

## Assessment of anthropogenic impacts and climatic factors on the shrinkage of Seyfe Lake (Central Anatolia, Turkey) during the past 35 years

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Lakes are valuable and sensitive freshwater reservoirs with ecosystems that are highly vulnerable to many external threats. Specifically, changes in lake surface area and water level fluctuations are important parameters to detect changes in lake ecosystems. These fluctuations and shrinkage levels of the lake area occur due to both climatic and anthropogenic factors. Some examples of such include but are not limited to changes in meteorological factors, land use, potable water supply, water withdrawal for agricultural irrigation, and plant product pattern factors play an important role in the sustainability of the lake region and the water resources in the basin. In this paper, Seyfe Lake was selected as the primary research area.

Seyfe Lake is located 30 km northeast of Kırşehir; the lake and its surroundings are a protected Ramsar site. The lake consists of a closed basin and the average area of the lake covers 35 km<sup>2</sup>, the calculation of which was obtained by interpretation of Landsat images and lake bathymetric studies. The average water depth of the lake is 1.65 m, with an elevation of 1110 m above sea level. The lake is recharged by rainfall, surface runoff, and underground flow. The discharge of the lake occurs via evaporation from the lake surface. The paper aims to evaluate the relationship between climatic and anthropogenic factors that caused the shrinkage of the Seyfe Lake surface area and water level changes in the lake to subsequently determine which factor predominantly posed a greater impact over three decades (1985-2020). Geological, hydrogeological, hydrological, and remote sensing surveys were carried out in the lake area and the basin. Furthermore, satellite images, meteorological data, lake bathymetric, and land cover maps were evaluated. It was determined that the lake surface area decreased from 66.87 km<sup>2</sup> to 1.86 km<sup>2</sup> and the lake area shrank by 93.78% between the years 1985 to 2020. In the period between 1990-2000, the total area of the lake was mainly controlled by climatic variations (precipitation and temperature). However, since the 2000s, there has been an increase in meteorological factors such as temperature and evaporation and contrastingly, a decrease in the amount of precipitation. When the land use maps of the study area were evaluated, it was determined that rain-fed agriculture shifted to irrigated agriculture since 2006 within the lake basin. Additionally, it was concluded that the farmlands area increased and the transition to irrigated agriculture led to an increase in the amount of water used in agricultural irrigation with uncontrolled groundwater withdrawal from the wells in the lake basin. As a result of the research carried out in the study area, it was concluded that climatic and anthropogenic factors caused the decrease in the lake surface area and human activities impacted a greater share in the lake level change and shrinkage in the surface area in the last 15 years.

**Keywords:** Lake shrinkage, climate factors, anthropogenic impacts, Seyfe Lake, Central Anatolia.