



ORIGINAL ARTICLE

A brief review on water resources and climate change

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ABSTRACT

Human-caused climate change poses a growing threat to water resources that are valuable today and for the future. In addition, climate change is thought to have negative impacts on food, economy, natural resources and sustainability worldwide. In this article, the relationship between water resources and climate change is discussed and the importance of water is emphasized. In addition, recommendations are made for the sustainable use of water resources.

Keywords: Global climate change, water, ecology, sustainability

Citation: KILIÇ ÇETİNKAYA, B. & ASLANDOĐAN, E., A brief review on water resources and climate change. *Journal of Global Climate Change*. 2022; 1(1): 1-6, DOI: 10.56768/jytp.1.1.01

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1. INTRODUCTION

Among the indispensable natural resources that emerged with the formation of the water world, there is water, which is the second most important resource after air and is critical for human life. It is a building block of people whose dependence on it continues until the end of their lives. In addition, the amount of water in the human body varies from 60 to 70%. People need 2.5 liters of water every day to meet their biological needs. In addition, the average daily urban water demand for needs such as drinking, cooking, cleaning and laundry, which are necessary for a healthy life, is 150 liters per person. Water not only ensures the existence of the human body, but also a healthy life, ecosystem and food (Yarenoğlu, 2017). It is indispensable for life and has a great influence on living and inanimate beings. The natural balance, the environment and the life cycle depend on water. The important role of water in soil formation, flower diversity and survival, as well as in natural phenomena is indisputable. People need water (Özsoy, 2009).

Another focus factor is the contribution of water to the social and economic development of humanity. To be specific, people settled down thanks to watering. So they were able to produce and store grain and other agricultural products. As a result, they established civilizations along and around water sources. Water is definitely the only natural resource in the world that should always be used sparingly. Nevertheless, little attention was paid to the vital role of water after the Industrial Revolution and was considered an insignificant resource. There is no other source to replace water as a building block for humans and other living organisms. Water goes through various processes to make it usable. However, it should not be forgotten that water is not an infinite resource, even if people think the opposite (Yarenoğlu, 2017).

In this review, the importance of water resources for life is discussed by taking advantage of the results of previous research. To elaborate, it discusses how water resources, threatened more severely than ever before by rising temperatures globally, can be used sustainably and managed responsibly and reasonably for future generations.

2. WATER SUSTAINABILITY

Sustainability is intended to be passed on to future generations without causing harmful complications in the established mechanisms of all ecosystemic elements. A decisive implementation of sustainability requires limited use of available resources. Efforts to ensure that human needs are met in the future place various constraints on the current exploitation of natural resources. Although preserving the ecosystem as an intact heritage seems to be the most natural method, the inadequacy of today's resources to meet the increasing needs causes some plan changes (Meriç, 2003).

Every individual has the right to have water that is safe and affordable to use in sufficient quantities to lead a clean, healthy, and productive life (Mejia et al., 2012). Unless the imbalance between overdemand and limited supply is eliminated, the world is reportedly facing an exponentially worsening global water shortage. Water sustainability is the basis of development. Water resources, because of the variety of services they provide, pave the way for poverty reduction, economic growth and environmental sustainability (Connor, 2015).

Water makes significant contributions to improvements in social well-being and growth, from energy security to food security, the environment and individual health. Water sustainability can be achieved through settlements that are compatible with the natural water cycle and the ecosystems that support it, and through measures to reduce ecological fragility and increase resilience to water-related disasters.

How to manage water resources is a challenge. An ever-increasing global population, rapid urbanization, settlement problems and uncontrolled economic development are reducing the quality of water resources and reducing their availability. All this must be taken into account for effective water management (Aküzüm et al., 2010).

Water management consists of various sub-components such as efforts to increase water supply in relation to various economic sectors such as

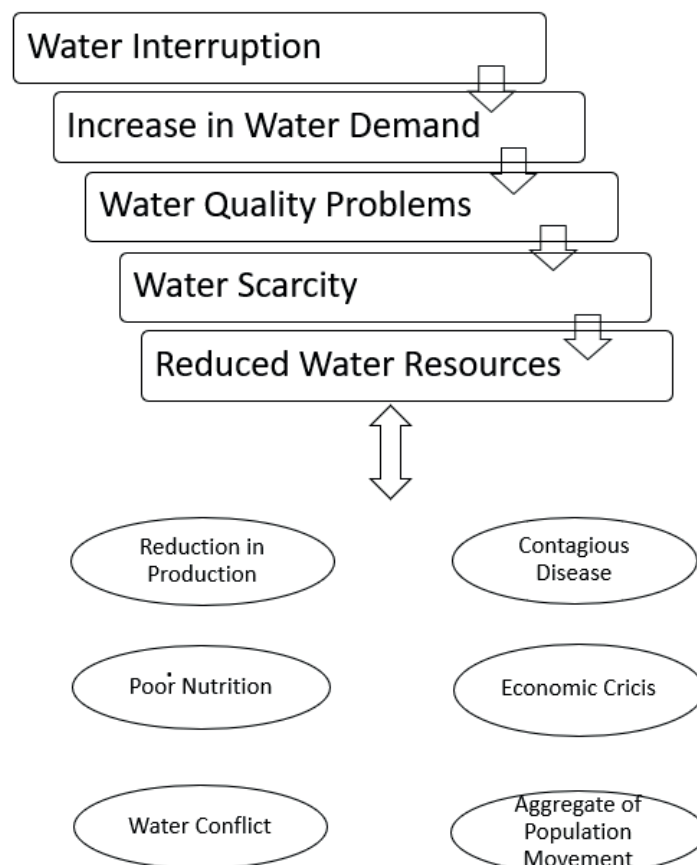
agriculture, industry, environment and transportation, management and planning of the demand for water under the stressful conditions of water resources, protection of water quality, production and implementation of managerial strategies, development of decision and support systems (Kırtorun and Karaer, 2018). Managing water resources effectively and sustainably is vital for sustainable development. The importance of water for flora and fauna, the preservation of ecological balance and socio-economic development. Given the growing scarcity, there is a growing need for optimal, economic and equitable use of resources, wastewater treatment and innovative holistic actions (Hoekstra et al., 2012).

3. INTERACTION BETWEEN WATER RESOURCES AND CLIMATE CHANGE

Observed and predicted changes in climate include depletion of water resources, increasing drought, ecological degradation, forest fires, erosion, a degraded agricultural system, diseases

and deaths caused by extreme heat (Aydoğdu, 2020). Drought is no longer considered a natural phenomenon, especially due to human intervention in the hydrological cycle. Aggressive and harmful use of water resources to disrupt ecology, ineffective interventions in wetlands and streams, unconscious drainage of groundwater resources, overuse of water for agriculture and livestock, and global climate change have caused irreversible effects. Figure 1 shows climate change as the obvious factor driving pressure on the water cycle through pollution, population growth and reckless land use (Kang et al., 2009). In addition, global climate change causes negative effects such as the critical decrease in water resources and the decrease in competition for them and the decrease in water quality (Doğan and Tüzer, 2011). All these impacts pose serious threats to water resources, which are vital to rural development and food production, and underscore the urgency of measures to manage them. Water resources management includes the determination and planning of wa-

Figure 1. Projected Effects of Climate Change on Water Resources (Dikmen, 2021)



ter rights, rational operation, effective protection and comprehensive observation of these resources (Karaman and Gökalp, 2010). The management of water resources aims to minimise the risks arising from global climate change and is supported by reasonable demands. Therefore, a wide range of adaptation techniques must be produced and applied for the conservation and conservation of water resources. New methods should be encouraged for approaches such as changing institutional practices with supply-demand strategies (Kindler, 2000). The increase in global water demand due to population growth and high temperatures requires effective demand management and the implementation of working water policy (Bayraç and Doğan, 2016).

Wetlands, which are the source of many important species, are home to 40% of all species in the world and 12% of animal species (WWF-Türkiye 2008). It also offers benefits such as tourism, recreation and aquaculture, as well as many other benefits such as flood control, coastline protection, groundwater nutrition, food storage, climate change control and protection from storms. The current growth rate puts heavy pressure on water consumption routines. Worldwide, groundwater is the main source of water in large rural areas and in arid and semi-arid regions. Groundwater has been widely used for many years and plays a very important role in water potential. Changes in the temperature regime have adversely affected the amount of snow, rain, groundwater and surface water. Surface waters cover 1.6% of Türkiye's surface area and most rivers flow into the seas surrounding the country (Kurt, 2020). Therefore, water resources are extremely important for energy production and agricultural production. The most obvious limiting factors in the use of water resources for economic purposes are irregular rainfall and flow.

The effects of climate change on water resources are due to a change in the rainfall regime. Precipitation is the primary source of the change in water balance, spatially and temporarily. Climate-induced changes in precipitation lead to critical hydrological consequences. Hydrological deterioration in a particular watershed is influ-

enced by changes in daily, seasonal, annual and decadal cycles. Decreasing rainfall caused by increasing temperatures can be the cause of undesirable events such as decreasing flow rate, a mixture of salt water and fresh water, and an increased storm incidence (Doğan and Tüzer 2011). Türkiye is located in an arid and semi-arid region. The country's current environmental problems, such as drought, desertification and salinity, are worsening as a result of global warming. In rainy regions, the salt that occurs naturally in the soil is transported by rainwater to groundwater and streams. It is then introduced into the seas and lakes. Therefore, salinity is lower in rainy regions. The purposeful use and high performance of irrigation tools is only possible with the drought eliminated and the expected amount of rainfall (Kadıoğlu, 2012). In order to combat agricultural and hydrological drought, the annual reasonable amount of gross water required for irrigation in Türkiye constitutes 48% of the 234 billionm³ of water determined by the General Directorate of State Hydraulic Works of Türkiye, which corresponds to 112 billion m³ (Öztürk, 2016).

The decrease in the amount of precipitation that feeds groundwater due to climate change and the careless and uncontrolled drilling of wells lead to the drying up of aquifers and lakes. It has been observed that the water levels accumulated in many dam reservoirs are decreasing. Above-average seasonal temperatures due to climate change caused by global warming and therefore rapidly melting snows increase the flow rate of streams discharged into dams. This causes floods and related disasters (Sandalcı et al., 2007; Sandalcı et al., 2011). Rising sea temperature endangers many species in the seas and oceans, endangering the activities of fishermen. Increased temperature accelerates evaporation, which reduces the volume of irrigation water (Bayraç et al., 2016). In addition, it is reported that the levels and qualities of lakes as important water resources are adversely affected (Sandalcı et al., 2011). The increase in water temperature threatens the chemical process in a particular lake due to the production of in-lake alkali (Psenner and Schmidt, 1992). The surface area and water potentials of some lakes are known

to have decreased significantly in quantity and quality. In addition, acid rain is listed among the main causes of degraded water quality. Acid rain is sulfur and nitrogen compounds linked to human activity. These compounds are effective in the transfer of chemical charges in rivers. Furthermore, acid rain plays a decisive role in the mineralization of organic nitrogen in soil (Bates et al., 2008; Delpla et al., 2009). It is estimated that shallow lakes will be most severely affected by a 2 O C increase in water temperature caused by climate change by 2070 (George et al., 2007; Malmaeus et al., 2006).

4.CONCLUSION AND RECOMMENDATIONS

This review discusses climate change and the importance of water resources and the potential impacts of climate change on water resources. The data obtained show that adaptive processes should be implemented against climate change and urgent efforts should be made to minimize the risks involved. In order to ensure the sustainability of water resources at their natural potential, the quantity and quality of groundwater and surface water should be evaluated. Annual water consumption records of countries should be produced by determining the water demands of societies. We propose that in order to protect water resources from overexploitation and pollution, to secure their supply in terms of quality and quantity, it is necessary to help educate and make communities more aware, and to adopt a long-term strategy on the rational use of these resources.

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