World Essays Journal / 3 (2): 30-33, 2015

Different Investigations of Environmental Impacts of Climatic Fluctuations on Lake Urmia

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ABSTRACT: Lake Urmia, with 140 km of length and 15-50 km width, has allocated an area of 5000 to 6000 sq. m in the northwest of Iran. The changes in the area of this lake are related to the fluctuations of the water level and gentle topography of its coast. The lake has an average depth of 6m with maximum depth of 14 m. The lake with a water inlet of 56/43 million cubic m per year has a volume of water equivalent to 33 billion cubic m. Its water level altitude from the open seas is 1278 m. This lake is surrounded by the mountains with an average of 2500 m altitude. The decrease of its size and its eventual destruction of Lake Urmia, does not merely include the loss of habitat of wildlife species such as native or introduced ones but alsowill destroy all the ecological capacities located in its zone. Villages, farmlands, gardens, and cities will not be safe. Lake Urmia plays the moderating role of climate in its range of influence. When there is no lake, the temperature of the area rises and eachincreasing temperature is followed by another rise. By the decrease in the size of the lake, the recursive energy level of the lake also decreases and thus the capacity of the lake to moderate the climatic conditions decreases. This is meant to state that the dryness of the environment has increased and as a result the evaporation from the surface of the lake aggravates and finally its size decreases again. From the perspective of the analysis of systems, in these circumstances, Lake Urmia and its environment has entered a situation of positive feedback which cannot lead to a desirable result.
Keywords: Lake Urmia, climatic fluctuations, environment, drought, precipitation

INTRODUCTION

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Lake Urmia contains high amounts of different ions that make the amount of its the salty to more than 350 g per L. Due to little amount of inlet water, the least amount of its saltiness levelis in spring (217 g per L) and the highest amount is in the end of summer and at the beginning of fall (350 g per L). Chemical composition of saltwater of Urmia Lake is sodium chloride sulfate (Shahrabi, 1981). This lake is a mineral source with economic and renewable values.

This zone can be divided into three subzones of east, south and west. The main rivers of the eastern subzone are as follow:

Aji Chai River
Biok Chai River
Ghale Chai River
Dufi Chai River
Mardagh Chai River
Leylan Chi River

The area of eastern subzone equals 17075 sq.km which is 32.4% of the total area of the zone. The most important rivers of this zone are as below:

Zarrineh River

Simineh River
Mahabad Chai River
Gadar Chai River

The area of the southern subzone equals 19815 sq.km that is 37.6 % of the whole area. The western subzone consists of the following rivers:
Barandouz Chai River
Shar Chai River
Rozeh Chai River
Nazlou Chai River
And a number of small rivers.

The area of the southern subzone equals 8116 mounts to 15.4 % of the total zone of Lake Urmia (5).

According to the information provided in the website of "Iran's water resources management; development section" in Lake Urmia region the situation of dams is as follows:
36 is the number of existing dams
12 is the number of dams under construction
40 is the number of dams being planned

Based on the reports of Water Resources Office, the water flowing into Lake Urmia is supplied by 15 permanent rivers, 7 seasonal rivers which often flow in winter and spring and approximately 39 floodways. According, its permanent rivers are Zarrineh Rood, Simineh Rood, Mahabad Chai, Gadar Chai, Barandouz Chai, Shahr Chai, Rozeh Chai, Nazlou Chai, Zola Chai, Aji Chai, Azarshar Chai, Ghaie Chai, Sufi Chai, Mardugh Chai and Leylan Chai.The seasonal rivers include Sheikh Chai, Shivan Chai, Kherkhereh Chai, Tivan Chai, Tesuj Chai, Darian Chai and Gapi Chai.

The noteworthy point is that, from the comparison of the list of constructed dams and the dams under construction in all the Lake Urmia Zone that has been planned by the Management of Iran's Water Resources Company, and the list of rivers flowing into Lake Urmia, it can be concluded that the result is 14 out of 15rivers that supply the water of the Lake, dam and diversion dam (such as Nazlou and Zola) has been constructed. According to a report by the Water Resources Office, three rivers of Simineh Rood, Aji Chai and Zarrineh Rood make 60% of the total inlet flow into the lake. In other words, while the three above-mentioned flows into Lake Urmia have been blocked, the lake deprives of receiving 60% of its share. The remaining 40 % is approximately blocked by other dams.

METHODS AND MATERIALS

Description of the Current State of the River

Examining the level of the lake shows that the level of Lake Urumia has started a decreasing trend since 1998 and its level has fallen below its ecological level since 2003 (1274.1 m) and from that time up to now, it has constantly maintained its decreasing trend by the annual average of 40 cm. Studying the satellite images of Lake Urmia in the second half of 2013-2014 demonstrate that with the decrease in precipitation and lack of adequate rainfall into the lake, Lake level declines and rollback has occurred especially in the southern area. As the level of the Lake has indicated on March 23rd2014, it has decreased from 69.1270 m to 15.1270 on September22nd 2014, which is the lowest recorded level during the last century. Table 1-1 displays the level fluctuations, water level and volume of the lake end of the March to the middle of September of 2014 and also shows its comparison with similar times in recent years.

Since the September 23rd2014 and with the start of the new annual waterfall year (2014-2015) abundant precipitations have occurred in the Lake Urmia Zone. So that only 97 mm last precipitation of one instance in September of the last year compared to the similar period of the last precipitation year has had 4750 % difference and compared to the similar average long-term period of 45 years has had 547 % difference. Total precipitation of new year water until the twenty-third of November 2014 has mounted to 125 mm.

Continuing rains in the months of November and December of the new precipitation year and the flow of water into the lake has generally increased the water balance, the level and the volume of the lake, so that the balance of the lake has increased 30 cm since 23rd of September of 2014 until 25th of November 2014. And in this period the volume of the lake has risen over 550 million sq. m. While in the similar period of the previous year (from 23rd of September 2013 up to 24th of November 2013) the average precipitation of the area has been only 45 mm and with 3 m decrease of the balance of lake in this period, the volume of lake has also decreased. According to the statistics of the latest hydrometric stations, the water flowing into the lake and passing by the mentioned stations in the months of October and September in the year 2014, it has been reported approximately 70 million sq. m and about 36 million sq. m for the year 2013. The fluctuations trend of level of the lake since the beginning of

the water year up to 24th of November 2014 shows that the level of the lake at this time has had an increasing trend in this time period (Figure 1-3). So that it has also advanced up to the balance of 48.1270, but with the stopping of the precipitations and non-flow of water into the lake, the level has rapidly decreased and thus the level of the lake has dropped. This would indicate salt disposition in the lake bed and consumption of water to dissolve the salt of the lake. With the onset of precipitations since the beginning of the water year and the flow of water into the lake, lake level fluctuations from the beginning of October, has been the total of 700 million cubic m. Also the amount of decrease of the lake level has been 150 million cubic m which has resulted from the evaporation and salt dissolution losses.

Climatic Changes Due to the Reduction of the Size of Lake Urmia

Based on the existing data, in a vast part of the region, that has lower than 2000 m altitude, the climatic type is more or less fixed (18). This phenomenon shows that in this climate the lake plays the moderating role for the climatic lake. In general, the evaporation process which has been estimated to have an annual average of approximately 1000-1500 mm is a cooling and lowering the environment's temperature process. Thus,the evaporation from the surface of the lake, part of the thermal energy in the form of latent energy is taken from the environment and it is repelled and as a result the climatic conditions are moderated. In fact, it is in these moderated climatic conditions that residential facilities and production has become available within the space surrounding Lake Urmia: In case the climatic conditions get dry, consequently living and working conditions become difficult and in critical condition, it might become completely impossible.

It is evident that by the reduction in size of the lake, the repelled thermal energy has also decreased and through this the lake is capable of modulating the conditions of decreasing the environment. This means on the one hand that under the influence of reduction in the size of lake and reduction in vaporizing level, the environment's temperature and dryness of the environment also increases the consequence of which is again more evaporation of the surface of the lake and more decrease in its size occurs. On the other hand, looking at the height distribution of the most important plains and population centers in the region reflects the fact that all of the above mentioned places are located at an altitude of less than 2000 m and as a result they are situated at the modulated area. Table 2 indicates number of these population centers (19)Change in land use is also one of the factors that have diverse influences on the lake and wetland ecosystem:

Increasing the size and number of residential centers
Increasing the size of farming lands
Increasing industrial and service giving units
Expanding the roads network

And many such things that all are being done irrespective of the environmental criteria. Expansion of farming lands in the eastern plains of Lake Urmia and parallel to that excessive exploitation of underground water resources has resulted in the penetration of salty water of the lake into the aquifers which not only threatens the ongoing activities in many parts of the agricultural farms of the plains, but also seriously pose a threat to the quality of underground water resources. The preliminary data show that the size of farming lands in this area in 1951 was 25 hectares, in 1971 it was 48 hectares and in 1991 it increased to 1225 thousand hectares. Here of the total number of 9459 deep and semi-deep wells, 1002 ones (equal to 10.6 %) of the wells became salty and deserted (20).

In appearance of the current situation on the one hand the nature of region and on the other hand human communities are involved. The nature has its own rules and man has not yet been able to get into its greatly complex and complicated essence. On the other hand, however, there are human communities that are governed by certain rules that they have regulated themselves and have made themselves accountable to obey them. Thus if it is supposed that an action be taken, it should be attempted to work on the same side of the inequality.

CONCLUSION

Today a part of the environmental impacts resulting from dryness of the ancient Mesopotamian wetlands, for the residents of Tehran, has emerged as air pollution smog. Therefore, we should visualize the time that the size of salt-marshes of Lake Urmia has more and moreexpanded and with every blowing of the wind, these salts are spread around. And in addition to soil degradation and farm products, it seriously threatens community's health. Based on the reports, saltiness of Lake Urmia has changed from 300 g per L to 340 g per L. These salts contain Magnesium, Calcium, Potassium, Sodium, Chlorine, Bromine, Phosphorous, Iodine, Lithium,Boron and other elements all of which can endanger human health as its share. There is no information available about the cumulative effect of these elements.

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