Scholars Journal of Agriculture and Veterinary Sciences OPEN ACCESS
Abbreviated Key Title: Sch J Agric Vet Sci
ISSN 2348–8883 (Print) | ISSN 2348–1854 (Online)
Journal homepage: https://saspublishers.com

A Baseline Study on the Water Occupancy Rates of Çermikler Dam (Sivas-Turkey) between 2015- 2019

Seher Dirican[1*]

[1]Department of Crop and Animal Production, Sivas Technical Sciences Vocational School, Sivas Cumhuriyet University, 58140, Sivas, Turkey

DOI: 10.36347/sjavs.2021.v08i07.002 | **Received:** 23.05.2021 | **Accepted:** 29.06.2021 | **Published:** 05.08.2021

***Corresponding author:** Seher Dirican

Abstract **Original Research Article**

Turkey because it is located in a semi-arid region precipitation varies greatly according to season and region. However, the increase in summer temperatures caused by climate change in Turkey, reduced winter rainfall, loss of surface waters, droughts that are more frequent, floods and erosion affects directly threatens water resources. This paper is about the water occupancy rates of Çermikler Dam in Sivas province. In this context, the water occupancy rate data of Çermikler Dam between 2015 and 2019 were evaluated. While the lowest water occupancy rate was determined as 6.2% in 2018, the highest water occupancy rate was determined as 42.0% in 2019. The average annual water occupancy rate of Çermikler Dam between 2015 and 2019 has been calculated as 24.50%. This indicates that Çermikler Dam is affected by drought. Therefore, droughts in Kızılırmak Basin where Çermikler Dam is located should be monitored. Accordingly, the waters of the Çermikler Dam should be managed. It is very important to use water rationally and efficiently.

Keywords: Çemikler Dam, Sivas, Turkey.

INTRODUCTION

Water is the most important requirement for the continuity of biological life. All living things absolutely need water to survive. Plants consist of high proportions of water, depending on the species. The ability of the nutrients presents in the soil to complete their natural cycle depends entirely on the water cycle. Increasing world population, rising living standards and deteriorating natural balance have increased the need for water even more. It is predicted that two thirds of the world population will live in regions suffering from water scarcity by 2025. The fact that climate change increases the duration and frequency of hot days and heat waves can cause an increase in drought intensity. Because, it is seen that the number of recurrence of drought has increased in the last ten years compared to other natural disasters. The damage caused by drought to the economy in Europe is around 116 billion USD in the last 30 years. In Turkey, the damage is 2.5 billion USD given by the drought that occurred in 2007 [1]. It is possible to reduce the damages caused by drought by taking precautions. The introduction of water harvesting techniques in which runoff waters formed because of rainfall are stored is only one of the preventive measures against drought-induced damages [2, 3].

Çermikler Dam, which is the subject of the paper, is located on the Kızılırmak River. The river takes its name from the red colored sandy clayey sediment at the base of the streambed in Sivas's Kızıldağ region. The length of Kızılırmak River is approximately 1300 km. There are 15 dams on the river, including Altınkaya, Bayramhacılı, Boyabat, Buğra, Çermikler, Derbent, Dutludere, Hirfanlı, and İmranlı, Kapulukaya, Kargı, Kesikköprü, Obruk, Sarıoğlan and Yamula [4]. The regime of the Kızılırmak River fed by rain and snow waters is irregular. It was determined that Kızılırmak River, which has an average flow of 184 m³/sec, reached a minimum flow rate of 18.4 m³/sec and a maximum flow rate of 1673 m^3/sec during 35 years of observation. The waters of Kızılırmak River descend in summer and reach their lowest level in August. Especially in July and August in some years, the flow rate was measured as 10 m^3/sec [5]. In the Kızılırmak Basin, there is an increase in temperatures and a decreasing trend in precipitation [6].

Dams are water storage facilities. Dams are one of the most important sources of energy production in developing countries that foster industry-centered economic policies. Dams do not only meet the energy

needs. At the same time, besides contributing to the economy of the country and the region, it accelerates social and economic development and creates new employment areas in the region. The main purpose of this paper is to reveal the water occupancy rates of Çermikler Dam located in Şarkışla district of Sivas province of Turkey between 2015 and 2019.

MATERIALS AND METHODS

Çermikler Dam is located on Kızılırmak River in Şarkışla district of Sivas province. Şarkışla district is within the boundaries of the Upper Kızılırmak section, which has the highest average altitude in the Central Anatolia Region. It is located in the southwest of Sivas province. Çermikler Dam started its operations in 2014. The distance of Çermikler Dam to Sivas city center is approximately 120 km. The altitude of Çermikler Dam is around 1190 meters. Şarkışla district consists of mountainous and hilly areas and a plain. The waters collected from Şarkışla Plain reach Kızılırmak River through Topaç Gorge. Gypsum karst has developed in some areas in the region. The climate of Şarkışla district where Çermikler Dam is located is dry in July, August and September, semi-arid in June and October, semi humid in April, May, November and very humid in four months between December and March. The climate type of Şarkışla falls into arid and less humid, first degree mesothermal climate type. According to the temperature observations of Şarkışla Meteorology Station between 1964 and 2005, the annual average temperature is 9.0 °C. According to the data obtained from the 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 was found in January with -3.9 °C. According to observations, 109.5 days of the year are open and the highest value is reached in August with 19.2 days. The lowest value is for February with 3.8 days. According to the precipitation observations, the annual average rainfall of Şarkışla has been determined as 414.4 mm. Monthly minimums are encountered in the months of July, August and September for the precipitation throughout the year. The amount of precipitation, which started to increase since September, has a high value in the winter months. The most precipitation falls in the spring season with 146.6 mm. The least rainy season is summer with 56.2 mm. The precipitation in the summer season is mostly in the characteristic of convectional precipitation. Çermikler Dam Hydroelectric Power Plant is the 7th largest power plant in Sivas with an installed power of 25 MW. At the same time, it is the 452th largest power plant in Turkey. Çermikler Dam Hydroelectric Power Plant can meet all the electrical energy needs of 16389 people in their daily lives with an average of 59525497 kilowatt hours of electricity generation. Çermikler Dam Hydroelectric Power Plant produces electricity that can meet the electrical energy needs of 19928 houses when only the residential electricity consumption is taken into account. The annual average production of Çermikler Dam Hydroelectric Power Plant is 80.651 GWh/year [7]. This paper was carried out in Çermikler Dam located in Sivas province of Turkey. In the paper, the values of the water occupancy rate data between 2015 and 2019 of the Republic of Turkey General Directorate of State Hydraulic Works for Çermikler Dam were used. Occupancy rate calculations are determined according to the ratio of active dam volume to total dam volume. The occupancy rate values of Çermikler Dam are shown in %.

RESULTS AND DISCUSSION

The average annual water occupancy rates of Çermikler Dam between 2015 and 2019 are shown in Figure 1. According to the data of the Republic of Turkey General Directorate of State Hydraulic Works, the water occupancy rate in Çermikler Dam was 20.1% in 2015, 20.6% in 2016, 33.6% in 2017, 6.2% in 2018 and 42.0% in 2019. (Figure 1). The average of the annual water occupancy rates of the Çermikler Dam for the period between 2015-2019 was calculated as 24.50 and its standard deviation as ±13.77. Although Çermikler is a five-year newly established dam, it has been observed that the water occupancy rate values are below the 25% band on average.

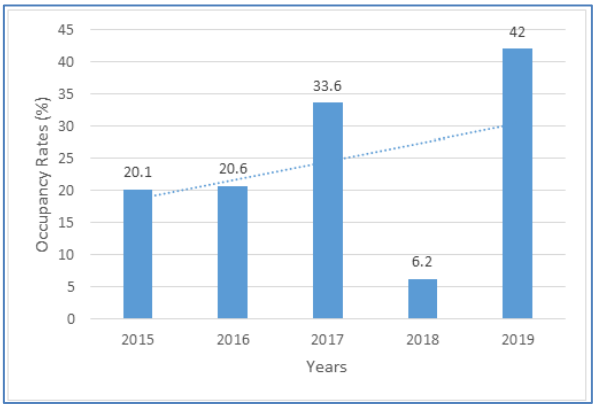

Fig-1: Water occupancy rates of Çermikler Dam between 2015 and 2019

According to Figure 1, the water occupancy rate of Çermikler Dam is around 20% in 2015 and 2016. In 2017, it increased to 33.6%. In 2018, the lowest water occupancy rate of Çermikler Dam for the 2015-2019 period was recorded as 6.2%. In 2019, the water occupancy rate increased to 42%. When the slope line given in Figure 1 is examined, it is observed that there is a slight increase in the water occupancy rates of Çermikler Dam in the 5-year period between 2015-2019.

Climate change is the sudden, severe and significant change that occurs in long-term weather events. It is being felt more intensely today due to the increase in human-induced activities. As a result of climate change, the global temperature has increased by

approximately 0.8 ° C in the last 150 years and continues to rise. Global warming has led to changes in the distribution of water resources in many parts of the world due to increasing greenhouse gas emissions [8].

Arslan et al. [9] reported mild, moderate and severe droughts in Kızılırmak Basin. According to this, there are few very severe droughts in 1, 3, 6 and 9 months periods in the basin, and there are not very severe droughts in 12 and 60 months periods. They found that when the period time from 1 to 60 was increased, the maximum drought duration increased in Kızılırmak Basin. In addition, when the droughts experienced in the Kızılırmak Basin were examined, they reported that the droughts experienced in recent years have lasted longer.

Considering the yearly occupancy rate of the reservoir capacity of the dams, it is possible to make predictions about drought [3,10]. Due to the droughts experienced in Kızılırmak Basin in recent years, the region where Çermikler Dam is located has been greatly affected by the drought. Temperatures above seasonal normals have revealed the danger of drought. According to the 2018 data of the Republic of Turkey General Directorate of Meteorology, the most arid year of the last 44 years was experienced in Turkey. Therefore, the lowest water occupancy rate of Çermikler Dam was observed in 2018 with 6.2% (Figure 1). Çermikler Dam is faced with a danger such as drought due to global warming. Accordingly, attention should be paid to the effective use of Çermikler Dam water.

CONCLUSION

With the rapid population growth in the world, more water and energy is needed. Instead of fossil fuels, which meet three-fourths of the world's basic energy needs but are rapidly decreasing, the trend towards renewable energy skis with less negative environmental effects compared to other sources has accelerated. Energy is the most important factor in industrialization in Turkey, especially the demand for electricity is steadily growing. Hydropower is the most important renewable energy source used in Turkey. The drought shows its effect in the Çermikler Dam on the Kızılırmak River. Therefore, droughts in Kızılırmak Basin should be monitored more carefully and planning and management of Çermikler Dam waters should be established accordingly.

ACKNOWLEDGEMENTS

The author, because the Çermikli Dam water occupancy rate data sharing would like to thank the Republic of Turkey General Directorate of State Hydraulic Works.

REFERENCES

1. Engindeniz, S., & Öztürk, G. (2010). Proposed measures for Turkish agriculture towards climatic change. Turkey 9th Congress of Agricultural Economics, 22-24 September 2010, Şanlıurfa, Turkey, 2, 956-963.
2. Lindoso, D.P., Eiro, F., Bursztyn, M., Rodrigues-Filho, S., & Nasuti, S. (2018). Harvesting water for living with drought: insights from the Brazilian human coexistence with semi-aridity approach towards achieving the sustainable development goals. Sustainability Journal, 10(622), 1-16.
3. Keskiner, A.D., Çetin, M., Şimşek, M., & Akın, S. (2020). Design of small earthen dam reservoirs lying in drought-prone areas: an application to the Seyhan River Basin. Teknik Journal, (586), 10189-10210.
4. Yüce, M.İ., & Ercan, B. (2015). Determination of rainfall-flow relationship in Kızılırmak Basin. 4th Water Structures Symposium, 19-21 November 2015, Antalya, Turkey, Proceedings Book, 410-418.
5. Bahadır, M. (2011). A statistical analysis of the flow changes of Kızılırmak River. Turkish Studies, 6(3), 1339-1356.
6. Anonymous. (2014). Assessment of temperature and precipitation in River Basins according to climate projections. Republic of Turkey, Ministry of Forestry and Water Affairs General Directorate of Meteorology, Research Department Climatology Branch Directorate, Ankara, Turkey, 81.
7. Anonymous. (2020). Sivas province 2019 environmental status report. Republic of Turkey, Sivas Governorship Provincial Directorate of Environment and Urban Planning, Environmental Impact Assessment and Environmental Permits Branch, Sivas, Turkey, 159.
8. Türkeş, M. (2008). What is climate change? Basic definition, causes, observed and predicted results of climate change. Climate Change and Environment Journal, 1, 26-37.
9. Arslan, O., Bilgil, A., & Veske, O. (2016). Meteorological drought analysis in Kızılırmak Basin using standardized precipitation index method. Nigde University Journal of Engineering Sciences, 5(2), 188-194.
10. Mendicino, G., Senatore, A., & Versace, P. (2008). Water resources management in agriculture under drought and water shortage conditions: a case study in southern Italy. European Water, 23(24), 41-56.