Research Paper: Assessing the Perception of Rural Communities Toward Climate Change (Case Study: Rural Areas of Kuhdasht, West of Iran)

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ABSTRACT

Purpose: This study aims to investigate the perception of the rural communities of Kuhdasht towards climate change and provide solutions to adapt to climate change.

Methods: The statistical population was selected from two groups of villagers and experts. Therefore, 173 villages with 376 households and 26 experts were selected as samples. Ten indicators evaluated residents' views towards climate change, and four components, including 20 indicators, provided solutions. Analytic Hierarchy Process (AHP) was used for weighting and prioritizing solutions.

Results: The results showed that snowing days and drought reduction are the main events from the villagers' point of view, and dust and the increase in sunny hours happened the least. There is a significant relationship between the climatic realities of the region and the residents' perception, age, and education level. The most important consequence of climate change from the point of view of rural communities is drought. The results suggest that economic solutions will affect climate change conditions in the area.

Conclusion: This study indicated a significant relationship between the area's climatic realities and the residents' perceptions. Furthermore, people in the studied area are well prepared to implement climate-related policies effectively.

1. Introduction

Today the climate change have intensified the disturbances and behavioral anomalies due. Reviewing the trends of climate, climate models and paleontology data in the past decades indicate the occurrence of unredeemable changes in the global climate (Hadei et al., 2022). The 21st century has generally been warmer than the last three centuries. All seasons have been warmer since 1659 (Office for National Statistics, 2022). According to the World Me-

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teorological Organization (WMO, 2022), extreme heat waves, droughts, and devastating floods in 2022 threaten millions of people and cost billions of dollars. The average global temperature in 2022 is about 1.15 (1.02 to 1.28) Celsius, higher than the pre-industrial era (1900-1850). As estimated by the Intergovernmental Panel on Climate Change (IPCC) in the Sixth Assessment Report, the effects of climate change escalate when the warming increases. The world now has high atmospheric carbon dioxide levels, so temperature below the Paris Agreement are hardly achievable (IPCC, 2022).

Climate change significantly impacts rural areas, mainly through its impact on the village's ecosystem, livelihood components, and food security. Villagers experience these impacts very directly because most ecosystems are in rural areas. Activities in rural areas also contribute to climate change (de Haen, 2007). Many factors affect villagers' livelihood, but recent studies show that climate change has become a significant factor that can multiply the vulnerability of villagers (Ma et al., 2018; Salik et al., 2016; Dasgupta et al., 2014). Some believe climate change can increase inequality, and the following shock and stress will significantly impact the vulnerability of villagers' livelihoods (Manandhar et al., 2011; Sujakhu et al., 2019).

As an arid and semi-arid country, Iran is exposed to drought and changes in climatic elements. This phenomenon leads to reduced agricultural production, the livelihood and well-being of rural households, and the destruction of natural resources (Keshavarz et al., 2010). Iran Statistics Center reported migration from villages has increased in recent years, and many villages have been deserted, so the rural population has decreased from 39% in 2015 to 29% in 2016. After the successive droughts of recent years, there is a hypothesis that climate change is one of the main factors affecting the reduction of the country's rural population (Jahangirpour & Bkhshodeh, 2022).

The analysis of climatic parameters in the rural area of Kuhdasht confirms the changes in climatic parameters. These changes can be seen in droughts, water resources, agriculture, migration, and the county's employment. The changes include precipitation patterns from snow to rain, the unequal distribution of showers, and the intensity and continuity of droughts. On the other hand, many people live and work in rural areas, and their lives are based on animal farming and agriculture, which are directly affected by climate change. Therefore, in recent years, several villages in the city have become deserted and uninhabited. As a result, many researchers investigate people's attitudes towards the climate and its changes to understand the interactions of the environment and society and human adaptation to climate change. The main goal of this study is to investigate the perception of the rural communities of Kuhdasht towards climate change and provide solutions to adapt to this phenomenon.

2. Literature Review

The climate is defined as the average weather conditions in a region. Climate change is caused by a significant variation in the average meteorological data in a certain period. However, climate change is an environmental and global issue affecting countries (Nguyen et al., 2016). Although the destruction and pollution of the environment have threatened life on Earth, some believe climate change ranks first among the 44 threats to humanity. The fluctuation of climate systems can cause climate change and have an external aspect (Shahraki et al., 2021). Among the signs of climate change are an increase in temperature, a change in precipitation patterns, an increase in sea level, and floods and droughts (Sampson & Drolet, 2017).

Rural areas are significant places that are influenced by climate change. Approximately 3.3 billion people, almost half of the world's total population, live in rural areas (Philp & Cohen, 2020). Climate change is a severe challenge to rural communities through extreme temperatures, droughts, floods, and seasonal changes, which have reduced crop and livestock yields, increased agricultural costs, decreased tourism, and caused job losses in many rural areas (Guyadeen & Daniel, 2023). Agriculture and related activities such as animal husbandry are often vital economic activities in rural communities. These activities significantly contribute to the emission of greenhouse gases (GHG) that, in a way, cause climate change. For example, agriculture and related operations account for 5% of total greenhouse gas emissions in Ontario, Canada. Rural communities depend highly on climate-related resources and ecosystems, such as local water sources and agricultural lands, for their culture, livelihood, transportation, and well-being (Guyadeen & Daniel, 2023).

Rural communities are more vulnerable to climate change impacts than other communities for several reasons. First, rural residents have lower incomes than their urban counterparts and have fewer resources to compensate for damages that may occur after a climatic disaster (Kumar, 2021). Second, main rural occupations are more vulnerable to the effects of climate change. For example,

rural areas have higher rates of agriculture-based jobs, and their economies are more susceptible to the impacts of climate events. For instance, a drought can significantly increase farmers' costs or reduce winter tourism in places with snowing. Third, these low incomes and high-risk jobs make rural areas dependent on government subsidies. Since climate change will increase the cost of living in rural areas, if government support cannot compensate for the imbalance in cost increases, these areas will suffer vulnerability. Finally, the demographic attribution of rural areas exposes them to the increased risk of natural disasters. In particular, the aging population of dispersed communities like villagers makes it difficult for emergency response (Alavalapati & Mercer, 2021).

Generally, villagers are the primary group in adapting to climate change and reducing the harmful consequences. They deal with the negative consequences of climate change as a social process based on the social construction of risks and damages of unusual weather conditions. Some experts believe that the farmer is the crucial decision-making actor in adapting to climate change (Adger, 2009; Arbuckle et al., 2013). So understanding climate change is essential to coping with its adverse effects and the livelihoods adaption (Gbetibouo, 2009). Having enough knowledge about it, people will reduce the negative consequences of climate change or take advantage of its positive effects (Zobeidi & Yazdan Panah, 2017). Climate change affects different regions' societies and environments (Masson & Lovell, 2014). Changes are both in the ecosystem and rural communities' economic and social systems (Sampson & Drolet 2017), for example, the decrease in production and increased immigration due to the loss of jobs (Abdolah Zadeh et al., 2022). Rural households are highly dependent on agriculture, natural resources, and livestock, so climate change can affect their income and livelihood resources (Poudel et al., 2020; Priyadarshi et al., 2019; Shaw, 2006): This dependence emphasizes the threat to the livelihood of rural communities after climate change (Mashiza et al., 2017). In this regard, understanding climate changes on local and regional scales can help to reveal the effects of this phenomenon on people's livelihoods and help to find resources and activities to adapt to the negative consequences of climate change (Shahraki et al., 2022). Therefore, knowing the level of awareness of the rural community to climate change and identifying the essential solutions can effectively reduce the possible effects and lead to the stability of villages.

A few studies were conducted related to this research topic, summarised as follows. Abdolah Zadeh et al., (2016) showed that people's understanding of the limitations of dealing with climate change is influenced by marital status, literacy level, length of stay, type of job, livestock ownership, and having drought insurance. Esmaeil Nejad & Podineh, 2016 stated that the most critical response of villagers to climate change is selling livestock, taking loans, borrowing from relatives, reducing planting and using agricultural inputs, choosing new businesses, and migrating. This study found a relationship between villagers' understanding of climate change and their living conditions. Shahraki et al. (2021) investigated the villagers' awareness of the signs of climate change and its relationship with the sustainable livelihood of local communities. The findings of this study showed that the age, number of livestock, history of livestock farming, length of stay in the village, and the amount of income of people have a significant relationship with understanding the occurrence of signs of climate change. The structural equation model evaluation findings showed a cause-and-effect relationship between the degree of understanding of climate change symptoms and people's livelihood changes. Hamidian pour et al. (2021) conducted a positive and significant relationship between farmers' awareness of climate change and the use of climate change adaptation strategies. Jahangirpour & Bkhshodeh (2022) investigated the effect of climate change on rural migration in Iran. The results of this study showed that when there is a decrease in rainfall, rural migration increases.

On the other hand, the increase in the average annual temperature and the warming of the Earth, due to its negative effect on the yield of agricultural products, leads to an increase in migration. Climatic factors have similar effects on the added value of the farming sector. It was considering added value of the agricultural sector has a negative relationship with immigration. The results of variance analysis showed that more than 70% of rural migration is explained by climatic variables, 24% by migration itself, and 4% by agricultural value added. Therefore, climate change is a very influential factor in rural migration. Salehi & Pazoki (2022) investigated the adaptation of villagers to climate change and its relationship with social factors. The results showed that the area of agricultural land (0.20), knowledge of information sources (0.18), institutional trust (0.17), and pressure of The norm of agricultural experts and village people's opinions (0.16) had a positive and weak correlation with villagers' adaptation to climate change. In addition, the results showed no significant relationship between the normative pressure of the village council, age, and income with the transformation of the villagers to the consequences of climate change. Shahraki et al.

(2022) studied the vulnerability of villagers' livelihoods to climate change in the Oghan watershed of Golestan Province. They showed that the vulnerability of livelihoods from climate change was more than average, and the most damage was to financial capital. The minor damage was to the human capital of the households.

As the number of household members rises, so does the number of livestock and the amount of agricultural land, the vulnerability of households' livelihoods to climate change. However, while monthly income and length of stay in the village increased, their vulnerability decreased. The results of this study verified that the vulnerability of the livelihoods of households from climate change was less when they used promoters and facilitators or were members of cooperatives and organizations and had local knowledge and technical skills to deal with climate change.

Nguyen et al. (2016) analyzed the level of awareness and attitude of the residents of the coastal areas of Vietnam. They concluded that, even though the level of knowledge regarding climate change was low, people had a good understanding of the effects of climate change on their livelihood. A study by Kabir et al. (2016) in Bangladesh showed that people significantly understood climate changes, especially rainfall patterns. Also, the variables of age, education level, income, and occupation type had a significant and positive relationship with their knowledge about climate change. (Kahsay et al., 2019). Also, the variables of gender, age, level of education, weather information, and distance to the market had a significant relationship with people's awareness of climate changes in the north of Ethiopia (Diouf et al., 2019) in Senegal. They concluded that women better understand climate change than men and seek more information in this field. Finally, residence area and ethnicity, marital status, literacy level, household size, net income, cultivated area, and organization membership have significantly affected people's perception of climate change. Therefore, understanding climate changes on local and regional scales can reveal the phenomenon's effects on livelihoods and help find resources and activities to reduce vulnerability and adapt to the negative consequences of climate change. Figure 1 shows the conceptual model of the research. As shown, there is a relationship between the level of perception of rural communities towards climate changes with demographic characteristics and the historical trend of climate variables.

3. Methodology

This research is a descriptive-analytical survey, using library and field research methods to collect information. The present study was formed in several main steps.

To understand the climate change in the target rural communities, first, the climate change indicators were prepared, and ten indicators were used as a researcher-made questionnaire to evaluate the villagers' perception of climate change (Table 2). Before conducting the survey, it is necessary to check the validity and reliability of the research tool to ensure the validity and consistency of the questionnaire questions, especially addressing the qualitative variables of villagers' perceptions of climate change. Therefore, validity and reliability tests of this study were conducted for the perception of climate change. The opinion of experts with appropriate scientific experience in the researched field confirmed the validity of the questionnaire. The reliability of the questionnaire was evaluated through Cronbach's alpha statistic with a range of 0 and 1. The amount of Cronbach's alpha was determined as follows in Table 1.

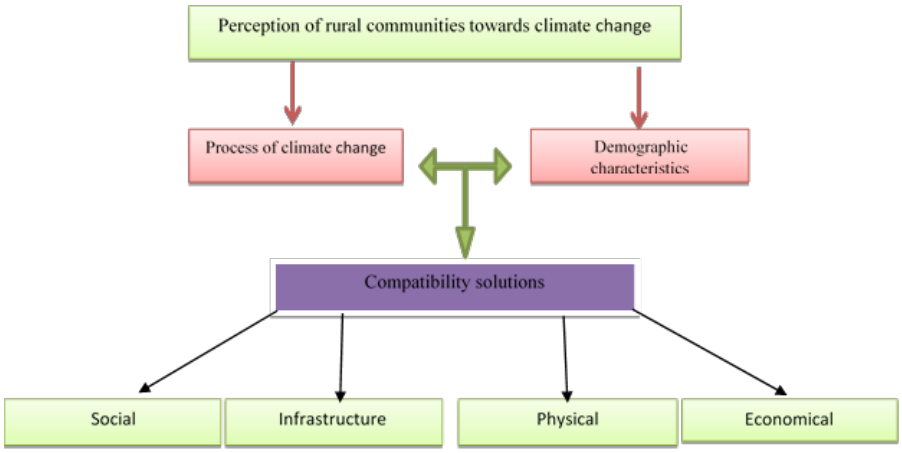

Figure 1. Research conceptual model

Table 1. Cronbach's alpha coefficient

Dimension	Cronbach's alpha
Villagers' perception of climate change	0.87
Solutions to climate change adaption	0.79

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In the second part, the villages of the study area were determined according to the village's location and importance in terms of population and function compared to other villages. The statistical population of the research includes the rural households of Kuhdasht County, which has 315 villages with 17100 households and 64128 people. The sample size was determined based on Cochran's formula and a probability level of 0.05%. One hundred seventy-three villages were selected as samples. Three hundred seventy-six questionnaires were distributed and received, Figure 2.

Questionnaires include two main parts: (1) characteristics of respondents (age, gender, outcome, education), (2) their views on climate elements (temperature, precipitation, snow cover, natural disasters, extreme weather). Solar radiation). A five-point Likert scale was used to determine the quantity of each question. The respondents were asked to indicate one of the options among 5 (completely agree), 4 (agree), 3 (neutral or uncertain), 2 (disagree), or 1 (strongly opposed) (Likert, 1932). Generally, when the average 1-5 Likert scores have ranges of 1.0 to 2.4, 2.5 to 3.4, or 3.5 to 5.0, they indicate disagreement, neutrality, or support of the opinion, respectively (Sun, 2002). Experts from public organizations and university faculty members were used to provide climate change adaptation solutions. In the experts and specialists section, 26 people were purposefully selected for the study. At this stage, four main components and 20 indicators were used (Table 3). The Analytical Hierarchy Model (AHP) was used in the last step for weighting and prioritizing criteria with Expert Choice software.

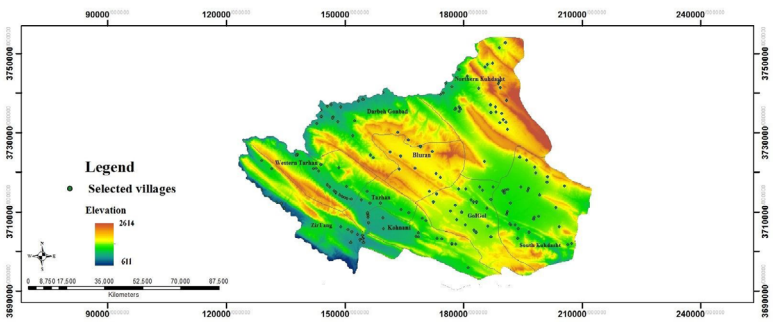

Figure 2. Selected villages

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Table 2. Indicators

Components	Indicator	Components	Indicator
Economical	Agricultural and livestock production insurance	Social	Field facilitators
	Credit facilities		Creation of cooperatives and local organizations
	diverse job opportunity		The performance of government institutions such as Rural municipalities and council
	Creation of industrial animal husbandry		Improving product management techniques
	Development of processing industries		Sharing experiences of adapting to climate change
Physical	Changing the cultivation pattern	Infrastructure	Road infrastructure
	Changing the agricultural calendar		Health Service
	Tillage operations		Establishment of agricultural service offices
	Cultivation diversity		Use of modern irrigation systems
	Diversity of water resources		Creating and facilitating market access for products

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Kuhdasht County, one of the cities of Lorestan Province, is located in the center of Kuhdasht County in the west of Lorestan Province. The average rainfall of this county is 410 mm per year, and the average temperature is 16 degrees Celsius. The soil of the region consists of lime and clay. The city's most important agricultural and horticultural items include barley, corn, sugar beets, vegetables, apples, pomegranates, grapes, peaches, figs, and apricots. In this county, Figure 3, traditional animal husbandry is also widespread.

4. Findings

Climate change has severe direct and indirect effects on rural communities and economies. Rural communities are believed to be vulnerable to climate change due to their dependence on agriculture and livestock. This vulnerability of rural households is due to exposure to climate change. Climate change implicitly creates environmental, social, and economic challenges for rural communities dependent on natural resources in these areas. Hence, adaptation to climate change is necessary to manage current effects and reduce future risks. There is a need for a better understanding of their climate vulnerability through an appropriate assessment method if they want to improve adaptation solutions for agriculture-dependent communities. The assessments can support the mainstream of climate change adaptation plans in communities to increase community resilience currently and in the future.

The climatic condition of the region

The average rainfall in the studied area is 410 mm, mainly in the year's cold months. Most precipitation occurs in the winter season and in a later stage in the spring season. The time series of rainfall in the area shows that the rain in the region has slightly decreased. However, the rainfall pattern has dramatically changed in a way that most of the rainfall occurs in a shorter period, and the rain has mostly a rainstorm pattern (Figures 4 and 5).

The dry year index of the studied area shows that periods of drought have occurred alternately in the area. The station data confirm moderate wet years between 2001 to 2009 and moderate drought from 2010 to 2016. In 2017 and 2018, the site had wet years. The trend of droughts shows the changes in precipitation patterns in the area (Figures 6 and 7).

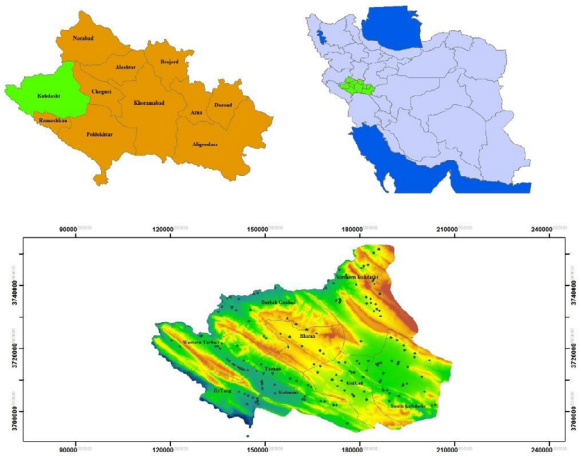

Figure 3. Area of study

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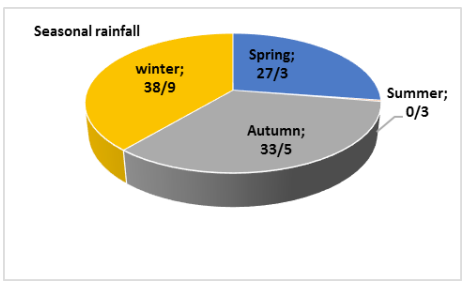

Figure 4. Seasonal precipitation trend of Kuhdasht weather station

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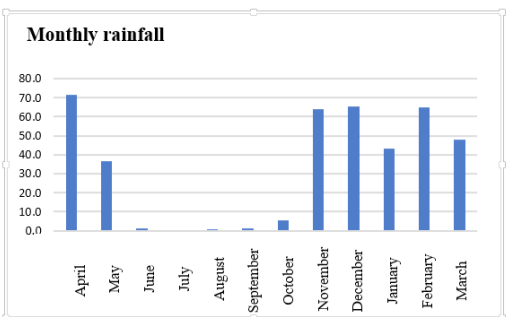

Figure 5. Monthly rainfall of Kuhdasht weather station

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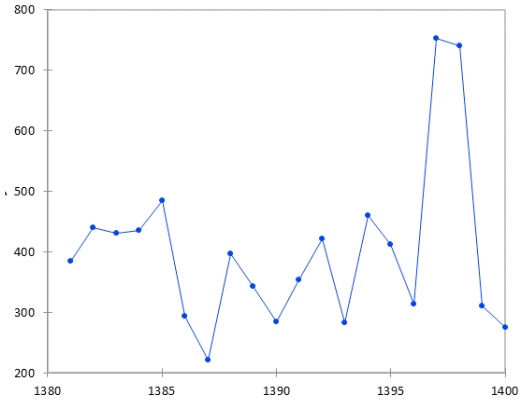

Figure 6. The Standard Precipitation Index (SPI) of 48 months in Kuhdasht weather station

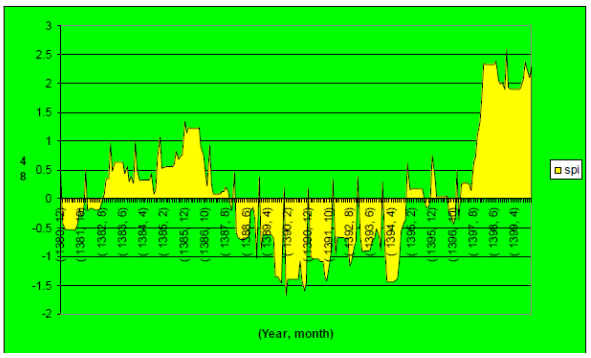

Figure 7. Annual precipitation trend of Kuhdasht weather station

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The long-term average temperature of the region is 16 degrees Celsius. The minimum temperature is 7.2, and the average maximum temperature is 24.8. The temperature is the highest from June to September, and from December to February is the lowest average temperature. The long-term temperature trend of the area (Figures 8 and 9) show that the temperature trend is increasing.

Based on the results, 72% of the respondents were male, and the rest were female. Most respondents were middle-aged and young (68% of the total sample was at least 50), while 32% were more than 50 years old. The results show that more than half of the respondents (54%) are literate at the diploma and middle school levels. People with higher education have the lowest proportion, which is 5%. 53% of the respondents had agriculture and animal husbandry simultaneously (in recent years, animal husbandry has decreased dramatically due to a shortage in fodder). 47% were engaged in agriculture or animal husbandry (Table 3).

Investigating Residents' Views on climate change

This study used ten indicators to evaluate the residents' opinions on climate change, Table 4. According to respondents, snowy days fell with a value of 4.85, and drought, with a value of 4.69, had the highest weights. On the other hand, intensive weather events (hail), dust, and increased sunshine hours, respectively, with values of 3.38 and 3.79, had the lowest average rating. This survey shows that most of the residents of the studied villages understand the climate changes in their environment. More than 85 percent of respondents agreed or strongly agreed that droughts have gotten intense, snow days have decreased, the weather has gotten warmer, precipitation has decreased, and hot days have increased. This perception is consistent with the climatic realities in the region. Figures 2 to 6 show that the drought in the studied area has intensified, and the rainfall pattern has changed. The temperature trend in the region is also increasing. After using observational and survey data on the relationship between climate change and residents' perception, the results show that the perception of the warming temperature experience has a significant relationship with the recorded temperature data and the recorded warmer waves. However, some evidence shows that residents' views may not be based on actual environmental changes or may not match the scientific climate records of the region (Beig & Salik, 2009). However, the research results showed that rural communities have less perception of the increase in sunny hours, the intensification of extreme weather events, and dust. Nearly 50% of people have felt the changes in these indicators.

The results show that residents' perception is more accurate for climate features that are easy to feel for human senses, such as increasing temperature, decreasing snowy days, and decreasing rainfall. However, their perception of actual conditions can be inaccurate for features such as sunshine hours and weather conditions. In some areas, especially in the mountainous regions of the studied area, meteorological stations must be equipped to observe climatic data accurately. Therefore, the observed data may not reflect the environmental characteristics in the villages where people live because there is much variation in the small climates (Aryal et al., 2016). Although there is quite an uncertainty about residents' perception, their knowledge of climate change and the environment is fundamental.

The rural resident's opinion regarding the most important consequence of climate change

A review of historical information and conversations with villagers in the study area showed that local communities faced climatic conditions over time and, in some cases, have created and achieved adaptation solutions.

According to the villagers, drought and, as a result, water shortage is the most important consequence of climate change that the rural communities of Kuhdasht have faced. More than 95% of people consider this risk the most significant effect of climate change. This understanding shows the strong dependence of the villagers' livelihood on the weather and its impact.

Due to the changes in rainfall patterns, flooding occurs in the form of a rainstorm and super heavy rains in the region. This risk has intensified in recent years, and 11% of people consider this risk crucial. The third hazard is dust, which has become more common recently. According to the respondents, the fourth climate risk due to climate change is heat stress, followed by cold stress, Figure 10.

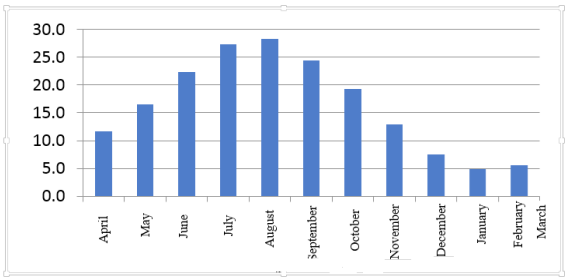

Figure 8. Average annual temperature trends of Kuhdasht weather station

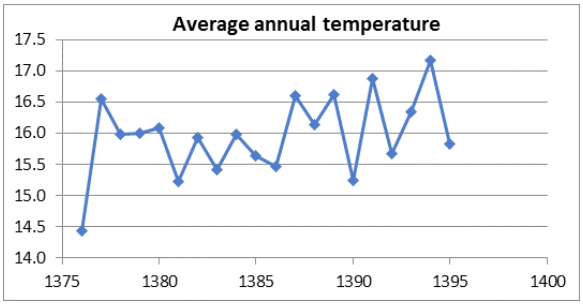

Figure 9. Average monthly temperature of Kuhdasht weather station

Table 3. Demographic characteristics of the studied villages

Variable	Geographical range	Frequency (percentage)
Gender	Male	72
	Female	28
Age	Less than 24	15
	25-35	18
	35-50	35
	50-65	20
	More than 65	12
Education	Illiterate	8
	Elementary	15
	Middle school	32
	Diploma	22
	Undergraduate degree	18
	Bachelor's degree and above	5
Occupational status	Agriculture and animal husbandry	53
	Agriculture or animal husbandry	47

Table 4. Indicators of perception of residents towards climate change

Indicator	Strongly disagree 1		Disagree 2		Moderate 3		Agree 4		Completely agree 5		Total	Standard deviation	Mean
	Number	%	Number	%	Number	%	Number	%	Number	%			
Has the weather gotten warmer?	0	0.00	2	0.53	40	10.64	75	19.95	259	68.88	376	0.96	4.57
Has the number of hot days increased?	0	0.00	12	3.19	44	11.70	60	15.96	260	69.15	376	0.95	4.51
Has the night temperature increased?	0	0.00	23	6.12	50	13.30	60	15.96	243	64.63	376	0.86	4.39
Is the frost less now?	5	1.33	15	3.99	73	19.41	80	21.28	203	53.99	376	0.71	4.23
Are the cold days less?	15	3.99	36	9.57	64	17.02	101	26.86	160	42.55	376	0.51	3.94
Has it been raining less?	0	0.00	5	1.33	45	11.97	131	34.84	195	51.86	376	0.76	4.37
Is the drought more severe?	0	0.00	0	0.00	25	6.65	66	17.55	285	75.80	376	1.08	4.69
Has the flood increased?	2	0.53	18	4.79	71	18.88	95	25.27	190	50.53	376	0.67	4.20
Have extreme weather events (hail) increased?	42	11.17	68	18.09	73	19.41	92	24.47	101	26.86	376	0.21	3.38
Is the period of snow coverage decreasing?	0	0.00	0	0.00	0	0.00	55	14.63	321	85.37	376	1.25	4.85
Is there more dust?	25	6.65	52	13.83	75	19.95	95	25.27	129	34.31	376	0.36	3.67
Have the sunshine hours increased?	12	3.19	52	13.83	79	21.01	92	24.47	141	37.50	376	0.43	3.79

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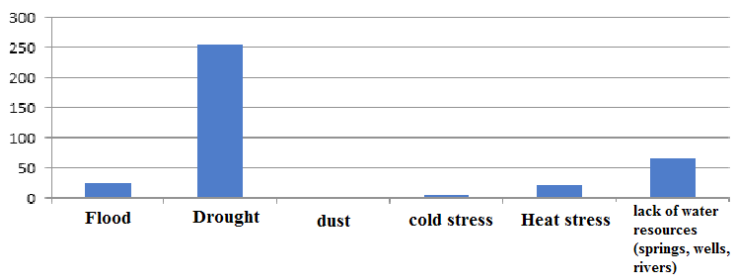

Figure 10. The most critical risks caused by climate change from the point of view of residents

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The Effect of Demographic Characteristics on the perception of residents towards climate change

Using Kendall's correlation test, the study investigated the influence of demographic characteristics on residents' understanding of climate change. The analysis showed that age and education significantly affect residents' perception of climate change. In contrast, there was no significant difference between gender and respondents' perceptions. Regarding education level, respondents with higher education and younger people showed a better understanding of climate change. This situation can be due to a higher level of education among youngsters, while seniors generally have a lower level of education. In consistency with these results, Frank (1998) and Deressa (2009) found that some factors (age and education level) affect the residents' attitudes towards climate change and their ability to adapt.

Table 5. Results of Kendall correlation analysis

Significance at 0.05 p-value	Correlation coefficient	Indicator
0.02	0.57	Age
0.215	0.35	Gender
0.04	0.62	Education

Solutions to climate change adaption

Adaptation responses to climate change in different regions are viable after evaluating adaptation approaches. Adaptation methods can be distinguished in several dimensions. These dimensions vary on a spatial scale (local, regional, national). The approaches can be categorized based on sectors (water resources, agriculture, tourism, public health, etc.), type of action (physical, technological, investment, regulation, market), actors (national or local government, international donors, private sector, NGOs, local communities and individuals), climate zones (arid, flood plains, mountains, Arctic, etc.), the level of income and development (least developed, middle-income and developed countries), or a combination of these categories. Table 6 summarizes the results of weighting based on the 5-point scale (Saaty, 1980) to provide the best compatibility solutions. In the next step, the matrix of pairwise comparisons of indicators and then the weight of these indicators was calculated by Expert Choice.

According to the opinion of experts and experts, among the economic solutions, job diversity is the key solution that can have a good effect on farmers' adaptation to climate change.

In the next stage, there is the development of processing industries, credit facilities, development of industrial livestock, and insurance arrangements (Figure 11).

Table 6. Final weight of components and indicators

Components	Normalized weight	Indicator	The main weights	Components	Normalized weight	Indicator	The main weights
		Agricultural and livestock production insurance	0.184			Field facilitators	0.194
		Credit facilities	0.188			Creation of cooperatives and local organizations	0.181
Economical	0.342	Diverse job opportunity	0.228	Social	0.206	The performance of government institutions such as Rural municipalities and council	0.216
		Creation of industrial animal husbandry	0.187			Improving product management techniques	0.173
		Development of processing industries	0.213			Sharing experiences of adapting to climate change	0.236
		Changing the cultivation pattern	0.213			Road infrastructure	0.206
		Changing the agricultural calendar	0.187			Health Service	0.186
Physical	0.289	Tillage operations	0.164	Infrastructure	0.163	Establishment of agricultural service offices	0.189
		Cultivation diversity	0.203			Use of modern irrigation systems	0.22
		Diversity of water resources	0.233			Creating and facilitating market access for products	0.199

Figure 11. Normalized weights of economic indicators

Also, among the environmental solutions, the diversity of water sources and changing the cultivation pattern are essential solutions. Cultivation diversity, agricultural calendar changes, and tillage operations in the later stages effectively adapt to climate changes (Figure 12).

Based on the sub-criteria of this indicator, sharing the experiences of adapting to climate change have the most impact. Many countries have appropriate and successful experiences, which can be applied to create the capacity to adapt to climate change in the studied area. The following steps include improving the performance of government institutions, such as village councils and field facilitators, creating cooperatives and local organizations, and improving product management techniques (Figure 13).

The essential infrastructural indicator, based on the opinion of experts, is the use of modern irrigation systems, which increase production efficiency.

Road infrastructures are in the following places, creating and facilitating market access for products and establishing agricultural service offices and health services (Figure 14).

The main components showed that the financial solutions with a weight of 0.342 impact climate change conditions in the studied area. After that, physical-environmental solutions, with a weight of 0.289. Social solutions, with a weight of 0.206, and infrastructure, with a weight of 0.163, are the next most influential (Figure 15).

Figure 12. Normalized weights of environmental-physical indicators

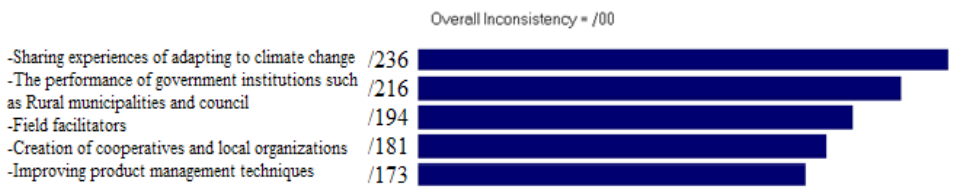

Figure 13. Normalized weights of social indicators

Figure 14. Normalized weights of economic indicators

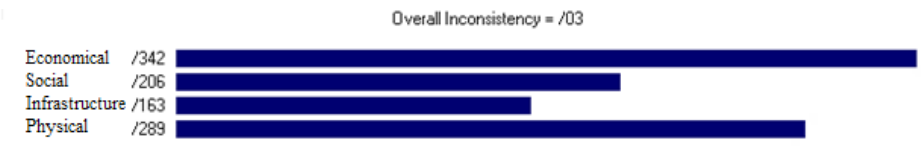

Figure 15. The normalized weights of the main components

5. Discussion

Climate change is a severe challenge with essential economic, social, and environmental consequences. Therefore, understanding climate change is effective in strategies to tackle global warming. Also, people's awareness of climate change is closely related to measures to reduce the consequences of climate change and change behavior to adapt.

This study used ten indicators to evaluate the residents' opinions on climate change. Findings showed that snowy days fell with a value of 4.85, and drought, with a value of 4.69, had the highest weights. On the other hand, intensive weather events (hail), dust, and increased sunshine hours, respectively, with values of 3.38 and 3.79, had the lowest average ratings. Also, there is a correlation between the area's climatic realities and the rural community's perception. More than 80 percent of the studied population referred to an increase in temperature, a decrease in snow days, and the intensification of drought. These results are consistent with studies (Risen & Critcher, 2011; Akerlof et al., 2013) that climate data and local people's perceptions confirmed a warming trend. However, some evidence shows that residents' opinions may not be based on actual environmental changes or may not match the scientific climate records (Beig & Salik, 2009).

Accordingly, the research results showed that rural communities have less perception towards the increase of sunny hours, the intensification of extreme weather events, and dust. Nearly 50% of people have felt the changes in these indicators. The results show that residents' perception is more accurate for climate features that are easy to feel for human senses, such as increasing temperature, decreasing snowy days, and decreasing rainfall. However, their perception could be more accurate due to the lack of knowledge of features that are difficult to detect and perceive, such as the number of sunshine hours. These results are consistent with studies (Wang, 2021).

The analysis showed that age and education significantly affect residents' perception of climate change. In contrast, there was no significant difference between genders in their perceptions. Regarding education level, the respondents with higher education showed a better understanding of climate change, and people with younger ages also had a good sense of climate change. Therefore, universities with a higher education level will have a higher capacity to deal with climate risk. These results are consistent with studies (Frank, 1998; Yan et al., 2006; Deressa et al., 2009; Wang & Cao, 2015).

According to the villagers, drought is the most important consequence of climate change faced by the rural communities of Kuhdasht. More than 95% of people consider this risk to be the most significant effect of climate change. This understanding shows the strong dependence of the villagers' livelihood on the weather and its impact. Observational data also indicate the trend of drought in the region. According to the opinion of experts, among the economic solutions, job diversity with the highest weight for the environmental solutions, the diversity of water resources, the social solutions, sharing the experiences of adapting to climate change and the infrastructure solutions, the use of new systems of irrigation are the most effective solutions. The economic solutions with a weight of 0.342 impact of climate change conditions in the studied area. Finally, physical-environmental solutions, with a weight of 0.289; social solutions, with a weight of 0.206; and infrastructure, with a weight of 0.163, are the most effective solutions.

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Conflict of Interest

The authors declared no conflicts of interest.

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