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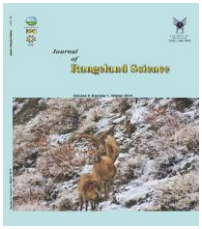

Research and Full Length Article:

Climate Change Impact on Quality of Life Indicators of Pastoralists (Case study: Rangelands of Haraz River Basin, Mazandaran province, Iran)

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Abstract. Climate changes pose great threats to the main services of ecosystems such as food security, water security and health. This research was carried out in Haraz river basin rangelands, Mazandaran province in the north of Iran in 2015-2017 to analyze the perspectives of Haraz river basin (HRB) pastoralists about climate change. From 5236 local pastoralists, the sample size was consisted of 350 ones based on Cochran formula. This study was conducted in 130 custom units (Samane Orfi) in HRB. At first, a questionnaire with 13 main criteria and 31 indicators related to quality of life was prepared and filled by local pastoralists. Cronbach's alpha was varied from 0.72 to 0.88. Independent indicators were compared via Mann-Whitney U test using SPSS 16. Rangelands of HRB were divided into two parts due to having a wide variety of environmental factors and management. Most of pastoralists believed that climate changes occurred in HRB and also, there was a strong convergence between the perspectives of two pastoral groups (pastoralists of Baladeh and Larijan) with long-term trends in all weather stations about changes in climate characteristics. The results of Mann-Whitney U test showed that pastoralists perceptions of climate change impact on quality of life indicators differ significantly in terms of increased migration, anger, frustration, conflicts between the pastoralists, decreasing sympathy, reduced sense of responsibility between pastoralists, reduced pastoralists′ participation in the range management actions, reduced effective participation in the improvement measures, increased distance between livestock pen and water resources ($p<0.01$) and reduced food intake regardless of health and management of livestock diseases and loss of social cohesion ($p<0.05$). It means that two groups believed that these indicators have been affected by climate changes with different weights. But no significant differences were observed for other indicators. The most important impact of climate changes from the perspectives of Baladeh pastoralists was on water quantity, migration, job insecurity, future expectancy and social conflicts with coefficient of variations of 0.207, 0.22, 0.297, 0.299 and 0.30, respectively with negative impacts. Larijan pastoralists believed that climate changes had the most important impact on migration, water quantity, future expectancy, social conflicts and job insecurity with coefficient of variation involving 0.26, 0.263, 0.277, 0.29 and 0.323, respectively with negative impacts. Although proper interpretation of regional climate change pattern is provided by pastoralists, extension services and increasing social awareness associated with global warming and climate changes should be prepared to cope with potential future threats of climate changes.

Key words: Climate Changes, Socio-economic Impact, Water Scarcity, Quality of Life Indicators

Introduction

Climate changes pose great threats to the main services of ecosystems such as food and water security and human health (McCarthy *et al.*, 2001; Lukenga, 2015). Declining rainfall and increasing temperature threaten the ecosystem services that support the livelihood of local people (Saadatfar *et al.*, 2013). Rangelands provide important livelihood support to the majority of local people of Iran. Most stakeholders are dependent on ecosystem services like forage for livestock, water supply and medicinal plants for their life. The fourth assessment report of the Intergovernmental Panel on Climate Changes (IPCC, 2007a) reported a severe impact of climate changes on mountain ecosystems because of its sensitivity to warming. It also suggests that Asian countries are likely to suffer from many extreme events such as droughts, floods, and glacier melts and will have negative impact on natural resources. Mountain communities are more vulnerable to environmental changes and also have a limited access to other resources, which means they have a lower potential for adaptation to these changes.

Increasing temperature affects both local people and livestock. Notably, the spring's discharge has decreased as compared to the past (Egeru, 2012). Environment is changing due to the impact of development and anthropogenic climate changes (IPCC, 2013, 2007b). Climate changes are predicted to pose a greater health risk and negative socio-economic impact on local people because of their high dependence on natural resources and residence in areas where the environment is changing quickly (Ford, 2012; Lukenga, 2015). The increasing biophysical vulnerability causes negative impact on livelihood, health, food and water security (streams and springs). Health as an element of life is an important issue for the IPCC. Climate change has negative impact on mental, emotional, spiritual, social, and physical health (Agata *et al.*, 2015; Lukenga, 2015). Taghdisi and Ahmadi Shahporabadi (2012) reported the migration of people from rural areas as one of the most challenges of rural development from the viewpoint of sustainable development in Iran, which weakens the rural economy and culture and makes agricultural employees older and have caused the instability of the situation in rural areas. Migration has greater negative impact but what should be considered is that the psychological effects of migration on stakeholders who stayed in rural areas are more important than financial impact. Khosh Akhlagh *et al.* (2010) investigated the role and effect of climate changes on the climate comfort in Yazd, Iran. The results of their study showed that the warming trend in Yazd synoptic station was increasing and most of the months had warming trend. So, it is expected that in the near future, cold months will have more comfortable condition, but temperature will increase in the warm months.

Local people and their knowledge play an important role in adaptation strategies due to climate changes and climate variability. Since local pastoralists live close to natural resources, they observe changes around them quite soon after they identify and adjust activities to adapt to these changes. Local pastoralists have developed a strong tradition of using rangeland resources balancing supply and demand. Rich and diverse types of traditional and local range management actions are found throughout Iran according to different cultures and socio-economic settings. Most of these actions are adaptive, flexible and low cost. According to International Association of Public Participation (IAP2, 2007) and Fig. 1, public should be first provided with balanced and objective information to assist stakeholders in understanding the problems (Inform) to cope with climate changes, and then to obtain

feedback on analysis (Consult); next level is working directly with the public throughout the process to ensure that public issues and concerns are consistently understood and considered (Involve). Then, it is to be partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution (Collaborate) and ultimately place final decision-making in the hands of the public (Empower). It means enabling local people to obtain the knowledge and skills necessary to participate totally in the climate change adaptation actions.

Fig. 1. International Association of Public Participation Spectrum moving from top-down (left) to increasingly engaged processes of community participation (International Association of Public Participation, 2007).

The aims of this study was to analyze climate change perception from the perspective of HRB pastoralists and climate change impact on pastoralists' quality of life indicators and to recommend how local adaptation practices can be integrated with programs or policies to strengthen the climate resilience of HRB stakeholders.

Materials and Methods

Study area

Haraz River Basin (HRB) is located in the Mazandaran Province in north of Iran (51°43' to 52°36'E and 35°45' to 36°22'N) (Fig. 2). HRB originates from Alborz mountain ranges and flows into the southern coast of the Caspian Sea. It has 230-5670 m altitude above sea level. It has 4079 Km^2 area with average annual precipitation between 302 (almost in central parts) to 1069 mm (in the eastern part). Also, the average temperature of the region varies from 5°C to 23.1°C. The average annual temperature is about 8°C. The HRB is the main source for agriculture activities particularly in downstream areas of the basin considered as one of the richest districts for summer rangelands in Iran.

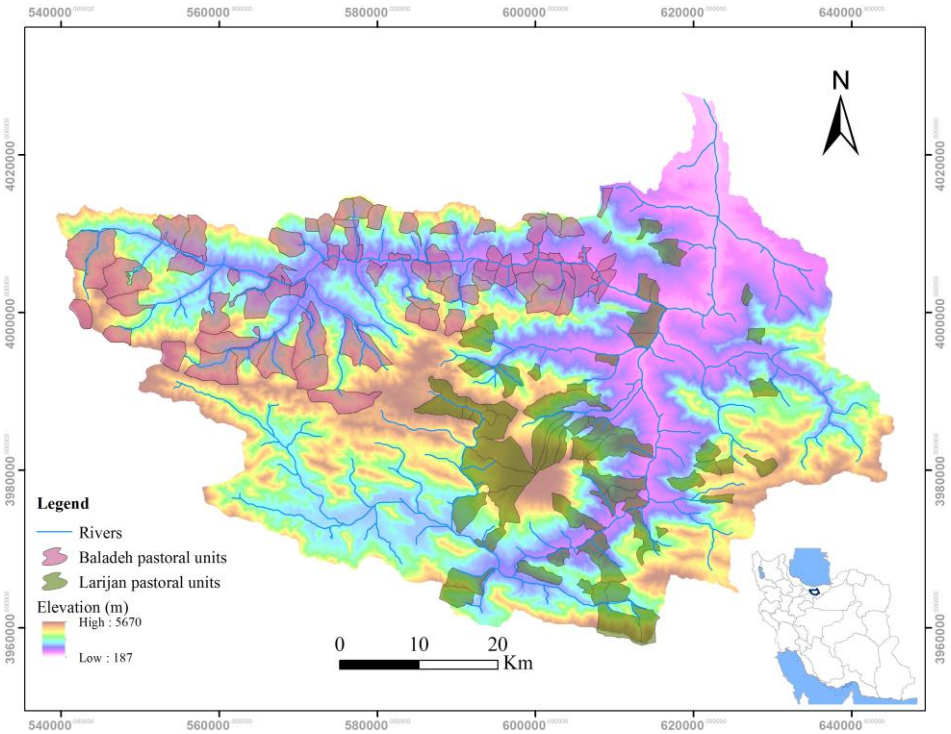

Fig. 2. Location of Haraz river basin and custom units

Data Collection

Preliminary data series were collected in the spring of 2015 and the main data series were obtained in 2015-2017. In consideration of the aim of the study and its conceptual framework, indicators were determined by in-depth interviews with local pastoralists, experts of natural resources and watershed management office of Mazandaran province, field visits and scientific literatures (WHOQOL, 1993; Raphael, 1996; Cummins, 1997; Bloom *et al*., 2001; Hagerty, 2001; Bucknell, 2002; Hayati *et al.*, 2006; Rezvani and Mansourian, 2007; Bruggemann *et al.*, 2007; Weingaertner, and Moberg, 2011). Thirty questionnaires were filled randomly in order to test reliability and consequently, the weaknesses of questionnaire were investigated and then solved (Cronbach's alpha varied from 0.72 to 0.88). Ultimately, the final questionnaires were filled by pastoralists based on multistage cluster sampling between local stakeholders of Baladeh and Larijan rangelands in Mazandaran province regarding the impact of climate changes on pastoralists' quality of life indicators. Rangelands of HRB were divided into two parts due to having a wide variety of environmental factors and management. Cochran formula was used for the estimation of sample size (Sarmad *et al*., 1999). Thus, as a sampling community of the pastoralists in Haraz River Basin (HRB), 350 individuals were chosen out of 5236 pastoralists who had grazing license and at least 20 year experience in the region. This study was conducted in 130 pastoral units in HRB. The overall research question was whether climate change has occurred in your area. Then, their perspectives were asked on the impact of climate changes on quality of life indicators. General question of the study was: to what extent climate variables have changed during 20 years? To cover different aspects of rainfall, minimum, maximum and average temperature qualitative questions were prepared. The questionnaire was prepared to cover all questions about temperature to provide an average temperature of the region by pastoralists. Items in form of Likert scale were set as 1(considerably decreased), 2 (somewhat decreased), 3 (no significant change), 4 (somewhat increased) and 5 (considerably increased). In order to determine increasing, decreasing or stable variation patterns, mean and mode of pastoralists' ideas were included as dominant ideas of them. According to the ideas of experts, pastoralists may not remember the climate of regions further than past 20 years, so a severe drought which is well remembered was determined as turning-point. Moreover, previous decade up to 2016 was used for assessing the climate changes. Then, long-term time series of annual precipitation, maximum and minimum temperature of some weather stations were used to provide a better insight to the happening of climate changes in the HRB since foundation up to 2015 (1966-2015). The weather stations with geographical coordinates located in HRB in Iran are presented in Table 1.

Statistical Method

Independent indicators were compared between pastoralists of Baladeh and Larijan via Mann-Whitney U test using SPSS 16. Usually, the Mann-Whitney U test is used when data are ordinal or when the assumptions of the t-test are not met. Criteria and indicators used in the research were as follows:

- Poverty (an increase in rural poverty);
- Food insecurity (hunger, increased food prices, increased food costs per month, decreased access to the food, reduced food intake);
- Social insecurity (feeling of powerlessness, social isolation);

- Health insecurity (illness and physical weakness, neglect in health care and animal disease control);
- Migration (increased migration);
- Health (depression, anger, sadness, frustration, anxiety, drug addiction, disease increases);
- Social conflicts (conflicts among pastoralists, distrust index, social status degradation, loss of social cohesion);
- The level of cooperation and assistance in custom units (decreased sympathy, reduced sense of responsibility between pastoralists);
- Social participation (reduced participation between government and pastoralists, reduced effective participation in the improvement actions)
- Water quantity (increased distance between livestock pen and water resources);
- The income continuation (income reduction from livestock, fluctuations in income from livestock);
- Job insecurity (fear of losing jobs);
- Hope for the future (reducing optimism about the future).

Highest impact of climate changes is ranked using the coefficient of variation of total indicators related to each criterion. In this study, Likert scale is used to measure different indicators of climate change impact on local pastoralists.

Table 1. Weather stations with geographical coordinates located in HRB in Iran since foundation up to 2015

Order number	Stations	Latitude (N)	Longitude (E)	Altitude (m)
1	Karehsang	52° 22'	36° 12'	220
2	Baladeh	51° 47'	36° 12'	2120
3*	Rineh	52° 04'	35° 53'	860
4	Panjab	52° 16'	36° 05'	2120
5	Razan	52° 10'	36° 11'	1640
6	Baijan	52° 17'	35° 59'	2240
7**	Ab Ask	52° 08'	35° 52'	1550
8	Namarestagh	52° 05'	36° 06'	2547

* Data are available from (1985-2008)
** Data are available from (1970-2007)

Results

Descriptive statistics of individual characteristics are presented in Table 2. Most of pastoralists (90.7% in Baladeh and 87% in Larijan) believed that climate changes have happened in HRB (Table 3). There was strong convergence between perspectives of the two pastoral groups about climate changes for annual rainfall and temperature (Tables 4 and 5). They believed that the number of rainy days decreased in all seasons. Amount of rain in autumn and spring and average annual precipitation decreased. But their opinions showed short and erratic rain in spring and summer seasons increased (Table 4). Also, their ideas indicated that the night temperatures decreased in spring and summer. But their opinions showed spring and summer temperature and average annual temperature increased (Table 5).

Table 2. Descriptive statistics of individual characteristics

Variable	Variable level	Baladeh%	Larijan%	Total%
Age	40-50	13.7	11.4	12.9
	51-60	43.6	47.2	44.9
	61-70	36.6	35.8	36.3
	>70	6.2	5.7	5.9
Education level	Illiterate	33	34.1	33.4
	Primary school	37.9	32.5	36
	Middle school	19.4	22.8	20.6
	High school and higher	9.7	10.6	10
The experience of pastoralism (years)	20-30	27.7	30.1	28.6
	31-40	37	34.1	36
	41-50	24.2	29.3	26
	>50	11	6.5	9.4
Another income sources	Gardening	3.1	4.9	3.7
	Agriculture	18.1	8.9	14.9
	Bee breeding	2.2	0.0	1.4
	Laboring	4.0	2.4	3.4
	Only pastoralism	55.1	60.2	56.9
	Other income sources	17.6	23.6	19.7
Ownership type	Private	19.4	14.6	17.7
	Collective	25.6	73.2	43.7
	Council	52.9	12.2	38.6
Exploitation state	Transhumance	0.0	33.3	11.7
	Semi-sedentary	8.8	40.7	50.0
	Sedentary	91.2	26.0	68.3

Table 3. Pastoralists' viewpoint about the occurrence of climate changes

Pastoralists	**Response**	**Frequency**	**Percent**
Baladeh	Yes	206	90.7
	No	21	9.3
	Total	**227**	**100**
Larijan	Yes	107	87
	No	16	13
	Total	**123**	**100**

Table 4. Mean/Mode values of seasonally and annual rainfall changes according to Pastoralists' viewpoint (1996–2015)

Question	Baladeh		Larijan		Cronbach's
	Mean*	Mode	Mean	Mode	alpha
The number of rainy days in spring (day)	1.39	1	2.20	2	0.84
Amount of rain in spring (mm)	1.41	1	2.37	2	0.86
Short and erratic rain in spring (min)	3.82	4	3.71	3	0.79
Short and erratic rain in summer (min)	4.33	5	4.18	5	0.73
The number of rainy days in summer (day)	1.96	1	2.09	1	0.82
The number of rainy days in autumn (day)	1.88	1	2.27	1	0.78
Amount of rain in autumn (mm)	1.50	1	1.88	1	0.88
The number of freezing days in autumn (day)	1.55	1	1.72	1	0.72
The number of snowy days in winter (day)	2.07	2	2.17	2	0.75
Amount of snow in winter (m)	2.39	1	1.56	2	0.84
Average annual precipitation (mm)	2.12	2	2.45	1	0.85

*=1(considerably decreased), 2 (somewhat decreased), 3 (no significant change), 4 (somewhat increased) and 5 (considerably increased)

Table 5. Mean/Mode values of seasonally and annual temperature changes according to stakeholders' viewpoint (1996–2015)

Question	Baladeh		Larijan		Cronbach's
	Mean*	Mode	Mean	Mode	alpha
Spring temperatures (°C)	4.78	5	4.46	5	0.78
Spring night temperatures (°C)	2.03	2	2.09	2	0.77
Summer temperatures (°C)	4.81	5	4.67	4	0.87
Summer night temperatures (°C)	1.99	2	2.37	3	0.74
Autumn temperatures (°C)	2.39	4	2.67	3	0.80
Winter temperatures (°C)	1.90	1	2.58	2	0.77
Average annual temperature (°C)	4.29	5	4.21	5	0.82

1(considerably decreased), 2 (somewhat decreased), 3 (no significant change), 4 (somewhat increased) and 5 (considerably increased)

Precipitation data analysis revealed that in the most of weather stations, a decreasing trend was found in annual time series as shown in Fig. 3 and Table 6. Also, a decreasing trend was found in autumn, winter and spring but in summer, the precipitation trend happened to be the opposite especially in Baladeh, Panjab and Namarestagh stations.

Maximum temperature data analysis showed seasonal and annual increasing trend in the most of stations but a significant decreasing trend was found in Baladeh station in winter and spring ($p<0.05$). A significant increasing trend was found in seasonal and annual maximum temperature in Karehsang station ($p<0.01$) and in the winter maximum temperature in Rineh station ($p<0.01$). In Baladeh station, only maximum temperature of summer showed a significant increasing trend ($p<0.05$). A significant decreasing trend was found in seasonal and annual minimum temperature in Baladeh station, but the minimum temperature showed an increasing trend in Karehsang and Rineh stations (Fig. 4 and Table 7).

Also, the embrothermic diagram of Baladeh synoptic weather station shows that the drought period of second decade had increased. It means the drought period in the second decade had occurred in April-December whereas the drought period in the first decade had occurred in May-November (Fig. 5).

Table 6. Z values of seasonal and annual precipitation using Mann-Kendall (1966–2015)

Stations	Winter	Spring	Summer	Autumn	Annual
Karehsang	-2.12*	-0.21	-1.17	-2.26*	-2.07*
Baladeh	-0.90	0.31	3.04**	-1.33	0.20
Rineh	-0.07	0.92	0.59	1.16	1.51
Panjab	-2.23*	-2.18*	1.99*	-0.43	-1.21
Razan	-2.78**	-1.43	0.70	-2.35*	-2.09*
Baijan	-0.86	-3.57**	1.63	-1.59	-2.51**
Ab Ask	-1.64	-2.73*	-1.50	-1.05	-2.38*
Namarestagh	1.07	-1.48	2.08*	1.30	0.68

* and ** = Significance at 5% and 1% probability levels, respectively

Table 7. Z values of seasonal and annual Minimum and maximum temperature using Mann-Kendall (1966–2015)

Stations	Winter		Spring		Summer		Autumn		Annual	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Karehsang	1.39	2.87**	1.97*	3.6**	2.97**	3.55**	3.48**	2.89**	3.50**	4.46**
Baladeh	-2.07*	-1.72*	-	-	-2.28*	1.71*	-	1.49	-	-1.44
			3.17**	1.93*			3.33**		3.77**	
Rineh	2.26**	2.16**	2.90**	1.09	3.17**	0.77	1.96	0.47	2.65**	1.21

* and ** = Significance at 5% and 1% probability levels, respectively

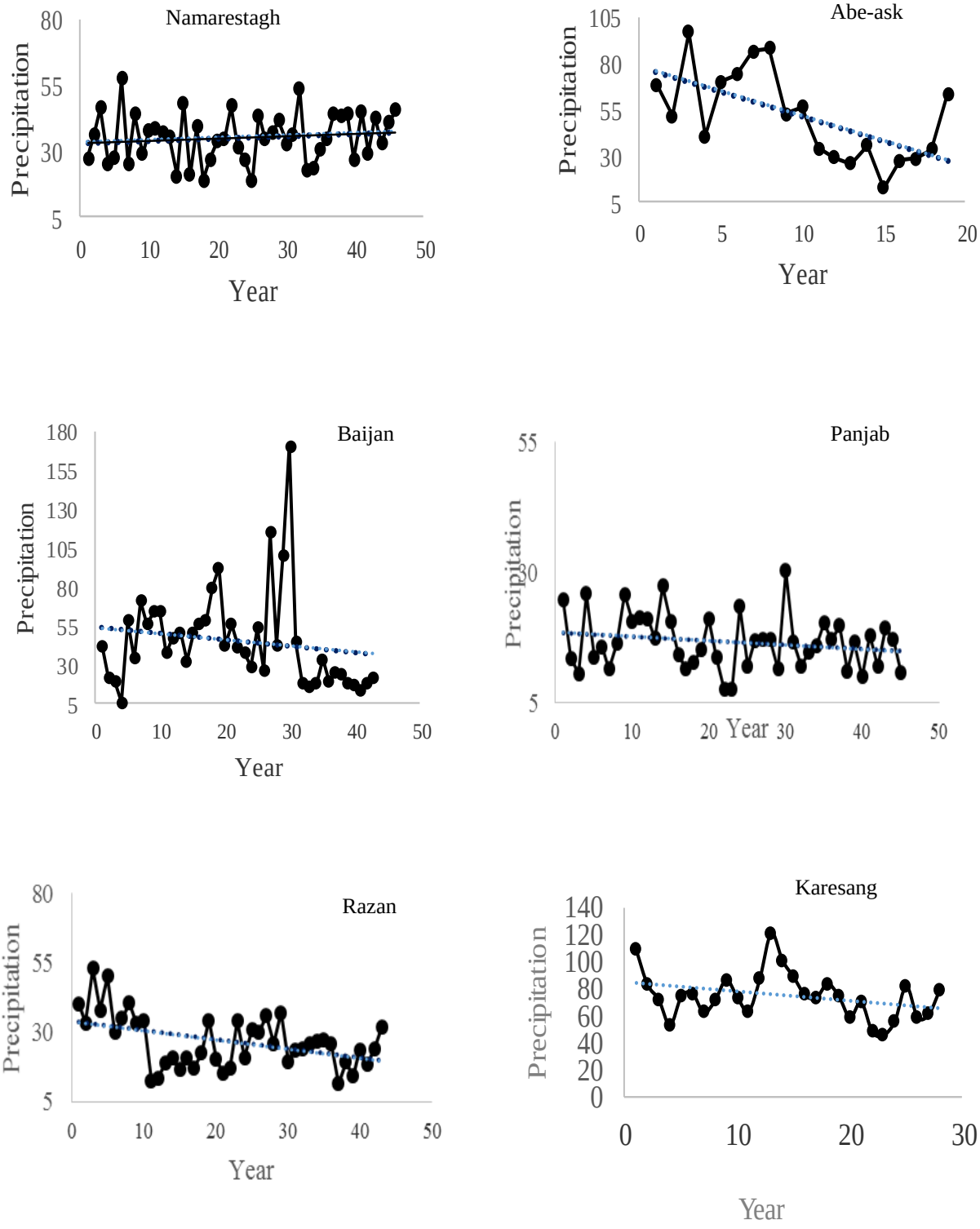

Fig 3. Annual rainfall (mm) time series

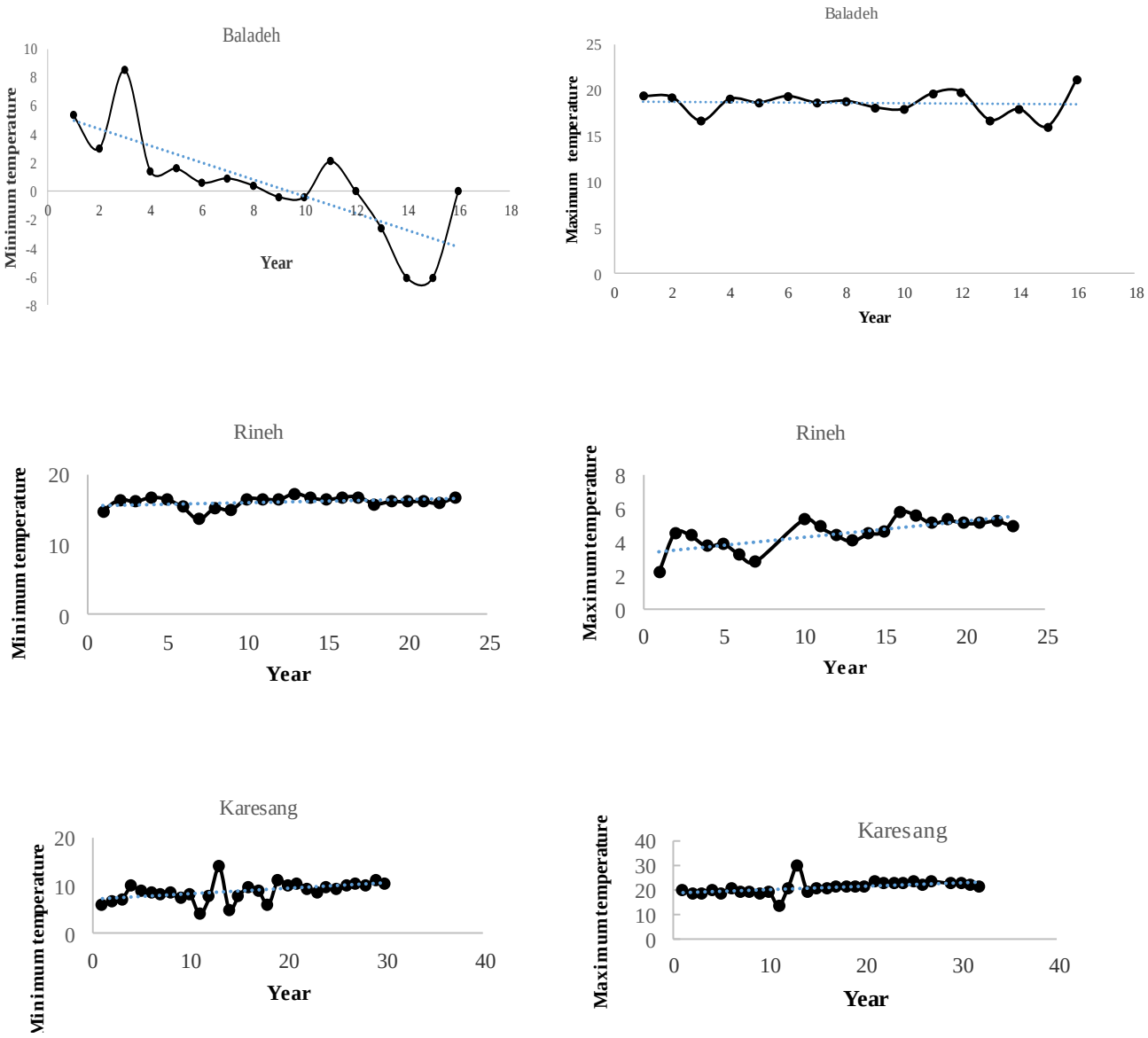

Fig 4. Annual temperature (°C) time series

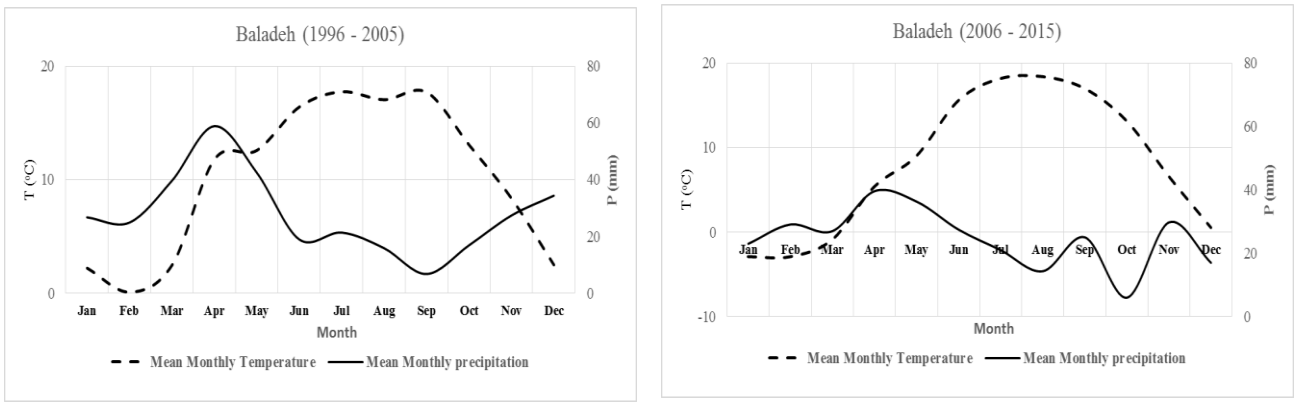

Fig 5. Embrothermic diagram of Baladeh synoptic weather station (1996-2015)

The pastoralists' viewpoint about impact of climate changes on quality of life indicators is illustrated in Table 8. Results showed significant differences between two regions for increasing of migration, the level of cooperation and assistance in custom units, social participation and water quantity ($P<0.01$) and health insecurity ($P<0.05$) but there were no significant differences in poverty, food insecurity, social insecurity, social conflicts, income continuation, job insecurity and hope for the future (Table 8).

The results showed that Baladeh pastoralists believed that climate changes had the highest impact on water quantity, migration, job insecurity, future expectancy and social conflicts with coefficient of variation of 0.207, 0.22, 0.297, 0.299 and 0.30, respectively with negative impact (Table 9).

Larijan pastoralists believed that climate changes had the highest impact on migration, water quantity, future expectancy, social conflicts and job insecurity respectively with coefficient of variation of 0.26, 0.263, 0.277, 0.29 and 0.323, respectively with negative impact (Table 9).

Table 8. Impact of climate changes on pastoralists' quality of life indicators

Criteria	Indicators	District	No.	Mean	SD	Z	Sig.
Poverty	An increase in rural poverty	BA	227	3.70	1.17	-1.71	0.09 ns
		LA	123	3.46	1.26		
Food insecurity	Hunger	BA	227	2.56	1.26	-0.58	0.56 ns
		LA	123	2.71	1.49		
	Rising food prices	BA	227	3.16	1.31	-0.43	0.67 ns
		LA	123	3.1	1.38		
	Rising food costs per month	BA	227	3.52	1.27	-1.38	0.17 ns
		LA	123	3.71	1.23		
	Decrease access to food	BA	227	2.42	1.12	-1.11	0.26 ns
		LA	123	2.27	1.02		
	Reduce food intake	BA	227	2.44	1.14	-2.49	0.01 *
		LA	123	2.13	1.08		
Social insecurity	Feeling of powerlessness	BA	227	3.23	1.12	-1.67	0.09 ns
		LA	123	3.02	1.15		
	Social isolation	BA	227	3.04	0.95	-0.85	0.39 ns
		LA	123	2.94	0.99		
Health insecurity	Illness and physical weakness	BA	227	3.14	1.18	-0.85	0.40 ns
		LA	123	3.05	1.08		
	Disregard for health and management of livestock diseases	BA	227	3.65	1.04	-3.11	0.01 *
		LA	123	3.28	1.08		
Migration	Increase in migration	BA	227	3.88	0.86	-2.74	0.006**
		LA	123	3.58	0.94		
Health	Depression	BA	227	3.29	0.93	-1.66	0.09 ns
		LA	123	3.11	0.97		
	Anger	BA	227	3.76	1.17	-5.20	0.000**
		LA	123	3.31	1.26		
	Sadness	BA	227	3.43	0.95	-0.57	0.57 ns
		LA	123	3.38	0.94		
	Frustration	BA	227	3.39	0.95	-3.42	0.001**
		LA	123	2.98	0.97		
	Anxiety	BA	227	3.43	0.99	-1.11	0.27 ns
		LA	123	3.51	1.15		
	Drug addiction	BA	227	1.93	1.33	-1.26	0.21 ns
		LA	123	2.22	1.55		
	Increase in disease	BA	227	4.35	0.75	-1.11	0.26 ns
		LA	123	4.41	0.81		
Social conflicts	Conflicts among pastoralists	BA	227	3.93	1.22	-3.11	0.002**
		LA	123	3.56	1.23		
	Distrust index	BA	227	3.81	1.11	-1.72	0.08 ns
		LA	123	4.06	0.89		
	Social status degradation	BA	227	3.54	1.08	-1.24	0.21 ns
		LA	123	3.66	1.17		
	Loss of social cohesion	BA	227	3.57	1.2	-2.15	0.03 *
		LA	123	3.85	1.12		
The level of cooperation and assistance in custom units	Decreasing sympathy	BA	227	3.19	1.21	-2.61	0.009**
		LA	123	2.86	1.03		
	Reduction the sense of responsibility between pastoralists	BA	227	3.07	1.16	-3.40	0.001**
		LA	123	2.64	1.02		
Social participation	Reducing participation between government and pastoralists	BA	227	2.92	1	-4.26	0.000**
		LA	123	2.45	0.74		
	Reduction the pastoralists′ *p*articipation in range management	BA	227	3.2	1.09	-4.72	0.000**
		LA	123	2.63	1.02		
Water quantity	Increase distance between Livestock corral and water resources	BA	227	4.30	0.89	-4.46	0.000**
		LA	123	3.84	1.01		
Income continuation	Income reduction from livestock	BA	227	3.86	1.29	-0.97	0.33 ns
		LA	123	3.68	1.43		
	Fluctuations in income from livestock	BA	227	3.82	1.23	-0.04	0.97 ns
		LA	123	3.71	1.36		
Job insecurity	Fear of job loss (for livestock)	BA	227	3.77	1.12	-1.71	0.09 ns
		LA	123	3.84	1.24		
Future expectancy	Reducing optimism about the future	BA	227	2.98	0.89	-1.40	0.16 ns
		LA	123	3.18	0.88		

ns, * and ** = no significant, Significance at 5% and 1% probability levels, respectively;
BA and LA respectively mean Baladeh and Larijan pastoralists.

Table 9. Comparing the impact of climate changes from the perspectives of pastoralists' viewpoint based on Coefficient of variation

Criteria	Coefficient of variation	
	Baladeh pastoralists	Larijan pastoralists
Poverty	0.316	0.36
Food insecurity	**0.51**	**0.45**
Social insecurity	0.33	0.36
Health insecurity	0.33	0.34
Migration	0.22	0.26
Health	0.33	0.33
Social conflicts	0.30	0.29
The level of cooperation and assistance in custom units	0.37	0.38
Social participation	0.34	0.35
Water quantity	0.21	0.26
The income continuation	0.33	0.37
Job insecurity	0.297	0.32
Future expectancy	0.299	0.27

Discussion and Conclusion

The findings indicate that the impact of climate changes includes warmer days, drier summers with unpredictable precipitation and milder winter. These changes lead to increased diseases, job insecurity and diminished wellbeing, migration, increased the intensity and frequency of extreme events, scarcity of freshwater and increased social conflicts. Based on our results, we can conclude that future climatic situations are associated with increasing unpredictability, introducing shocks with different degrees in the livestock sector necessitating different formal and informal mechanisms (Orlove, 2009). Reducing water resources is a prominent impact of climate changes (Yan *et al*., 2015; Rana *et al*., 2014; Miyan, 2015; Gunten *et al*., 2015; Meng *et al*., 2016; Berton *et al*., 2016). Our observations indicated that many natural springs were drying up and water resources have been reduced. It seems that main reason for drying up water springs was the increase in temperature, the decrease in precipitation and decrease in snowfall.

Climate change is a reality and many scientific publications have concluded that climatic uncertainty will increase in the future and will create a harsh situation for local pastoralists' perceptions if adaptation and mitigation policies and plans do not effectively address their problems and concerns. Unfortunately, though local pastoralists' perceptions are at the forefront of the issue of adaptation, there is no adequate technology for them to participate effectively in the discussions regarding the development of adaptation plan and strategies at the HRB. Addressing climate change impacts on rangelands needs new and synthesized rangeland management knowledge, continuous policy support and experience (Orlove, 2009; Rana *et al.*, 2014). Having adequate and relevant knowledge and skills can provide a basis to design and implement climate change adaptation measures in water resources management at local level. Scientific publications emphasize that local knowledge has a key role to fight against global climate changes and in dealing with adaptations (Lammel *et al.*, 2011). Adaptation can reduce negative impact of climate changes by local people to adjust with climate changes and helping them to cope with its consequences (Bryan *et al.*, 2009). Documentation of pastoralists' viewpoint on climate changes can provide policy recommendations to facilitate adequate adaptation to climate changes (Lio *et al.*, 2016). It is important to remember that the capacity of local people to adapt to climate changes and

reduce the impact will depend on their socio-economic and environmental conditions and available resources. Pastoralists at HRB are adapting to climate changes stresses using their measures, innovation and local knowledge. It is important to culturally explore appropriate ways to enhance their adaptive capacities as well as put in place favorable policies and programs to support them. Technical knowledge of adapting actions is one of the most important factors in dealing with climate changes (Agrawal, 2009; Orlove, 2009); thus, extension services should be provided easier for pastoralists. Pastoralists with traditional opinions deny the threats of climate changes and avoid other people to adapt the situation. These thoughts may root in religious and cultural beliefs or other different sources of information (Dang *et al.*, 2014); therefore, providing rangeland pastoralists with enough and proper extension services by planners and authorities of natural resources in order to cope with climate changes seems necessary. Although proper interpretation of regional climate changes pattern is provided by pastoralists, extension services and increasing social awareness associated with global warming and climate changes should be prepared to cope with potential future threats of climate changes.

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اثر تغییر اقلیم بر شاخص‌های کیفیت زندگی بهره‌برداران مرتعی (مطالعه موردی: مراتع حوزه آبخیز هراز، استان مازندران)

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چکیده. تغییر اقلیم تهدیدات زیادی بر خدمات مهم اکوسیستم مانند امنیت آب و غذا و سلامت می‌گذارد. به منظور بررسی اثر تغییر اقلیم بر شاخص‌های کیفیت زندگی بهره‌برداران مرتعی، این تحقیق در حوزه آبخیز هراز، استان مازندران واقع در شمال ایران در فاصله زمانی ۱۳۹۴ تا ۱۳۹۶ انجام شده است. از ۵۲۳۶ نفر دامدار بومی این حوزه، جامعه آماری تحقیق ۳۵۰ نفر با استفاده از فرمول کوکران تعیین شد. این تحقیق در ۱۳۰ سامان عرفی داخل حوزه هراز انجام شده است. ابتدا ۱۳ معیار و ۳۱ شاخص کیفیت زندگی تعیین شد و از طریق پرسشنامه از بهره‌برداران بومی پرسیده شد. عدد آلفای کرونباخ برای سوالات مختلف پرسشنامه بین ۰/۷۲ تا ۰/۸۸ متغیر بود. در این تحقیق از آزمون ناپارامتریک من‌ویتنی برای تعیین اختلاف دیدگاه‌ها استفاده شد. مراتع حوزه آبخیز هراز به دلیل داشتن تنوع در عوامل محیطی و مدیریت متفاوت به دو گروه متفاوت بلده و لاریجان تفکیک، همچنین دیدگاه بهره برداران با آمار ایستگاه‌های هواشناسی داخل حوزه در مورد تغییرات در ویژگی‌های آب و هوایی مقایسه شد. نتایج آزمون من‌ویتنی نشان داد که نظرات بهره‌برداران مراتع بلده و لاریجان در مورد اثرگذاری تغییر اقلیم بر شاخص‌های مهاجرت، عصبانیت، دلسردی، درگیری و نزاع در بین بهره‌برداران، کاهش همدلی و یکدلی، کاهش حس مسئولیت، کاهش مشارکت دولت و بهره‌بردار، کاهش مشارکت فعال در عملیات اصلاحی در حال اجرا و افزایش فاصله آغل تا منابع آب در سطح ۱ درصد و بر شاخص‌های کاهش مصرف مواد غذایی، بی‌توجهی به بهداشت و مدیریت بیماری‌های دام و کاهش انسجام اجتماعی در سطح ۵ درصد معنی‌داری بود، یعنی دو گروه معتقدند که تغییر اقلیم با وزن‌های متفاوت بر این شاخص‌ها اثر گذاشته است. اما نظرات دو گروه در مورد سایر شاخص‌ها یکسان بود. از دیدگاه بهره‌برداران مراتع بخش بلده، تغییر اقلیم بیشترین اثر را به ترتیب با ضریب تغییرات ۰/۲۰۷، ۰/۲۲، ۰/۲۹۷، ۰/۲۹۹ و ۰/۳ بر معیارهای کمیت آب، مهاجرت، ناامنی شغلی، امید به آینده و تضادهای اجتماعی داشته که این اثرات منفی بوده است. بهره‌برداران مراتع بخش لاریجان معتقدند که تغییر اقلیم بیشترین اثر را به ترتیب با ضریب تغییرات ۰/۲۶، ۰/۲۶۳، ۰/۲۷۷، ۰/۲۹ و ۰/۳۲۳ بر معیارهای مهاجرت، کمیت آب، امید به آینده، تضادهای اجتماعی و ناامنی شغلی داشته که این اثرات منفی بوده است. با وجود درک صحیح مردم از الگوهای رفتار اقلیم در منطقه، لازم است خدمات ترویجی و فرهنگ‌سازی در ارتباط با گرمایش جهانی و تغییر اقلیم در بین بهره‌برداران صورت گرفته تا در برابر تغییرات احتمالی آینده آماده باشند.

کلمات کلیدی: تغییر اقلیم، اثرات اجتماعی- اقتصادی، کمبود آب، شاخص‌های کیفیت زندگی