



Analysis of the Consequences of Reducing Water level in Lake Urmia on the situation of Agricultural Sector in West Azarbaijan province, Iran

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ABSTRACT: Lake Urmia is one of the world's lakes that has overt and covert capacities in its. This lake is located in the eastern part of West Azarbaijan province. Lake Urmia is a favorable environment for creating income, and also we can say a tremendous impact on the region's climate. Loss of Lake Urmia water we can be named as a crisis for agriculture. The main objective of this study is to analyze the economic and social consequences of reduction in Lake Urmia water on agriculture in West Azerbaijan province that has been done by descriptive and survey method. Data was collected by questionnaire and using factor analysis techniques were investigated in the SPSS software. And then items under test were classified into 6 consequence that the financial consequence was identified as the most important factor with eigenvalue of 3.244 which in fact, includes 12.975% of the consequences of reduction in water of Lake Urmia.

Keywords: Lake Urmia, consequences, water deficit, agriculture, Urmia

INTRODUCTION

Lake Urmia in terms of sea level is the twentieth in size and saltiest lake in the world after Dead Sea. The length of the Lake Urmia varies from 130 to 146 km and its width of 58 km to 15 km (between Zambil Mountain and Islamii Island). The volume of water in Lake Urmia in an area of 5 thousand and 822 square kilometers with an average depth of 5.4 meters is estimated to be over 31 billion cubic meters. Lake Urmia Basin has 52 thousand and 47 square kilometers, which is located in the provinces of West and East Azerbaijan, Kurdistan and a very small part in Turkey (Mohammadian, 2012). Agriculture in West Azarbaijan province as a very obvious profession is for people who live in this province. A profession that has always existed in the past, due to favorable climatic variability in the region. Climate changes such as flooding, hail, drought and so on damages the balance of this area, but this has been a short-term climate changes and their effects does not exceed than a few more years. While the subject of this research in relation to climate changes which may be permanent effects on farming and destroy agriculture in the entire West Azarbaijan, these changes is in relation to the crisis that the Lake Urmia is facing with it, that

here, the economic and social effects it on agriculture is discussed.

Lake Urmia is one of the largest lakes supersaturated of salt in the world, located in the North West of Iran, is now at risk of drying up. Recent environmental crisis and the drying up of Lake Urmia is now one of the biggest risks to the country's geological. This lake is located at the lowest point of a closed basin with an approximate area of 52,000 square kilometers, which part of it is located in Kurdistan Province. Lake Urmia is a national park and one of the largest sites in Iran that have been introduced as a UNESCO Biosphere Reserve (Lak *et al.*, 2012).

Unfortunately, during the last few years, a widespread drought was dominant in our country, so that during 3-4 years, many ponds and small lakes were dry and the lake water level dropped significantly. Decrease in precipitation and increase in evaporation of water was caused the salinity of the Lake Urmia water reach up to 300 grams per liter. The Lake Urmia became smaller and smaller and due to the coastal retreat (up to tens of kilometers), salt marsh were formed in large areas around the lake. Unfortunately, in recent years the formation of salt marsh has spread even in central areas of the Lake Urmia.

So that a major part of its areas are drying up and a huge mass of salt is remained on the bottom and in fact, the lake is transforming into a salt desert in the middle of the green provinces of West Azarbaijan, East Azarbaijan and Kurdistan. Even thought about this issue is a very difficult and unpleasant.

Soltani and Karbasi (2002) research on the executive role of legal regime of the Helmand River in moderating Sistan drought found that limitations of water resources, particularly drought, is the main cause of the mass exodus of villagers to the city. If the villagers are facing with water shortages, families are forced to migrate collectively. Drought and lack of access to sufficient water, causing a sharp drop have been in the production of agricultural products, especially wheat. This problem has been more severe in the lands for dry farming as the majority of the area under cultivation in the region has been allocated to this product.

Lack of water and rain have exacerbated the loss of pasture and vegetation cover and its consequences has affected to parts of economic, social and environmental factors. Most of these consequences cannot be estimated with money because farmers in addition to the loss of work and income, social security will also lose, and continuation of life will be difficult for the villagers and the migration of rural households will lead to marginalization in the cities and also other economic and social problems (Rashidpour, 2004).

In a study of Akhtari and Mehdian (2006) that carried out in relation to the spatial analysis of drought indices in Tehran province, they concluded that effects of ecological, economic, social and political due to drought is a function of the size of the area affected, duration, intensity, time and sequence of droughts and the degree of vulnerability of the environment and human. In addition, negative and obvious results from severe and periodic drought are: reducing the superficial flow, drop the static level, Reducing soil moisture and atmosphere, intensifying evaporation and water requirement for plants, algae growth and water scarcity in agriculture and industrial sectors, soil erosion, urban problems, destruction of agriculture and livestock, weed and insect infestations, decreasing food products, reduce the level of health and nutrition and in the end, poverty, economic and social ravages such as inflation, increasing imports and external debt and deficit of trading balance.

Despite thousands of years long efforts, not only still is remaining vulnerability of the effects of drought and water shortages, but in some countries for various reasons is increasing. Palash and Kardavani (2010) carried out a study on drying up of Hamoon Lake, they concluded that with the loss of this lake were unemployed thousands of farmers and fishermen, and if

it is not organized their employment, Sistan will lose population above and or this population will work in occupations of false. As a result, many social and economic issues and problems will emerge for this event.

Hassanalizadeh (2012) in this regard, stated that drying up or loss of Lake Urmia water utterly off ecological balance of the North-West of the country. It changes climate and direct impact on the mentality of people who for years have lived by the lake and will cause the migration of million people of them. The existence of this lake so far has led to the development of coastal properties in the mountainous region and weather modification.

Husary (2002) was conducted a study using qualitative research and PRA techniques and have concluded that the distribution of population, economic activity and social issues is strongly influenced by water access. Based on this research, rural migrants a major causes of themselves migration know lack of access to sufficient water for agriculture and drinking due to drought. If provide access to water, land owners often return to the village. The main factor the conflict between rural families and reducing participation in group activities and reducing the general level of life in the region is drought and as a result is water shortages.

Knutson (1998) carried out research on how to reduce the risk arising from drought and he concluded that drought is severe shortage than normal, if take more than one season or a long time period, this phenomenon will effects upon the economic and environmental sectors. Karami *et al* (2006) pointed out that the definition of drought is not absolute and in any region is defined for it area as particular. Any drought is different in terms of intensity, duration and extent. In general, the drought can be considered equivalent to a period of dry and abnormal weather that lasted long enough to create a serious imbalance in the status of hydrological one area.

Liu *et al.*, (2008) stated that at present one of the major concerns of global is drought, water scarcity and its impact on agricultural production and economic development. Campbell *et al.*, (2010) stated that the water crisis caused by drought, such as drying up lakes or rivers has caused that this crisis is not considered as a serious phenomenon for farmers. But the complexity of underlying factors, and intertwined negative consequences arising from this, this phenomenon has become into one of main concerns of farmers residing in areas with critical situations.

Knuston *et al.*, (1998) pointed out that drought has certain consequences or effects. Sometimes the effects are synonymous with the consequences. The effects are signs of vulnerability. Drought has high impact on social and economic standards.

Direct effects of drought include a wide range, such as loss of production, reduction in water levels, increasing the risk of fire, raising livestock and wildlife mortality. But also drought has indirect effects such as reducing crop yields, rising prices for food, unemployment and migration. Ebadat (2010) in this regard states that created dust from drying up salt lakes can be a reaction to changes in the Earth's vegetation cover, so in this respect should not be overlooked the role of human activities on top the natural conditions of geographical environment. The effects of dust may be continued to a distance of 4000 km from the main source and lead to adverse effects of environmental and numerous damage in the fields of agriculture, industrial, transport and communication systems. In addition to settling many elements, the dust may lead to deposition of soluble salts in the soil and thus create widespread salinization. For example, it can be noted that direct effect of dust particles is on the amount of radiation and its indirect effect is on the level of carbon dioxide and biochemical cycle in the atmosphere.

Kaskaoutis (2008) states that drying up Salt Lake which causes to spread salt in the air, typically, speed climbing the particles in the storm increases to few meters per second. By this phenomenon, fine particles can be suspended a long time before the sediment in the air and also travel a great distance. It mostly occurs in April and leaves negative effects on human societies.

The overall goal of this research is to analyze the consequences of reducing water in the Lake Urmia in West Azarbaijan province on state of agriculture from the perspective of farmers. As well as specific objectives of this research are: Identifying personal characteristics the farmers, Evaluate the economic and social consequences of reducing water of the Lake Urmia in West Azarbaijan province's agricultural landscape that all these issues are examined from the perspective of farmers.

MATERIAL AND METHODS

Methodology this study is from type of descriptive-survey researches and survey instruments in this study is a questionnaire. Context of survey research is the implementation of the questionnaire on a sample of respondents who elected from among the population.

Based on objective, this study has been from type of applied research because we have used from theories, rules and principles and techniques that are codified in basic research to solve actual and executive problems. Also based on the nature and method, this research is from type of relational and causal researches due to discover and explore the relationship between independent variables and the dependent variable. As well as this research has been a descriptive study due to describe the variables. Required data were collected through observation, interviews, questionnaires, extracted from documents and so on and were investigated using factor analysis techniques in the software SPSS. The size of the statistical population the farmers, in cities surveyed were equal to 101,213 (i.e. cities of Urmia, Mahabad, Miandoab, Oshnavieh, Piranshahr and Naghade) and statistical population of agricultural experts in West Azarbaijan province were equal to 1023 persons. The sample size was calculated using the Cochran's formula equal to 155 farmers and 110 agricultural experts. Quantitative data were analyzed using descriptive statistics and factor analysis. In relation to descriptive statistics were used statistics such as mean, variance, mode, standard deviation, maximum and minimum variables. And in general we can say that to explain the status of phenomenon and the issue studied by language of statistics was described visualization.

RESULTS AND DISCUSSION

A. Personalization features the farmers in the province of West Azarbaijan

Results Table 1 shows that most respondents are in the age group 31 to 40 years and most farmers surveyed with 30 percent are in level of primary education. In fact, between what can be concluded from the table is that among 100 literate farmer 30 persons (30%) had a primary degree. As well as more farmers studied (n = 61) with 39 percent are engaged in job of the agriculture. Most farmers studied by 48.3 percent of farmers use from the well to supply its water resources for doing agricultural activities. 35.9% of farmers were working to cultivate apples, in fact, from among 131 respondents' farmer to questions, 47 people are apple growers.

Table 1: Frequency distribution of personal characteristics of the farmers.

Classification of age	Frequency	Percent
Less than 25	20	14.3
25-30	22	15.7
31-40	38	27.2
41-50	36	25.7
More than 25	24	17.1
Literacy levels		
Literate	100	68.49
Illiterate	45	31.51

Education		
Primary	30	30
Guidance	23	23
High school	17	17
Diploma	18	18
Collegiate	12	12
Occupation of farmers		
Agriculture	61	39
Horticulture	54	37
Livestock	22	15.1
Beekeeper	1	0.7
Pisciculture	1	0.7
How to access to water		
River	12	9
Well	113	48.3
Aqueduct	4	3
Rainwater	5	7.5
None	2	1.5
Main crops		
Sugar beet	43	32.8
Wheat	21	16
Corn	10	7.6
Pea	2	1.5
Apple	47	35.9
Other products	8	6.1

B. Prioritization of social consequences of reducing water in Lake Urmia from the perspective of farmers

As can be seen in Table 2, from between consequences caused by reducing water in Lake Urmia, the items described below are important and more valuable than other items respectively, these items are: Increasing tension and stress among farmers (CV = 0.254), Exacerbating poverty among farmers (CV = 0.256), and

the tendency to false jobs (CV = 0.288). This means that farmers these three items have been described as the most important factor and social consequences to reduce water in Lake Urmia on state of agriculture in West Azarbaijan province. And also item related to the reduction of collaboration in collaborative work among villagers (CV = 0.445) has the lowest importance than other variables. Other findings are shown in Table 2.

Table 2: Prioritization of items related to social consequences of reducing water in Lake Urmia from the perspective of farmers.

Variables	Mean	Standard deviation	CV	Rank
Increasing tension and stress among farmers	4.07	1.034	0.254	1
Exacerbating poverty among farmers	3.92	1.005	0.256	2
Tendency to false Jobs	3.86	1.113	0.288	3
reducing incentives for agricultural development between villagers	3.54	1.125	0.318	4
Social inequalities related the distribution of inputs such as fertilizer, water, ground	3.92	1.279	0.324	5
reducing job opportunities for farmers	3.38	1.134	0.335	6
Increasing disputes and fights between farmers for having the contribution to supply water resources	3.64	1.242	0.341	7
Strained relations between farmers	2.97	1.086	0.366	8
Increase the amount of migration villagers to cities	2.73	1.085	0.397	9
The disappearance of local organizations	2.87	1.299	0.428	10
Reduction in group collaboration between villagers	2.99	1.332	0.445	11

Likert spectrum: very low = 1, low = 2, moderate = 3, high = 4, very high = 5

Source: research findings

C. Prioritization of items in relation to the economic consequences from the perspective of farmers

As can be seen in Table 3, from between consequences caused by reducing water in Lake Urmia, the items described below are important and more valuable than

other items respectively, these items are: Annually decrease in income of farmers (CV = 0.232), Increase the cost of production of agricultural products (CV = 0.243), and increased investment risk for farmers (CV = 0.246).

Table 3: Prioritization of items in relation to the economic consequences of reducing water in Lake Urmia from the perspective of farmers.

Variables	Mean	Standard deviation	CV	Rank
Annually decrease in income farmers	4.07	0.945	0.232	1
Increase the cost of production of agricultural products	4.1	0.999	0.243	2
Increasing investment risk for farmers	4.03	0.995	0.246	3
Reducing agricultural crop yields	4.08	1.067	0.261	4
The disappearance of tourism industry	3.95	1.139	0.288	5
Increasing debt to government agencies	3.78	1.135	0.300	6
The disappearance of agricultural jobs	3.77	1.138	0.302	7
Change in exploitation regime	3.64	1.170	0.321	8
The devaluation of the assets of villagers	3.57	1.158	0.322	9
The disappearance of agro-based manufacturing industries	3.54	1.168	0.330	10
The disappearance of agricultural products due to soil salinity caused by wind erosion	3.76	1.279	0.340	11
The disappearance of irrigated farming land and its conversion to dryland	3.73	1.287	0.345	12
Increasing indebtedness to individuals	3.03	1.296	0.428	13
Reduction wages in the agricultural sector	3.1	1.355	0.437	14

Likert spectrum: very low = 1, low = 2, moderate = 3, high = 4, very high = 5

Source: research findings

This means that farmers these three items have been described as the most important factor and social consequences to reduce water in Lake Urmia on state of agriculture in West Azarbaijan province and also item related to And the reduction of wages in the agricultural sector (CV =0.437) has the lowest importance than other variables. Other findings are shown in Table 3.

D. Results obtained from factor analysis of the consequences of reducing water in Lake Urmia

To analyze the consequences of the reduction of water in Lake Urmia was used from factor analysis method. Calculations done from the perspective of experts and farmers showed that the internal consistency of the data was appropriate, (KM0 farmers=0.753) and Bartlett's statistic was significant at level 5%, which represents a very good position of the data for entering the factor

analysis. After a factor rotation by varimax method, items studied were divided into six factor.

Based on Table 4, the findings of the factor analysis of the items related to the consequences of reducing water in Lake Urmia from the perspective of farmers indicate that highest eigenvalue is related to the first factor at about 3.244 and is explained 12.975% of the variance related to the economic consequences of reducing water in Lake Urmia. The eigenvalues of second factor is 3.019 and explain 12.364% of variance. Other factors along with the eigenvalues, percent of variance associated with each factor can be seen in Table 13. The sum of these factors is equal to 65.600%. This means that the six factors explain 65.600% of the consequences of reducing water in Lake Urmia on Western Azerbaijan province's agriculture.

Table 4: Extracted factors along with eigenvalues, percent of variance and variance cumulative percentage.

R	Factor Name	Eigenvalues	% of eigenvalues variance	% of total factors
1	First factor	3.244	12.975	12.975
2	Second factor	3.091	12.364	23.340
3	Third factor	2.953	11.812	37.151
4	Fourth factor	2.581	10.322	47.473
5	Fifth factor	2.482	9.927	57.400
6	Sixth factor	1.050	8.200	65.600

In Table 5, it can be seen the factors along with items related to each factor with their coefficients which has been named based on the placement of items in each factor.

According to the farmers and experts in most villages of West Azerbaijan province, most of the villagers are engaged in agricultural work, and the only work that comes from a farmer is cultivate crops and depends on all their assets to this thread. So when agriculture wiped out due to any factor or suffers from a risk, consistently

reduced the income of farmers and lead to poverty them. This result is consistent with research Palash *et al.* (2010).

The villagers, mostly due to their temperament and attitude to the ancestral life are not willing to leave their homes (in the villages studied) but they are involved in jobs such as smuggling and these jobs have been replaced instead of farming.

Table 5: Factors along with items related to each factor with the amount of their coefficients.

Factor Name	Variables	coefficients
1. financial consequence	The devaluation of the assets of villagers	0.529
	The disappearance of agricultural jobs	0.558
	Increased investment risk for farmers	0.664
	Reduction in wages in the agricultural sector	0.665
	Increased debt to governmental organizations	0.722
	Increasing disputes and fights between farmers for having the contribution to supply water resources	0.647
2. Environmental and social consequence	Tendency to false Jobs	0.722
	Social inequalities in the distribution of inputs such as fertilizer, water, ground	0.687
	Exacerbating poverty among farmers	0.515
	Increasing tensions and stresses among farmers	0.534
	The disappearance of tourism industry	0.690
	Increase the amount of migration villagers to cities	0.658
3. The consequence of the disruption of rural solidarity	Reduction in group work among villagers	0.658
	Strained relations between farmers	0.649
	The disappearance of local organizations	0.758
	Annually decrease in income farmers	0.601
4. The consequence of Farm Production Management	Increase in the cost of production of agricultural products	0.608
	The increasing indebtedness to individuals	0.757
	Reduced agricultural crop yields	0.656
	Change in exploitation regime	0.810
5. Agricultural structural consequence	The disappearance of irrigated farming land and its conversion to dryland	0.809
	The disappearance of crops due to soil salinity caused by wind erosion	0.755
6. The consequence of declining motivation among farmers	Reducing incentives for agricultural development between villagers	0.614
	Reducing job opportunities for farmers	0.536

According to many farmers Reducing water in Lake Urmia has been a pretext for smuggling, or rather the farmers in the city to carry out activities such as the colportage and after the earn money return to the villages at night. This finding is compatible with work Khosh Akhlagh *et al.*, (2010). In relation to the economic consequences of reducing water in Lake Urmia views of experts and farmers on the importance of consequences varies with each other and more farmers have emphasized on issues that as follows:

Farmers believe that their income is affected by many factors, one of which is reduction of Lake Urmia water, so that when Lake Urmia water has decreased the amount of underground water has also been reduced (The results of research in relation to the personal characteristics of farmers on how to use water resources, more than 70% of farmers from underground water sources such as wells they use). When water is not available to farming as a main factor, then Agriculture will not be as well. This findings is compatible with Rashidpour (2004).

According to a lot of farmers, at present, for access to underground water than in the past, they must be delved deeper land that it has led farmers to pay more costs for agricultural inputs (fuel, labor, pipes, etc.). This findings is compatible with Rashidpour (2004).

Farmers have seen the consequences of reducing water in Lake Urmia from the economic point of view and they believe that the economic consequences of reducing water in Lake Urmia is 23.868% and its social consequences is 15.764%. This means that a total of 39.632%, reducing water in Lake Urmia has been the economic and social consequences. From the perspective of farmers, destroying rural economy is a fundamental consequence of the reducing water in Lake Urmia that creates social consequences. In fact, farmers believe that as long as it is not meet their economic needs, it cannot focus on the social needs. According to Maslow's theory as long as the basic needs of a community is not satisfied then it cannot meet the needs of the other.

RECOMMENDATIONS

Solutions that can be offered from the perspective of farmers in relation to the mitigate the effects of the crisis of Lake Urmia on state of agriculture include the following:

1. The equal distribution of inputs like water, fertilizer, pesticides, and land between villagers and farmers
2. Increasing job opportunities for villagers

3. State aid as compensation, an increase in credit insurance, subsidies for agricultural inputs
4. Improvement of irrigation and drainage systems to improve water efficiency
5. Other approaches that can be effective in relation to reducing the effects of the crisis of Lake Urmia include: The use of correct procedures for agricultural operations such as time management, irrigation, fertilization, tillage, etc., improving irrigation and drainage systems to increase water efficiency, enhanced welfare facilities in the rural sector, technology and mechanization of agriculture, using a strain resistant to salinity and dehydration, changes in how culture and type of cultures, salt washing from farms to increase crop yield, coexistence with water crisis in Lake Urmia and promoting public organizations.

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