

A Glance at One Decade of Water Occupancy Rates of Maksutlu Dam Lake, Sivas, Turkey

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Abstract— This study focuses on the water occupancy rates of Maksutlu Dam Lake in Sivas of Turkey between 2010-2019. While the highest occupancy rate of Maksutlu Dam Lake was found as 32.36% in 2011, the lowest occupancy rate was determined as 2.50% in 2014. The average occupancy rate was calculated as 16.33 ± 11.44 between 2010 and 2019. This shows that approximately eighty percent of Maksutlu Dam Lake has been empty at one decade. Accordingly, it was determined that there was a significant decrease in water occupancy rates in Maksutlu Dam Lake between 2010-2019 due to drought. Therefore, the water of Maksutlu Dam Lake should be used rationally. In addition, it is very important to take the necessary precautions against the water crisis that will occur in dry periods and to prepare a water management plan for Maksutlu Dam Lake.

Keywords— Climate, Drought, Maksutlu Dam Lake, Sivas, Turkey.

I. INTRODUCTION

Fresh water resources are limited and inadequately distributed in the world. Dams are strategically important water structures. They are built to produce electricity, store water for irrigation, supply for drinking water, control flood hazards, navigation, aquaculture, fisheries, recreation or other uses. Dams are artificial lakes where water accumulates. Dams accumulate water during seasons when rainfall is high and enable water to be used in summer when rainfall is low. Dams have very important functions such as accumulating water, raising the water level and forming a large water surface. Climate change, which has emerged as a result of global warming both in the world and in Turkey, is one of the leading global problems today. The increase in air temperature caused by climate change and irregular precipitation regimes constitute drought. Drought is defined as a natural event that causes the land and water resources to be adversely affected and the hydrological balance to deteriorate due to precipitation falling significantly below the recorded normal levels [1]. Drought is a gradual phenomenon and can occur for a short time or last for years. It is an insidious natural disaster that is observed in a slow-growing process with an unknown beginning and end. The effects of drought are

multifaceted and affect every stage of life; environment, urban life, economy, agriculture, food, water, health, etc. The effects of drought are usually first seen in agriculture and gradually spread to other water dependent sectors. Turkey, a risk group in terms of the effects of global warming are among the countries. It is estimated that especially the Mediterranean and Middle Anatolian regions will be more affected by climate change in the future [2,3]. Maksutlu Dam Lake, which has been selected as a research area, is located in the Middle of Anatolian region of Turkey. This study is related to the one decade of water occupancy rates of Maksutlu Dam Lake in Sivas.

II. MATERIALS AND METHODS

Maksutlu Dam Lake is located in the district of Şarkışla in Sivas province. Maksutlu Dam is about 80 kilometers away from Sivas province center. It is located on the Maksutlu Creek in the Kızılırmak Basin. The technical data of Maksutlu Dam Lake are presented in Table 1. Maksutlu Dam Lake was built between 1975 and 1977 for irrigation purposes. The dam is constructed in homogeneous soil filling type and has a height of 25.5 meters from the foundation and a water accumulation

volume of 2.95 million cubic meters (Table 1). It is used to irrigate 400 hectares of land, and the average irrigation rate is 17.5% [4]. The pond serves to irrigate 400 hectares of land (Table 1). The average depth of Maksutlu Dam Lake is 7.02 meters [5]. There are promenade and picnic areas around Maksutlu Dam Lake, which is close to the district center of Şarkışla.

Table 1: Technical data of Maksutlu Dam Lake in Sivas.

Date of Construction	15.04.1975
Date of Operation	15.11.1977
Goal of Dam	Irrigation
Creek	Maksutlu Creek
Body Fill Type	Soil
Height	25.5 m
Lake Volume	2.95 hm ³
Lake Area	0.42 km ²
Irrigation Area Gross	400 ha

Şarkışla District, where Maksutlu Dam Lake is located, is found in the Central Anatolia Region of Turkey. For this reason, summers are hot and dry, and winters are quite cold. The district receives the most precipitation in the spring and autumn seasons. Şarkışla and its surroundings have steppe vegetation with the effect of climatic conditions. Parallel to this, while there are no naturally grown trees, herbaceous species are widespread. The average altitude of Şarkışla is more than 1250 meters. It consists of mountainous and hilly areas and plains. The Şarkışla plain is suitable for agriculture. A large part of the economic life in the district consists of agriculture and animal husbandry activities. Barley, wheat, rye, onion, potato, triticale, oat, vetch, beet, corn, broad bean, pea, turnip and clover are among the agricultural products grown in Şarkışla district. Carp and chub fish live in Maksutlu Dam Lake. These fish are mostly caught by the local people with fishing line. In this study, the active water occupancy rate values of Maksutlu Dam Lake belonging to the General Directorate of State Hydraulic Works of Turkey between the years 2010-2019 were evaluated.

III. RESULTS AND DISCUSSION

The mean annual water occupancy rates of Maksutlu Dam Lake between 2010-2019 are presented in Figure 1. According to the data of water occupancy rate in Maksutlu Dam Lake was 31.71% in 2010, 32.36% in 2011, 17.9% in 2012, 7.1% in 2013, 2.5% in 2014, 13.5% in 2015, 9.5% in 2016, 5.1% in 2017, 30.9% in 2018 and 12.7% in 2019

(Figure 1). The water occupancy rate of the Maksutlu Dam Lake varies between 2.50% and 32.36%. The highest water occupancy rate value was found in 2011. The lowest water occupancy rate value was determined in 2014. The mean occupancy rate was calculated as 16.33 ± 11.44 between 2010 and 2019. It is clearly seen that the slope line in Figure 1 is downward. Maksutlu Dam Lake has a water occupancy rate of 12.7 in 2019. When this value is compared with 2018, the water occupancy rate of Maksutlu Dam Lake decreased by 18.2 percent in 2019.

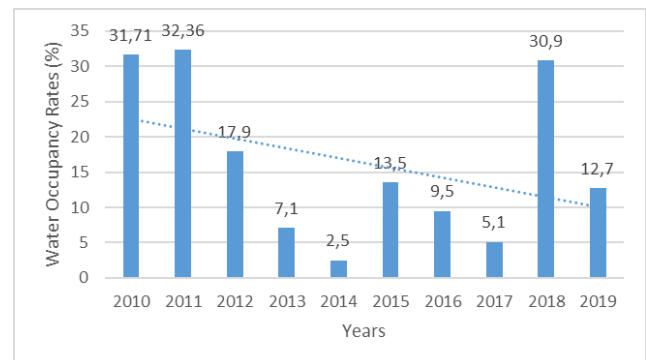


Fig. 1: Annual average water occupancy rates of Maksutlu Dam Lake.

Turkey is located in the semi-arid/semi-humid mid-latitude region. Like many countries in the same region, Turkey has a drier climate in some periods, while a more humid climate prevails in some periods [6]. One of the most important effects of climate change on Turkey is drought [7]. When the one-decade water occupancy rate balance of Maksutlu Dam Lake is examined, the water budget is generally in a negative state. Accordingly, it was observed that the water of Maksutlu Dam Lake could not be protected. It has been determined that there has been a serious water loss due to drought in the Maksutlu Dam Lake in recent years. These detected water losses can be observed with the withdrawals in the dam lake, especially in the summer season. The lowest water occupancy rate was determined in Maksutlu Dam Lake in 2014 with 2.5 percent. This figure was recorded as the lowest level of the last ten years in the lake. Accordingly, it is foreseen that serious problems will occur in Maksutlu Dam Lake due to the increasing drought and gradually decreasing water occupancy rates in recent years.

Drought is one of the main problems of agricultural production [8]. As in many parts of the world, the agricultural sector uses the most water in Turkey. Water potential is decreasing due to climate change. As the demand for increasingly limited water resources increases rapidly, the amount of water used in agriculture is limited and world food security is endangered [9]. Maksutlu Dam Lake is one of the most important fresh water resources of the Şarkışla district and is primarily used for irrigation

purposes. If the water occupancy rates in Maksutlu Dam Lake continue to decrease in this way in the following years, a “restriction decision” should be applied in agricultural land irrigation. According to this decision to be implemented, a limited amount of water should be given from Maksutlu Dam Lake for irrigation of agricultural land. The amount of water to be given at a limited rate should be determined by the irrigation unions in the district and the Regional Directorate of State Hydraulic Works. Care should be taken to distribute water equally and fairly from the Maksutlu Dam Lake. In addition, calculations regarding the limited water use in the dam lake and water management must be done very well.

It is thought that the restriction decision to be implemented regarding the irrigation of agricultural lands in Maksutlu Dam Lake may be beneficial in certain aspects. However, the first thing to do is to protect the water occupancy rate in Maksutlu Dam Lake. The survival of the creatures in Maksutlu Dam Lake depends on the water occupancy rate. Of course, applying restrictions is the solution, but farmers need to be well-aware of this issue. In areas where wild irrigation continues, drip irrigation can be used. Production around Maksutlu Dam Lake may need to be limited. In addition, fruit and plant production that requires excessive water can be stopped. Instead, it can be started to produce fruits and plants that require less water.

IV. CONCLUSION

With this study, it was determined that the water occupancy rates of Maksutlu Dam Lake faced a serious decrease between 2010 and 2019. Accordingly, the water occupancy rates of Maksutlu Dam Lake are alarming. For this reason, it is necessary to use the water of Maksutlu Dam Lake rationally. Also, necessary studies should be initiated for sustainable living life and agricultural production. The most important thing that can be left to future generations should be water and livable nature.

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REFERENCES

[1] M. Karaer and H. T. Gültaş, “Evaluation of drought occurrence in Bilecik's using standardized precipitation index method,” J. S.D.U. Facul. Agricul., pp. 303-308, 2018.

[2] K. Öztürk, “Global climatic changes and their probable effect upon Turkey,” G.U. J. Gazi Edu. Facul., 22, 1, pp. 47-65, 2002.

[3] E. Kapluhan, “Drought and drought in Turkey effect of agriculture,” Marmara Geograp. Rev., 27, pp. 487-510, 2013.

[4] H. Çevlik and M.I. Elibol, “Yamula dam lake limnology,” Ministry of Environment and Forestry, General Directorate of State Hydraulic Works, Department of Operation and Maintenance, Ankara, Turkey, pp. 1-186, 2014.

[5] SGPDEU, “Sivas province environmental status report for 2017,” Sivas Governorate, Provincial Directorate of Environment and Urbanization, pp. 1-143, 2018.

[6] E. S. Turan, “Turkey’s drought status associated with climate change,” J. Nat. Haz. Environ., 4, 1, pp. 63-69, 2018.

[7] S. Özüpekçe, “Drought analysis and relationship with water resources of Western Mediterranean Basins closed area”. Int. J. of Geograp. Edu., 43, pp. 317-337, 2021.

[8] B. Çakmak and A. Aküzüm, “Agricultural infrastructure and irrigation,” Global Crisis, Turkey and Food Security Symposium, 15 October 2009, Ankara, Turkey, Proceedings Book, pp. 189-214, 2009.

[9] B. Çakmak and Z. Gökalp, “Drought and agricultural water management,” Gaziosmanpasa J. Sci. Res., 4, pp. 1-11, 2013.