

# The Ecological and Environmental Investigation of Lake Urmia During the Recent Years

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**ABSTRACT:** Lake Urmia, as the second largest salt lake, is near to a complete drying which creates the biggest environmental crisis in a large and highly populated region of Iran. The catchment area of Lake Urmia includes numerous aquatic and terrestrial habitats. Within the ecologic zone of the lake, 17 significant sites including the lake, terrestrial habitats (i.e. islands inside the lake) and surrounding lagoons exist which are regarded as important sites for protection and management. Most of these lagoons are not properly run and due to excessive agricultural activities, they are almost destroyed. The increase of exploitation of water resources in upstream regions of catchment area has severely influenced these lagoons. The wide plains around the lake and their connections with subsidiary freshwater wetlands create a significant ecologic area which covers a wide range of important animal and plant species. The resumption of associations and functions of these elements and the protection of significant ecologic resources inside the lake (e.g. *Artemia*) is highly significant. The social, economic, environmental and political consequences of this event is unpredictable. In regard to the reasons of drying of the lake, the public opinion has been gradually convinced that widespread dam construction on one hand and unchecked depletion of underground water resources with drilling of thousands of illegal wells on the other lead to deprivation of the lake from a major portion of its natural share of water which are the major reasons for the present catastrophic situation. Based on the historical evidence, the periodical droughts and random reduction of precipitations cannot be solely the reasons of current situation because during the past thousands of years, this phenomenon has occurred for many times, but there is no evidence on occurrence of present situation in the past. The present drying of Lake Urmia is not a natural event but presumably a "human-made" one which has not happened for the past 130,000 years.

**Keywords:** Lake Urmia, ecologic, pollution, lagoon, precipitation, drought

## INTRODUCTION

The Ecological and Environmental Study of Lake Urmia during Recent Years

Since a long time ago, water has been highly significant in dry lands and deserts of Iran because with the exception of western and northern parts of Iran, the other regions are in a zone with insufficient rainfall. The problem of salty waters is one of the issues which our country is still facing. Lake Urmia is one of the most important and valuable aquatic habitats of Iran (Iamalipur, 2002). This lake is the largest internal lake of Iran and due to its naturally and ecologically unique characteristics, it was introduced as a national Park, a UNESCO biosphere reserve and a part of Ramsar site. Almost 550 plant species with one and multiple years of age are identified in the ecological zone of the lake. The dominant vegetation of this zone includes halophyte, terrestrial and aquatic species. The Lake Urmia is the cold-season habitat of migratory aquatic birds, especially ducks and species which dwell near the water which gives the lake an international significance. The islands inside the lake house are the largest breeding population of Flamingo with between 200-500 pairs of white pelicans. Around 11 aquatic birds in danger of extinction have been identified in the lake. The southern islands of the lake provide the

habitat for two species of mammal in danger of extinction, namely Persian fallow deer and Armenian buck. Among the most significant invertebrates of the lake, we can point to *Artemia* which is the local brine shrimp species of the Lake Urmia and the most important nutritional source for most of aquatic birds such as Flamingoes. However, the increase of salinity has created problems for reproduction of this species.

## **MATERIALS AND METHODS**

Lake Urmia is located between latitudes of 9'-37° north and longitudes of 12'-38° east. It is between East and West of Azerbaijan provinces. It is the biggest internal lake with an area of 5822 square km and the twentieth lake of the world in regard to its width. The length of the lake ranges from 130 to 146 km and its width ranges from 58 to 15 km. The least width of the lake is between Zambil Mountain and Islami Island. The area of catchment basin of the lake amounts to 52355 square km. This lake has 102 small and large islands among which Islami Island is the biggest one (Imamalipur, 2002). From the perspective of chemical classification, the water of Lake Urmia is of chlorinated type. The remaining dissolved elements in the water in periods of high water level amount to relatively 220-280 g/L. Indeed, in periods of low water levels the concentration of minerals is more than the above-mentioned range. As a result, this lake is the second salt lake of the world after Dead Sea. The volume of lake water in an area of 5822 square km and depth of 4-5 m amounts to 31 billion cubic meters (Hashemi, 2002).

### ***Influential Factors upon Rainfall of the Region Closeness to Sea***

The width of Lake Urmia is almost one-tenth of its catchment area. From the view point of rainfall, the lake has no noticeable effect upon increasing the rainfall at its surrounding. At the east and 300 km from Lake Urmia, the Caspian Sea is located. Although the latter could potentially act as an influential factor in supplying sufficient humidity for rainfall in the region where the lake is located, the high Alborz Mountains inhibit any effect upon the regional weather. The inward air currents from Siberia and central Asia might carry the humidity of Caspian Sea into the basin of Lake Urmia.

### ***Region topography.***

A major proportion of basin of Lake Urmia is constituted by mountainous areas, the mean temperature of which is lower than other regions of Iran. As a result and due to the fact that humid currents often enter the region in winter, almost half of precipitation of the region from December to March is snowfall (Hashemi, 2002).

### ***Passing currents from the region.***

The most basic factor of regional precipitation is the effect of intercontinental air currents passing from the region. These currents are generally divided into two kinds. The humid air current from Pacific Ocean and Mediterranean Sea during winter and early spring crosses the region and provides significant precipitation as snowfall in high mountains and other highlands. The cold air current of the region originates from Siberia and central Asia the effect of which is reduction of regional temperature (Hashemi, 2002).

### ***General Issues***

The satellite images of Lake Urmia in 2003 show the evident division of the lake into two halves due to the crossing bridge at its center. The Lake Urmia is the largest permanent catchment of western Asia which is at the northwest of plateau of Iran. The national park of Lake Urmia is one of the most interesting natural habitats of animals in Iran. At the moment, 27 mammal species, 212 bird species, 41 reptile species, 7 amphibious species, and 26 fish species constitute the wild life of the lake. The water of Lake Urmia is highly saline and its value of dissolved salt is twice of the oceans (Imamalipur, 2002).

As a result, no fish or seashell lives in it with the exception of species of crustaceans (*Artemia*), diatoms and phytoplanktons. The lake water never freezes. The swimmers can float themselves on the water surface. The Lake Urmia has 102 islands all of which are considered by UNESCO as global natural reserve. The Ash Island is the habitat of small and beautiful birds such as shelduck and firebird as well as a number of Persian fallow deer and wild sheep (ewe and buck). To visit the lake and its islands, the visitors can use the two ships of Sahand and Nooh or different boats at Golmankhane Port. Lake Urmia in Azerbaijan region is also proper for water sports such as swimming, boating and water skiing along with its role as a significant natural habitat but it is still drying. This lake attracts numerous visitors in different seasons, especially summer, due to its beautiful beaches and saline water. Because of its diverse mineral materials, it is one of the rarest natural resources which is currently facing serious threats. At the moment, it has the risk of complete drying and during the past 13 years its surficial level has

reduced up to 6m. The assignment of 90% of water resources of the region to agricultural section, high evaporation and unauthorized withdrawals from groundwater through drilling wells are the reasons of drying of the lake. The experts state that if the lake dries, the temperate climate of the region will turn into a warm one with salt winds and the regional environment will radically change. Against the drying of the lake, a protest occurred on March 2011.

## DISCUSSION AND CONCLUSION

Some of the solutions of the problem are:

**Transferring water from Aras River:** The studies of this project initiated in 1980. This project was mostly done to supply the drinking water and satisfy the industrial requirements of more than 3.5 million people of the provincial population, offset the shortage of underground water reservoirs, and balance the level of water in the lake along with improvement of agricultural lands in the project through modern irrigation methods. Of the other project objectives, one could point to prevention of water crisis in 2046 and reduction of social tensions originating from insufficiency of water resources.

**Transferring water from Caspian Sea:** It is discussed as the second choice which is highly problematic and expensive.

**Removing agricultural means from surroundings of the lake:** This issue demands further studies and determination of places in which planting and consumption of water for agricultural means can be prohibited so as to contribute to revival of the Lake Urmia .

**The destruction or depleting dams :** Some believe that for saving the lake, some of the dams of the region should be destructed, all of the regional dams should be depleted of water and storage of water behind them should be prohibited. Blocking the unauthorized wells and prevention of water withdrawal from them seem essential but impossible in reality as the past experiences have shown (Hashemi, 2002). None of the above suggested solutions is ultimate solution because different factors have contributed to current crisis. Therefore, different studies, determination of main factors, and developing some solutions based on them are necessary. Confidence in a strategic system should be made through asking the assistance of everybody. In this regard, creating a public website for obtaining comments and suggestions of the experts is essential. The cultivation and agricultural patterns of the region should be studied and based on new conditions of the region, water management and irrigation methods should be redesigned. The construction of more dams should be prohibited, the new regions should be environmentally protected, the catchments should be fed, excessive withdrawal of underground water should be prevented, development of industries such as water industries should cease and unchecked development of cities around these natural habitats should be controlled and studied. These cases properly show the complexity of the subject. They need using different thoughts and acting based on these studies. A comprehensive and combined plan is needed. It is better to find confidence in a strategic system and apply the aid of everyone in this regard. A good way to do this is to develop a public website for obtaining the comments and suggestions of associated experts. The study and modification of cultivation patterns in catchment areas of Lake Urmia should seek two objectives. The first objective is reduction of demand for water and cultivated area. It is noteworthy that in the past 30 years, the cultivated area around Lake Urmia increased from 150 to 415 thousand hectares (Najafi&Gholamali, 2014).

**Study and modification of irrigation methods:** Mr. Chitchian, minister of power, was quoted saying that Ministry of Agricultural Jihad can use the help of farmers to change the cultivation and irrigation patterns of the region, save about one billion cubic meter of water and let the saved water into the lake. The authors of present study do not believe in numerical estimation but regard such approaches and endeavors as proper despite of the fact that such a task could be time consuming and difficult (Najafi and Gholamali, 2014).

The implementation of watershed management projects can significantly influence the revival of Lake Urmia. Up to now, 570,000ha of catchment areas of the lake in West Azerbaijan Province have been studied and are ready for doing the project.

The organization of illegal wells and unauthorized water withdrawals from the wells are also significant because during past 25 years, more than 22,000 deep wells have been drilled for irrigation of gardens and urban consumption.

The cessation of new studies to construct more dams

Study and prohibition from completion of constructing dams in the region

**Revision of storage of regional waters behind the existing dams:** It is currently possible to release water from active dams but letting them into the lake demands more coordination because these dams provide drinking water of cities and satisfy industrial and agricultural requirements. Therefore, the release of reserves of such dams

should be preceded by notification to farmers that for current year, a definite area of agricultural lands cannot be cultivated.

volumes of water, and prevention from development of new towns around the lake

Creating an environment culture and enhancing the environmental awareness among the public in order to make them cooperate and stimulate public favor towards saving the lake can also be useful. At the moment, almost 6 million people live and work in the region and 4.5 billion cubic m of water is consumed. Without the aid of such population, we cannot do significant measures.

Consistent monitoring and surveillance over the measures: The restoration plan will be successful only when it is consistently monitored and controlled. The precise control refers to measurement management, comparison of activities and results with developed programs, determination of probable gaps and their analysis, development of reform plans and execution of reform plans which lead to further monitoring. As a result, the concept of cyclical format of the plan and continuity of management practices become tangible. These concepts should be included in the associated plans and projects for saving Lake Urmia so as to give the next generations a chance to use this natural present.

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