

## Research Article



# An Assessment of Effects of Climate Change on Human Lives in Context of Local Response to Agricultural Production in District Buner

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**Abstract** | The study entitled “an assessment of effects of climate change on human lives in context of local response to agricultural production was conducted in District Buner-Pakistan. Tehsil Gagra, out of the six tehsils of district Buner, constituted the universe of the study. A sample size of 370, was randomly selected from the total population of 10142 through proportional allocation method. The conceptual framework comprised of two study variables i.e “agriculture production” and “climate change effects on human life”. To establish association between the study variables the perception of climate change effect on human life was indexed and cross tabulated with local response to agricultural production at bi-variate level, using chi-square test statistics. The study found that climate change effects on human life had a highly significant association ( $P=0.000$ ) with greenhouse gases has decreased the agricultural productivity; climate change has reduced the production of crops( $P=0.000$ ); soil erosion and landslides have increased( $P=0.000$ ); Due to climate change forests, fruits and vegetables have become scarce( $P=0.000$ ); water logging and salinity has affected the production of crops( $P=0.000$ ); and loss of agricultural productivity affecting the local economy with effects on human lives. The study concluded that, climate change has drastically affected the agricultural practices, resulting into low crop production, soil erosions and water logging salinity. Taking climate change adaptation measures to minimize the impacts on agriculture and economy as well as policy formulation and implementation to cut short the emission of greenhouse gases were major recommendations.

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## Introduction

In today's world the humanity is confronting with various challenges whether it may be social issues like terrorism or violation of human rights, economic depressions, or depletion of natural resources. Climate change is also one of them which is adversely affecting our lives. Climate change has a great impact on our society and environment that augments significant

strain on our natural resources United Nations Environment Programme (UNEP, 2009). Global effects of climate change are directly or indirectly related with human lives, giving a warning to the lives of the people. Such effects are better judged from devastated agriculture, imbalance in ecosystem, increasing vulnerability to natural disasters and to human related diseases like epidemics etc. Inter-Governmental Panel on Climate Change (IPCC,

2014). Consequences of climate change are not limited to a single continent or region of the world, but, it has shown its effects to all the five continents of the world. However, continents of Africa and Asia are more exposed to the impacts of climate change. Furthermore, the countries which come in the circle of South Asia has also been facing the consequences of climate change (World Bank, 2007).

Global assessment of the climate change on food production suggests that there is a potential threat for creation of socio-economic disparities among the people of different regions. Developing countries are vulnerable to such disparities as compared to the developed nations because of traditional agricultural practices, political instability, unemployment, health problems, and low level of awareness among the people to perceive the climate change impacts (Rosenzweig and Parry, 1994).

Climate is the primary factor for the agricultural productivity. With change in climatic patterns agriculture sector has affected with increase in pest diseases, under production of crops and less resilience to the changes in climatic features. Crop and livestock production has affected by change in the seasons due to weather shift. It has also enhanced the soil erosion and frequently affected the various types of crops. Crop simulation models shows that climate change impacts has affected both the moisture and temperature patterns, which clearly indicates the reduction in productivity (Adams et al., 1998).

Like other developing nations of South Asia, Pakistan is more susceptible to the rippling waves of climate change. Pakistan is in the grip of climate change with the already existing issues in every sector (Foreign Policy Group, 2016). Pakistan's geographical location is one of the remarkable creation on the surface of the earth. It has mountain ranges, plains, plateaus and rivers. Division into Northern and Southern Pakistan gives two diverse features to its climate. Global Change Impact Studies Centre (GCISC, 2009). The North-Western border of Pakistan starting from Koh-i-Hindukash passing through Suleiman Mountains to the Koh-i-Kirthar ranges, forms the rigid and rugged mountains areas of the region (GCISC, 2009).

Agriculture which is the backbone of the economy and has direct relation with the growth rate and development of a nation has affected with climate

change. The empirical studies conducted by the researchers globally and nationally suggest that 1 °C increase in temperature has doubling effects on the agriculture in terms of productivity (Kane et al., 1992). Climate change has resulted in melting of the snow in the mountainous regions. It has affected the sustained water resources, which is a source of irrigation in plain areas. The frequent melting of glaciers increases the discharge of water resulting in two main threats. First, it has affected the agriculture sector because too much water is harmful for crops and second is the flow of water without taking use of it (Hussain et al., 2005).

Study conducted by Pakistan Institute of Development Economics (PIDE, 2009), says that productivity of agriculture depends on two factors, first is the change in the season and second is the location, where agricultural practices are practiced. Study proposes that agricultural practices in marginal lands with a high exposure and vulnerability affects the agricultural production. On one side, there are frequent occurrences of natural disasters events and on another, the vulnerable location makes the productivity at risk. Change in the seasonal cycle, temperature and precipitation patterns are increasing the vulnerability and threatening whole Pakistan, however, the severity is increased in North-Western region due to climatic shifts and vulnerable location of the agricultural sector (Shakoor et al., 2011).

The province of Khyber Pakhtunkhwa (KP) forms the part of this region and it consists of 26 districts. District Buner is one of them which has mountainous ranges, plain areas and variable climatic patterns. Similarity between the other parts and study area creates vulnerability to climate change impacts. Global, climate change is casting its shadows on every sector of life, and the same situation in Tehsil Gagra, District Buner. Climate change affecting farmer agriculture/livestock and socio-economic condition of the people living in the locality. Besides, it is also affecting the health and disrupting the developmental projects and creating the socio-economic disparities. Further, it is increasing risks to conflicts and marginalization of the local people of Tehsil Gagra (Israr et al., 2016). The present study is design keeping in view the drastic effects of climate change agricultural productivity with the review of local perceptions in district Buner, Pakistan.

## Materials and Methods

The study was carried out in Tehsil Gagra, one of the six Tehsils of the District Buner. A multi stage stratified random sampling technique was adopted for sample selection. At first stage Tehsil Gagra, was purposely selected. At the second stage of multi stage sampling out of three Union Councils (UCs), only two UCs namely Shalbandi and Rega were randomly selected. Further, from each UC, one village was randomly selected namely Amnawar from UC Shalbandi, and Takhtaband from UC Rega. The total population of the village Amnawar and Takhtaband stands, at (Household) 7367 and 2775(H.H) respectively as per [District Census Report \(2017\)](#). The total household population of two villages stood at 10,142. A sample size of 370 was determined as per criteria of Sekeran (2003). The total sample size was distributed through proportional allocation method as shown below in Table 1.

$$\chi^2 = \sum_{i=1}^r \sum_{j=1}^c \frac{(O_{ij} - e_{ij})^2}{e_{ij}}$$

$$N_i = \frac{n \times N_i}{N} \dots (1)$$

(Chaudhry and Kamal, 1996)

$n$ = Total sample size = 370;  $N$  = Total Household Population of each selected village;  $N_i$ = Household population size of each village;  $n_i$ = required sample size for each village; Finally required sample size of the Household from each village was selected by using simple random sampling technique.

**Table 1: Proportional allocation of sample size.**

Serial No.	Name of the Village	Population Size (N)	Sample Size (n)
1	Amnawar	7367	269
2	Takhtaband	2775	101
Total		10,142	370

Primary data was collected from the heads of the randomly selected households through interview schedule. The Conceptual framework composed of two variables i.e. "Perception of response towards agricultural Productivity" and "effects of climate change on human life". Each of the study variables was measured on a three level liker scale. The scales were constructed by pooling attitudes statements on each variable from the available literature. The variable "effects of climate change on human life" was indexed

and cross tabulated with "agricultural production". Keeping in view the qualitative nature of the data, Chi-square test statistics ( $\chi^2$ ) was applied as the most appropriate non parametric procedure for testing the association among variables. The following equation (ii) was used for calculating chi-square value.

$$\chi^2 = \sum_{i=1}^r \sum_{j=1}^c \frac{(O_{ij} - e_{ij})^2}{e_{ij}}$$

Where,

$\chi^2$ = Chi Square for two categorical variables;  $O_{ij}$ = Observed frequencies in the cross-classified category at ith row and jth column;  $e_{ij}$ = Expected frequencies regarding ith row and jth column.

## Results and Discussion

### *Perception of local respondents about impacts of climate change on agricultural production*

Table 2 disclosed that, majority of the respondents 90.5% were of the view that, greenhouse gases effect has decreased the productivity of the crops, with 4.1% of the respondents were in disagreement and 5.4% of the respondents had neutral responses. It could be inferred from the information that the study was no exception in the term of vulnerabilities to seasonal alterations. Study carried out by [Safdar et al. \(2014\)](#), also shows that North-Western parts of the country are more susceptible to climate and weather related events. The reason is the high vulnerable location of agricultural practices in the hilly and mountainous areas. Greenhouse gases effects and climate change has increased the number of floods in magnitude and intensity with rising temperature. Such floods wash the standing crops by reducing the local production affecting the daily needs of the local community. Climate change shortening of the growing season for crops like wheat and maize has occurred, providing less time for crops to mature fully. Besides, increase in salinity and water logging due to climate change has affected the production of crops in the local community ([Javed et al., 2014](#)).

As floods have increased in the study area, local people perceived increase in drought frequency as well. Out of total 370 respondents, 86.2% of the respondents were of the view that due to climate change frequency of drought has increased, 3% had differed in their opinions and 10.8% had neutral responses. It is obvious from these findings that the coincidence of

**Table 2:** Frequency and percentage distribution of local respondents regarding impacts of climate change on agricultural production.

S.No	Statement	Agree	Disagree	Neutral	Total
1	Greenhouse effect has increased the agriculture productivity.	335(90.5)	15(4.1)	20(5.4)	370(100.0)
2	Climate change has reduced the production of crops.	335(90.5)	15(4.1)	20(5.4)	370(100.0)
3	The frequency of drought has increased which reduced crops production.	319(86.2)	11(3.0)	40(10.8)	370(100.0)
4	Soil erosion has increased.	335(90.5)	15(4.1)	20(5.4)	370(100.0)
5	Landslides have increased.	335(90.5)	14(3.8)	21(5.7)	370(100.0)
6	Forest, vegetable and fruits have become scarce.	341(92.2)	9(2.4)	20(5.4)	370(100.0)
7	Plant species composition has changed.	301(81.3)	14(3.8)	55(14.9)	370(100.0)
8	Water logging and Salinity has affected the production of crops.	351(94.9)	4(1.0)	15(4.1)	370(100.0)
9	Loss of financial assets of farmers has created hurdles in their stability.	350(94.6)	15(4.1)	5(1.3)	370(100.0)
10	Climate change has affected the local economy because of reduction in agricultural productivity.	360(97.3)	3(0.8)	7(1.9)	370(100.0)

**Source:** Field Survey, 2017 (Number in the parenthesis shows percentage and number outside the parenthesis shows the frequency).

drought and unexpected rains has completely changed dynamics of the study area. According to Ministry of Climate Change Pakistan, intensive increase in temperature create stress in the form of availability of less water for crops to irrigate. One degree Celsius increase in temperature decrease the yield by 5-7%. Less availability of water creates drought situation affecting the productivity of crops and meadows become dry to provide grass for the animals (PIDE, 2013). Increase in drought frequency has doubled due to deforestation in the local community. Trees provide an environment friendly atmosphere and a source of high humidity for the precipitation. Local farmers are facing the negative impacts of climate change in the form of severe drought causing loss to the agriculture and livestock productivity (Khan, 2017).

Almost 90.5% of the respondents were of the view that soil erosion has increased due to impacts of climate change. The remaining 4.1% had their views that erosion has not increased and 5.4% of the respondents had neutral responses. Study has similar findings conducted by Nearing et al. (2004), that global warming is expected to a more speedy hydrological cycle pouring more and intensive rainfalls. Increase in rainfall amount increases chances for more erosion and runoff. Top fertile layer of the soil is also washed away with flowing water reducing the agricultural productivity. Similarly, steep slopes increase the soil run off with increase of precipitation as well as increase in intensity of hydrological processes speed of the soil erosion. Soil erosion and landslides have a close relation with each other; Landslides is the flow of materials abruptly down the hill or mountain

(Farrel, 2007).

The study further disclosed that, 90.5% of the respondents had the view that, landslides have increased, 3.8% had disagreement and 5.7% had neutral views. These findings were in consonance to the preceding results that climate change has put the agricultural patterns to an uncertain conditions of prediction. Landslides have direct relation with amount of water that comes from the precipitation. Due to ground cutting and simultaneously deforestation combine factor resulted a number of landslide. Climate change has increased the floods frequency, threatening more the soil or rock masses located at the edge of the mountain or hill. So both the climate change and anthropogenic activities are mainly responsible for increase in landslides (Hewitt, 1998). Due to landslides in the mountainous area blockage of the roads occurred, disrupting the export and import of the agricultural products. Because of which local farmers are heavily affected in terms of financial losses (Dragoni and Sukhija, 2008).

Likewise, as climate change effects has increased the soil erosion especially of top fertile layer, similarly production of vegetables and fruits has also become affected. Table 2 further indicated that 92.2% of the respondents were of the positive responses about decrease in production of vegetables and fruits, 2.4% were in disagreement with the statement and 5.4% had neutral responses. Study carried out in Swat District shows that, with increase in temperature, it has affected the growing season length for fruits and vegetables growth. Better growth and production



depends on the optimum temperature specified for a crop. Climate past data about Swat has shown that 1.5 degree Celsius increase in temperature may affect the production of vegetables and fruits upto 7% (Hussain and Mudasser, 2007). High temperature accompanied with high stress of water, creates scarcity of water to irrigate crops, vegetables and fruits, so the ultimate result is the reduction in production. Besides, nutritional quality is also affected due to high temperature and elevated amount of carbon dioxide (Nasir, 2006).

One of the detrimental effects of climate change is the change in the composition of plant species. Local perception level has shown that majority of the respondents i.e. 81.3% were of the view that plant species composition has changed while 14.9% respondents were unaware of the change that has occurred due to climate change and remaining 3.8% were in disagreement with the change in plant composition. These findings indicated that, climate change carries a holistic disturbance of the prevalent order. It included changes in soil structure, water availability practices and production patterns. Research carried out by Siddiqui et al. (1999) shows that, plant composition changes on the basis of species density, richness and functional types. Study has also shown that Ephemeral plants are more exposed to the high precipitation and temperature, as these species cannot absorb high fluctuations in weather events. Abundance of the species at a particular location has the capacity to absorb the environmental shocks and stresses. Furthermore findings of the study carried out by Shakoor et al. (2011), unearthed that climate change has a high impact on the agriculture of the local community. Major reason is the change in annual precipitation and temperature which affects the plant species especially the wheat. Old varieties of wheat is more susceptible to effects of climate change and has a declining production. However, the new and hybrid varieties have the resilient capacity to climate change. Climate change has intensified the problem of water logging and salinity decreasing the agricultural production in the study area.

Table 2 further discovered that 94.9% of the respondents were of the perception that agricultural production has decreased, 1% were disagreed to the statement and 4.1% of the respondents were neutral in responses. Water logging and salinity is a great hurdle in increasing the productivity of crops. Water logging

and salinity occurs due to seepage from underground water reservoirs, leaching of salts due to excessive irrigation, broken canals system and lowering of the water table below the surface. Water logging and salinity has increased due to high precipitation and flooding in the plains reducing area for cultivation of crops limiting the production (Qureshi et al., 2008). Findings of the study collected from 25 sample settlements conducted by Kahlowan and Azam (2002), suggests that 38% of the area in Pakistan is water logged and 14% saline, only remaining 45% of the area for the cultivation of crops. Recent climate change impacts has increased the processes that has affected the production of crops. Farmers have dependency on the agricultural sector to meet their daily needs and get satisfaction from the farming practices.

However, climate change has affected the lives in terms of financial losses and reduction in production. The study indicated that 94.6% of the respondents were of the view that their survival is under threat, 4.1% of the respondents were different in their opinions and 1.3% of the respondents had neutral responses. According to Food and Agriculture Organization (FAO, 2014), agriculture sector is one of the most affected sector due to climate change consequences. Agriculture sector has a direct relation with the farmers. Impacts on agriculture sector due to increase of frequency of disasters, soil erosion, water logging and salinity has direct effects on the farmer's lives. Similarly, Inter-Governmental Panel on Climate Change (IPCC, 2015), findings suggested that people having dependency on primary sector like agriculture and livestock, mining, forestry and fishing; then financial losses are high as these people mostly belong to lower and middle class families. So financial loss creates threats to the very stability of farmers.

Likewise, economy and agriculture is linked with each other in a close nut. Agriculture provides raw materials to the industries and then provide a back up to the developing economy. Recent climate change has affected the production of agriculture due to which local economy has also affected. Almost 97.3% of the respondents had the perception that climate change has affected the local economy, 0.8% had disagreement with the statement and 1.9% had neutral responses. An increase in temperature affects the growing cycle by shortening the maturity period of a crop to grow completely. Frequent floods wash away the crops and hard work of the farmers in minutes. Decrease in

productivity limits the raw material for the industries to make alternate products to strengthen the economy as disclosed by (The Times, 2015). Due to decline in agricultural productivity, recovery costs and loss to farmers assets are usually recorded high (Jaswani et al., 2008).

#### *Association between agricultural production and climate change effects on human life*

Table 3 dismantled various statements of agriculture production have been associated with climate change effects on the human lives to analyze the situation. The study depicted that a significant ( $P=0.000$ ) relationship was found between greenhouse gases effect has decreased the agriculture productivity, with effects on the human life. Greenhouse gases effect is the trapping of gases and the radiations from the earth in the long wavelengths in the upper atmosphere that increases the temperature. Evidence has been provided by Mitchell (1989), in a study conducted in context of greenhouse gases emission. Findings of the study has shown that greenhouse gases like  $SO_2$  and  $NO_2$  goes up to the upper atmosphere and react with water molecules forming Sulphuric acid and Nitric acid and these chemicals then go down with the effect of acid rain damage the crops and reduce their productivity.

Similarly, a significant ( $P=0.000$ ) association was found between that climate change has reduced the production of crops, with effects on human life. Study conducted by UNHabitat (2014), has shown that on one side climate change has affecting the social and economic sector but on other side, world is facing the consequences of increased population growth. Climate change has reduced the production of crops, especially of wheat and maize. Pesticides attacks have also increased due to high precipitation and severe dryness of the agriculture regions. Increased frequency of floods have consequently damaged the standing crops declining the production.

Likewise, a highly significant association ( $P=0.000$ ) was found between climate change and the frequency of drought has increased reducing the crop production. In this regard, a study conducted by Bonan (2008), has shown that frequent increase of drought events has decline the production of crops. In Pakistan, monsoonal winds enter through eastern and western depression bringing rainfall on the plains. However, due to weather shift a change in the trajectory path of winds have occurred, limiting the precipitation on

Southern plains reducing the productivity of crops.

In addition to above, a significant ( $P=0.000$ ) linkage was found between the soil erosion and landslides have increased, with climate change effects on the human life. Agriculture productivity depends on soil as it forms the fertile layer for crops growth. Findings of the study conducted by Nunes et al. (2008), showed that due to climate change intensity and frequency of hydro-meteorological disasters increased. Floods wash away the material that comes in its path and erosion of fertile layer occurs depriving the land surface from the production of crops. Landslides occur in the mountainous areas blocking the roads, disrupting the export and import of agriculture items. Besides, agriculture crops are affected due to slide of materials on the nearby fields in the hilly areas.

Furthermore, a significant ( $P=0.000$ ) relationship was found between due to climate change forests, fruits and vegetables have become scarce with effects on human life. Sultana et al. (2009) was of the view that due to floods erosion of the soil occur, loosened the roots of the trees to flow with the water. Anthropogenic activities also play its notorious role in cutting of the trees for fuel and to make the wooden materials. Productivity of fruits and vegetables decline due to high temperature, precipitation with increase in pest diseases. Change in regularity of seasons affect the growing period for vegetables and fruits.

The study further indicated a significant ( $P=0.000$ ) association was found between plant species composition has changed, with climate change effects on the human life. Increase amounts of  $CO_2$  in the atmosphere and climate events alters the chemical composition of plants. Such change can be measured in the form of decline in nutritional quality and loss of medicinal usage. Ecological balance may be disturbed due to change in the nature of plants with the loss of economic value for the community (Amedie, 2013).

Yet a significant ( $P=0.000$ ) relationship was found that water logging and salinity has affected the production of crops, with climate change effects on the human life. Study conducted in Dhaka, Bangladesh by Alam and Rabbani (2007) shows that water logging and salinity rise with increase in frequent rainfalls and floods. Salts accumulation occur with blockade of air that reduces the availability of nutrients adversely affecting the productivity of crops.

**Table 3:** Association between agriculture production and climate change effects on human life.

Agriculture Production			Climate change effects on lives of human			
S. No	Attributes		Agree	Disagree	Total	Statistics
1	Greenhouse gases effect has decreased the agriculture productivity	Agree	335(90.5)	0(0.0)	335(90.5)	$\chi^2$ -291.547
		Disagree	0(0.0)	15(4.1)	15(4.1)	P=0.000
		Neutral	14(3.8)	6(1.6)	20(5.4)	
		Total	349(94.3)	21(5.7)	370(100.0)	
2	Climate change has reduced the production of crops	Agree	335(90.5)	0(0.0)	335(90.5)	$\chi^2$ -282.830
		Disagree	0(0.0)	14(3.8)	14(3.8)	P=0.000
		Neutral	14(3.8)	7(1.9)	21(5.7)	
		Total	349(94.3)	21(5.7)	370(100.0)	
3	The frequency of drought has increased which reduced crops production	Agree	319(86.2)	0(0.0)	319(86.2)	$\chi^2$ -229.906
		Disagree	0(0.0)	11(3.0)	11(3.0)	P=0.000
		Neutral	30(8.1)	10(2.7)	40(10.8)	
		Total	349(94.3)	21(5.7)	370(100.0)	
4	Soil erosion has increased	Agree	335(90.5)	0(0.0)	335(90.5)	$\chi^2$ -291.547
		Disagree	0(0.0)	15(4.1)	15(4.1)	P=0.000
		Neutral	14(3.8)	6(1.6)	20(5.4)	
		Total	349(94.3)	21(5.7)	370(100.0)	
5	Landslides have increased	Agree	335(90.5)	0(0.0)	335(90.5)	$\chi^2$ -282.830
		Disagree	0(0.0)	14(3.8)	14(3.8)	P=0.000
		Neutral	14(3.8)	7(1.9)	21(5.7)	
		Total	349(94.3)	21(5.7)	370(100.0)	
6	Forest, vegetable and fruits have become scarce	Agree	341(92.2)	0(0.0)	341(92.2)	$\chi^2$ -280.340
		Disagree	0(0.0)	9(2.4)	9(2.4)	P=0.000
		Neutral	8(2.2)	12(3.2)	20(5.4)	
		Total	349(94.3)	21(5.7)	370(100.0)	
7	Plant species composition has changed	Agree	301(81.3)	0(0.0)	301(81.3)	$\chi^2$ -255.887
		Disagree	0(0.0)	14(3.8)	14(3.8)	P=0.000
		Neutral	48(13.0)	7(1.9)	55(14.9)	
		Total	349(94.3)	21(5.7)	370(100.0)	
8	Water logging and Salinity has affected the production of crops	Agree	349(94.3)	2(0.5)	351(94.8)	$\chi^2$ -332.854
		Disagree	0(0.0)	4(1.1)	4(1.1)	P=0.000
		Neutral	0(0.0)	15(4.1)	15(4.1)	
		Total	349(94.3)	21(5.7)	370(100.0)	
9	Loss of financial assets of farmers has created hurdles in their stability	Agree	339(91.5)	15(4.1)	354(95.6)	$\chi^2$ -50.265
		Disagree	5(1.4)	3(0.8)	8(2.2)	P=0.000
		Neutral	5(1.4)	3(0.8)	8(2.2)	
		Total	349(94.3)	21(5.7)	370(100.0)	
10	Climate change has affected the local economy because of reduction in agricultural productivity	Agree	349(94.3)	11(3.0)	360(97.3)	$\chi^2$ -170.807
		Disagree	0(0.0)	3(0.8)	3(0.8)	P=0.000
		Neutral	0(0.0)	7(1.9)	7(1.9)	
		Total	349(94.3)	21(5.7)	370(100.0)	

**Source:** Field Survey, 2017; Number in the table represent frequencies and number in the parenthesis represent percentage proportion of respondents and in the last columns  $\chi^2$  represent value of Chi-Square and number in parenthesis represent P-value (Significance).

Similarly, a significant ( $P=0.000$ ) association was founded between loss of financial assets of farmers has created hurdles in their survival is under threat, with climate change effects on the human life. Supporting the statement Arbuckle et al. (2015) say that as farmers are generally poor with a few resources and short of money, so their exposure level to effects of climate change is high as compared to other sections of society. The other reason behind high exposure level of farmers is their dependency only the farming practices. Floods and other climate events wash away their assets and spendings in farming threatening their stability.

A high level of significance ( $P=0.000$ ) was marked in the loss of agricultural productivity affecting the local economy, with climate change effects on human life. Findings of the study conducted by WWF-Pakistan (2014), surrounding the Indus plains shows that Pakistan has agro-based economy which is in threat due to climate change. Recent climate variability has affected the regular patterns of rainfall in summer and winter. Temperature increase has affected the tolerance of the crops to external shocks, ultimately reducing the productivity. Industries run on the production from agriculture sector contributing to the economy. However, with decline in agriculture productivity, local economy has also affected negatively.

## Conclusions and Recommendations

The study found that Climate Change resulted into some abrupt changes in the weather conditions which emanated surge in temperature, alterations in seasonal cycle i.e. early start of winter and summer and ending of these at the earlier as well along with unpredictabilities in rainfall patterns with prevalence of summer season for a long period and time than usual. It was further explained that increased temperature had also led to early melting of snow and disrupted the monsoonal winds patterns disturbed agriculture sector. It was further emanated from the findings of the study that greenhouse effects had reduced the agriculture production along with increased frequency of disasters, soil erosion was taking place unabatedly, and plant species composition met with a disorder, water logging and salinity has taken roots in study area, which had negatively affected the livelihoods and its patterns of local community.

## Recommendations

- Policy formulation and implementation to cut short the emission of greenhouse gases to stop further damage to the environment.
- Climate Change Adaptation (CCA) and mitigative measures are to be taken to minimize the impacts on health, agriculture and local economy.
- Government and concerned departments are to be strengthened to combat with the effects of climate change by institutionalizing their role and increase the capacity of the staff.
- Private sector should come forward to render their services in the community by creating diversification in the livelihoods, so that the dependency level only on farming practices be decreased.
- Over exploitation of the natural resources like forests be avoided, as these forests absorb the  $\text{CO}_2$  and other harmful gases and also contributing towards balance of the ecosystem stopping the erosion and act as a best natural mitigative barrier to the floods.

## Novelty Statement

This research is one of the few studies which attempts to highlight how farmers see climate change in their social setup.

## Author's Contribution

Rahat Naz collected and entered the data and prepared the draft research paper. Mussawar Shah conceived and designed the research and finalized the research paper. Asad Ullah analyzed the data and helped in interpretation of results and writing research paper draft. Intikhab Alam finalized the interview schedule and organized literature review. Younas Khan collected the data and helped in drafting and editing the research paper.

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