%, respectively, and the percentages of usable water resources are around 8, 11, and 5%, respectively (FAO, 2007; Biswas & Tortajada, 2019; Pachauri & Meyer 2014; UNU, 2013; Mishra et al., 2021).

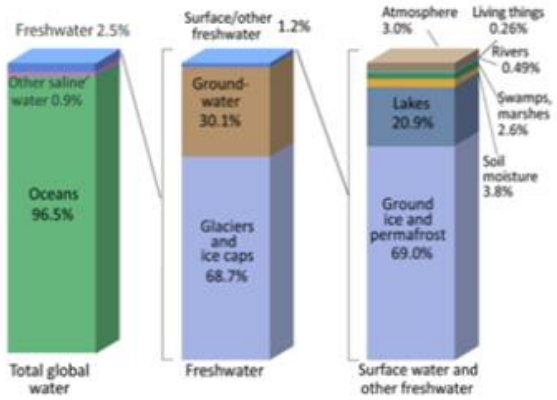
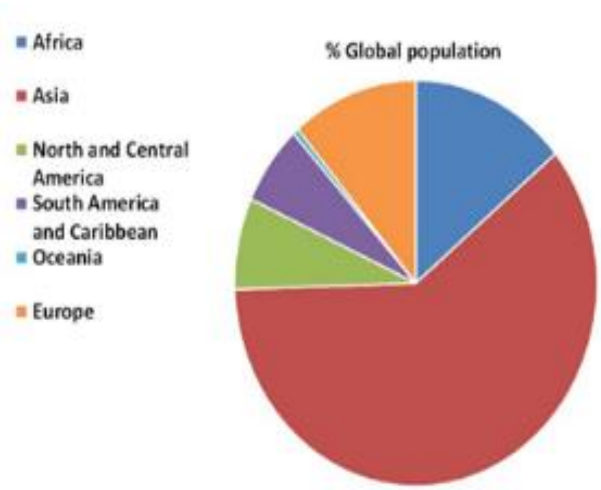



**Figure 1.** World Water Distribution (Shiklomanov, 1993).



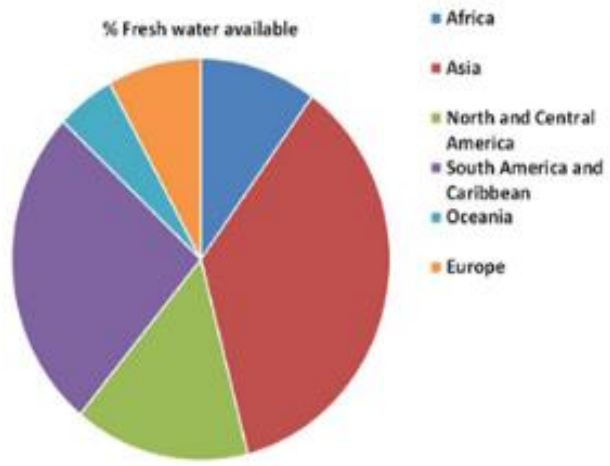




**Figure 2.** World Water Distribution (Shiklomanov, 1993).

The effects of drawing too much water from both surface water and groundwater are frightening. The most striking example in this regard is the drastic reduction in the size of the Aral Sea (Figure 3) and Lake Chad (Figure 4).

**Figure 3.** The Change of the Aral Sea over Time (Yıldız, 2019).

Today, the Aral Sea has shrunk by 90 percent and retreated up to 170 kilometers from its former shores. In the Aral Sea, an area of 33 000 km$^2$ has completely dried up and the mineral content of the water has increased. The lake ecosystem has almost completely disappeared. The Aral Sea, which was known as the 4th largest lake in the world until about 65 years ago, has turned into Aral sand today (Yıldız, 2019).

Lake Chad has largely dried up due to the overheating of the earth with the change in

climatic conditions and the unconscious use of water. Lake Chad has shrunk by more than 90% in the last forty years (Gao et al., 2011), while its surface area was approximately 25 000 km$^2$ in 1963, it has decreased to 1350 km$^2$ today (Arendal, 2022).

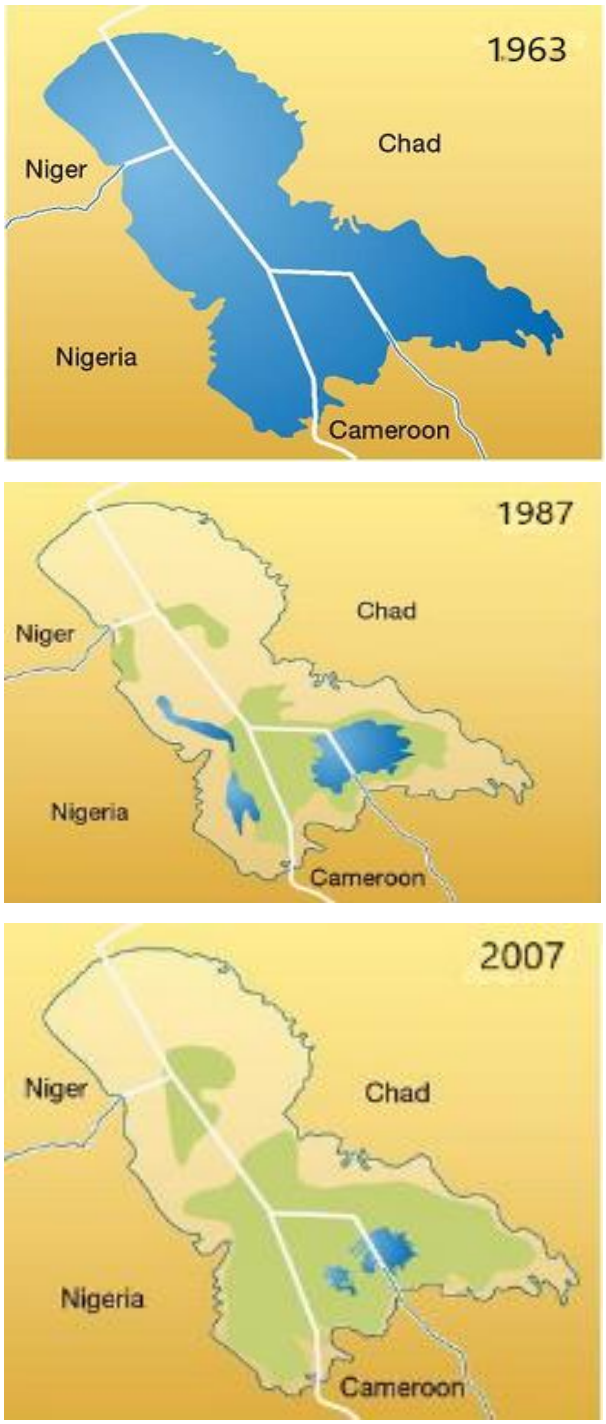



**Figure 4.** Change of Lake Chad depending on time (Arendal, 2022)

Our water resources in the world are decreasing day by day and we are not aware of it. People use water in a wasteful way, as if they have unlimited resources, in this period when our resources are facing depletion. However, if it is known that every drop of water causes irreversible losses in our lives, perhaps we can see the Aral Sea, Lake Chad, etc. water resources would not be what they are today.

Although Türkiye has freshwater resources consisting of lakes and rivers, it is not a water-rich country and is a candidate country to experience water problems in the near future if necessary, precautions are not taken. In Türkiye; Due to reasons such as drought and unconscious use of water, inability to control resources, uneven distribution of precipitation and resources according to regions, and opening of water resources for use with short-term projects, decreases are observed in the existing water capacity. The consumable surface and underground water potential of our country is around 110 km$^3$/year (Yılmaz, 2015). Although the theme of 2022 World Water Day is the use of groundwater ("Groundwater: Making the invisible visible"), we must protect groundwater from pollution and use it sustainably (SBB, 2018). We need to balance the needs of people and our world. Groundwater feeds ecosystems while protecting the base stream of rivers, preventing ground subsidence and seawater from entering the interior. There is a decrease in the groundwater level due to excessive water withdrawal by opening uncontrolled wells and insufficient precipitation. This causes collapses, which we call sinkholes, depending on the geographical structure (Figure 5). Sinkholes, which are also seen in Türkiye, and sea waters that enter the inner parts of the

coastal areas and cause the groundwater to become salty can be given as an example.

**Figure 5.** The Sinkhole Occurring in the Southeastern Anatolia Region

Today, in order for a country to be considered water-rich, it is accepted that it should have a water potential of approximately 10,000 $m^3$/year per person, while this value is around 3600 $m^3$/year in our country.

When classification is made according to the presence of water, the countries are.

If the amount of usable water per person is more than 8 000-10 000 $m^3$/year, water-rich,

If the amount of usable water per capita is less than 2.000 $m^3$/year, water shortage

If the amount of usable water per person is less than 1.000 $m^3$/year, it is considered water poor (Aydın et al. 2017).

While the amount of water per capita in the world was 16.800 $m^3$ in 1950, this amount decreased to 7.300 $m^3$ in 2000. In 2025, it is estimated that per capita water consumption will decrease to approximately 4.800 $m^3$. According to water resources, Brazil ranks first with 8.233 $km^3$ of renewable water, while Russia ranks second with 4.508 $km^3$, and the USA ranks third with 3.069 $km^3$ of renewable freshwater (Yılmaz, 2015). According to the Mundi index, Türkiye ranks 42nd in terms of renewable freshwater amount with 211.6 $km^3$ (FAO, 2015).

The amount of usable water per capita in our country is around 1.500 $m^3$/year, and it is estimated that this value will decrease to 1.300 $m^3$ by 2025. (Burak, et al., 1997; Akın & Akın, 2007). According to the annual amount of water per capita, our country is a country experiencing a water shortage. This shows that our country has limited water resources.

## 4. Water Requirement, Water Use and Effect on Ecosystem

In underdeveloped countries, the amount of water used by a person for daily drinking, cooking and cleaning is 10 liters. A woman in Africa and Asia travels an average of 6 km a day, carrying 20 liters of water to her home. Moreover, most of the time, this water is not even clean and drinkable (Taşkın, 2019). According to United Nations data, a child dies every 9 seconds due to contaminated water. 1.4 billion people in the world are deprived of clean potable water. 470 million people live in water-scarce areas and this number is expected to increase 6 times by 2025. Every year, 250 million people suffer from water-borne epidemics. The UN estimates that 700 million people worldwide could migrate by 2030 due to intense water scarcity. (FAO, 2007).

The direction, overuse and pollution of rivers and lakes for irrigation and industrial and municipal uses can cause significant environmental damages and the collapse of ecosystems.

Besides industrial and urban use, agricultural activities and plastic waste also have a great impact on the pollution of the ecosystem and water. Excessive fertilization and spraying used

in agricultural areas cause pollution in surface and underground waters and damage the ecosystem. It is estimated that by 2050, the nitrogen and phosphorus ratios in wastewater will increase by 180% and 150%, respectively. In addition, other chemicals used in agricultural areas are around 2 million tons per year. Among them, herbicides have 47.5%, insecticides 29.5%, fungicides 17.5% and other chemicals 5.46% (Boretti & Rosa 2019).

Today, plastic waste is another source of pollution. Microplastic contamination, which has gained importance especially recently, has started to pose a threat to health as well as water and the ecosystem (Rist et al., 2018). Macroplastics, which are thrown into the aquatic environment or reach water reserves from the land through precipitation, reach sizes that can be easily consumed by living things through chemical and physical corrosion. Plastics that have reached a size of less than 5 mm through an abrasion in this way are called secondary microplastics. In addition, microplastics smaller than 5mm, which are currently produced for use in various industrial processes, and hygienic and cosmetic products, are also called primary microplastics. Plastic particles smaller than 1µm are called nanoplastics (Arthur et al., 2009; GESAMP, 2015; ECHA, 2019; Fonseca et al., 2017; Aslan, 2018; Welle & Franz, 2018; Andrady, 2017). Microplastics, or tiny plastic particles, are pollutants found almost everywhere in the world. Researchers have detected microplastics in many places from the summit of Mount Everest to the Mariana Trench and even in baby poop. Also in recent studies, it has been stated that plastic particles are found even in human blood (Leslie et al.). In nature, primary and secondary microplastics and nanoplastics can be directly or indirectly consumed by many organisms, from zooplankton to whales, through the food chain. Human, which is a part of the food web, is among these creatures (Rist et al., 2018). Studies focused on zooplankton, benthic invertebrates and fish show that microplastics affect the metabolism of living things negatively, cause oxidative stress, reduce the immunity and fertility of the living thing, and cause injuries and obstructions in the digestive tract (Kwon et al. 2022; Xie et al. 2022; Yuan et al. 2022; Akçay et al. 2020). Recently, the increase in the consumption of ready-to-eat foods covered with plastic packaging and films, especially in primary schools, is one of the important issues that should be considered in terms of child nutrition.

## 5. Measures to be Taken

In order not to experience water and environmental problems in the future or to reduce these problems as much as possible, we need to take the necessary measures today and use our resources in the most effective way. Impermeable surfaces (such as roads, pavements, and parking lots) that increase with urbanization cause rainwater to be polluted by mixing with the sewer system without allowing it to complete its natural cycle, or to cause flood disasters by flowing rapidly after heavy rains. These negative effects can be prevented with a series of regulations that will ensure the management of rainwater. Even if high-income countries have very limited water resources, they can feel this problem at a very low level by minimizing the problem of access to water thanks to the rational management of water resources. On the other hand, they produce high-cost alternative solutions by using new technologies. Low-income countries, on the

other hand, experience the issue of access to water much more severely and deeply, since they are insufficient in terms of making use of resources, even if the annual amount of usable water per capita is high. Saudi Arabia is the world leader in water desalination. The estimated amount of fresh water produced by Saudi Arabia annually is approximately 1.06 billion $m^3$, followed by Bahrain with 0.3 billion $m^3$. (Petruzzello, 2022). Traditional methods such as dams that provide water for large populations and inter-basin water transfer cannot provide quick solutions to the problem of access to water, considering both their financial burden and considerable construction time. On the other hand, adapted innovative solutions that do not require large financial resources and investments and focus directly on the local problem can quickly overcome the problem of access to water. One of the low-budget, local solutions for water supply is rainwater harvesting, which has been practiced for centuries. Simple systems for collecting and storing rainwater can work better than expected at the local level. For example, the use of rainwater to be collected from roofs or various surfaces in schools for toilet and garden irrigation will significantly reduce the water requirement in schools. On the other hand, it is possible to use rainwater in agricultural irrigation with simple arrangements to be made in the fields. This contributes to meeting the high-water demand (WWF 2020).

## 6. Conclusions

Water is an essential substance not only for humans but for all living things. In many regions, water supply and unequal distribution of water resources in time and space, changing living and climatic conditions are important problems. Water resources are in danger of diminishing due to climate change, global warming, misuse and pollutants. If the necessary precautions are not taken, many countries of the world will suffer from serious water and food scarcity in the future. The existence of sufficient quantity and quality of water is the basic condition of freshwater ecosystems, as well as food security and sustainable development, and therefore the future of humanity. Conservation of freshwater resources is therefore very important.

Therefore.

New water management strategies must be developed due to the threat of water scarcity.

Water treatment plants should be built and their efficient operation should be ensured.

Measures to prevent water pollution should be implemented as soon as possible.

The "0 waste" project should be supported by reducing the use of plastic.

It should respect nature and measures to protect the natural balance should be taken as soon as possible.

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