



Assessing the Water Occupancy Rates of the Kanak Dam Lake between 2016-2021 in Sivas Province, Turkey

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Abstract: *With all its forms and various functions in the atmosphere, water plays an important role not only for the continuity of the climate, but also for the existence of life. Global warming and climate change, which arise as a result of the increase in the concentration of human-induced greenhouse gases in the atmosphere and threaten the entire ecosystem, have begun to affect our lives as the most important problem of the future. Kanak Dam Lake was built between 2010-2013 for drinking water supply and agricultural irrigation. This study was carried out to evaluate the water occupancy rates of the Kanak Dam Lake, located in the district of Şarkışla, in Sivas province of Turkey, between the years 2016-2021. While the lowest water occupancy rate in Kanak Dam Lake was determined as 7.10 percent in 2019, the highest water occupancy rate was determined as 59.90 percent in 2019. The average annual occupancy rate of Kanak Dam Lake between 2016-2021 was calculated as 33.67 percent. These figures indicate that the Kanak Dam Lake has been affected by drought. Accordingly, the effective and rational use of the Kanak Dam Lake in drinking water supply and agricultural irrigation is of great importance in terms of sustainability.*

Keywords: *Kanak Dam Lake, Water occupancy rates, Sivas, Turkey.*

1. INTRODUCTION

Global warming and climate change are increasing the risk of drought worldwide. As a result of the increase in the world population, urbanization, climate changes, deforestation and desertification, drought is threatening the society, environment and countries [1]. Drought is a natural event that affects water resources, agriculture and all living things. At the same time, drought; It is the slowest developing, most insidious, most dangerous natural disaster that causes the most comprehensive socio-economic damage. Like earthquakes, drought is a natural disaster that can occur in various sizes [2]. The Mediterranean geography, where the climate is arid and semi-arid, is thought to be the area that will be affected more by drought. All droughts first start with meteorology, that is, insufficient precipitation, and its effect manifests itself as hydrological, agricultural and finally socio-economic drought. The effects of drought vary both spatially and temporally. Each region or basin is different both in terms of topography and in terms of social consciousness. Due to its climatic characteristics, Turkey is not a rich country in terms of water resources due to precipitation climatology. Turkey's location and its climatic characteristics are in a position to be affected by the risk of drought. For this reason, the possibility that the drought trend that has been going on in the Central and Eastern Mediterranean Basin and Turkey since the early 1970s may be strengthened should be taken into account. In order to prevent serious water problems and shortages that may be faced in the future, realistic and applicable water policies supported by laws should be established and implemented immediately [3]. While the demand for drinking and agricultural irrigation water increases regularly in Turkey as well as in the whole world, the available water resources on earth are in limited quantities. In addition to population growth, developments in living standards increase the demand for water. There is a need to evaluate the effects of global warming and climate change in terms of planning and operating water resources. Considering the possible effects of global warming and climate change, the management and sustainability of water structures is necessary for the economy of countries. The main purpose of this study is to evaluate the

water occupancy rates of the Kanak Dam Lake, located in the district of Şarkışla in Sivas province, between the years 2016-2021.

2. MATERIAL AND METHOD

The Kanak Dam Lake is located on the Kanaközü Creek located on the Kızılırmak River basin within the borders of the Şarkışla district of Sivas province. In addition, it is stated in the project map no U-01/P3 that the dam is located between Elmaağacı locality and Ağıltepe, 12 km south of the Şarkışla district of Sivas province [4]. The rock units outcropping in the Kanak Dam Lake area and in its vicinity consist of Danian-Middle Thanetian aged Kaleköy formation (tuff, agglomerate, andesite), Upper Thanetian aged Konakyazı formation (limestone, shale, tuff, basalt, marl) and Quaternary alluvium with slope wash [5]. From the Google Earth Pro application, it has been determined that the axis location of the Kanak Dam body is located at $39^{\circ} 16' 28.08''$ N and $39^{\circ} 29' 48.21''$ E coordinates. The Kanak Dam, which is a clay core sand and gravel fill type, has a height of 37.50 meters. The lake area at normal water level is 1.84 square kilometers. The volume of the Kanak Dam Lake is 23670000 cubic meters (Table 1). Kanak Dam Lake has a net irrigation area of 2313 hectares and the amount of water withdrawn is 11800000 cubic meters [6]. Kanak Dam Lake was built for the purpose of supplying drinking water and irrigation water.

Table1. Some technical features of the Kanak Dam Lake.

Province	Sivas
Construction Date	2010-2013
Purpose	Drinking water, Irrigation
Creek	Kanaközü Creek
Body Fill type	Sand and Gravel
Height	37.50 m
Lake Volume	23.67 hm ³
Lake Area	1.84 km ²
Net Irrigation Area	2313 ha

The district of Şarkışla, where the Kanak Dam Lake is located, consists of mountainous and hilly areas and plain. The waters collected from the Şarkışla Plain reach Kızılırmak River via the Topaç Strait. Gypsum karst has developed in some areas in the region. The climate of the Şarkışla district is dry in July, August and September, semi-arid in June and October, semi-humid in April, May and November, and very humid in the four months between December and March. The climate type of Şarkışla is arid and less humid, first degree mesothermal climate type [7]. According to the temperature observations of the Şarkışla Meteorology Station between 1964 and 2005, the annual average temperature is 9.0 °C. According to the data received from the Şarkışla Meteorology Station, the hottest months were determined as July and August. The average temperature for July and August is 19.8 °C. The coldest month average is in January with -3.9 °C. According to the precipitation observations, the annual average precipitation amount of Şarkışla district was determined as 414.4 mm. Monthly minimums of precipitation spread throughout the year are encountered in July, August and September. The amount of precipitation, which started to increase as of September, has a high value in the winter months as well. The highest precipitation falls is 146.6 mm in the spring season. The least rainy season is summer with 56.2 mm. Precipitation in summer is mostly convective precipitation.

This study is about the Kanak Dam Lake located in the district of Şarkışla in Sivas province of Turkey. In the study, the values of the water occupancy rate data between 2016 and 2021 for the Kanak Dam Lake belonging to the General Directorate of State Hydraulic Works in Turkey were used. The occupancy rate calculations were determined according to the ratio of the active dam volume to the total dam volume. The water occupancy rate values of the Kanak Dam Lake are shown in percent (%).

3. RESULTS AND DISCUSSION

Changes in the annual average water occupancy rates of Kanak Dam Lake between 2016 and 2021 are presented in Figure 1. According to the data of the General Directorate of State Hydraulic Works in Turkey, the water occupancy rate in Kanak Dam Lake was 50.90% in 2016, 18.10% in 2017, 34.20% in 2018, 7.10% in 2019, 59.90% in 2020 and 31.80% in 2021. While the highest water occupancy rate for Kanak Dam Lake was determined as 59.90% in 2020, the lowest water occupancy rate was determined as 7.10% in 2019 (Figure 1). The average annual water occupancy rates of Kanak Dam

Lake were calculated as 33.67 and the standard deviation was ± 19.68 for the period between 2016-2021. In this case, it indicates that there has been a decrease in the water level in the Kanak Dam Lake with the effect of drought for the years 2016-2021 and that the dam lake has not been fully filled. Accordingly, the average water occupancy rate of the Kanak Dam Lake, which is calculated as 33.67 percent according to the annual water occupancy rates between 2016-2021, may pose a potential risk for drinking water supply and agricultural irrigation.

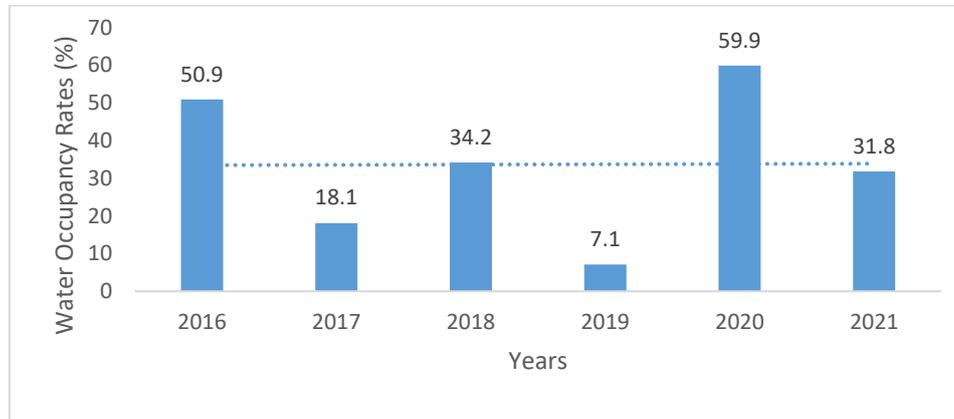


Figure1. Changes in the water occupancy rates of Kanak Dam Lake between 2016 and 2021.

The impact of climate change on water resources is due to changes in precipitation characteristics. Changes in precipitation due to climate can have very important consequences for hydrology and water resources. The most important disaster that Turkey will experience due to global warming and climate change is drought. Turkey, which is mostly under the influence of a semi-arid climate, is one of the countries that will be most affected by global warming and climate change. The most important reason for this is that there is a desert belt just south of Turkey and this belt moves towards the north with warming [8]. Arslan et al. [9] detected mild, moderate and severe droughts in the Kızılırmak River Basin. Accordingly, there are few very severe droughts in the 1, 3, 6 and 9 month periods in the basin, and there is no severe drought in the 12 and 60 month periods. They determined that the maximum drought duration increased when the period time was increased from 1 to 60. In addition, when the droughts in the Kızılırmak River Basin were examined, they found that the droughts experienced in recent years lasted longer. When the slope line given in Figure 1 is examined, it is observed that the water occupancy rates of Kanak Dam Lake in the 6-year period between 2016-2021 are in a straight line around 30 percent. Although the Kanak Dam Lake is only nine years old, its water occupancy rate is around 30 percent on average. This means that approximately seventy percent of the Kanak Dam Lake is empty during this working period.

Due to the activities related to the use and management of water, the lack of precipitation or the change in the type and intensity of precipitation, it is necessary to monitor and plan the drought phenomenon according to the duration of the effect. It is not easy to identify and monitor drought events because of uncertain start and end times, the increase in the total impact, the high impact and economic impact on more than one resource at the same time, and the complexity of its nature. As a result of meteorological drought, significant problems in irrigation of agricultural lands, hydrological problems such as insufficient water collection in dams, insufficient drinking water resources, and adverse effects on the environment, social life and socio-economic systems are the inevitable negative results [1]. According to the 2019 data of the General Directorate of Meteorology, Turkey had the driest autumn of the last 39 years. Compared to the same season of the previous year, the precipitation rate in Turkey decreased by 47 percent on average in the autumn of 2019. In the Central Anatolia region of Turkey, where the Kanak Dam Lake is located, the precipitation average of the autumn season in 2019 is 42.2 mm, the normal average is 91.1 mm, and the average precipitation for the autumn season in 2018 is 80.6 mm. There was a 54 percent decrease in precipitation compared to the seasonal normal and a 48 percent decrease compared to the previous year. Therefore, the lowest water occupancy rate of Kanak Dam Lake was observed in 2019 with 7.10 percent (Figure 1). Kanak Dam Lake is faced with a danger such as drought due to global warming and climate change. Accordingly, it is of great importance that the waters of the Kanak Dam Lake are used effectively and rationally in drinking water supply and agricultural irrigation.

4. CONCLUSION

Due to the drought experienced in Turkey and the Central Anatolia region in recent years, Kanak Dam Lake has also been greatly affected by drought, temperatures above seasonal normals and precipitation below seasonal normals have brought the danger of drought to Kanak Dam Lake. It is necessary to put into practice the technologies that enable the Kanak Dam Lake waters, which are used for drinking water supply and agricultural irrigation, to use less water, energy and workforce with the right methods and techniques. Thus, it is possible for the waters of the Kanak Dam Lake to be more stable and sustainable. In order to use the waters of the Kanak Dam Lake in a stable and sustainable way, the biggest task falls to the local people and farmers.

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