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Water level decline at Iran's Lake Urmia: changing population dynamics

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ABSTRACT

This paper examines the effects of decreasing the water level of Lake Urmia on migration and geographical distribution of the population in the eastern coastal settlements in Northwestern Iran. Initially, we considered the migration statistics from 2006 and 2016, compiled by the National Statistics Office. Then, by using kernel density estimation in ARC GIS, we examined the geographical distribution of the population. Findings of this study show that between 2006 and 2016, about 71.85% of the migrants in the province were from the villages around the lake, which caused the complete evacuation of 53 villages and a sharp decline in population in a number of other villages. While 28.42% of it was related to the other settlements in the province. Also, the results of the density estimation function show that, from 2006 to 2018, most of these villages lost their population, and most of the people are now inhabited in the suburbs of the central cities. It has led to an imbalance in the distribution of population, facilities, etc. The decline in the water level of the lake and the resulting fine dust has played an important role in reducing employment in the agricultural sector and, ultimately, led to reduced rural-urban migration. It seems that with the intensification of the consequences of climate change in Iran and the expansion of the water crisis in the country, the migration crisis around Lake Urmia, by generating socio-economic costs, will be a major challenge for development in this region.

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Population; immigration; climate change; drought; Lake Urmia

Introduction

Migration and redistribution of the population within the country is one of the most important factors that socio-economic policymakers consider in order to control the population and direct population relocations (Jennings & Gray, 2015). Studies show that rural-to-urban migration in developed countries is close to zero (Lagakos et al., 2020). However, this type of movement in developing countries is still recognised as a problem and creates economic and social problems for these countries (Datta, 2012). According to the studies, there is no one factor which can be identified as a sole driving force for migration. In 1855, Ravenstien introduced the distance, attraction and repulsion

factors, reciprocal flow, and the spatial features of the habitat components as the important migration factors. Following Ravenstien, different theories regarding the causes and factors of migration have been introduced, which mostly emphasised the role of attraction and repulsion factors in the origin and destination points (i.e. Borjas, 1989; Lee, 1966; Todaro, 1969) and the contribution of economics (i.e. Stark, 1991; Stark & Bloom, 1985; Taylor, 1999) in decision-making for migration. De Haas (2009) also argues that the determinant of migration is the inequality level in socio-economic development along with relative deprivation in access to development opportunities and resources (De Haas, 2009). Neo-classical migration theory also argues the climate changes as the migration cause, which has led to an increase in rural-urban migration (Marrita-Cascante & Stocks, 2013).

Nowadays, human migration is one of the most controversial subjects in climate change investigations (Bettini, 2014; Telford, 2018), and has emerged as one of the most important challenges facing the international community (Wamsler et al., 2013). Severe and persistent droughts at different temporal periods have threatened many regions and caused destruction in natural resources. NASA's report on weather conditions over the next 30 years has raised concerns in many countries around the world, including the Middle East. There is a noteworthy point in this report that Iran ranks fourth on the list of 45 countries at risk (NASA, 2013). Climate change affects human activities in various aspects, directly and indirectly. Climate change may not only affect agriculture, and human health, but also the patterns of human habitats, energy consumption, transportation, industry, local characteristics, and the other structural aspects that affect the quality of human life (IPCC, 1992).

According to statistics of the International Organization for Migration (IOM), in 2017 a total of 18.8 million people out of 257.7 million immigrants in the world migrated directly due to environmental factors (Duncan & Popp, 2017).¹ For example, Lake Utah in the United States, Aral Sea in Kazakhstan and Uzbekistan have caused health problems to the residents of these areas and have been the source of population displacement and rural-urban migration in these areas (Campbell et al., 2011). Similar trends can be considered in Iran. Iranian citizens in the southeastern provinces, especially in Sistan and Baluchestan, have experienced such risks (Mosallanejad, 2008). In addition, climate change has led to mass migration in the past. For example, in the 1930s, thousands of people were forced to immigrate to California due to the drought (Stern, 2006). Based on the evidence impacting the residents of the African, Asian and Central American continents and the Pacific Ocean, climate change has caused relocation of the large numbers of vulnerable residents and communities (Wirsching et al., 2013). By intensifying these effects, climatic migration is now becoming an adaptable form of the human relationship with the environment: migrations which are no longer an 'exceptional situation' but are the beginning of a new paradigm in which migration will be the 'natural state' of human life.

Among the most important environmental resources that have been destroyed by drought are water resources and lakes, which are increasingly exposed to extinction and drying up (Ashraf et al., 2019). Meanwhile, salt lakes have been more affected by the droughts (Williams, 2002). Drying of these resources not only affects the plant and animal life around them, but also influences the demographic changes and the emergence of social problems and crises in the surrounding area, including rural and urban centres (Salimi, 2015). Urmia Lake is one of the inland lakes in Iran which has experienced a decrease in its water level in the last few decades and has strongly affected the

surrounding towns and villages. According to various social, economic and environmental criteria, Urmia Lake plays an important role in the northwestern part of Iran and is one of the main habitats of *Artemia* in the world (Abatzopoulos et al., 2006). The lake is registered as a protected environmental heritage by UNESCO (Birkett & Mason, 1995).

Currently, human, plant and animal habitats are threatened by the drying up of the lake within a radius of 500 km. It is predicted that in the event of possible drying of this lake, we will see salt rain in many neighbouring provinces. Due to the prevailing winds in the region in the southwest, west and southeast directions, the coastal cities in the east to northeast and even northwest of Urmia Lake will have the highest damage probability due to salt storms (Ahmadi & Akbarzadeh, 2018). Agriculture, horticulture, animal husbandry, handicrafts, beekeeping and industry play a major role in the rural economy of the region in the surrounding areas of the lake (Delju et al., 2013). Therefore, preventing the lake from drying up has become the main mission of the Iranian government (Banihabib et al., 2015).

Increasing unemployment due to the loss of agricultural land and the related social and economic problems (Mohammadi Hamidi et al., 2019), the creation of salt winds as a threat to agricultural lands on the shores of the lake and the inhalation of salt dust (Asghari-Kaljahi et al., 2018), which could cause cancer and lung problems (Musapour et al., 2019), are some of the greatest environmental disasters caused by drying up the Urmia Lake. One of the consequences of this phenomenon is the large population movement around the lake. Thus, the statistics of the rural population growth rate over the past years in the lake area show that the rural population growth rate over the last three decades is almost negative. In 2016, the rural population decreased by about 13,181 people compared to 2006 (growth rate of -5.3). These changes have been able to reduce the integrity and effectiveness of the elements of the residential system and the connections between them, and the result has been formation of an inefficient and fragmented residential system.

In the present study, we examined the rate of migration and population displacement, especially the rural population in the Lake Urmia basin. The main purpose of this article is to (1) investigate the migration rate from the eastern shores of Urmia Lake and compare it with other settlements in the study province, (2) study the spatial reflection of population migration in the eastern shore of the lake in the form of urban and rural housing habitats, (3) investigate the effects of reduction of the water level of the lake as a repulsive force for the immigrant population (forces and factors that cause immigration). In this study, we have also tried to address the negative effects of the environment on migration and population displacement in the study area (Cai et al., 2016) (Figure 1).

Methodology

The migration data used to reflect the spatial patterns of migration were the lifetime migration data derived from 5th and 6th national censuses conducted at the provincial level in 2006 and 2016. Also, the kernel density estimation model was implemented to analyse the data in Arc GIS software.

The kernel density tool calculates the density of the features in a neighbourhood around those features. It can be calculated for both point and line features. Possible uses include finding density of houses, crime reports, or roads or utility lines influencing a town or wildlife habitat (Silverman, 1986).

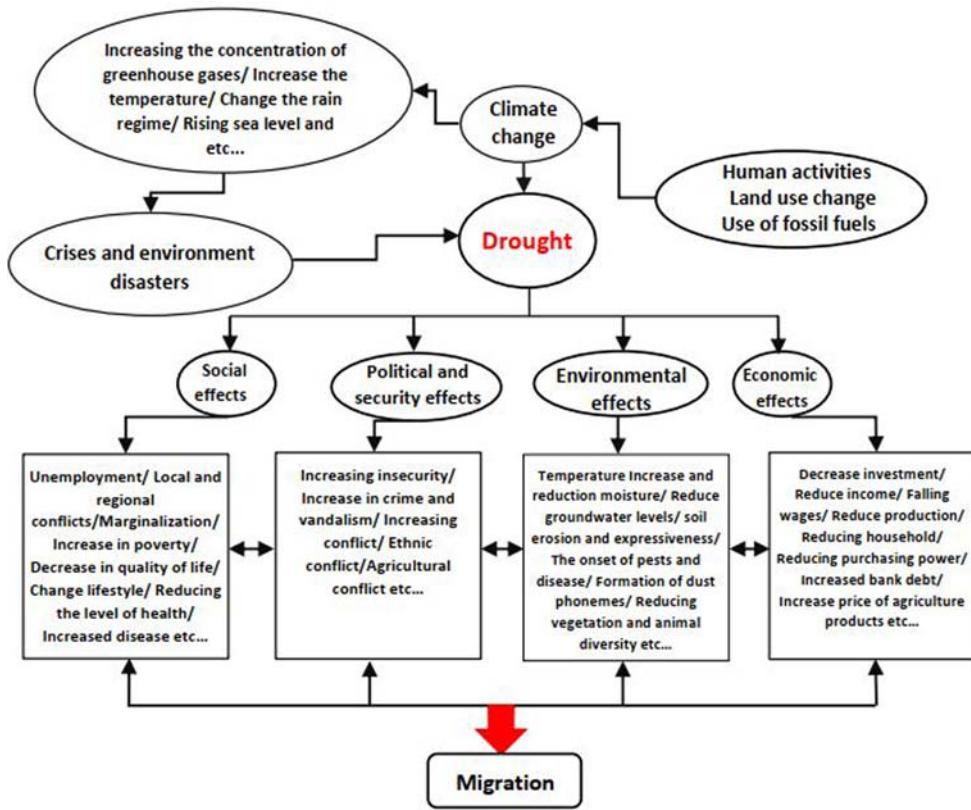


Figure 1. Effect of climate and environmental changes on human migrations.

Eck and colleagues described the method as follows: The quartic kernel density method creates a smooth surface of the variation in the density of point events across an area. Point density is a continuous function, and in order to present an effective and accurate impression of its distribution, a scheme that recognises this continuity is needed (Krisp & Špatenková, 2010; Langford, Magnire, & Unwin, 1991).

This methodology for choosing the search radius is based on Silverman’s rule-of-thumb bandwidth estimation formula but it has been adapted for two dimensions. This approach to calculating a default radius generally avoids the ‘ring around the points’ phenomenon that often occurs with sparse datasets, and is resistant to spatial outliers- a few points that are far away from the rest of the points (Figure 2).

Predicting the density for points

The predicted density at a new (x, y) location is determined by the following formula:

$$Density = \frac{1}{(radius)^2} \sum_{i=1}^n \frac{3}{n} \cdot pop_i \left(1 - \left(\frac{dist_i}{radius} \right)^2 \right)^2$$

for $dist_i < radius$

where $i = 1, \dots, n$ are the input points. Only include points in the sum if they are within

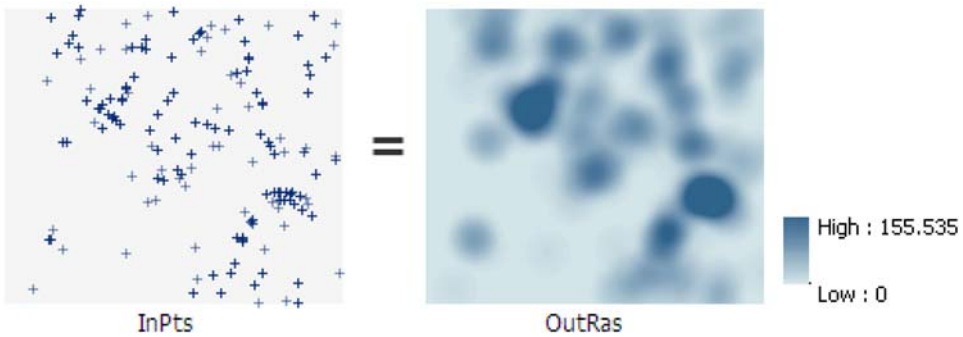


Figure 2. OutRas = Kernel Density (InPts, None, 30) (www.esri.com).

the radius distance of the (x, y) location; pop_i is the population field value of point i , which is an optional parameter; $dist_i$ is the distance between point i and the (x, y) location.

The calculated density is then multiplied by the number of points, or the sum of the population field if one was provided. This correction makes the spatial integral equal to the number of points (or sum or population field) rather than always being equal to 1. This implementation uses a Quartic kernel (Silverman, 1986). The formula will need to be calculated for every location where you want to estimate the density. Since a raster is being created, the calculations are applied to the centre of every cell in the output raster.

Study area

Lake Urmia in northwest Iran is the largest salt water lake in the world and the second saline lake after the 'Dead Sea' in the Middle East; furthermore, it is regarded as the largest permanent drainage basin in west Asia (Delju et al., 2013). The Lake Urmia Basin is located between $37^{\circ}4'$ to $38^{\circ}17'$ latitudes and $45^{\circ}13'$ to 46° longitudes in northwest Iran and covers an area of $51,800 \text{ km}^2$ which comprises 3.15% of the entire country and includes 7% of the total surface water in Iran (Azizzadeh & Javan, 2018) (Figure 3).

Regarding the factors causing lake drying, studies have shown that 65% of water level decline is related to climate change and 10% of decreased precipitation over the lake itself. In addition, out-system factors are imposed apart from the systems. These factors are human-made, and it is expected to be dry due to human use of environment such as overuse of surface water resources, dam construction, etc. Dam construction, as the human intervention, accounts for 25 present of Lake Urmia decline (Hassanzadeh & Zarghami, 2012) (Figure 4).

According to Iranian political country divisions, Urmia Lake is located between two provinces, East and West Azerbaijan. Considering the dominant direction of the winds in the area is west-ward, in the present study we focused on the eastern coast of the lake (East Azerbaijan province) which is more affected by decreasing water levels in the Urmia Lake (Figure 3). Based on the political divisions in 2018, East Azerbaijan province consisted of

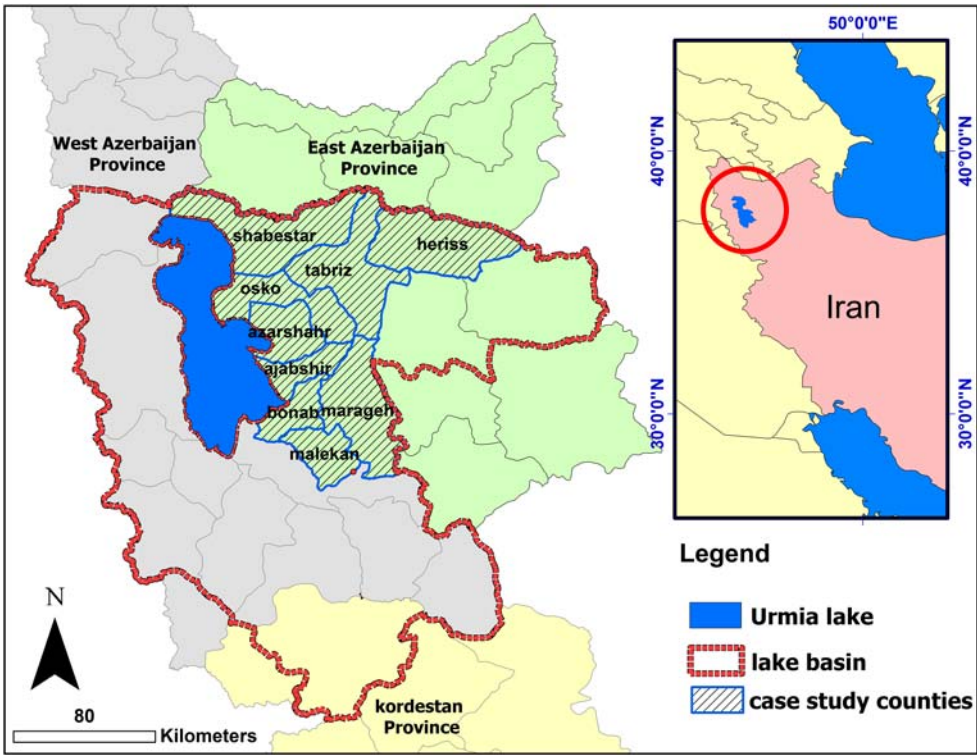


Figure 3. The location of east Azerbaijan province and Urmia Lake in the country divisions.

20 towns, 44 districts, 62 cities and 142 villages. A total of 43.3% of the province’s area is located in the Lake Urmia basin which includes 9 towns and 18 districts and has been studied in the present study (Figure 3).

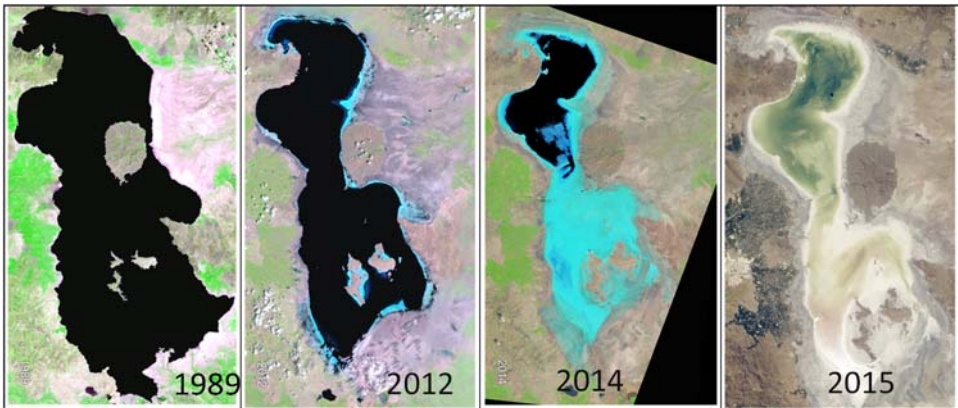


Figure 4. Satellite images of Lake Urmia in 1989 (left), 2001–2014 (centre) and 2015 (right): these images obviously show the negative trend of water-level and gradual shrinkage of the lake over 26 years (nasa, 2015).

Results

East Azerbaijan province; at the top of the migrant- sender provinces in Iran

In the last 50 years, East Azerbaijan province has been under intense immigration, and is ranked first among other immigrant sending provinces in Iran (Table 1).

During the 2011–2016 censuses, a total of 17,614 people left the province. Most of the immigrants who left the province (43.31%) migrated due in order to follow their families, and 13.53% included young people who had emigrated to Education. Declining lake water levels and, consequently, unemployment are the causes for people migrating to other provinces (Table 2).

The age composition of the immigrants shows that the highest share of immigrants belongs to the age groups of 25–29 and 30–34 years, respectively. This number was 13.5% and 13.9% for the whole province, 11.9% and 13.4% for men and 15.2% and 14.4% for women, respectively. In total, 96.9% of immigrants are under 60 years old and only 3.1% are 60 years old or older (Figure 5).

In order to identify the migration type (urban or rural), the urban and rural population was examined. According to statistics, in 2006, 66.7% the province population was in urban and 33.5% in rural areas, while in 2016, the corresponding values were 71.9 and 28.1%, respectively. The findings show that the size of rural populations is decreasing day by day and in contrast, the urban population is increasing (Figure 6).

Comparing the graphs, it is clear that the population of the villages is decreasing and more of these villages are being depleted. According to the census results, currently, East Azerbaijan province has 3083 villages, of which 138 villages have been depleted and are void of inhabitants compared to the 1996 census. In 2006, the number of depleted villages reached 378 villages. Finally, according to the last census in 2016, 494 villages in this province were depopulated, which has multiplied since 1996 (Figure 7).

In addition to the aggravating factors of migration in the country as presented in Table 2, there are other factors involved in migration in this province, among which the role of reducing the water level of Lake Urmia should be mentioned. In order to investigate the effects of decreasing the Lake's water level for the surrounding rural settlements, rural demographic changes in other towns of the province (which are not directly affected by declining lake water levels) were also examined to compare their statistics to reveal the lake's direct effects (Figure 8).

Out of 3083 rural areas in the province, 823 villages are inside the Lake Urmia basin and 2260 rural areas are outside the basin. As shown in Figure 8, the number of villages in the lake basin is less than the rest of the province. Also, the number of uninhabited villages in this area has reached 53 villages according to the latest census.

A noteworthy point in this statistic is the number of immigrants from settlements (rural-urban) in the study area compared to the other towns. According to the statistics, 71.58% of

Table 1. Immigrants entered and exited during consecutive census.

Census year	Entered immigrants	Exited immigrants	Net immigration
1986–2006	148,946	302,156	153,210
2006–2011	65,079	72,480	7,401
2011–2016	154,278	171,892	17,614

Note: Iran Statistical Yearbook.

Table 2. Reasons for emigrating from the province according to the results of the last census of 2016.

The cause of immigration	Immigrants number	Immigrants percent
Following the family	7,945	45.10%
Education	2,384	13.53%
Access to more appropriate accommodation	2,122	12.05%
Performing or terminating military service	1,533	8.70%
Finding a job	1,068	6.07%
Job transfer	765	4.34%
Finding a better job	642	3.65%
Completing education	163	0.93%
other	992	5.63%
Total	17,614	100

Note: Iran Statistical Yearbook.

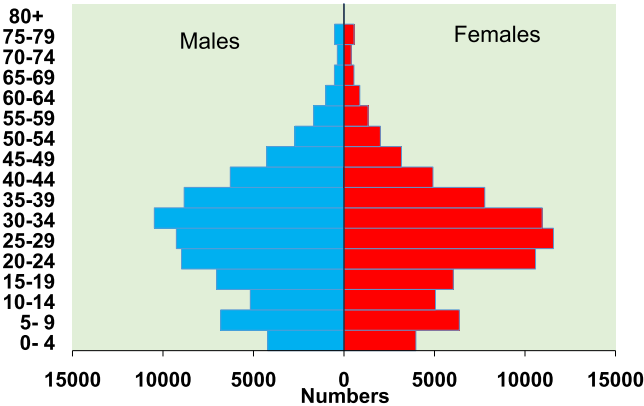


Figure 5. Age composition of immigrants from East Azerbaijan province in 2016. (Iran statistical yearbook).

the province’s migration in the last five decades has been from settlements located in the Lake Urmia basin area, while 28.42% of it is related to the other settlements in the province. Therefore, by comparing the statistics, the effects of lowering the water level of Lake Urmia on the rate of migration from the lake basin in the east coast can be proved (Figure 9).

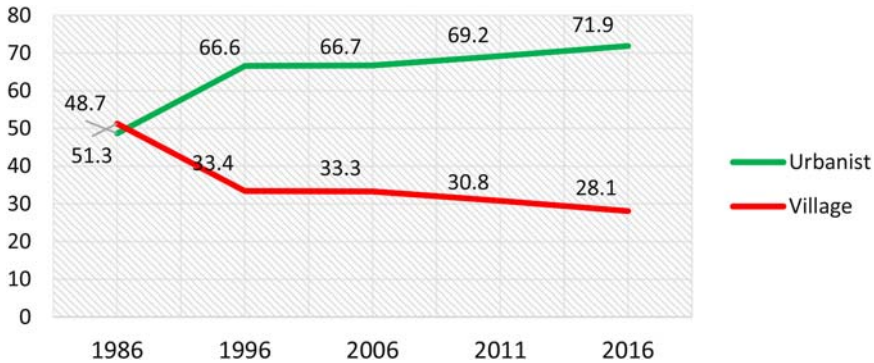


Figure 6. The percent of population in urban and rural areas; in 2016, 71.9% of province population was in urban areas.

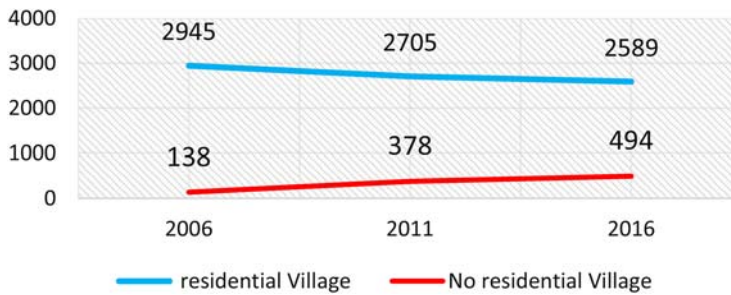


Figure 7. The populated and depopulated villages in the East Azerbaijan Province according to consecutive census.

Investigating the density of rural-urban population in the eastern shore of the lake basin using the kernel density estimation function

One of the important functions of spatial analysis in the geographic information system (GIS) medium is the Kernel density estimation function. This function is able to spatially draw the density of a geographical complication in a region. This function is used in many applications and can draw a zone and an even surface according to the area and type of variable in the region. One of the most important applications of the DENSITY function is in estimating population density at the geographical levels, which has been used to compare rural population density in the Lake Urmia basin during the two census periods of 2006 and 2016 (Figure 10).

The rural settlements on the eastern shore of the Urmia lake basin, which are directly affected by the lowering of the water level of the lake, included a total of 747 villages in 2006, of which 60 villages were completely depleted in the census in 2006. Also, this number has reached a total of 823 villages in 2016, of which 53 villages have been completely uninhabited during the census in 2016 (Figure 11).

Investigating the density of urban population in the eastern shore of the lake basin using the kernel density estimation function

Climate change causes people to emigrate either from remote and coastal areas to the inland areas or from drought-affected farms to cities, while also accelerating urbanisation (IPCC, 1992). Given that urban areas are the destination for more than 90% of rural immigrants, these cities are gradually facing a shortage of facilities and other socio-economic and environmental problems. Therefore, urban areas and demographic changes in these areas, such as rural, are under threat. According to Figure 6, in 1986, the population of East Azerbaijan province was 48.7% urban and 51.3% rural, which in 2006 was 66.7% urban and 33.3% rural. Finally, according to the latest census results in 2016, the percentage of urban population has reached 71.9% and the rural population has reached 28.1%. As statistics show, the urban population is increasing every year. This trend is evident in developing countries. In Iran, this trend is observed in other provinces, but in the Urmia lake basin, this trend has intensified and the number of immigrants from rural to urban areas and depopulated villages in this area is higher

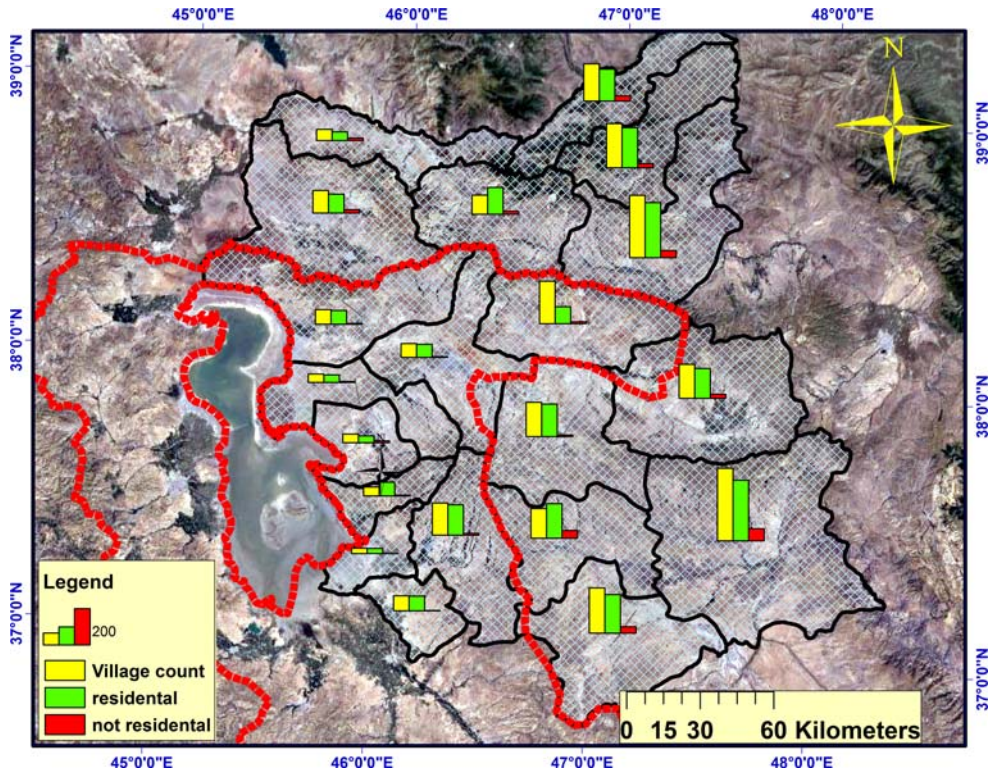


Figure 8. Populated and depopulated villages in the studied towns: (a) Yellow bars represent the percent of rural population in the district, (b) Green bars indicate the percent of populated villages, (c) percent of villages that have lost their population and are now uninhabited.

compared to other parts of the province. In this section, using the kernel density estimation function, monitoring of urban population changes during the two census periods is discussed (Figure 12).

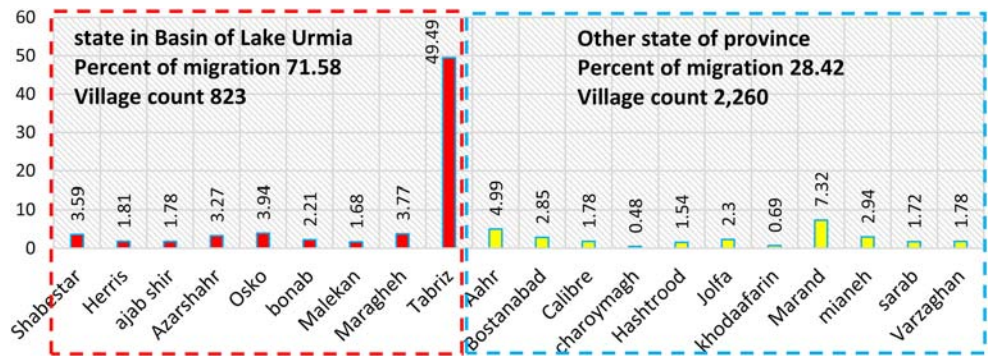


Figure 9. Comparison of the immigrants percent in Lake Urmia basin and the other parts of the province (In total, nine cities of East Azarbaijan province (Shabestar, Heris, Ajab Shir, Osko, Bonab, Malekan, Maragheh and Tabriz) are located in the Lake Urmia basin, which are mostly affected by the changes of this lake. The diagrams show the negative impact of the lowering of the lake’s water level on these settlements compared to other settlements in the province).

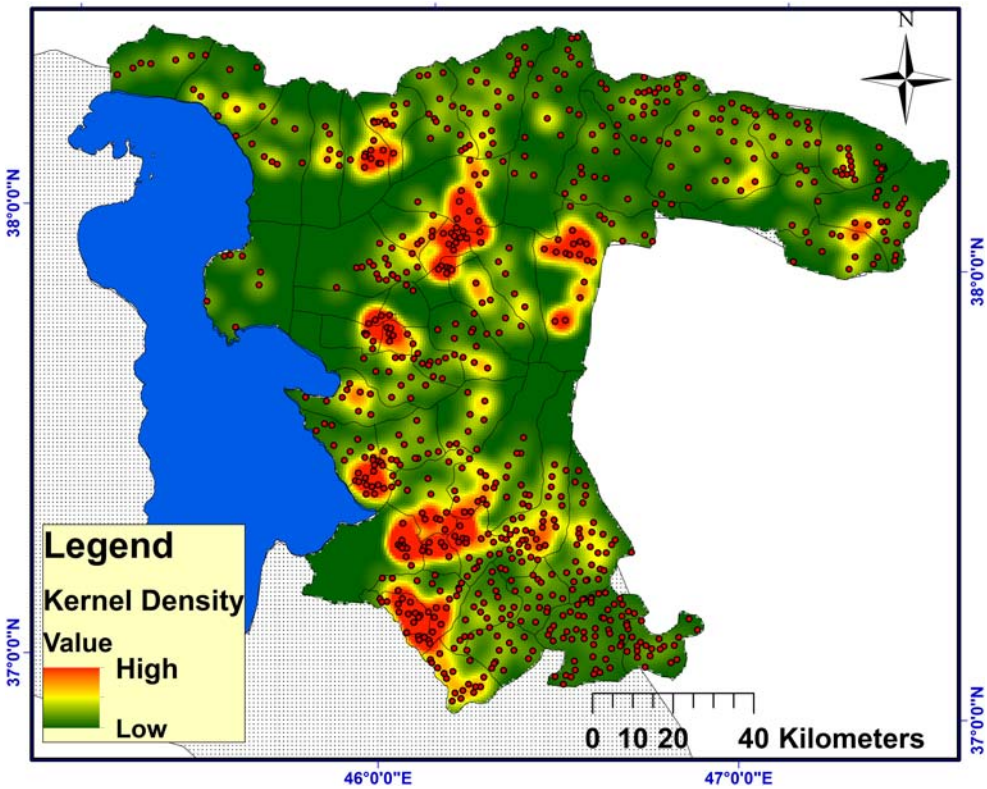


Figure 10. Population density of rural areas in 2006 at the basin (As can be seen in the figure, the population density in some parts of the basin is very high).

According to the 2006 census, the population of 33 urban settlements in the Lake Urmia basin was equal to 1,897,590, and most of these cities have been redefined as urban areas in the last five years, according to the country division rules, and these areas have lower populations (Figure 13).

In the 2016 census, the urban population in the Urmia lake basin was equal to 2,381,486. Over a period of 10 years, about 500 thousand people have been added to cities in the basin. In this year, the number of cities with more than ten thousand people was equal to 15. The population in the other cities has also increased.

Discussion

Water salinity and salt dust caused the migration of residents

According to studies by the Urmia Lake Rehabilitation Headquarters,² the lake's drying up has resulted in deposits of salt sediments and emergence of a bed conducive to formation of dangerous dust during severe storms. Considering the direction of the prevailing winds in the region, which are in the southwest, west and southeast, the probability of damage to the coastal cities of the eastern to northeastern and even northwestern shores of Urmia because of salt storms is very high (Gholampour et al., 2015). Undoubtedly, expansion of the frequency of events and expansion of the salt storms arising from the bed of Urmia

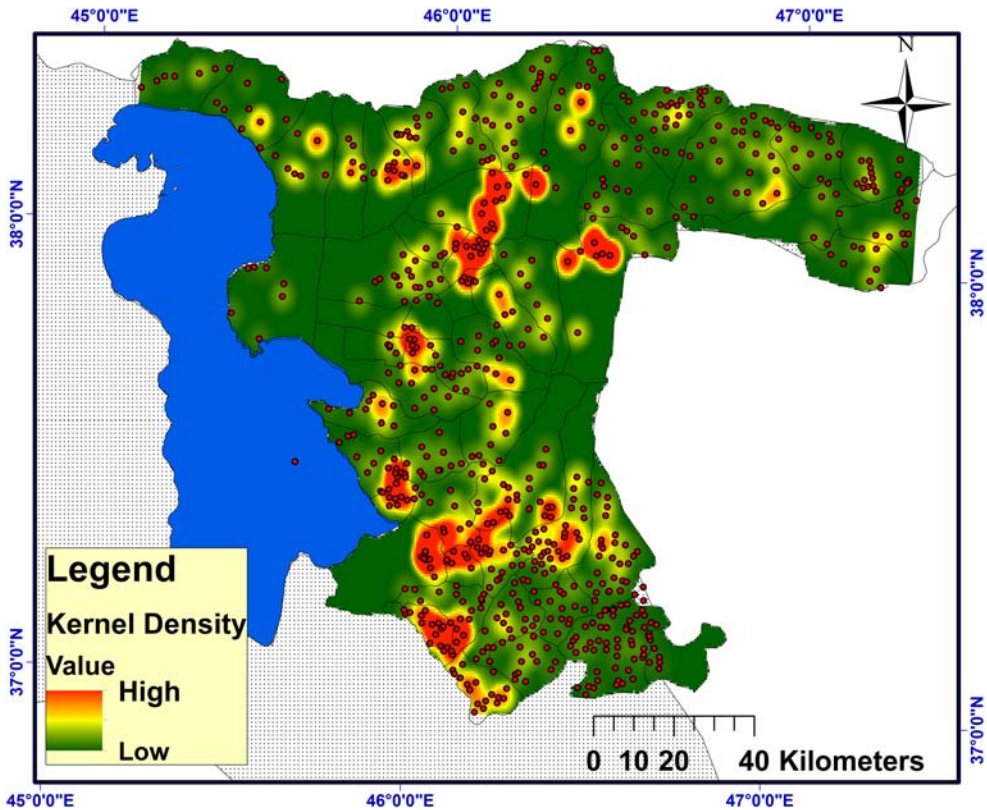


Figure 11. Population density of rural areas in 2006 at the eastern shore of Urmia lake basin (This figure also shows the population density of rural areas in 2016, which compared to 2006 shows a decrease in population density as well as the absence and depopulation of most villages in the Urmia lake basin).

Lake are the most crucial consequences of the drying up of this lake, which is the most obvious cause of threat to human settlements around it. According to the results of (Pezeshki & Firouzi, 2018), salt dust from Urmia Lake could threaten the lives of living organisms and humans living in the region and neighbouring areas in various ways and have many environmental, social and political impacts. These dusts can also pose potential and widespread risks in neighbouring provinces and even in neighbouring countries. Figure 14 shows the area of distribution of possible fine dust if the drying process of Urmia Lake intensifies.

The image above was taken using the buffering command in the ARC GIS software environment. The areas covered by the Urmia Lake fine dust were simulated at four distances of 25, 50, 75 and 100 km from the lake. As shown in the Figure 14, more than 90% of the settlements are located within 100 km of the Urmia Lake, while according to non-experts, if the lake dries up, the surrounding area up to 500 km in radius will be threatened and endangered which, in addition to the northwestern provinces of the country, will include Iran's neighbouring countries. At present, fine dust threatens a large area of the lake basin. The findings of Asghari-Kaljahi et al. (2018) also prove the existence of fine dust in the area and show that the presence of this fine dust is in

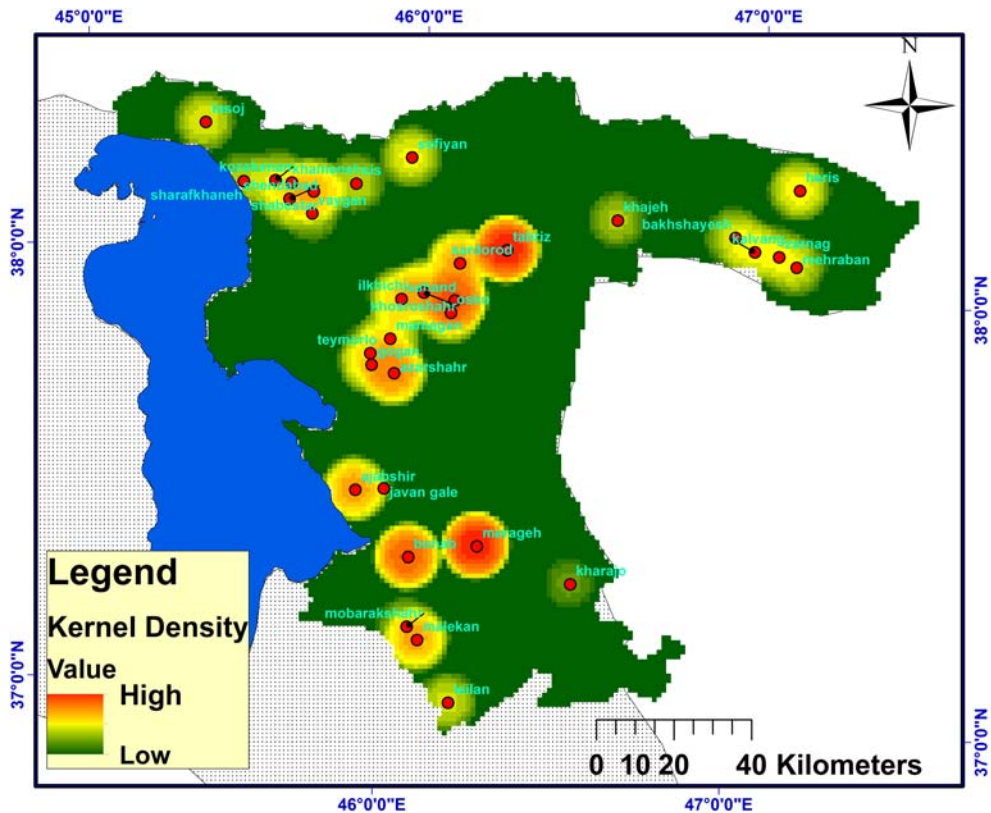


Figure 13. Urban population density in 2016 on the eastern shore of the Urmia lake basin.

in an increase in the unemployment rate and the migration of nearly 3 million people in both East and West Azerbaijan provinces. The findings of Ebrahimzadeh et al. (2014) show that with the destruction of agricultural lands in the Urmia Lake basin, followed by the closure of 34 factories of conversion industries (dependent on lake water and agriculture) in East Azerbaijan province, will exert irreversible impacts on all economic, industrial, social, and cultural areas, and will lead to forced migration of rural people and marginalisation around cities. Given that the economy of East Azerbaijan province is mainly from agricultural section, so the weakness of agricultural potential, mainly rain fed farms and the aggravation of successive droughts have been very effective in the migration of people from rural areas. Also, according to Figure 3, most of the immigrants are young people aged 25–29 and 34–30, who have mostly left these villages to find work and study. To find out from the available data of the Statistics Organization, the status of the different employment sectors in the study area over the past 10 years was evaluated. The composition of employment includes three categories: agriculture, industry and services, which are classified based on the international classification of the economic activities (Figure 15).

According to the results of surveying the labour force in 2019, 21.2% of the province's employees were in the agricultural sector. As shown in the graph, the employment rate in the agricultural sector is declining. As can be seen, in 2009, the employment rate in the

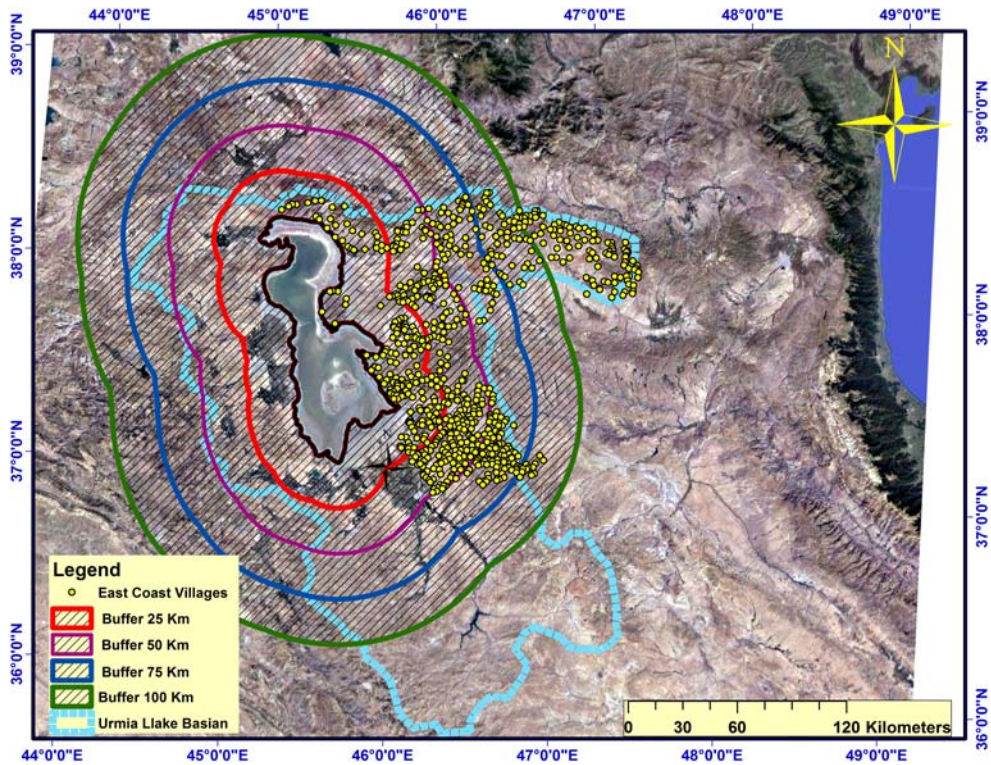


Figure 14. The area of distribution of salt storms from Urmia Lake.

agricultural sector was 25.2%. In contrast, the number of employees in the service sector is increasing every year, as can be seen in the graph. In 2019, a total of 34% of the province's employees were employed in the service sector, compared to 32.4% in 2009. Finally, employees in the industrial sector are declining, as is the service sector. In 2019, 35.7% of employees were employed in the industrial sector. While in 2009 it was 41.5%. Therefore, the industrial sector, like the agricultural sector, is losing employment in the province. This is proof for the increasing migration from villages to urban areas of the region.

The effect of population displacement on urban imbalance

Climate change and extreme weather conditions have three major effects on the urbanisation in the arid areas (areas experiencing the drought), including: increased migration from arid areas to the urban areas, changes in regional economies to reduce the relative share of agriculture and increase the number of cities and towns in these regions (Portnov & Paz, 2008). In recent years, the lack of coordination between the industrial and capitalist population in large cities and provincial capitals in Iran, while causing large cities to take wealth and development opportunities from the small cities, has led to an imbalance in the distribution of facilities, population, etc. Unequal distribution of facilities can be considered as the result of population concentration and activities in special areas which causes severe population movements. The lack of rapid control of this phenomenon will cause the separation of small and medium-sized cities and the

occurrence of migration flows from low level settlement to the high level settlement system, which will gradually create huge problems for the country's residential network, especially in large cities. One of the problems with the concentration of population in some parts of the city, is the disruption of the hierarchical system of settlements (Amakchi, 2004; Clayton et al., 2003). According to demographic data, the urban population in the study area has increased significantly in recent years, which can be considered the period of 1956–2006 as a period of reflection of policies and reform developments in Iran, which is mainly reflected in the urban areas and urbanisation with a significant growth rate of 5.13%, while creating an imbalance in the network and urban system of the country, has caused disruption and contrast in the national system, which has had adverse effects on the spatial development and regional and national planning.

Conclusion

In this study, we investigated the effects of the water level decline of Lake Urmia on population movement and migration. The take-home messages of this study are as follows:

The dust storms, declining groundwater level, and unemployment, especially in the agricultural sector, are the most important and severe consequences of the water level decline of Lake Urmia that has caused people to migrate from this area.

Due to the geopolitical position of these areas (insecure borders with Iraq and Turkey), increased migration due to declining water levels in Lake Urmia these regions will face political and security consequences in the future. Therefore, it seems that planners and policymakers need to consider not only the climatic consequences but also the social, demographic, economic, and political consequences of this change.

Although programmes and measures have been accomplished in recent years to restore the lake and actions were taken towards environmental sustainability, these

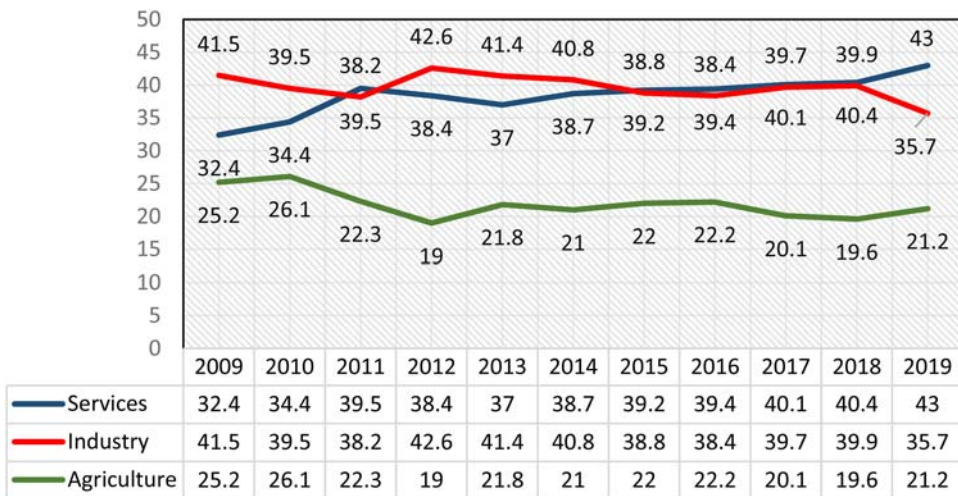


Figure 15. The employment rate at the different sectors over next 10 years.

actions are too slow to achieve the desired conditions of sustainability. Moreover, the results of this study showed that these programmes and measures have not been effective and migration still continues.

In order to avoid migration, (1) collaboration with national and international institutions offering best-practice examples of adapted management to hazards is required, (2) the image of the Lake Urmia region needs to be improved by providing incentives, and (3) Investigation and identification the main roots of migration by using methods such as casual layers' analysis so that for proper planning can be doing to deal with this hazard can be suggested.

Notes

1. Environmental migrants are persons or groups of persons who, predominantly for reasons of sudden or progressive change in the environment that adversely affects their lives or living conditions, are obliged to leave their habitual homes, or choose to do so, either temporarily or permanently, and who move either within their country or abroad (Duncan & Popp, 2017).
2. The workshop of Urmia Lake revival was formed with the objective of applying integrated solutions in the field of lake basin management and presenting several solutions under the responsibility of the Ministry of Energy and in collaboration with the Ministry of Agriculture Jihad, and Planning and Budget Organisation of Iran together with the Department of Environment headquarters in 2013-10-17. They first of all investigated practical solutions to revival of the lake by focusing on the previous studies and views of people in relevant organisations related to Urmia Lake. Next, they presented the results to the council of ministers for final decision making. (<https://www.ulrp.ir/en/>).

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