

**O 15. THE MAJOR REASONS FOR THE EXTINCTION OF LAKES IN TURKEY -
POSSIBLE ECONOMIC PROBLEMS AND SOLUTION PROPOSALS**

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ABSTRACT: In consequence of the effect of global warming, the absence of large rivers feeding lakes, evaporation, lack of rainfall and excessive hot days together with the increase in water demands because of evaporation, agricultural use, drinking and utility water and environmental reasons causes the lake level to decrease. This situation creates problems in terms of both ecology and economy, and the appearance of natural areas is also adversely affected. Within the scope of this study, the economic and ecological problems that our lakes are exposed to in general terms, the danger of extinction and the necessary measures to be taken to prevent these problems were discussed.

Keywords: *Lakes, Economic problems, Measures*

INTRODUCTION

Water is a necessary substance used in every phase of human life for the completion of people's vital needs such as nutrition, circulation, respiration, excretion and reproduction (Yazici, 2019; Yazici and Akça, 2019). Besides being a vital element contributing to the creation of natural habitats, the body of water is also a natural habitat in itself (Yazici and Aşur, 2018). As it is one of the most essential prerequisites for life, the presence and quality of the water in an environment are of utmost importance. 3/4 of the earth's surface is covered in water. However, approximately only 1% of the water is drinkable and 70% of this water is used in agriculture. In short, the drinkable water that plays a definitive role in the existence of life, is very limited on the face of the earth. This is the reason why the freshwater resources of all countries have started becoming more valuable than mineral deposits. Saline waters constitute approximately 1386 million km³ (over 97.5%) of all water on earth. 70% of all freshwater is stored in ice caps or glaciers. 30% of it is under the surface of the earth. The fresh-surface water sources such as rivers and lakes only constitute around 93 100 km³ which is around 1/700 of the 1% (UNC, 2014). With the addition of the indicated 14 billion m³ of potential groundwater, Turkey's consumable surface water and groundwater total up to 112 billion m³, 44 billion m³ of which is being used (General Directorate of State Hydraulic Works, 2015).

According to the data provided by the United Nations, 1,4 billion people do not have access to safe drinking water. 470 million people currently reside in regions that are suffering from water scarcity and this number is expected to increase 6 times in 2025. 250 million people each year contract water-borne epidemic diseases and approximately 10 million of them die as a result of water-related illnesses (Esenyel, 2001).

Wetlands are often located on the valley plains and bottomlands where industrial, urban, and agricultural development activities are the highest (Url,1). This situation leads to the change and destruction of wetlands. The destroying of wetlands leads to habitat destruction of natural life and the subsequent extinction of species. Wetlands are the world's biggest genetic reservoirs; it is estimated that they contain around 40% of all species and 12% of all animal species. Wetlands also prevent water floods and erosions by keeping the excess water and storing it after excessive precipitation. They help maintain the necessary water level for agricultural activities. Due to their increased biological activity, they also reduce nitrate and phosphate contamination.

Turkey, with its annual water consumption of 1555 m³ per capita, is considered to be a country suffering from water shortage. 98% of the fresh surface water sources are lakes. There are over 100 natural lakes and 550 dam lakes in Turkey. Although the number of lakes in Turkey is high, the surface area that they

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cover is relatively small. Lakes are of high importance not only for the survival of wildlife, but also for their significance for human needs such as climate moderation, transportation, and irrigation. There is an increased production of organic matter in wetlands. Carbon enters the soil by transferring CO₂ from the atmosphere into the soil through plant residues and other organic solids. 1% increase of organic carbon in 1 hectare of agricultural land provided 100kg pure nitrogen, 15kg phosphorus, 15kg o pure sulphur, and contributed 850 tons to the water holding capacity of the soil in the first 15 cm, which was a finding that has to be explained to the farmers in a detailed way

Way (Sultansazlığı Biocultural Project, 2012. General Directorate of Nature Conservation National Parks). Natural shore zones are transition zones between aquatic and terrestrial ecosystems, and are also important habitats for numerous plant and wildlife species. Furthermore, shore zones offer various natural, economic and aesthetic opportunities. They have multiple necessary functions in or near urban areas as they enable the creation of natural habitat for the flora and fauna of the city, offer some recreation opportunities to the citizens, and regulate urban ecology (Tülek, and Barış, 2014).

The lakes on the surface of the earth are the home of various species and serve as stops on migration routes.

THE REASONS FOR THE EXTINCTION OF LAKES

Unplanned Water Infrastructure Projects

In 2011, it was decided that there will be a total investment of 3.1 billion Turkish Liras made in the energy sector. According to this, the biggest investment will be made by the General Directorate of State Hydraulic Works (Devlet Su İşleri-DSI) with a billion Turkish Liras. It was announced that DSI will spend a billion liras for the completion of the dam and hydroelectric power plant (HEPP) projects. However, the hundreds of HEPP projects which have been planned and are under construction for almost all rivers in Turkey, from the easternmost to the westernmost of our country, from the Eastern Black Sea to Çoruh, from Küre to Köyceğiz, create numerous environmental and social problems. Our rivers and wetlands, which are a part of the hydrological system, have started vanishing due to the “transforming every single water source into energy” approach and because of faulty plans made without the consideration of water basins. Because of the dams/hydroelectric power plants installed on river tributaries connected to the wetland for various purposes such as energy, irrigation, flood protection and drinking water, the wetlands now lack sufficient water which is necessary for their survival. This consequence causes numerous problems concerning fish flow and threatens the biodiversity in and around the wetland (WWF, 2011).

The Excessive Use of Water in Agriculture

On basis of sectoral water usage, 72% of the share is consumed by the agriculture sector in Turkey. However, in the agriculture sector, where a significant portion of the water is consumed, only 8% of the irrigable land is watered through pressurized irrigation (sprinkler and drip irrigation), and the remaining 92% is watered with the use of traditional surface irrigation methods (furrow, basin, and border irrigation). The groundwater-fed wetlands are shrinking due to the intense water withdrawal and the inefficient use of water for agricultural irrigation purposes. In specific, our wetlands in Central Anatolia such as Beyşehir Lake, Tuz Lake, Ereğli Reed Bed, Kulu Lake, Meke Lake, Seyfe Lake, Sultansazlığı, Akşehir - Eber Lakes, have all been among the most important wetlands to experience serious water-level declines due to the excessive and insensible agricultural irrigation (WWF, 2011).

Pollution

The quality of the water is as important as the quantity of the water when it comes to the fulfilment of both the needs of human beings and the ecosystem. However, in the past and to this day, the funding, scientific research, and public interest in the water quality have been significantly less than the attention given to the quantity (World Water Assessment Programme, 2012). Wetlands are polluted with domestic, industrial and agricultural waste. Due to the decrease in the water quality, biological diversity has started disappearing and the local people whose livelihood depends on those areas are suffering.

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Eğirdir Lake, Bafa Lake, Tuz Lake, Gediz Delta, Uluabat Lake, Beyşehir Lake, Eber Lake, Burdur Lake, Göksu Delta, Sapanca Lake, Akyatan Lagoon are just a few of the wetlands in danger of pollution (WWF, 2011).

Illegal Hunting and Fishing

The natural structure and balance of our wetlands are disturbed by the use of illegal methods of hunting and fishing during fish breeding seasons. Eğirdir Lake and Beyşehir Lake are some of the lakes that have been affected by poaching and unsustainable fishing practices (WWF, 2011).

Other Investments (highways, mines, etc.)

In recent years, large scale-infrastructure projects and mining operations which will directly affect our wetlands, have been brought forth. Highways create the biggest problems. For instance, Uluabat Lake, which is considered to be one of the most important wetlands in Turkey, is currently highly affected by the Istanbul-Bursa-Izmir highway. The wetland is threatened because a significant part of the motorway will pass through the wetland buffer zone south of the lake, and viaducts will be built inside the lake (WWF, 2011),



Figure 1. Uluabat Lake, Turkey (Url 2)

Problems Concerning Management

The primary institution responsible for the planning and managing of our country's water resources is the General Directorate of State Hydraulic Works. However, there are 18 more institutions alongside DSI that directly or indirectly also have a say in the planning, investment, monitoring, and inspection of our water resources. On the other hand, the distribution of authorities who are working on the water quality and quantity to different institutions, has also led to problems in practice (WWF,2008).

Amendment to the Regulation on the Conservation of Wetlands

One of the most important and powerful legal tools developed for the protection of Turkey's wetlands, the Regulation on Protection of Wetlands, was amended and published in the Official Gazette on 26 August 2010. When the old and new regulations were compared, it was seen that the prioritisation of the "conservation" of wetlands was altered and the "utility" oriented regulations were made to create "loopholes". With the amendment made in the Regulation on the Protection of Wetlands, rivers were not included in the definition of wetlands. In addition to that, in the new Regulation, the provisions that have been made state that there will not be any protection zones created around rivers. The changes made on the Buffer Zone's borderlines -one of the protection zones defining the activities around wetlands- which in the old regulation were "at least 2500 metres" but were changed to the extremely ambiguous and open to abuse "not exceeding 2500" statement, will also pave the way for numerous

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projects (construction, energy and industrial investments) which will negatively affect the ecological, biological and hydraulic character of the wetlands. Consequently, the new Regulation threatens the future of wetlands by excluding the main arteries of the wetlands from protection status (WWF, 2011).

The Draft Law on Conservation of Nature and Biological Diversity

With the introduction of the Environment Chapter to the European Union accession period, it has been established that our country is required to adapt to the EU's nature protection legislation. In this context, the Draft Law on Conservation of Nature and Biological Diversity prepared by the Ministry of Environment and Forestry as a "requirement of the European Union accession period" does not reflect the Birds and Habitat Directives, which are two of the main directives of the EU on nature conservation. Within the Turkey Progress Report published by the European Commission on 9 November 2010, the draft was described as "worrying". The aforementioned draft removes the "Natural Site" status of 1261 Natural Sites in our country and paves the way for their destruction. However, numerous interferences that would harm nature, especially concerning HEPPs, have been prevented thanks to the protection boards of Natural Sites. If the Law on Conservation of Nature and Biological Diversity is enacted in its current form, this will lead to the irreversible destruction of our natural areas, which have been protected to this day (WWF, 2011).

Renewable Energy Law

The draft law aiming to encourage the use of renewable energy resources, which play a vital role in meeting the increasing energy needs and combating climate change, was accepted by the Grand National Assembly of Turkey on 29 December 2010, and it came into force. Albeit somewhat delayed, the encouragement of renewable energy investments on a legal basis, is a positive development for Turkey. Nonetheless, the changes made in Article 5 of the Law contain elements that may prove to be harmful to our natural habitats. The Law, aiming to promote renewable energy, allows investments even in areas that have been guaranteed to be protected by special legal regulations and international agreements, such as; national parks, natural parks, natural monuments and nature conservation areas, conservation forests, wildlife conservation and development areas, special environment protection zones, natural sites. The Renewable Energy Law in its current form, enacted by the Grand Turkish National Assembly, threatens the protected areas which constitute only 5% of our country's surface area. While the promotion of renewable energy is a very important step in combating climate change, the fact that the aforementioned law opens our protected natural areas to investment, creates a great discrepancy (WWF, 2011).

THE ECONOMIC NEGATIVE PROBLEMS THAT THE REASONS FOR THE EXTINCTION OF LAKES WILL CAUSE

Production

As it can be observed in Eğirdir and Beyşehir lakes, the food chain has been disrupted and the fish species diversity and numbers have been severely damaged due to the introduction of alien species into inland wetlands. For instance, 500-600 tons of fish used to be harvested from each of Eğirdir and Beyşehir lakes, but after the introduction of the sudak fish species into the waters, the figure dropped to 10-15 tons (Republic of Turkey Ministry of Forestry and Water Affair, General Directorate of Nature Conservation and National Parks, 2013).

Reed

Reeds and straws are not only used for the weaving of wicker and baskets, but are also valuable as insulation materials and in cellulose production in paper mills. For example, before the paper mill in Afyonkarahisar was closed, 4/5 of its cellulose needs were supplied by the reeds of Eber Lake. Before their drying out, over a million bundles of reeds were cut from Ereğli and Sultan Reed Beds. However, due to the drying out in these areas and reed bed declines, there has been a significant decrease in

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production (Republic of Turkey Ministry of Forestry and Water Affair, General Directorate of Nature Conservation and National Parks, 2013).

Tourism and Entertainment

Lakes are ideal locations for birdwatching, photographing, fishing, hunting, hiking, and water sports, due to their beautiful scenery and wildlife. Every day, more and more people visit lakes and their surroundings to watch birds, take photos and paint. Even though lake tourism still attracts a lot of interest, the increasing number of drying lakes has affected it severely. Furthermore, the food chain has been disrupted and there has been a decrease in bird diversity due to the introduction of alien species in the lakes (Republic of Turkey Ministry of Forestry and Water Affair, General Directorate of Nature Conservation and National Parks, 2013).

PRECAUTIONS THAT NEED TO BE TAKEN TO PREVENT THE EXTINCTION OF LAKES

In the past years, numerous lakes in Turkey have dried out both due to climate change and improper agricultural practices. The drying lakes are also creating numerous problems in relation to our ecosystems; while thousands of bird species are under serious threat, numerous fish species are going extinct in many regions. The drying of a lake three times the size of Van Lake in the past fifty years in Turkey, is a consequence of not only improper agricultural irrigation but also of wrong farming and energy policies. Many of our wetlands, especially our shallow lakes, have vanished or are on the verge of disappearing. Global climate change is contributing to the acceleration of this extinction (Url 3). The adverse conditions of our country’s rivers are clearly indicated in Figure 1 (WWF, 2011).

Table 1. The Wetlands and Situations in Turkey

Wetland	Status
Akşehir – Eber Lakes	The lakes have significantly shrunk due to inefficient water usage. Fishing and reed harvesting practices, which were important sources of livelihood for the region, have almost come to an end.
Akyatan Lagoon	Due to the suspended solids coming from Ceyhan River, the biggest problem of the lagoon has become sedimentation.
Bafa Lake	The domestic, industrial and agricultural waste collected along the Great Menderes River has created a big pollution problem in the lake. The water level of the lake has been decreasing due to excessive agricultural water use.
Beyşehir Lake	It has shrunk by 75%, its current size is approximately 50.000 hectares. It is in danger of drying or pollution.
Burdur Lake	The water level of the lake has dropped by 10 metres in the past 27 years, and there is a 27% decrease in its volume.
Delta of Great Menderes	As a consequence of the use of the water that feeds the delta for agricultural irrigation, most of the time, no water reaches the delta. As for the water that reaches the delta, it creates pollution as it carries industrial wastes.
Eğirdir Lake	The water quality of Eğirdir Lake, which is Turkey’s biggest freshwater lake, has been decreasing significantly due to agricultural pollutants.
Ereğli Reed Bed	85% of it has dried out and climate hardening has been observed in the region.
Eşmekaya Reed Bed	Has completely dried out.
The Gediz Delta	In danger of drying out due to water withdrawal for agricultural irrigation, and pollution because of untreated industrial and settlement wastes.
Güvenç Lake	It has been completely dried out.
The Göksü Delta	Intensive agricultural irrigation, excessive water withdrawal and uncontrolled well drilling pose serious threats for the area.
Hotamış Reed Bed	It has completely dried out.

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İğneada Floodplain Forests and Lakes	There is a water shortage due to the drought and transportation of the water from the streams that feed the area to Istanbul, and casual tourism and unplanned urbanization create pollution in the area.
İznik Lake	In danger of pollution due to the wastes reaching the lake from industrial facilities, settlements, and small olive oil factories in the surrounding area.
Kulu Lake	It has shrunk by 90% due to excessive groundwater abstraction. Water accumulation can be observed seasonally.

Table 1. The Wetlands and Situations in Turkey (cont.)

Wetland	Status
Manyas Lake	The water availability of the lake is under threat due to excessive water withdrawal for agricultural irrigation and a decrease in precipitation.
Meke Lake	In danger of drying out due to excessive groundwater abstraction.
Sapanca Lake	It is at the risk of pollution caused by the untreated wastewater coming from industrial facilities, settlements and agricultural fields.
Seyfe Lake	90% of the lake has dried out.
Suğla Lake	It has completely lost its natural lake feature. It was converted to a storage facility by the State Hydraulic Works (Devlet Su İşleri-DSI).
Sultan Reed Bed	The wetlands which used to be 90 thousand hectares 10 years ago have decreased to 1500 hectares, and the reed bed areas have decreased from 3200 hectares to 1000 hectares.
Tuz Lake	The lake which is responsible for 60% of Turkey's salt production and has highly important natural values has shrunk by 60% due to excessive groundwater abstraction for agricultural irrigation.
Uluabat Lake	In danger of pollution due to drying out, industrial activities, and use of agricultural fertilizers and pesticides. The highway that is planned to pass by the lakeside poses a new great threat to the existence of the lake.
Yumurtalık Lagoons	The area cannot be fed due to the dams created for energy, irrigation, flood protection and drinking water. Salinization can be observed.

The measures that we need to take to prevent the extinction of our lakes can be listed as follows;

- Determining the lake pollutants and activating wastewater treatment systems, completing the infrastructure of wastewater treatment facilities, reinforcing the necessary sanctions in this regard, conducting researches on the cleaning of the already existing pollution and the recreation of the lakes,
- Providing clean water intake from water resources suitable for the lake to ensure water circulation within the lake,
- Encouraging and supporting the farmers around the lake area to plant crops suitable for farming without water by changing the planting portfolio, because plants such as beet and corn consume a great amount of water,
- To explain the importance of wetlands to the people residing in the region, and raise awareness with educational training,
- To research for job opportunities for local people to increase their income from reed beds,
- Creating new production models to increase the income level of the locals by protecting the lake rather than consuming the lake's resources, creating projects to provide job opportunities in different fields,
- To work on the recreation of lakes and create promotion videos, documentaries, advertisements and spots to increase the attraction of tourists and to initiate bird watching tourism,
- To revise and make changes on the usage of the lake as a hunting area, to prohibit hunting in the lake for a certain period of time to help increase the population of game animals, and to increase the awareness of hunters on this issue,
- To take precautions to ensure the conservation and sustainability of the wildlife living around the lake,
- To take the necessary measures which will play a major role in the protection of the lakes, such as; preventing the illegal well-drilling of the underground resources feeding the lake for agricultural practices, not allowing agricultural land to be used in regions that have become arid

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due to lack of seasonal rainfall, and implementing practices to transform these areas back into wetlands (WWF, 2011).

CONCLUSION AND SUGGESTIONS

To begin with, the country's approach towards water resources should be revised as Turkey is not a country rich in water. All segments of society need to understand that our water resources are a limited social and economic resource.

As mentioned in the WWF (2011) study; we need to take important steps to protect our water resources in multiple ways and use them economically. The most important steps are; to prepare the National Water Act. The National Water Act needs to be prepared on basis of the water's quality and quantity, basin level, and in relation to participation and "demand management". A National Water Database should be established. Our wetlands must be protected and the further destruction of existing areas should be prevented. The number of protected areas should be increased. The social and environmental impacts of water infrastructure projects must be taken into consideration and prior to the construction of new water infrastructure projects, the potential water saving possibilities through efficiency enhancement must also be calculated, aside from the natural capacity and values of water ecosystems. All planned projects should be taken into consideration within the scope of the Social and Environmental Impact Assessment, which takes into account probable climate change impacts and alternative development options. The use of illegal water should be stopped, necessary steps should be taken to prevent the use of illegal water in all sectors and to ensure the reuse of the water consumed, especially by the industry sector.

Necessary researches should be conducted for saltwater treatment and water transfer between basins. The rational management of our water resources should be adopted. The water issue of each basin must first be resolved within itself, and the most effective use of existing resources must be ensured.

There should be radical changes in agricultural policies and practices. Agriculture-water-environment policies should be compatible and complementary to one another (Yazici and Arslantaş, 2019). National and regional agricultural production planning should be made, the farmer registration system and agricultural data should be updated. The condition of "good agricultural practices" should be imposed on the providing of direct income support. A regional support system that takes into consideration criteria such as climate, soil and water structure, and biodiversity should be established, instead of a product-based support system. Government support should be provided for the producers who switch to environmentally friendly alternative products, and the alternative product suggestions should be developed on basis of using less water. Instead of the unplanned use of water for irrigation, sprinkler and drip irrigation systems which ensure more economical water use should be made widespread.

If the necessary precautions are not taken in Turkey, the possibility of encountering a great water shortage in the future is high. Taking into consideration the current status of our water resources, the growth rate of the country's population and our water consumption habits, it is likely that the water problem will grow significantly in the near future. The water demand is increasing in Turkey, just like the rest of the world. However, despite this, it cannot be said that the water resources are used efficiently. While technological advancements make our lives easier, they also often pose a serious threat to nature. Due to global warming, warmer and days without water await the world. Using and preserving our natural resources and water in the most efficient and economic way, has to become a habit so that these negative consequences affect us as little as possible.

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