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A Study on Water Occupancy Rates in Mursal Dam Lake for the Last Five Years

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Abstract*— *This study focuses on the water levels of Mursal Dam Lake in the Central Anatolia Region of Turkey over the last five years. The study utilizes water level data for Mursal Dam Lake from 2020-2024 obtained from the General Directorate of State Hydraulic Works of Turkey. The study determined that the water levels of Mursal Dam Lake varied between 30.3% and 6.5%. The average water level for Mursal Dam Lake over the last five years was calculated as 18.32±10.75%. According to this data, the trend in water levels for Mursal Dam Lake over the last five years has been decreasing. This indicates that the water level of Mursal Dam Lake has decreased by approximately 80% on average over the last five years. This suggests that alarm bells are ringing for Mursal Dam Lake and that the risk of drought continues. To protect and sustainably utilize water quality of Mursal Dam Lake, it is recommended that water be used sparingly and measures be taken to reduce water demand in the agricultural sector, where water consumption is highest.

Keywords*— *Mursal Dam Lake, Sustainability, Water Occupancy Rates, Water Quality.

I. INTRODUCTION

Global climate change, whose effects are felt worldwide, is of great importance in terms of the measures that need to be taken. The climate has changed due to the influence of natural processes and human activities. The increase in the amount of greenhouse gases released into the atmosphere triggers global warming, leading to climate change. All countries are facing the negative effects of climate change. The negative consequences of climate change affect the whole world. Climate change, which generally originates from human actions, encompasses many different sectors such as energy, industry, agriculture, livestock, environment, health, and transportation. In recent years, the effects of climate change on humans and natural systems have become increasingly evident. In many regions of the world, changes in precipitation patterns and the melting of ice masses negatively affect the volume and quality of water resources. In particular, extreme weather events cause deterioration in soil quality, difficulties in obtaining food and drinking water, health problems, damage to living areas, and loss of life, negatively impacting life [1]. Water, which is at the center of this disruption, is not only a fundamental element for the continuation of life but is also gaining increasing importance. This situation presents both risks and opportunities for Turkey. The negative impact of climate change on water regimes makes these resources scarcer, more valuable, and therefore more contested, transforming water into a security issue, a development matter, and a foreign policy tool. Climate change is a global threat that directly affects not only the physical structure of the atmosphere but also the sustainability of all life. Freshwater is an indispensable natural resource for both the continuation of biological life and the sustainability of human communities. The extremely limited amount of usable surface freshwater makes this resource vital and strategic. Basic sectors such as agriculture, industry, energy production, and

the economy are largely dependent on freshwater. It also plays an important role in providing drinking water and sanitation. Factors such as the increasing global population, rapid urbanization, and climate change are increasing the pressure on existing freshwater resources every day, creating serious risks in terms of water security and supply [2]. Since the environmental, social, cultural, and economic impacts of climate change can vary depending on the level of development of countries, it is necessary to pay attention to the environmental, physical, social, and economic characteristics of each city at the local level [3].

In Turkey, the average annual rainfall is approximately 574 millimeters, corresponding to an average of 450 billion cubic meters of water per year. The usable surface water potential is approximately 94 billion cubic meters per year. Including the groundwater potential, which is estimated at 18 billion cubic meters, Turkey's usable surface and groundwater potential is approximately 112 billion cubic meters per year, of which 57 billion cubic meters are used. 77% of this 57 billion cubic meters is used in agriculture, and 23% is used for drinking, domestic, and industrial purposes. According to the widely accepted indicator for per capita annual water consumption, an amount between 1000-1700 cubic meters per year is considered the water stress range. Water stress is calculated by dividing a country's groundwater and surface water resources by its water consumption in households, industry, and agriculture. In Turkey, the annual per capita available water amount was 1652 cubic meters in 2000, 1544 cubic meters in 2009, and 1346 cubic meters in 2020, and is gradually decreasing. With these figures, Turkey is categorized as a country experiencing water stress [4]. In this context, if water usage habits in Turkey continue as they are today without change, a serious water crisis will be faced, especially with the increasing impact of the global climate crisis. This study concerns the water levels of Mursal Dam Lake in the Central Anatolia Region of Turkey over the last five years.

II. MATERIAL AND METHODS

Mursal Dam Lake is located in the Divriği district of Sivas city in Turkey. Situated on the Nih River, its construction was completed between 1986 and 1992. Mursal Dam is a clay-cored sand-gravel fill type dam. With a storage capacity of approximately 13000000 cubic meters, Mursal Dam Lake was initially constructed for energy production and irrigation of agricultural lands. Later, Mursal Dam Lake began to be used for the supply of drinking and utility water. The Mursal Hydroelectric Power Plant, with a total installed capacity of 9 megawatts, accounts for 0.036% of the electricity produced by hydroelectric power plants in Turkey and 0.010% of the total electricity consumption. Mursal Dam Lake has a net irrigation area of 2228 hectares. The amount of water drawn from Mursal Dam Lake is approximately 2.79 hectometers cubic. The drinking and utility water of Divriği district is supplied from the Mursal Dam Lake and, after being treated at a treatment plant with a capacity of 330 cubic meters per hour, is distributed to the entire district via the drinking water network. To meet the drinking and utility water needs of Divriği district, 1.99 cubic hectometers of water are treated annually at the treatment plant before being supplied to the network. The ratio of the population served by sewage services to the municipal population in Divriği district is 100%. There is no wastewater treatment plant in Divriği district [5].

Located in the Upper Euphrates River Basin, Divriği district possesses both natural and cultural resources. In this area, where different geological periods from the Paleozoic to the Quaternary are observed, various landforms have been created by the influence of north-south compressional tectonics. The north and south of the basin are surrounded by mountainous areas. The district has a continental climate, with an average annual temperature of 11.2 °C and an average annual rainfall of 370.1 mm. In this area, where the dominant vegetation is steppe, juniper and oak are common, and sparse black pine species communities are encountered [6]. According to the Turkish Statistical Institute's 2024 data, the main sources of livelihood for Divriği District, which has a total population of 16,204 people, are mining, agriculture, and tourism.

This study was conducted using the water level data of Mursal Dam Lake between 2020 and 2024, which was made publicly accessible by the General Directorate of State Hydraulic Works of the Republic of Turkey on December 11, 2025 [7]. Mursal Dam Lake includes data with an active water volume of 3 million cubic meters and above. The water levels of Mursal Dam Lake were calculated as the ratio of the active dam volume to the total active dam volume. The water level data for Mursal Dam Lake were determined as a percentage.

III. RESULTS AND DISCUSSION

The water levels in Mursal Dam Lake were recorded as 15.5% in 2020, 30.3% in 2021, 6.5% in 2022, 28.8% in 2023, and 10.5% in 2024. Accordingly, it is observed that the slope of the water levels in Mursal Dam Lake over the last five years is downward (Figure 1). The highest water level in Mursal Dam Lake over the last five years was found in 2021 at 30.3%, while the lowest was found in 2022 at 6.5%. The average annual water level in Mursal Dam Lake over the last five years has been calculated as 18.32±10.75%.

Accordingly, when looking at the last five years, it is observed that the water levels in Mursal Dam Lake have followed a fluctuating trend. The water level in Mursal Dam Lake was 30.3% in 2021, but decreased by 23.8% in one year to 6.5% in 2022. Similarly, the water level in Mursal Dam Lake was 28.8% in 2023, but decreased by 18.3% in one year to 10.5% in 2024. In relation to this situation, it has been determined that the slope of the water levels in Mursal Dam Lake over the last five years is downward.

According to Dirican [8], the highest water level in Mursal Dam Lake was determined to be 74.1% in 2013, while the lowest was reported as 3.9% in 2014. Furthermore, the average annual water level of Mursal Dam Lake between 2012-2019 was reported as 18.79 percent.

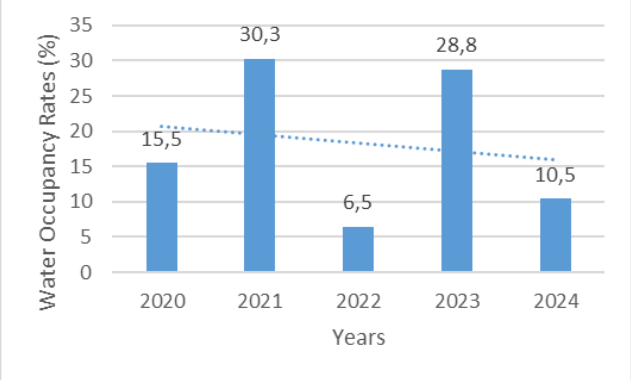

Fig. 1: Water occupancy rates of Mursal Dam Lake

Recent studies conducted in Kılıçkaya and Yapıaltın dam lakes in Sivas city have also revealed a similar decreasing trend in water level values as in Mursal Dam Lake [9,10].

This study found that the water levels in Mursal Dam Lake varied between 6.5% and 30.3% over the last five years. These rates indicate that the water level in Mursal Dam Lake has consistently been below 30.3% for the past five years. Furthermore, the average annual water level for Mursal Dam Lake over the last five years was found to be 18.32%. Thus, increasing water demand, the irresponsible use of water, and the lack or insufficiency of expected rainfall have caused a decrease in the water level of Mursal Dam Lake, resulting in an average water level below 20%.

Recently, it is a fact that the risks and threats posed by climate change on environmental systems have had extremely serious consequences for freshwater resources. Rising temperatures increase evaporation rates, leading to a decrease in the amount of surface and groundwater reserves. At the same time, irregularities and seasonal shifts in rainfall patterns disrupt the natural water cycle, negatively impacting both the accessibility and quality of water. Climate change not only reduces the supply of freshwater but also threatens the sustainable management of water resources [2]. Climate change, a global problem affecting not only Turkey but the entire world, is causing a gradual depletion of water resources. Furthermore, climate change negatively impacts many areas, from food and health to the economy and security. Climate change is a development problem. The consumption-oriented use of resources by the global economic and financial system to maximize profits, the creation of geographical imbalances, and the release of harmful waste into nature are the most significant factors in the disruption of biodiversity and ecological balance. Therefore, this rapid deterioration has become a vital issue. In Turkey, extreme weather events are becoming more visible due to climate change. An increase of between 1.5 and 4.0 °C in average air temperature is expected in Turkey, while a decrease in total rainfall is anticipated. These temperature increases are 1-2 °C higher than the world average. In this context, the biggest problem is drought [11].

Sekendur [12] reported that there is a trend towards drought in the Southeastern Anatolia, Eastern Anatolia, and Central Anatolia regions of Turkey. In particular, the Central Anatolia Region, which is prominent in agricultural production, received low rainfall, and a trend towards drought was observed in Sivas city. Furthermore, it was noted that the Central Anatolia Region had significantly higher reference evapotranspiration and climatic water deficit values among the areas with the highest levels in Turkey. In addition, according to the standardized precipitation index, Sekendur [12] determined that there is a statistically significant increasing trend of drought in the

Central Anatolia, Mediterranean, Eastern Anatolia, and Southeastern Anatolia Regions.

The Divriği region, where the Mursal Dam Lake is located, contains forests consisting of oak, juniper, and black pine species. The area surrounding the Mursal Dam Lake has largely lost its natural character due to its transformation into irrigated agricultural land. In the irrigation areas controlled by the Irrigation Union in Divriği District, irrigation is carried out using flood irrigation management with approximately 1,200,000 cubic meters of water [5]. Globally, water is most commonly used for agricultural irrigation, and this is also true for the Mursal Dam Lake. Agriculture, due to its strategic importance, holds a special place in the use of water resources. The importance of efficient and effective water use in agricultural irrigation is increasing every day. Flood irrigation reduces soil and crop fertility. Because flood irrigation damages the soil structure, it causes erosion. Flood irrigation leads to soil erosion and water waste [13]. The solution for irrigation in the Mursal Dam Lake is the use of modern irrigation systems. Using modern irrigation methods allows for the avoidance of water waste, excessive fertilizer use, preservation of soil fertility, prevention of salinity, and prevention of water erosion. Therefore, to prevent the loss of water in the Mursal Dam Lake, flood irrigation should be avoided and modern irrigation methods should be used.

Regarding drought, not only the amount of rainfall but also how much of the rainfall evaporates into the atmosphere is important. Although the average annual rainfall in the arid regions of Central Anatolia, where Mursal Dam Lake is located, is around 300 mm, it is not spatially and temporally homogeneous. Even during the growing season, soil water input is not continuous; it generally occurs in peaks with intermittent rainfall followed by long periods of drought [14]. Therefore, a drought-resistant plant pattern suitable for the area surrounding Mursal Dam Lake should be preferred.

IV. CONCLUSION

As a result, it is a well-known fact that water resources have vital importance, in addition to their social, economic, and ecological value. Due to the effects of climate change, problems related to water resources are causing significant consequences globally in social, economic, and environmental dimensions. In addition to climate change, rapid population growth and changes in water consumption habits are increasingly putting pressure on water resources. Therefore, the protection and sustainable use of Mursal Dam Lake is of particular importance to ensure that healthy and sufficient water is left for future generations.

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