Islamic Relief

Community-based Climate Change Adaptation in Khyber Pakhtunkhwa (KPK), Pakistan

October 2011

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Community-based Climate Change Adaptation in Khyber Pakhtun Khwa (KPK), Pakistan

1. INTRODUCTION

1.1. Background of the Study

Climate change is the defining human development challenge of our time. It threatens to stall poverty reduction and hard-earned progress made in achieving the Millennium Development Goals (MDGs). In the countries of South Asian region, including Pakistan, the early signs of climate change are already visible. Out of the last 12 years of the last century, 11 were the hottest of the last 400 years where temperatures in Pakistan reached 53 degree C and in Finland 37 or so. These changes are already threatening the lives and livelihoods, health and well-being of millions, especially the poor and vulnerable, who lack the financial, technical, human and institutional resources to adapt. It requires knowledge, skills and resources to adapt to the changing climate.

Future changes in precipitation, incidence of extreme events, sea level and glacial cover are expected to affect food security, nutrition, and access to water, sanitation, shelter, health, labor productivity, productive sectors and household incomes. These changes may exacerbate the already low levels of human development in the region (Iqbal et al, 2009))

It has frequently been argued that farmers base their farm decisions on their lifelong experiences. Over time, they learn and acquire deep understanding of their environment and gradually adapt their crop production technologies accordingly. T. W. Schultz argued way back in early 1960s in his work on transforming traditional agriculture that small farmers were quite efficient and are rational in resource allocation given their knowledge and skills (Schultz, 1964). However, with the climate change, farmers' previous experience and knowledge are increasingly becoming irrelevant and they are required to allocate their resources based on less reliable experience and knowledge. They are required to adapt and re-adapt to changing climate. That makes agriculture more risky and demand more research and education to enhance their understanding of the climate change process.

Pakistan's status as a developing country dependent mainly on agriculture makes it particularly susceptible to the effects of climate change (floods, droughts, and cyclones). Agriculture in Pakistan is a major economic contributor to the national GDP with about 24% share and employs about 45% of the labor force (GOP, 2011). Pakistan is divided into ten agro-ecological zones based on physiographic divisions (PARC, 1980) and almost a third of Pakistan's total area is classified as rangeland (GOP/RCA, 1992) that support two-thirds of the entire population of sheep and goats and over half of the cattle population of the country. Millions of herders and pastoralists depend on rangelands for their livelihood, especially women farmers. Livestock farming plays a significant role in the economy of Pakistan.

The Potential Climate Change impacts in Pakistani Agriculture are: vulnerability of crops to heat stress, possible shifts in spatial boundaries of crops, changes in productivity potential, changes in

water availability and use, and changes in land use systems. Significant increases in requirements were observed in the rice-wheat, maize-wheat, and cotton-wheat systems and availability of meat. Areas such as changes in cropping patterns, water availability, production system management and land use require urgent attention.

Climate change adaptation challenges in Pakistan are a crucial and urgent need for institutional and financial capability for climate change adaptation. The need for an adequate monitoring system for the prediction of likelihood of occurrence of extreme events, or the assessment of possible changes in weather patterns, thus making disaster mitigation strategies extremely difficult. Therefore, improving the adaptation capability and thereby reducing vulnerability and encouraging sustainable policies should be of the highest priority for Pakistan.

Research and documentation of grassroots level knowledge and skills that help farmers adapt to changing climate is found very useful for the farming communities and policy makers alike. Where farmers learn from what works and what doesn't and benefit from the best practices, governments need this information to tailor their strategies for providing farmers the needed support.In the backdrop of the above mentioned scenario, this study is an effort to address the issues related to the impact of the climate change on some of the vulnerable areas of Khyber Pakhtunkhwa (KPK) province of Pakistan, with an intention to redevelop some strategic mechanism for community-based adaptation processes to reduce the negative impact of climate change and to protect the people living in more vulnerable areas.

1.2. Objectives

The main objective of the study was to investigate the impact of the climate change on the farming communities and to assess the Community-based Climate Change Adaptation Responses and Methods adopted by the affected communities of the 4 selected districts of Khyber Pakhtunkhwa (KPK) province of Pakistan. The findings of the study would help in developing community-based strategies and policies to address the impact of the climate change and to reduce its negative impact on the people of these areas.

1.3. Locale of the study

The study was conducted in the 16 villages of the 4 selected districts of the Khyber Pakhtunkhwa (KPK) province of Pakistan. These districts were selected on the basis of their location, which is always exposed to natural disasters and calamities, like heavy rains, floods and earthquakes. The list of the selected districts, with summary information, is given in Table 1; while details of the selected villages and particulars of respondents from these areas have been placed at Annex 1.**Table 1: Selected Districts and other Particulars**

No.	Districts	Villages	Respondents	Males	Females
1.	District Charsadda	6	25	19	6
2.	District Nowshehra	6	24	18	6
3.	District Swabi	2	8	6	2
4.	District Mardan	2	8	6	2
5.	**Total**	**16**	**65**	**49**	**16**

In-Depth-Interviews were conducted with the selected male and female members from all the 16 villages, while PRA activities were conducted only in 3 selected villages of 2 districts, including Charsadda and Nowshehra.

1.4. Profiles of the Respondents

In all 65 respondents, including 16 (25%) females and 49 (75%) males were selected from 16 villages of 4 districts for the In-Depth-Interviews (IDIs). While, for conducting PRAs activities, groups of 15 to 20, male and female community members were respectively selected from each village. The age groups of the respondents fall in the limits of 30 to 90 years of age.

Education wise**,** the respondents included mostly illiterate persons (72%); while, the rest of the respondents included 7.5% primary, 6% middle, 9% matric/high, 3% Fa/FSc, and 1.5% BA/BSc level educated people. For a comparative analysis see figure 1.

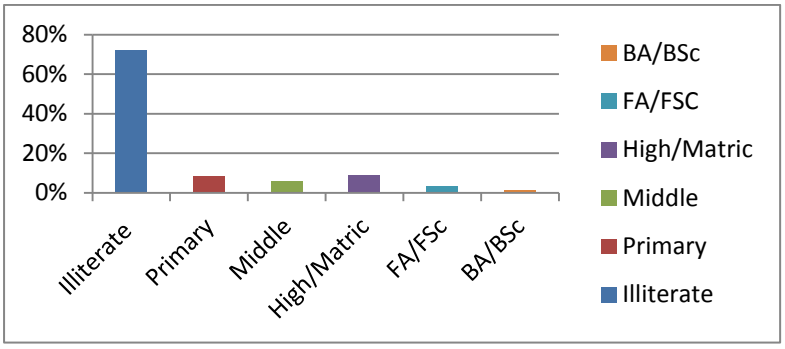


Figure 1 Education levels of Respondents

Professions wise, respondents included 72% farmers, 25% housewives, 1.5% laborer and 1.5% government servants. See Figure 3 for comparison.

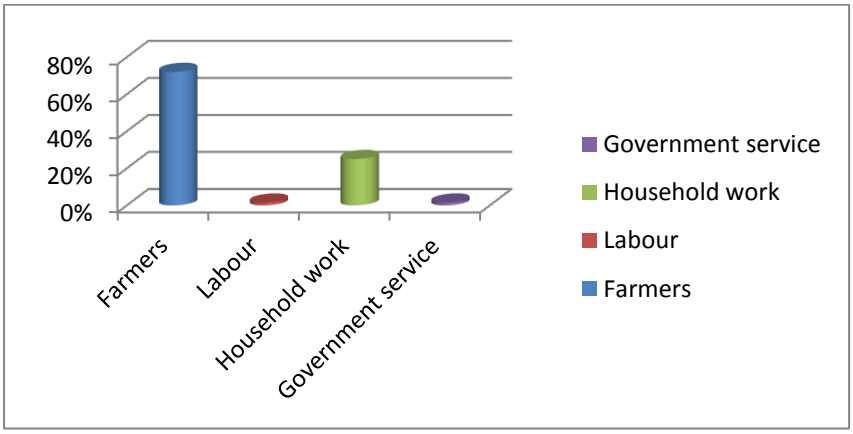


Figure 2 Professions of Respondents

With reference to **the** Economic Status, the reported average monthly incomes ranged in between the minimum level of Pak Rupees 2,000 to maximum Pak Rupees 50,000. The reported income is a family income, not of the individual respondents. Major source of all the respondents was farm income, while some of them (37%) have some additional non-farm income sources like, livestock, poultry farms, shop keeping, labor and government services. In all, 63%, respondents were totally dependent on farm incomes.

1.5 Research Methodology and Tools

1.5.1 Research Purpose

The research purpose of this study is to look into adaptation techniques within the farming and pastoral communities in the PKP region of Pakistan. It shall also ideally look into interventions that derive opinions from the farming communities about the adaptation techniques that they may locally practice. Also, and importantly establishing the crucial level of climate change realities that these areas have witnessed.

For the purpose of research, the following terms are defined below:

Climate Change: A change in the state of the climate that can be identified (e.g. using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period of time (typically decades or longer) whether due to natural variability or as a result of human activity (IPCC 2007).

Adaptation: Actions to reduce the vulnerability of an institutional system (e.g. a city government), population (e.g. low-income community in a city) or an individual or household to the adverse impacts of anticipated climate change. Adaptation to climate variability consists of actions to reduce vulnerability to short-term weather shocks and to climate variability. (Satterthwaite et. al. 2007).

Vulnerability: identifies the links between different vulnerabilities and assets. These relate both to external shocks and stresses, as well as to internal capacities to resist or withstand them. Vulnerabilities can be physical infrastructure (eg earthquakes), economic, politicio-legal (rights and current political scene), social and psychological in nature and can affect different groups of the population, particularly women and children (see Moser and Satterthwaite 2010).

1.5.2 Sampling

A two stage or stratified sampling techniques would be employed to select the area and 3 sub-zones within the Mardan area of Khyber Pakhtunkhwa (KPK).

In each sub-zones five villages were selected. In each village four farmers representing different classes of farm sizes were selected at random.

1.5.3 Secondary data collection and review

Secondary data collection, review and analysis is the most cost-effective way to gather a clearer, detailed analysis at the local level banking on all possible information available in the public domain. Secondary data when used correctly is a valuable source of information for gaining knowledge and insight into a broad range of issues and phenomena, especially looking at gaps both in literature and gaining insight into local trends and tested methodologies. Secondary data complements primary data by proving a baseline to primary data.

In this case, we intent to conduct a secondary data collection on climate change adaptation in KPK areas of Pakistan and look into climate change adaptation literature within farming and pastoralist

communities in other parts of the world. Additional emphasis would be paid on similar topographies, socio-economic situations and the nearest cultural areas. Since our emphasis is more on farming communities we would look into similar crops or growing seasons in other parts of the world, and establish any facts into climate change adaptations that might have been run. Below is a summary of the secondary data procedure that we shall apply:

- **Research Design**: The aim of the secondary research design would be to collect all possible background data on the following areas:
    1. Agricultural variables and practices (rainfall, crops, soil types, and uses, irrigation, etc.)
    2. Livelihood systems (rural, urban, on-farm, off-farm, informal, livestock etc),
    3. Demographic (population, population growth rate, rural/urban, gender, ethnic groups, migration trends, etc.),
    4. Infrastructure (roads, electricity, communication, water, sanitation, etc.),
    5. Environmental status and climate change related problems (with special reference to agriculture)

- **Sources of Secondary Data:** Official statistics, technical reports, scholarly journals, literature review articles, reference books and international development data.

- **Validation of Secondary Data quality:** In order to keep the secondary data quality intact, the following tips would be used while selecting and analyzing the secondary data available.
    1. Publication date – recent, relevant or outdated
    2. intended audience – Is the intended audience other researchers or the general public or policy makers, is the information source for general public or elementary,
    3. Coverage of the report – Is the document's coverage of the topic area broad or too narrow? does it add new information or provide better references/sources that can be verified
    4. Check on the primary or secondary data source used in the report - What are the source's credentials and methods used? If it is a secondary source, does it accurately cover and report on the primary sources?
    5. When compared to related data are the measures somewhat consistent? If data sources disagree citation would be crucial.

1.5.4 Expert interviews and consultations

The process of secondary data collection and analysis must involve people with different perspectives and competencies. Focusing on three core competencies of people that we shall involve for expert interviews and consultations:

- People with sectoral climate change intervention and knowledge skills
- Local people with inherent geographical and climate change knowledge
- Research institutes or independent researchers with strong level knowledge on climate change adaptation or gaps on data collection. Our aim would be to collect information on

the field and the summary analysis that might be missing from the government or local terrain.

To include expert opinion, advice and dig deep into the matter with valuable sources of information we shall seek advice from sector specialists and other experts working in climate change adaptation for farming and rural communities in PKP.

For this matter, we have arranged an expert interviews and consultations with various governmental departments in Pakistan.

1. Ministry of Agriculture
2. Ministry of Environment and Climate Change

1.5.5 Primary data Collection

Primary data collection is a useful tool for collecting new data, especially in areas that have been less explored or on new trends that require a good amount of data analysis to verify the existing records or bring credibility to trends in data. In the case of climate change adaptation, the current vulnerabilities and variation make primary data collection a crucial start for a region like the KPK, especially since our background research has indicated that climate change adaptation data collection in KPK region of Pakistan has been until recently neglected.

In order to proceed with primary data collection, we looked into the major types of primary data collection and concluded that Participatory Research Methods (PRA) would be the best way forward. In climate change, a community-level participatory approach at the micro-level is intended to provide realistic insights into the experience of the impacts of severe weather traumas among low-income groups in a way that is not feasible for any macro-level analyses. Since we are looking into climate change adaptation especially into the agricultural section, it would only be democratic and crucial to include the most important rural stakeholder within the adaptation process: the farmers. Also, PRA techniques have been greatly used on forests[1], livestock-keepers[2] and on numerous participatory poverty assessments worldwide.

1.5.6 KPK Questionnaire Background

As explained above; in each cluster of 5 villages in KPK, 1 PRA will be conducted to assess the climate change community vulnerability, sensitivity and capacity to adapt to climate change challenges at the community level.

We have a structured questionnaire with a mixed bag of the types of questions asked. They shall include both open ended that is used for breaking the ice in an interview especially when moving around in the KPK areas. We intend not only to value the respondents' own words but also go with the intention of finding out the farmer's feelings on climate change. This is what is referred to as the Likert-scale in research methodology. We also have a couple of closed questions that shall help us

[1] Two general references that are easily obtainable are the books by Donald Messerchmidt (1995) and by Jane Carter (1996)
[2] References include guidance (and examples) on the use of certain visual methods in relation to CPRs (IIED, 1994; Waters-Bayer and Bayer, 1994; Conroy, 2001).

collect rank ordered data when all response choices shall be put forward to the farmers so as to obtain a quantitative statistical result. Finally we shall club the farmer response category wise for data analysis.

Themes are derived from the background contextual discussions and analysis of vulnerability, adaptation and climate change nexus, which are then detailed into the questions as seen on the questionnaire. These basic broad themes include the following:

1. Community characteristics: Background identification of the community's most salient and general characteristics.
2. Severe weather related to climate change: Identification of types of severe weather, the history of community in relation to changes in severe weather over time.
3. Vulnerability to severe weather: Identification of vulnerable groups, areas and assets, affected by severe weather associated with climate change.

4. Asset adaptation to severe weather: Identification of assets at household, small business and community level, and strategies and solutions of asset adaptation to climate change.

Institutions supporting local adaptation: Identification of institutions and their importance in adaptation to climate change.

A number of research methods, including Literature Review, Visits to relevant organizations, Survey and Interviews, Focus Group Discussions (FGDs) and Participatory Rural Appraisals (PRAs), were applied for data collection.

Following research tools were prepared and used for data collection:

- Questionnaire for In-Depth-Interviews (IDIs)
- Check list for Focus Group Discussions (FGDs)
- Check list for PRAs

1.5.7 Data collection from Research Organizations

A number of relevant organizations working on the climate change and its impact were visited for discussions and collection of secondary data to plan the study and also to use that for comparative purposes and to cross-check and verify and validate the findings of this study.

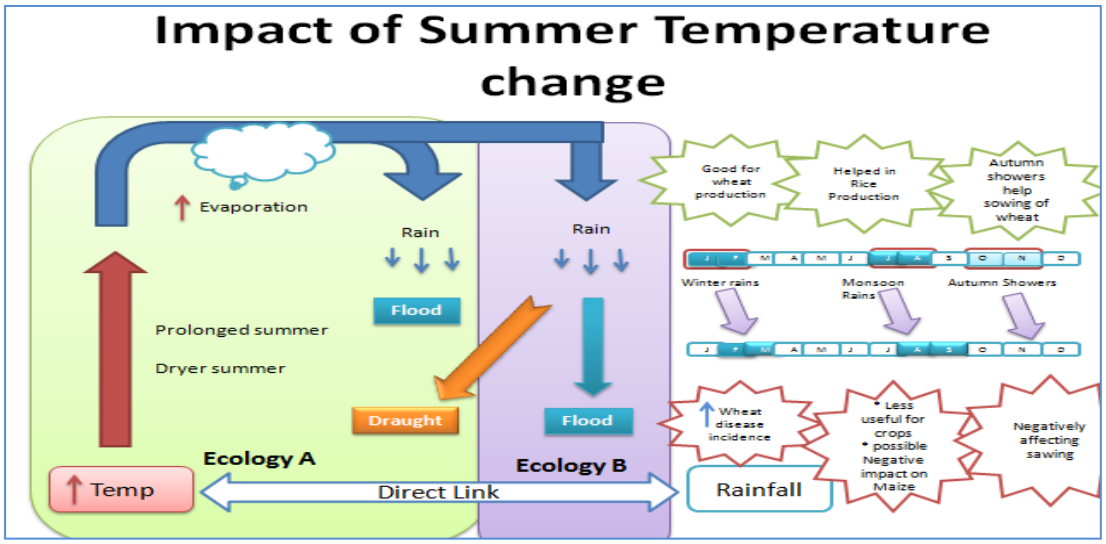
Some of the visited institutions and research organizations include:

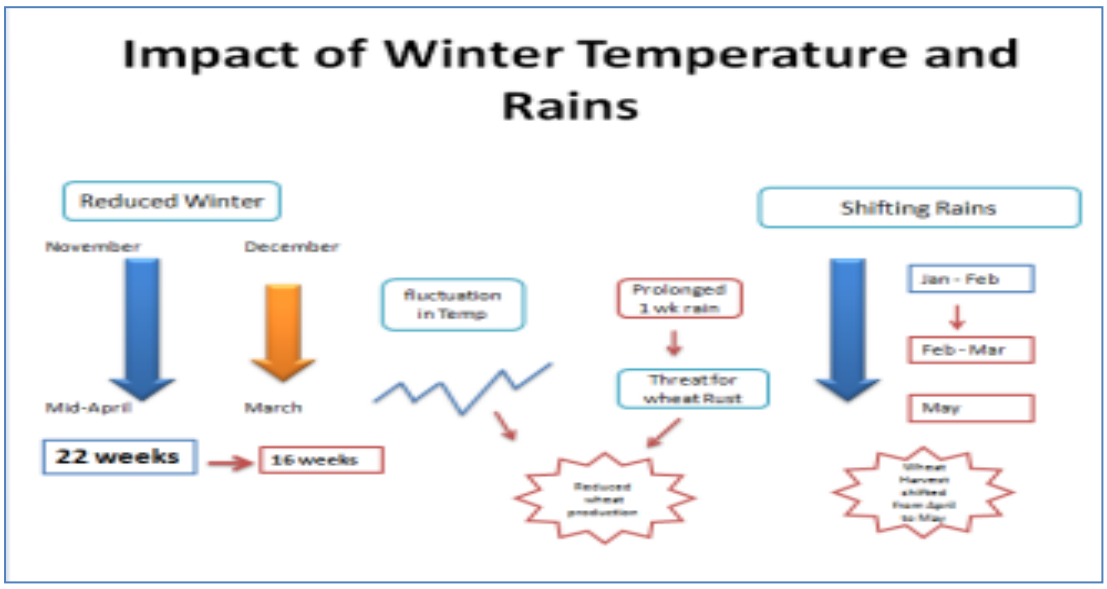
1. Pakistan Agricultural Research Council (PARC), Islamabad
2. National Agricultural Research Centre (NARC), Islamabad
3. Global Change Impact Assessment Research Institute, Islamabad
4. Ministry of Environment, Islamabad
5. Metrological Department, Islamabad
6. Agricultural Research Centre, Turnab, KPK
7. Cereal Crops Research Institute, Peer Sabaq, Nowshehra

2. How Local Communities See the Climate Change

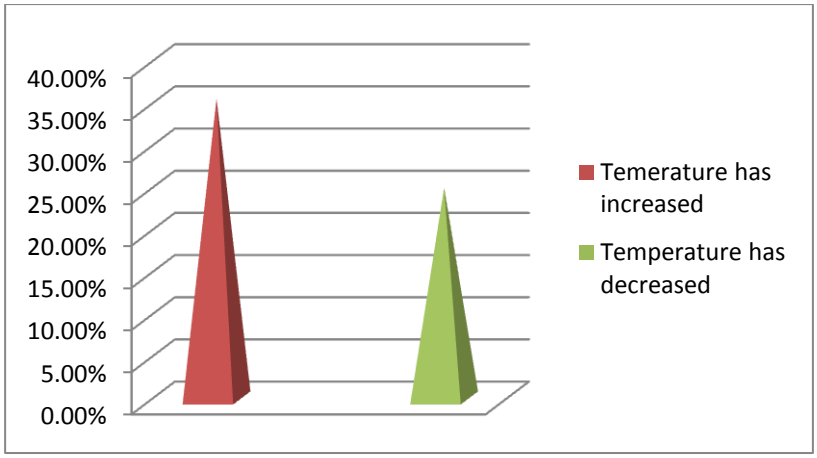
2.1. Temperature Changes

Any change in temperature may trigger a series of changes in the food production systems at the local level. While temperature have direct impact on water regimes through evapotranspiration, together with moisture levels, it can alter the local conditions to the levels that can affect pest composition and threats, may cause new plant and animal diseases, and in extreme cases, may dictate changes in crop and livestock choices. Peng et al (2004) using 6 year data from 227 irrigated rice farms in Asia found that rising temperature, especially night temperatures have serious effects on rice yields and may cause 10-20 percent yield losses. Figure below depicts some of the temperature impacts at the local level. The figure was used to explain the possible climate change impact to the farming communities.





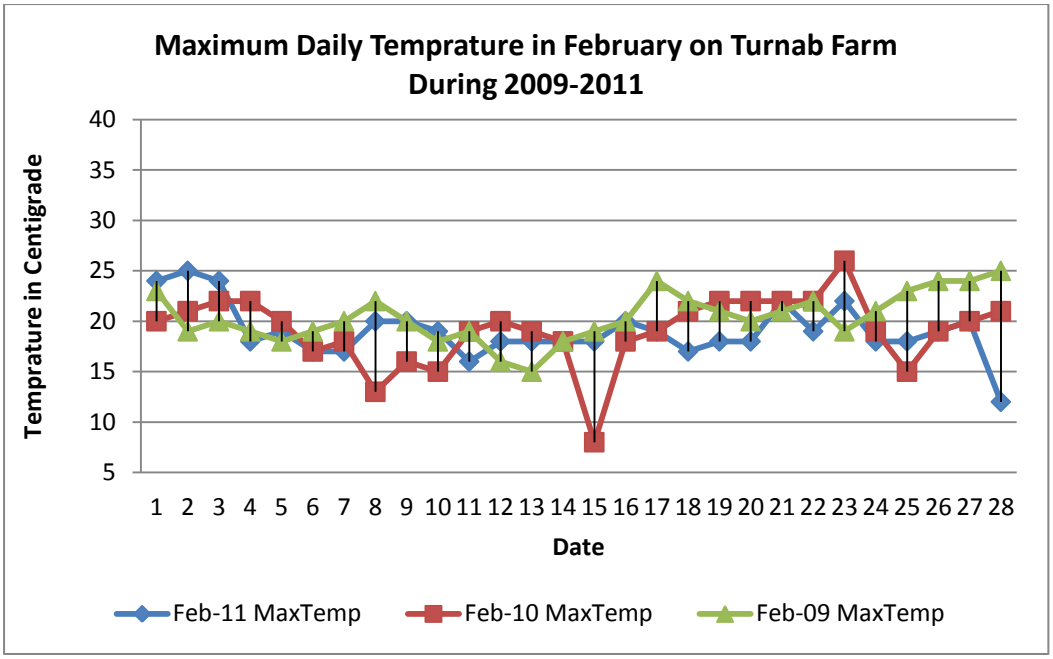
Responding to the question about the changes observed in temperature during the last 10 years, 72% respondents noticed the change in the temperature and 34 percent of them said that the temperature has increased, while 28% said that, in general, temperature has decreased during last 10 years. This confusion is understandable because there is no general trend in temperature and it fluctuates around its mean. It is hard for the communities to notice the trend in the historical averages. That also shows that temperature variation does not reflect any particular trend that communities can easily understand and predict.



Source: survey data

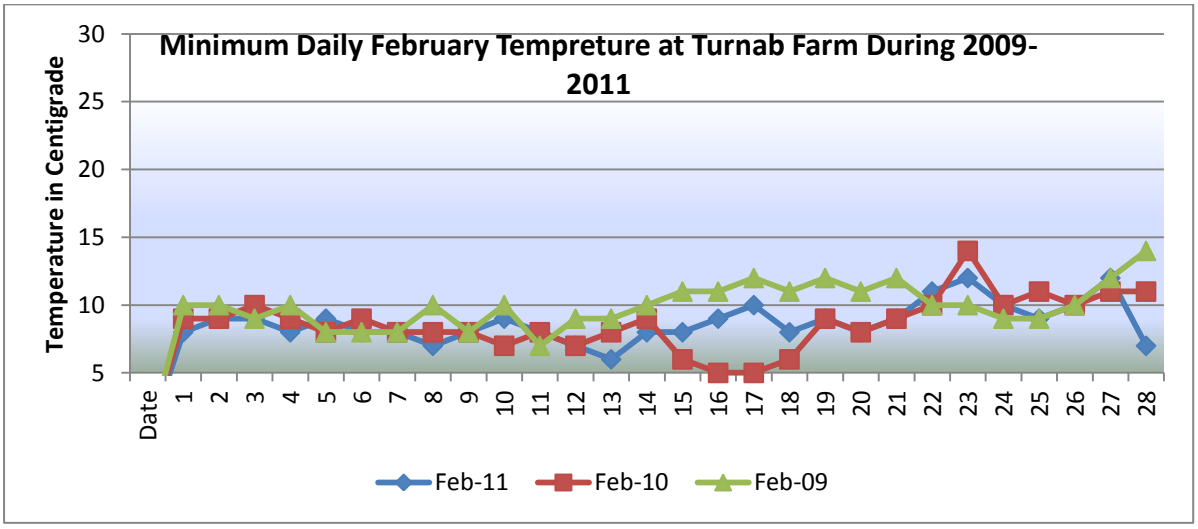
Figure 1: Temperature Changes

The data collected from the nearest research station on daily minimum and maximum temperature for the months critical for the wheat production, the main staple food crop; help explain the climate change phenomenon in a more meaningful way. The daily minimum and maximum temperature is graphed for February, March and April for the last three years. While it is not difficult to see lot of variation in daily temperature in the last three years, there is no particular trend.It is noticed that temperature fluctuates around the average. However, substantial variation from the mean, both positive and negative, have become the norm in recent years. These temperature changes are expected to have significant impact on certain crops.

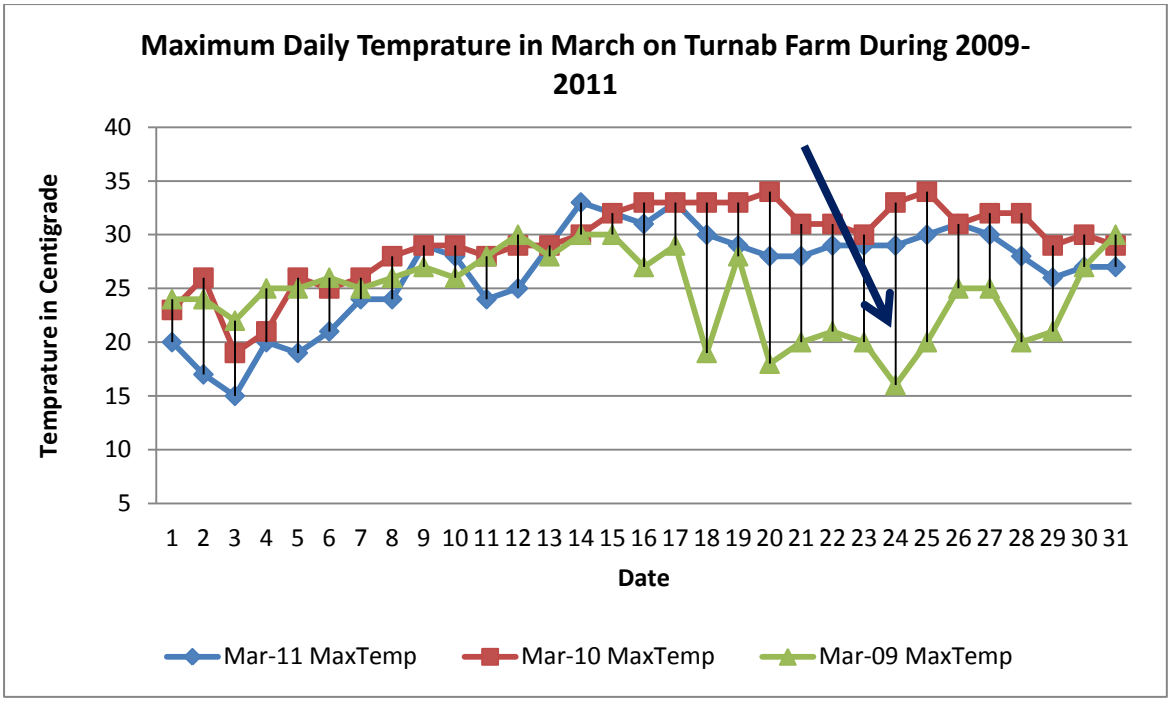


Source: data from research station

When we look at the 2010 daily temperature for February, first two weeks are warmer and then temperature suddenly below 10 degree C. This fluctuation is adequate to confuse the grain formation process in wheat and may cause serious negative impact on grain the formation and weight of wheat grain.

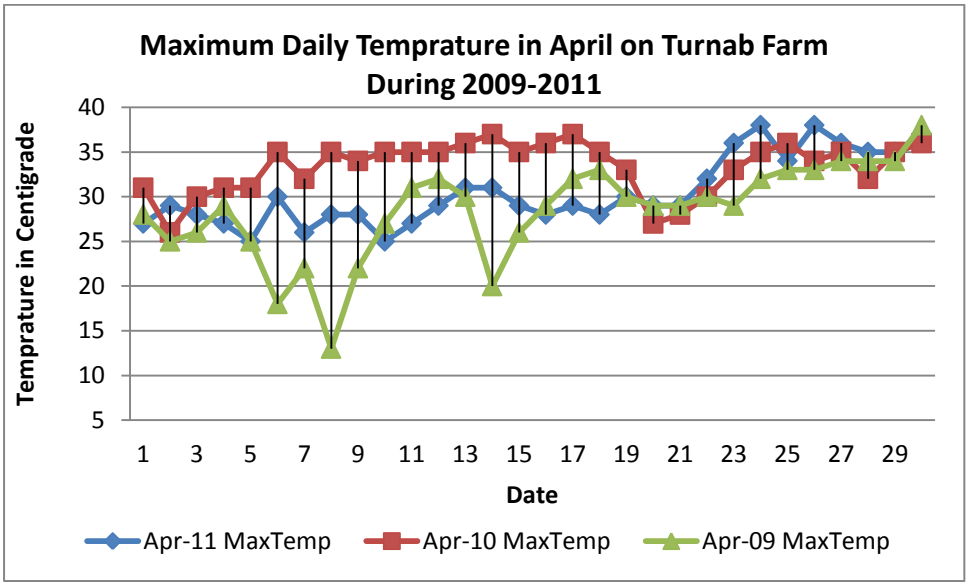


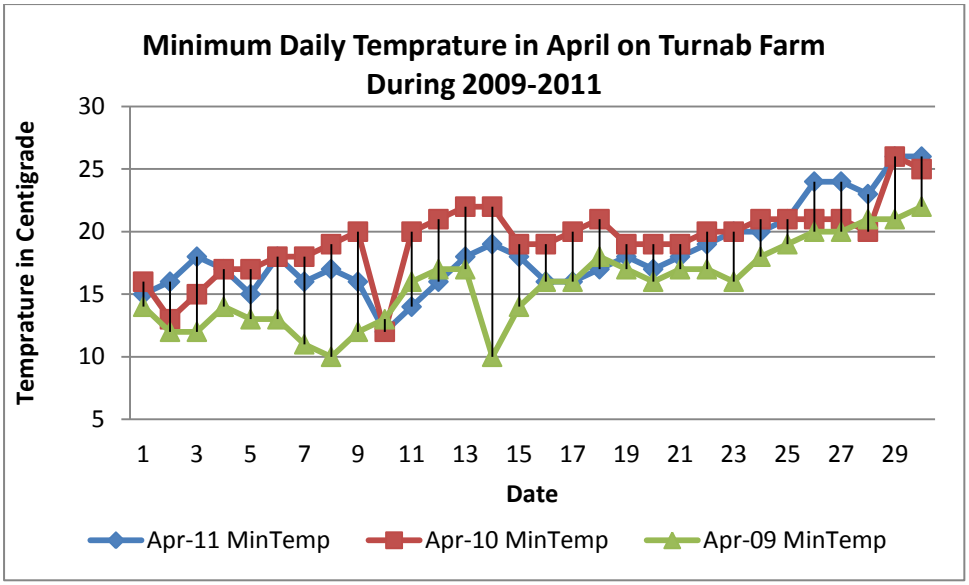
Source: Data from the research station



First part of March is warmer than the later half in 2009. This fluctuation can have drastic negative impact on wheat grain formation.

In the last two years, temperature is consistently higher than 2009 level. That may result early maturity of wheat crop means losing many crop growing days.





Low temperature in winter can even effect sugarcane crop. Some communities suffered heavy frost couple of years back and they lost almost all of their sugarcane crop.

2.2 Seasonal Changes Observed in Rainfall

In the recent years, rainfall patterns are showing signs of change. Sometimes rainy seasons start a bit late and the very next year sees rains much earlier than expected. As change in rain patterns have serious consequences for agricultural operations and the crops that farmers grow in this season, communities used to use their lifelong experiences to make their predictions about the rains and base their farm decisions on the available community knowledge.

In response to the question on the seasonal changes observed in rain fall during the last 10 years as compared to the period before the year 2000, following responses were given by the respondents on the status of the rainfall in different seasons:

About Summer Season Rains, 25% said that rainfall has increased, 73.5% said that rainfall has decreased; while 1.5% told that no changes have been observed.

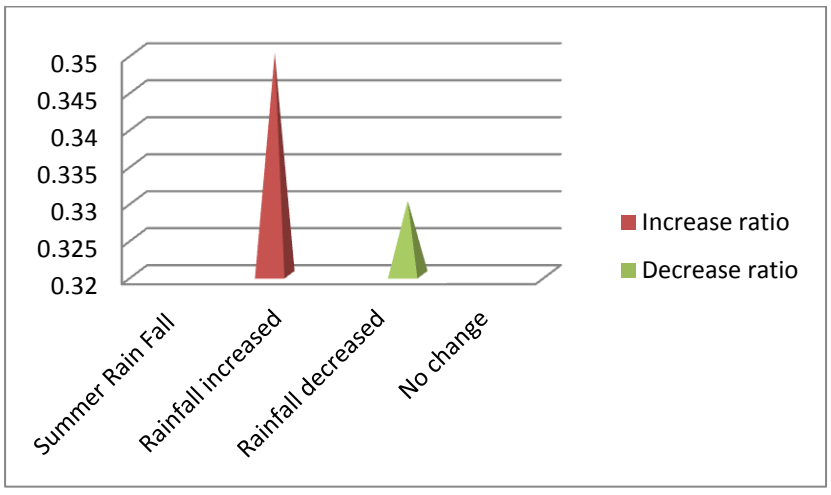


Figure 2: Changes in Summer Season Rainfall

About Winter Season Rains, 11% said that rainfall has increased; 86% said that rainfall has decreased; while 3% told that no changes have been observed.

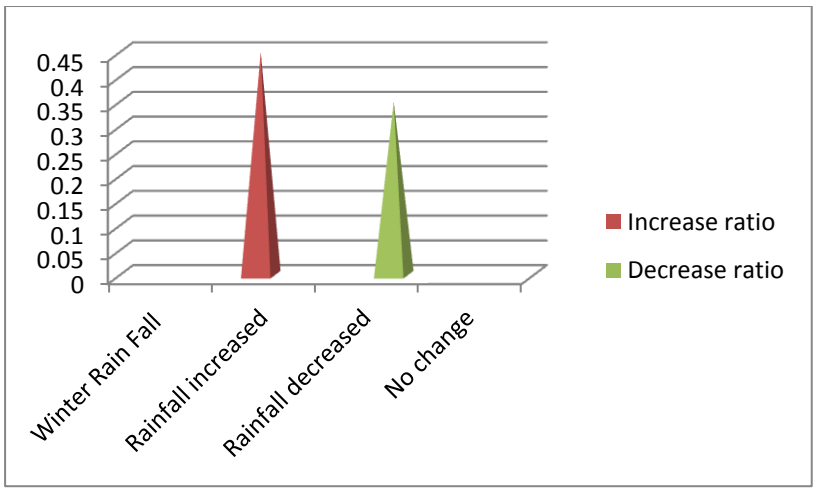


Figure 3: Changes in Winter Season Rainfall

About Monsoon Season Rains, 20% said that rainfall has increased; 78.5% said that rainfall has decreased; while 1.5% told that no changes have been observed.

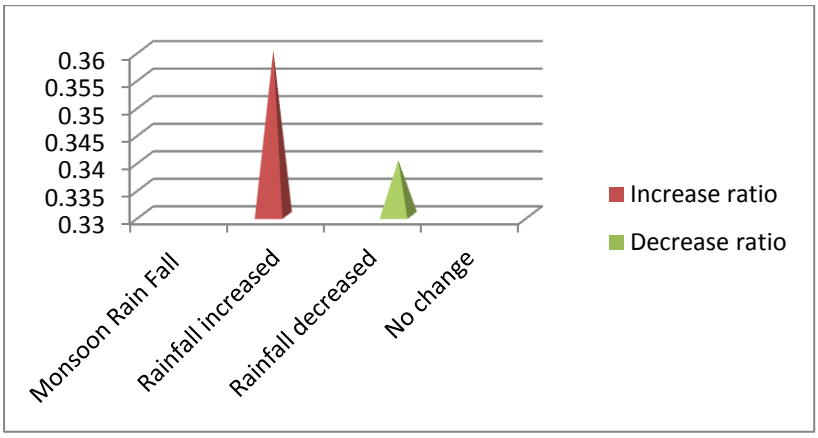


Figure 4: Changes in Monsoon Season Rains

About Spring Season Rains, 12% said that rainfall has increased; 82% said that rainfall has decreased; while 6% told that no changes have been observed.

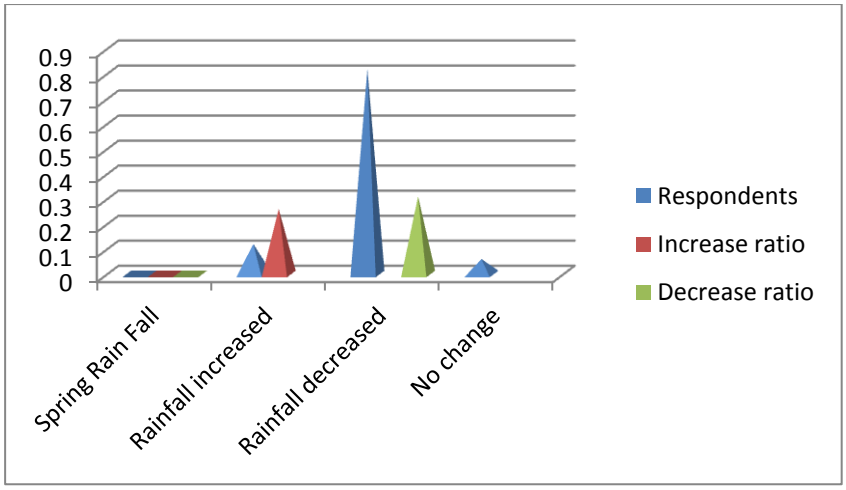
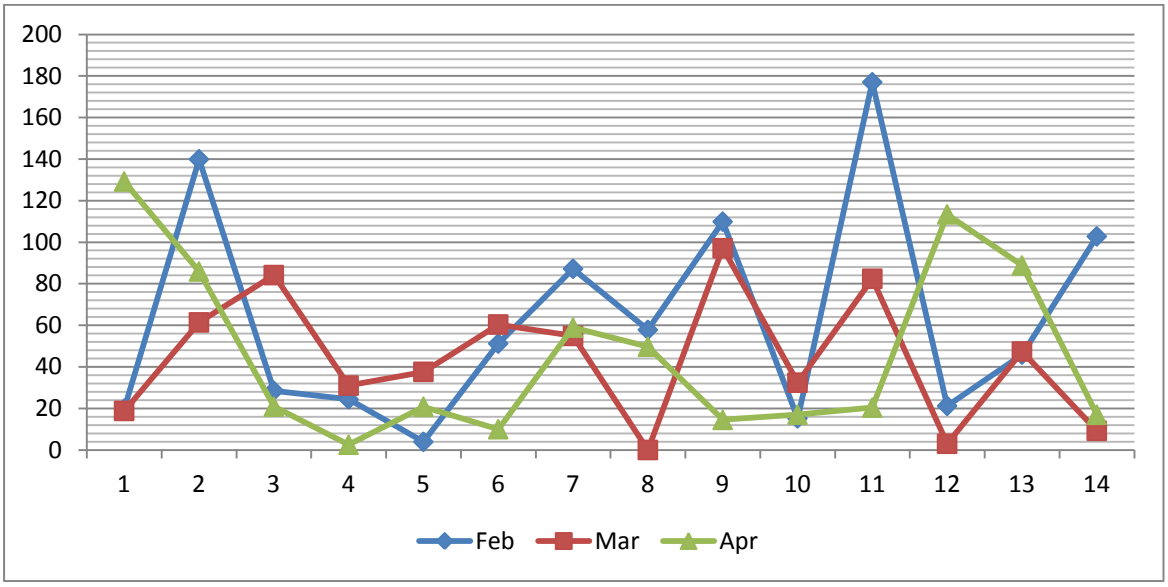


Figure 5: Changes in Spring Season Rainfall

Rainfall and Temperature Distribution during Wheat Grain Formation Period in the Area

Rains and Temp	2009			2010			2011		
	Feb	March	April	Feb	March	April	Feb	March	April
Rainy Days	6	5	9	8	2	5	9	4	5
Cloudy Days	12	18	13	16	7	11	20	9	10
Rainfall	45.9	47.40	88.8	102.8	9.2	16.95	78.9	19.8	32.8
Min Temp	4.9	7.4	11.4	5	11.6	15	5.7	9.7	12.5
Max Temp	25	30	38	26	34	37	25	33	38

Rainfall Distribution during Grain Formation Period of Wheat from 1997 to 2010



The actual data collected from the nearest research station help assess the community knowledge about the rainfall patterns. In the last 12 years, rainfall in Febrauary showed a mixed trend. Five years out of 12 witnessed below average and very low rainfall . On the other hand, two years witnessed a vry high rainfall. That's why communities got confused about the quantity of rainfall they received in spring. More than 80 percent of the community members were right in their assessment and based their opinion on five below average years of rainfall. While the 12 percent who opined that rainfall has increased were expressing their opinion based on the years with unusually high rainfall.

Communities were of the view that low rainfall in February affects the grain formation negatively and the high rainfall, on the other hand, if create high level of humidity can enhance the risk of wheat yellow rust.

2.3. Changes in Starting Time of Seasons

Changes in the starting time of winter, summer and rainy seasons have some serious implications for the agriculture. Any early or late winter will have impacts on the sowing dates of winter crops. On the other hand, if summer starts earlier can significantly reduce the wheat growing days and thus negatively affect wheat yields.

Sharing their observations about the changes in the starting time of seasons during the last 10 years as compared to the period before the year 2000, the respondents gave the following answers:

Referring to the change in Summer Season starting time, 69% respondents told that some changes have occurred and 31% were of the opinion that no changes have occurred. Explaining the starting time changes 43% said now Summer Season starts earlier as compared to the past years, in average 24 days earlier; while 26% said that it starts later as compared to past, in average 21 days.

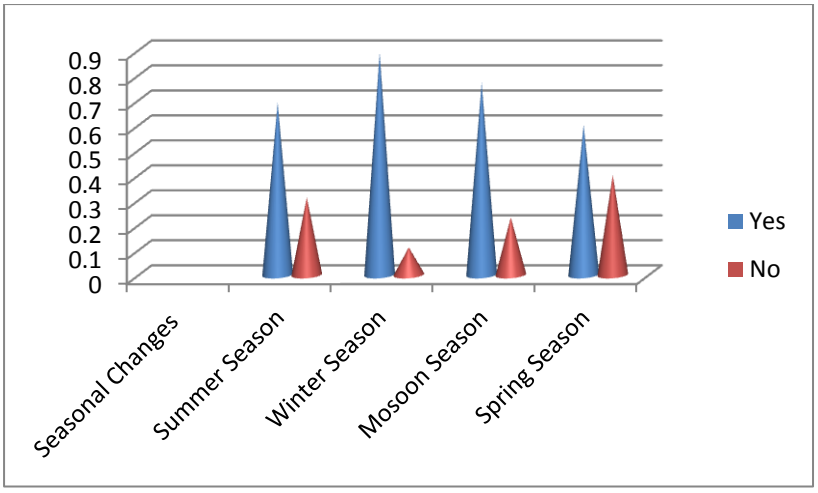


Figure 6: Changes in Starting Time of Seasons

Referring to the change in Winter Season starting time, 89% respondents told that some changes have occurred and 11% were of the opinion that no changes have occurred. Explaining the starting time changes 17% said now Winter Season starts earlier as compared to past years, in average 17 days earlier; while 72% said that it starts later as compared to the past, in average 29 days.

Referring to the change in Monsoon Season starting time, 77% respondents told that some changes have occurred and 23% were of the opinion that no changes have occurred. Explaining the starting time changes 14% said now Monsoon Season starts earlier as compared to past years, in average 15 days earlier; while 63% said that it starts later as compared to the past, in average 23 days.

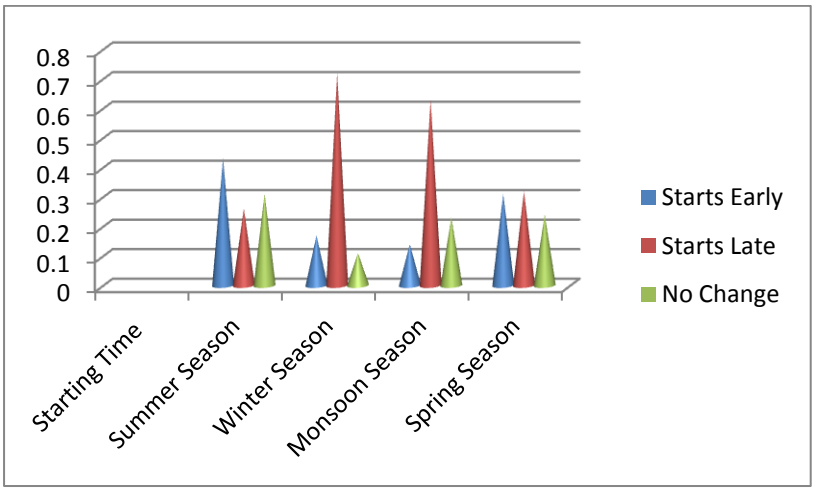


Figure 7: Early and Late Starts of Seasons

Referring to the change in Spring Season starting time, 60% respondents told that some changes have occurred and 40% were of the opinion that no changes have occurred. Explaining the starting time changes 31% said now Winter Season starts earlier as compared to past years, in average 18 days earlier; while 32% said that it starts later as compared to the past, in average 14 days.

2.4. Changes in the Duration of Wet and Dry Months of the Year

Commenting on the observations on the changes in the duration of Wet and Dry months of the year during the last 10 years as compared to the period before the year 2000, the following responses were received:

On the changes in duration of Wet (Rainy) months, 92% respondents confirming the occurred changes said yes and 8% said that no changes have been observed. Explaining the nature of change, 18.5% respondents said that duration has prolonged, approximately by the average of 19 days; while, 73.5% said that duration has shortened, in average by 35 days.

On the changes in duration of Dry months, 94% respondents confirming the occurred changes said yes and 6% said that no changes have been observed. Explaining the nature of change, 80% respondents said that duration has prolonged, approximately by the average of 47 days; while, 14% said that duration has shortened, in average by 27 days.

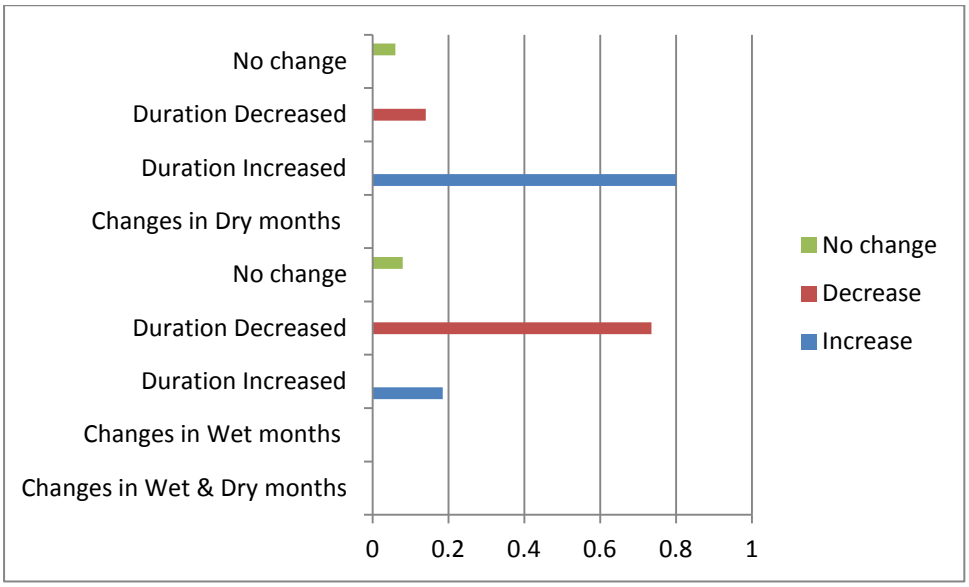


Figure 8: Changes in Duration of Wet and Dry Months of the Year

2.5. Changes in the Sowing and Harvesting Timings

Sharing their observations on the changes in the sowing and harvesting timings during the last 10 years as compared to the period before the year 2000, following responses were recorded:

It was confirmed by 71% respondents that changes in sowing timings of major crops have taken place and 29% said that no changes have been observed. Talking about the nature of changes, 31% said that the sowing starts early, by an average of 26 days; while, 40% said that now a day, sowing starts late, by an average of 21 days.

Regarding the change in harvesting timings, 61.5% respondents confirmed that some changes have taken place in harvesting timing of major crops and 38.5% said that no changes have been observed. Talking about the nature of changes, 35.5% said that the harvesting starts early, by an average of 16 days; while, 26% said that now a day, harvesting starts late, by an average of 17 days.

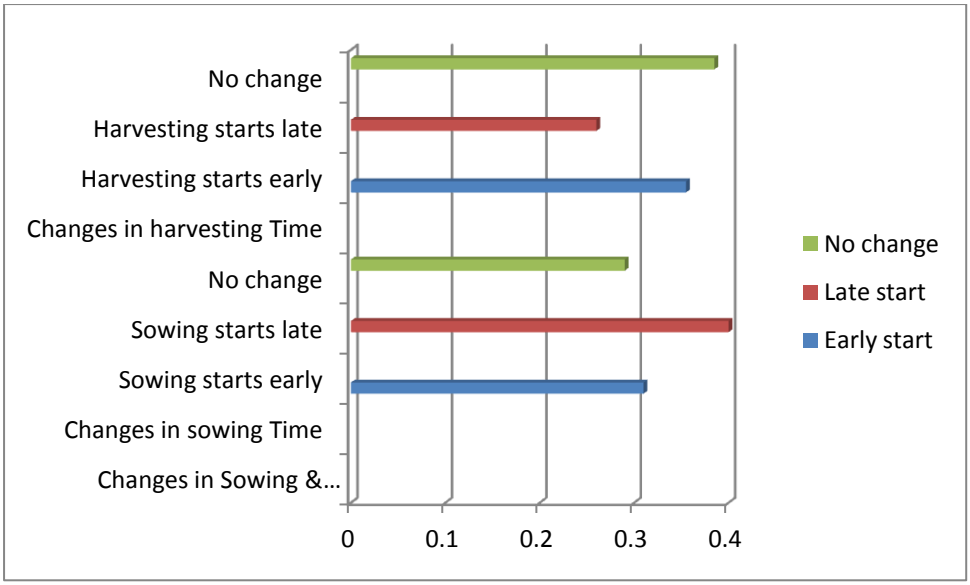


Figure 9: Changes in Sowing and Harvesting Timings

2.6. Changes in the Intensity level of Summer and Winter Seasons

Responding to the question about the changes observed in the intensity level of Summer and Winter seasons during the last 10 years as compared to the period before the year 2000, the respondents shared the following opinions:

Referring to the intensity level in the Summer Season, 74% respondents said that intensity has increased on average of 37%; while, 24.5% said that intensity has decreased by 21%; while, only 1.5% were of the opinion that no change has occurred in the intensity level.

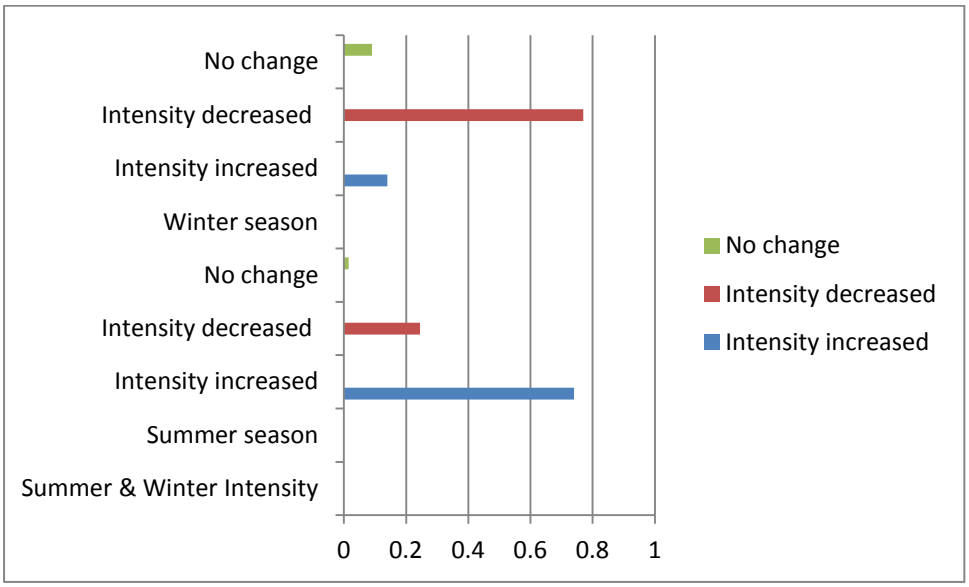


Figure 10: Summer and Winter Intensity Levels

Referring to the intensity level in the Winter Season, 14% respondents said that intensity has increased on average of 23%; and 77% said that intensity has decreased by 28%; while, 9% were of the opinion that no change has occurred in the intensity level.

2.7 Changes in the Pest-Attacks on the Crops

There is evidence that changes in temperature and humidity induced by climate change tend to alter the incidence, intensity and distribution of crop and animal pests and diseases. Changes in invasive and alien species are also observed. For instance, according to the researchers in the nearby agricultural research institute at Pir Sibhak, wheat yellow rust is on increase in the area for the last few years.

When communities were consulted regarding the changes observed in the pest-attacks on the crops during the last 10 years the respondents commented as following:

A large number of respondents (80%), said that pest attacks on the crops have increased on the other hand, 17% disagreed and said that the pest attacks have decreased. While a small percentage of people (3 percent) failed to observe any change in the pest build up and the associated diseases.

Highlighting the details and reasons of the increase/ decrease and impact of pest attacks on crops following factors were mentioned:

a) *Reasons of increase and impact*
   - Due to hot and prolonged dry weather/season.
   - Increased because no rest is given to land between cultivation of two crops.
   - Due to continuous cultivation of lands.
   - Due to change of crops/varieties.
   - Due to climate change like changes in temperature and rainfall.
   - Pest and worms attacks have increased on wheat, vegetables, sugarcane, and maize and also on trees.
   -
   - Due to pest attacks Sugarcane cropping has decreased.
   - Termite attacks on Sugarcane and other crops.
   - Environmental and seasonal changes.
   - Environmental pollution.

b) *Reasons for decrease*
   - Due to availability of new technologies.
   - Increased use of pest control methods.

2.8 Changes in the Livestock Diseases

In response to the question about the changes observed regarding the livestock diseases during the last 10 years following facts were shared:

More than 80% respondents were of the view that livestock diseases have increased by an average and 18.5% opined that livestock diseases have decreased during this period.

Highlighting the details and reasons of the increase / decrease in livestock diseases following factors were mentioned:

a) *Reasons of increase and impact*

- Infections, cough, flue, fevers, foot and mouth diseases have increased.

- Due to soil and water born diseases.
- Due to lack of rain and prolonged dry weather.

- Due to climate changes.
- Due to heavy sprays and use of pesticides on crops and fodder
- Due to flood hazards.
- Diarrhea, swelling, infections have increased.

b) *Reasons for decrease*

- Due to availability of better veterinary and treatment facilities
- Use of medicines.
- Use of herbs and home-made medicines and traditional treatments.

2.9 Changes in the Crops' Diseases

Identifying the changes observed regarding the crop diseases during the last 10 years as compared to the period before the year 2000, respondents disclosed the following facts:

It was told by 81.5% respondents that crop diseases have increased by an average of 40% during last 10 years and 14% told that crop diseases have decreased by an average of 41%, during this period; only 4.5% said that no change has been observed.

Highlighting the details and reasons of the increase / decrease in livestock diseases following factors were mentioned:

a) *Reasons of increase*

- Increased due to dryness of crops.
- Due to use of fresh cow-dung as manure and also due to use of chemical fertilizers.
- Due to low fertility.
- Due to Climate change and its impact.
- Due to temperature changes.
- Dry weather conditions.
- Due to less rain as compared to past.
- Sugarcane and wheat diseases have increased.
- Due to lack of crop rotation.
- Water shortage and floods.
- Increase in diseases of shaftal and sugarcane.
- Due to carelessness.
- Due to seeds and leaves dryness.

b) *Reasons for decrease*

- Use of latest pesticides.

- By using new control methods.
- Now new technology is available to control diseases.

2.9.1 A comparative Analysis of Pest Attacks, Livestock and Crop Diseases

A comparative analysis of the pest attacks on the crops, livestock diseases and crops' diseases have been presented in the following figure:

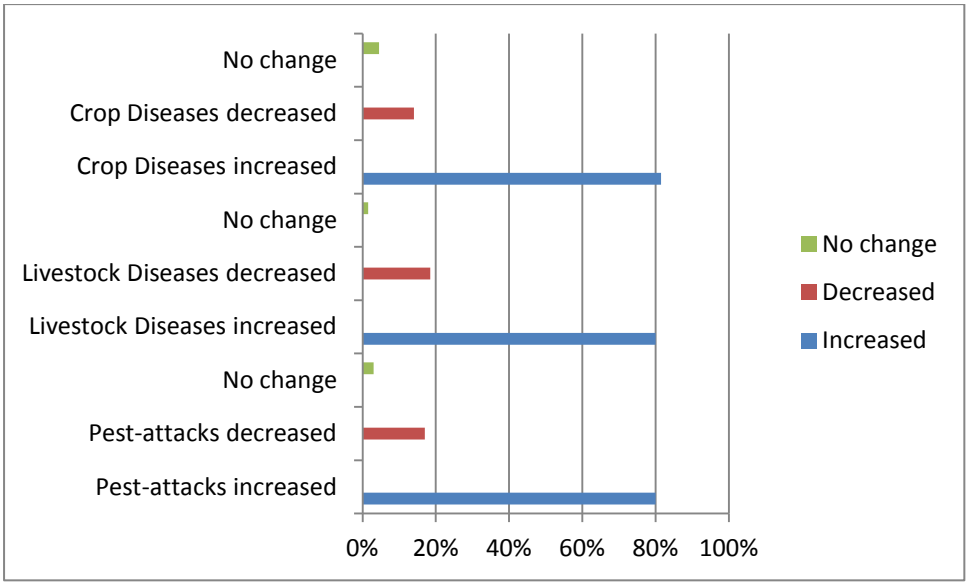


Figure 11: A comparative Analysis of Pest Attacks, Livestock and Crops' Diseases

3. Community-based Adaptation Response to Climate Change

Climate change is affecting farming communities and there is very little understanding at the national level on the adaptation needs of the communities. As a result, current adaptation deficit in agriculture is quite high. According to the FAO report on state of the food insecurity in the world, number of people at risk from hunger has increased from 300 million in 1990 to almost 1 billion in 2010 (FAO, 2009). However, communities do use their experience and knowledge to adapt to changing climate.

3.1 Climate Change and Water

Pakistan, like many countries of the region, is expected to face more uneven distribution of water due to climate change (Ali et al 2009). Spatial variability in rainfall together with uncertain flows in the rivers may cause changes that require serious adjustments and adaptation in farming practices. With increased temperature, irrigation water requirements of different crops also change putting extreme pressure on already decreased and uncertain supply of irrigation water.

While water regimes are changing, new crop production technologies not only help save irrigation water, help in reducing GHG emissions also. For instance, in particular, it has been estimated that modified rice drainage and straw incorporation practices could reduce global CH_4 emissions from rice cultivation by up to 30%. (Burney et al).

Respondents were asked about the impact of the temperature increase on the need of the increase of the irrigation water for different crops during last 10 years. As expected, it was hard for the farmers to quantify the changes in irrigation water requirements for different crops. Percentage scaling system was used to map the responses. In response, 92% people said that overall irrigation water requirement has increased up to 43% due to increase in the temperature during last 10 – 15 years. Only 8% farmers were of the view that they didn't practice any change in irrigation schedules of the crops they grow.

Crop-wise details based on their responses have been given in the following table:

Table 16: Impact of Temperature Increase on the Irrigation Water Needs

No.	Increase Level	NA/No	Less than 10%	11 to 20%	21 to 30%	31 to 40%	41 to 50%
	Crops						
1.	Sugarcane	29%	14%	24.5%	6.5%	9%	17%
2.	Tobacco	89%	9%	1.5%	00%	00%	00%
3.	Maize	17%	15%	34%	14%	3%	17%
4.	Wheat	12%	23%	26%	28%	3%	8%
5.	Rice	75%	1.5%	6.5%	3%	00%	14%
6.	Winter vegetables	34%	23%	11%	18.5%	3%	11%
7.	Summer vegetables	32%	26%	8%	18.5%	4.5%	11%

The opinions expressed indicate that the level of the needs of irrigation water has increased almost for all the major crops sown in the area, like, Sugarcane, Maize, Wheat and summer and winter Vegetables. Shortage of irrigation water has compelled farmers to switch from sugarcane production

to social forestry, a farmer opined. In this village, Agra Payan, there used to be five sugarcane crushing machines running full time throughout the harvesting season. But there is no such arrangement these days, he said. Even Charsada Sugar Mill has stopped its functions in the area.

3.2 Impact of Adopting new varieties of seeds/crops on the Irrigation Water Needs

Responding to the question about the impact of adopting new varieties of different crops on the need of irrigation water during last 10 years; 91% people said that the irrigation water need has overall increased approximately, up to 44%, due to either adopting new seeds or sowing new crops, during last 10 – 15 years. For instance, new hybrid varieties of maize require a lot more water than those of local maize varieties.

Crop-wise details based on their responses have been given in the following table:

Table 17: Impact of Adopting new varieties of seeds/crops on the Irrigation Water Needs

No.	Increase Level	NA/No	Less than 10%	11 to 20%	21 to 30%	31 to 40%	41 to 50%
	Crops						
1.	Sugarcane	36%	12%	12%	17%	3%	20%
2.	Tobacco	92%	6%	2%	00%	00%	00%
3.	Maize	20%	12%	29%	18.5%	3%	17%
4.	Wheat	17%	17%	23%	23%	6%	14%
5.	Rice	82%	3%	4.5%	3%	1.5%	6%
6.	Winter vegetables	40%	20%	11%	9%	6%	14%
7.	Summer vegetables	38%	20%	9%	11%	8%	14%

The given opinions indicate that the level of the needs of irrigation water has increased due to adopting new seeds or crop varieties, almost for all the major crops sown in the area, like, Sugarcane, Maize, Wheat and summer and winter Vegetables, ranging from 10% to 50%, respectively.

3.3 Climate Change and New Technologies

On asking about the status of new technologies adopted or used by the farmers in response to climate changes and their impact on the weather during the last 10 years as compared to the period before the year 2000, a large majority of respondents (95.5%) said yes. They indicated that the usage and adoption rate of various technologies is approximately 50%. Only, 4.5% respondents expressed that no new technologies have been adopted.

Details of the responses have been classified in the following table:

Table 18: New Technologies Adopted by the Farmers

No.	Adoption Rates	NA/No	Less than 10%	11 to 20%	21 to 30%	31 to 40%	41 to 50%
	Technologies/Processes						
1.	Irrigation	28%	22%	22.00%	18.50%	5%	6%
2.	Sowing	18.50%	28%	15.00%	15%	11%	12%
3.	Crop Harvesting	52%	22%	9%	8%	6%	3%
4.	Crop Threshing	9%	11%	12%	5%	11%	52%

5.	Plowing &Tilling	14%	15.00%	14.00%	15%	14.00%	28%
6.	Pest Control	12%	11%	6.00%	17.00%	17%	37%
7.	Water Harvesting	83%	11%	3%	0.00%	3.00%	0%
8.	Water Management	74%	14%	6%	4.50%	1.50%	0%
9.	Soil Conservation	74%	19%	2%	3.00%	1.50%	2%
10.	Livestock	23%	11%	17%	11.00%	18.50%	20%

Responses indicate that new technologies have been adopted and used mainly in crop threshing, pest control, plowing and tilling, and in livestock; while, the adoption rate in sowing and irrigation has been modest and for all other technologies like, crop harvesting, water harvesting, soil conservation and water management, it has been very low.

3.4 Changes occurred in the cropping patterns

Expressing their opinions on the changes, which have occurred in the cropping patterns in response to the climate changes and their impact on the weather during the last 10 years as compared to the period before the year 2000, a large number of respondents (94%) confirmed that a number of changes have been observed. They estimated the level of changes, approximately as 45%. Only 6% respondents disagreed and said there are no remarkable changes observed.

Details of level of changes in the processes, on the basis of given responses has been classified in the following table:

Table 19: Changes Occurred in the Cropping Patterns

No.	Rate of Changes	Not Applicable	Less than 10%	11 to 20%	21 to 30%	31 to 40%	41 to 50%
	Nature of changes						
1.	New crops introduced	29%	29%	9.00%	3.00%	8%	22%
2.	Old crops discarded	35.00%	37%	9.00%	6.00%	6%	6%
3.	Covered area increased	37.00%	6%	27.00%	15.00%	3%	11%
4.	Covered area decreased	77.00%	0%	11.00%	6.00%	0%	6%
5.	Irrigation needs increased	15.00%	6%	18.50%	15.00%	5%	40%
6.	Irrigation needs decreased	94.00%	3%	1.50%	0.00%	2%	0%
7.	Cost of Water increased	26.00%	5%	4.50%	14.00%	9%	42%
8.	Cost of Water decreased	100.00%	0%	0.00%	0.00%	0%	0%
9.	Use of local pest control methods continued	43.00%	35%	12.00%	6.00%	2%	2%
10.	Use of new pest control methods introduced	14.00%	8%	4.50%	9.00%	9%	56%
11.	Number of crop-varieties increased	14.00%	14%	9.00%	11.00%	19%	34%
12.	Number of crop-varieties decreased	83%	6%	3%	1.50%	5%	2%
13.	Use of local crop disease control methods continued	37%	38.00%	14.00%	1.50%	3%	6%
14.	Use of new crop disease control methods introduced	15%	6%	17%	6.00%	12.00%	43%
15.	Use of local methods for animal husbandry continued	25%	38%	17.00%	8.00%	4.50%	8%
16.	Use of new methods for animal husbandry introduced	9%	19%	17%	14.00%	9.00%	33%
17.	Use of local disease control methods for livestock continued	22%	44%	14%	14.00%	0.00%	6%
18.	Use of new disease control methods for livestock introduced	11%	17%	5%	11.00%	11.00%	45%

The research team conducted focused group discussions with the group on the changes they have experienced over time in their food production system. Having men and women farmers with age ranging from 30 years to 90 years in the PRA groups, it was interesting to trace the changes that local food production has experienced in the last six decades. Just to keep the discussion more focused, we decided to cover the period from the 1947, the year of independence of Pakistan. It was easy for the farmers to relate their analysis to a well identified reference point in time.

Using crop mapping techniques, researchers asked the farmers to map old and new crops cultivated in the area. The male and female groups drew maps on the ground independent of each other listing the crops they grow these days and also the crops they have stopped growing due to various reasons over time. They identified several crops that they used to grow and they are not part of their existing farming systems. At the same time they were also able to trace the changes in the farming systems and the new crops that got introduced in the system. While many new crops completely replaced the old crops, in other instances, the new crops partly displaced the old ones and affected the allocation of area to different crops within the farm plans.

Among several factors responsible for this change, communities consider climate change was the major determining factor for the decisions regarding allocation of land for different economic options available to the farmers. For instance, the area is popular for its sugarcane production. This is evident from the fact that the first sugarcane research institute of the country is situated in this area. Farmers have had a well developed market for the cane and the raw sugar they produced. The largest market of the country for raw sugar, particularly GUR (farmers-produced raw sugar), is also located in Peshawar. However, due to climate change the supply of irrigation water reduced to the levels that farmers have to replace sugarcane with low water demand crops. It is not just the supply of irrigation water that affected the sugarcane production in the area, farmers pointed out that unexpected frost a few years back also seriously affected sugarcane crop. Farmers suffered a lot of crop loss due to that frost. One sugarcane grower shared his experience that couple of years back frost damaged his sugarcane crop to the extent that he was unable to sell that. Buyers were offering Rs. 60000 (about 500 Pounds) per acre of sugarcane before the frost but no one was ready to pay even Rs. 6o (About 50 Pence) after the frost. . So many farmers shifted to vegetables, rice, and social forestry. Due to reduced sugarcane production in the area, the Charsada Sugar Mills closed their operations in the area.

In the recent past, vegetable production has increase many fold in the area. Women farmers identified that onion production has gone down and the production of garlic has increased substantially. Potato has also been included in the farming systems.

Besides listing the crops, the group also highlighted the variations, caused due to low level of rain fall and increasing dry period, in the sowing time (10 – 15 days late) and harvesting times (7 – 10 days early), comparing the periods from 1960 to 2000 and from 2001 to 2010. The group members were of the opinion that yield of Maize and Wheat has substantially increased, from 200Kgs per acre to 800 Kgs per acre.

The analysis of the above opinions indicate that the substantial changes have been observed in in more than one areas related to the cropping pattern. The highest rate of changes has been pointed out by the farmers as:

- Use of new pest control methods have increased.
- Use of new disease control methods for livestock has been adopted.
- Use of new crop disease control methods.
- Cost of irrigation water has increased.
- Irrigation needs have increased.

- Number of crop varieties has increased.
- Use of new methods for animal husbandry has been introduced.
- New crops have been introduced in the area.

3.5 Access to the Facilities and Services

Responding to the access to different services and facilities, needed for day to day livelihood purposes, the respondents told that the some of the listed facilities and services are not available in the villages and surrounding areas, but in case of most of the available facilities and services, male members of the communities have comparatively little more access to but females have a very limited access or even no access to some of the facilities, like mobility rights and property rights.

Table 20: Access to the Facilities and Services

No.	Nature of facilities /Services	Available	Not Available
1.	Access to climate information	5%	95%
2.	Access to agricultural extension department services	23.00%	77%
3.	Access to market for sale of produce	88.00%	12%
4.	Access to market for purchase of farm inputs	94%	6%
5.	Access to credit sources/Banks	57%	43%
6.	Access to water resources	67%	33%
7.	Access to water management department extension services	25%	75%
8.	Freedom and social mobility for males	100%	0%
9.	Freedom and social mobility for females	9%	91%
10.	Access to property rights (males)	98%	2%
11.	Access to property rights (females)	5%	95%
12.	Access to veterinary hospital	63%	37%
13.	Access to health facilities (BHUs)	72%	28%
14.	Access to education for boys	92%	8%
15.	Access to education for girls	89%	11%
16.	Access to NGOs extension services	89%	11%

3.6 Major Constraints Faced by the Communities

The major constraints which limit the access to the facilities and service include:

- In most of the villages the government extension services are either not available or are non-functional and without resources.
- Lack of access for the females is mainly due to social and cultural practices.

For a comparative situation of access to the facilities and services see the following graph.

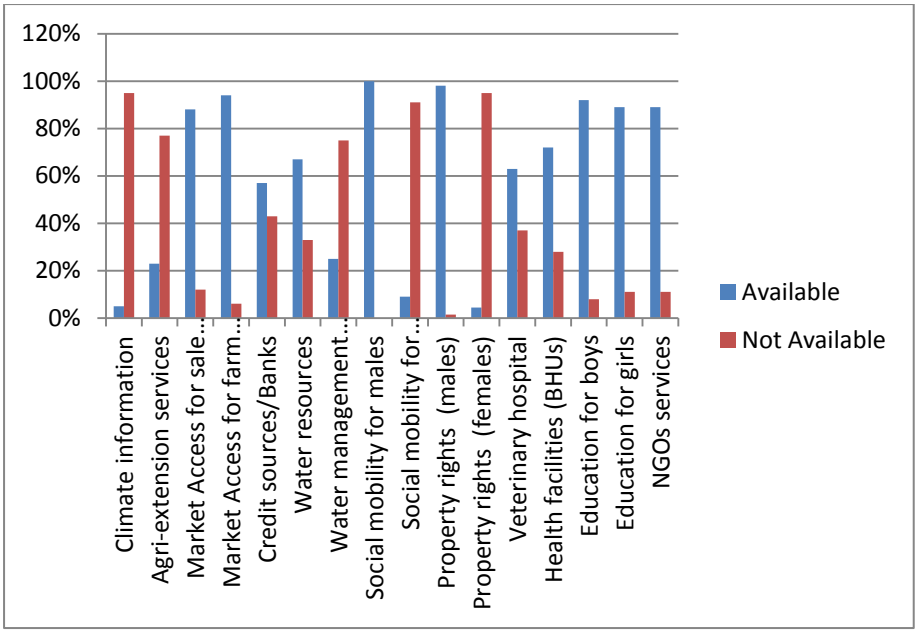


Figure 12: Access to Facilities and Services

3.7 Sources of Information and Consultation for the Communities

Responding to the question about the information and consultation sources with regard to the adaptation response to climate changes and their impact on the weather, it was told that the culture of getting information and consultation was very poor. In most of the cases people do not consult other community member or stakeholders for this purpose.

Some of the referred sources of information and consultation include: Hujra and Jirga; NGOs; other farmers and community members; government officials and school teachers. Given details of the sources on the basis of the consultation frequency, are mentioned in the following table and graph:

Table 21: Sources of Information and Consultation

No.	Sources of information/ Consultation	No consultation	Less than 10%	11 to 20%	21 to 30%	31 to 40%	41 to 50%
1.	Other community members	43.00%	14%	11.00%	4.50%	2%	3%
2.	Other farmers	46.00%	14%	8.00%	4.50%	3%	0%
3.	Agriculture department staff	51.00%	5%	3.00%	3.00%	3%	8%
4.	Imam Masjid	54.00%	6%	4.50%	3.00%	2%	2%
5.	School teachers	58.00%	8%	1.50%	1.50%	0%	0%
6.	Patwari	58.00%	6%	3.00%	0.00%	0%	2%
7.	Members of Union Council	62.00%	5%	0.00%	0.00%	0%	0%
8.	Hujra / Jirga	30.00%	22%	12.00%	8.00%	8%	5%
9.	Government officials	52.00%	2%	8.00%	1.50%	3%	6%
10.	NGOs	35.00%	20%	12.00%	6.00%	3%	5%

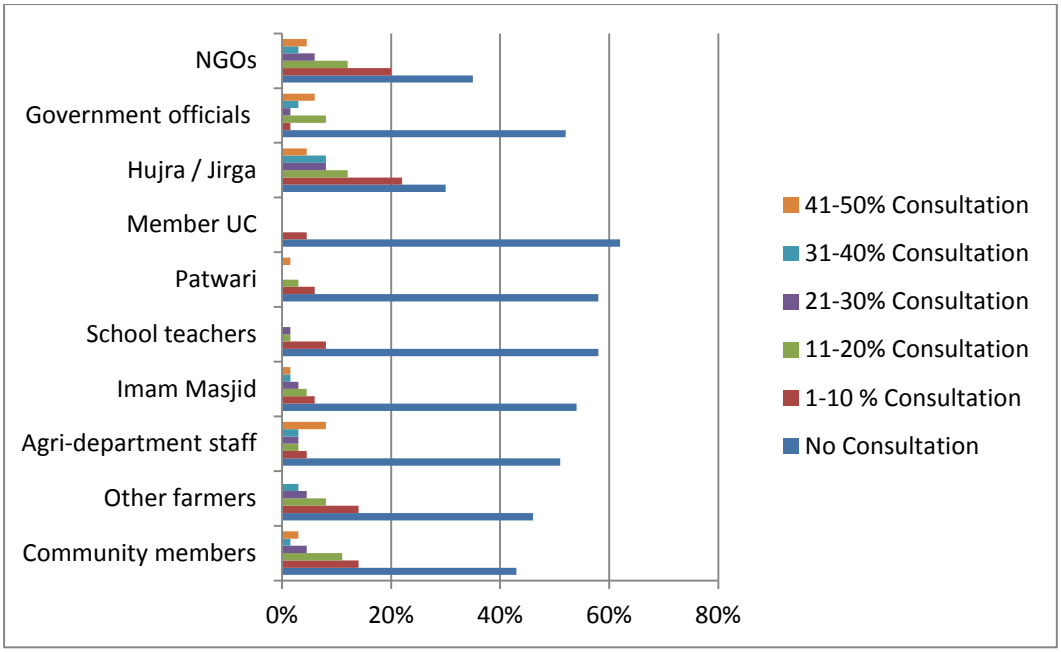


Figure 13: Sources of Information and Consultation

3.8 Factors of Vulnerability for the Communities' members

The respondents identifying the major factors of vulnerability for the community members with regard to the adaptation response to climate changes and their impact on the weather, said that the serious most and significant factors include Economic, Educational and Social Status of the community members. While, other factors like, age, gender, land holding, location of residence and social and cultural values have secondary impact.

The detailed responses about the vulnerability factors on the basis of their intensity are given in the following table; while a comparative analysis is shown in the graph below:

Table 22: Factors of Vulnerability for the Communities' members

No.	Vulnerability Factors	No impact	Less than 10%	11 to 20%	21 to 30%	31 to 40%	41 to 50%
1.	Age	45%	24%	14.00%	6.00%	6%	5%
2.	Gender	78.00%	3%	3.00%	8.00%	5%	3%
3.	Economic Status	17.00%	17%	33.00%	3.00%	5%	26%
4.	Land-holding	67.00%	6%	15.00%	6.00%	2%	3%
5.	Location /Residence	82.00%	9%	3.00%	3.00%	2%	2%
6.	Social status	84.00%	11%	3.00%	0.00%	2%	0%
7.	Culture & Customs / Values	86.00%	9%	3.00%	0.00%	0%	2%
8.	Educational status	49.00%	12%	9.00%	0.00%	2%	28%

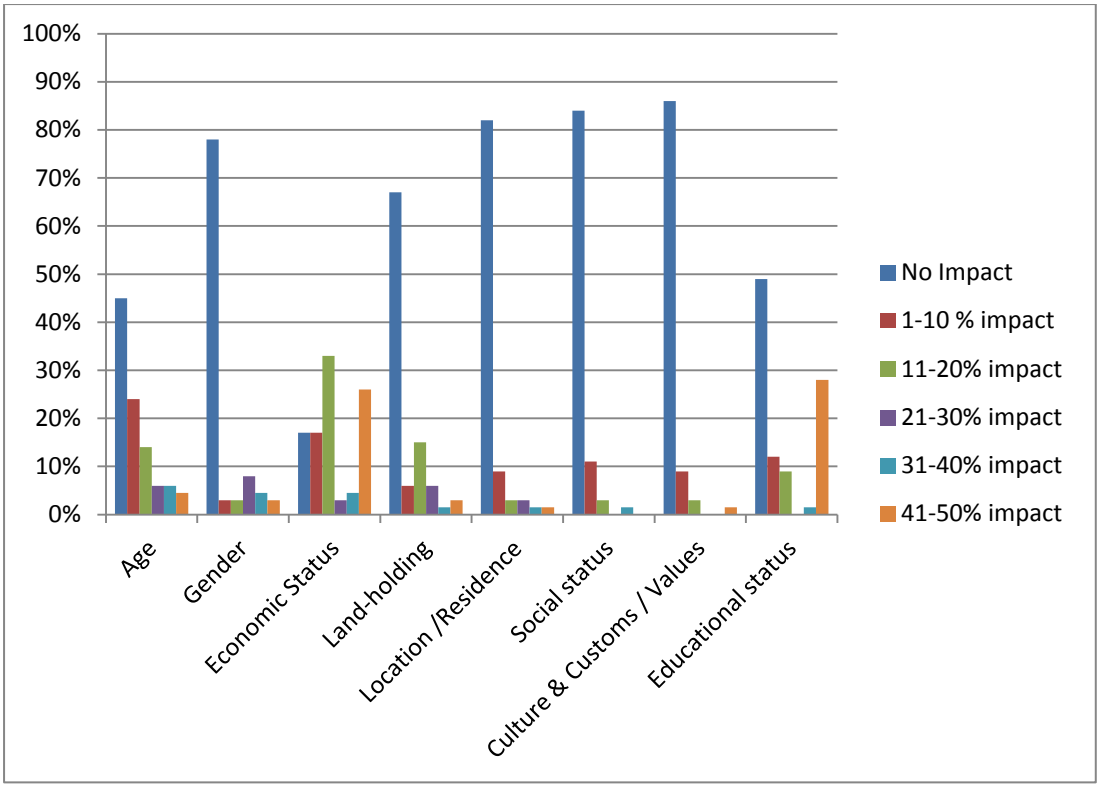


Figure 14: Factors of Vulnerability

4. Community – based Local Adaptation Strategies

4.1 Existing Role of the Stakeholders in the community-based strategy formulation

Responding to the question on the existing role of different stakeholders in the community-based local adaptation strategy formulation with regard to the adaptation response to climate changes and their impact on the weather, they said that most of the stakeholders are not playing any major role in this matter. Some of the stakeholders which have been playing any role, include NGOs, Hujra and Jirga, and some individual members of community, while a limited role of government officials, imam masjid and youth/children was also mentioned. The rest of the stakeholders' like, MNAs, MPAs, Members of Union Councils, School Teachers, Patwari, and female community members were identified as almost in-active stakeholders.

Details of the identified roles of different stakeholders on the basis of their contribution and effectiveness in strategy formulation, are given in the following table and compared in the graph:

Table 23: Existing Role of the Stakeholders in the community-based strategy formulation

No.	Stakeholders	No role	Existing Role				
			Less than 10%	11 to 20%	21 to 30%	31 to 40%	41 to 50%
1.	Individual members	54%	9%	20.00%	12.00%	3%	2%
2.	Union Council members	87.00%	6%	3.00%	0.00%	0%	3%
3.	MNA	89.00%	2%	0.00%	4.50%	0%	5%
4.	MPAs	91.00%	0%	3.00%	1.50%	0%	5%
5.	School teacher	89.00%	2%	3.00%	4.50%	2%	0%
6.	Patwari	86.00%	6%	1.50%	4.50%	0%	2%
7.	Imam Masjid	72.00%	6%	11.00%	4.50%	3%	3%
8.	Hujra / Jirga	46.00%	19%	14.00%	9.00%	8%	5%
9.	Government officials	69.00%	5%	9.00%	8.00%	2%	8%
10.	NGOs	43.00%	15%	9.00%	9.00%	9%	14%
11.	Female community members	89.00%	8%	0.00%	0.00%	2%	2%
12.	Youth/children	78.00%	11%	4.50%	4.50%	2%	0%

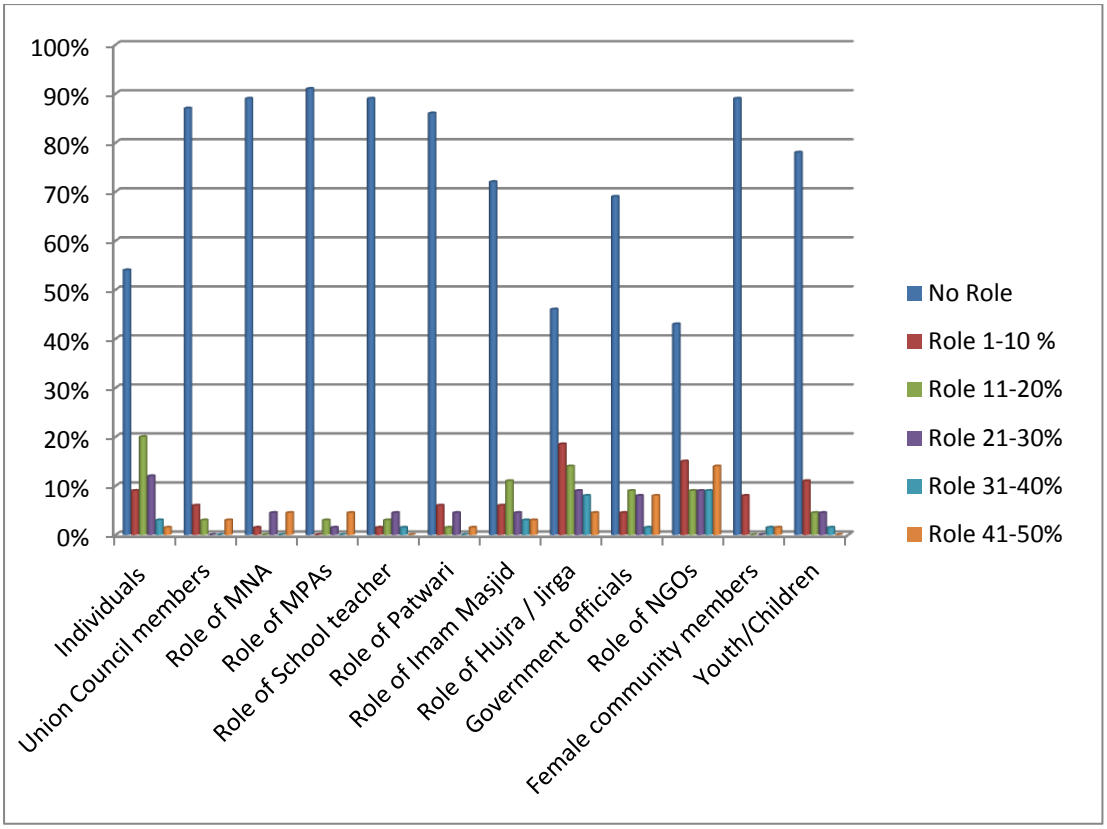


Figure 15: Existing Roles of Stakeholders in Adaptation

4.2 Future Role of the Stakeholders in the community-based strategy formulation

Responding about the future roles of different **stakeholders** in the community-based local adaptation strategy formulation with regard to the climate changes and their impact on the weather, the respondents emphasized that only government officials, NGOs and Hujra/Jirga can play significant roles; while all other stakeholders, excluding females, including Imam Masjid, school teachers, MNAs, MPAs, Patwari, Union Council Members and Youth can also play some roles in strategy formulation. For details see the following table and graph.

Table 24: Future Role of the Stakeholders in the community-based strategy formulation

No.	Stakeholders	No Future Role	Yes: Can Play a Role
1.	Individual members	40%	60%
2.	Union Council members	78.00%	22%
3.	MNAs	80.00%	20%
4.	MPAs	81.00%	19%
5.	School teachers	75.00%	25%
6.	Patwari	80.00%	20%
7.	Imam Masjid	77.00%	23%
8.	Hujra / Jirga	35.00%	65%
9.	Government officials	31.00%	69%
10.	NGOs	35.00%	65%
11.	Female community members	92.00%	8%
12.	Youth/children	83.00%	17%

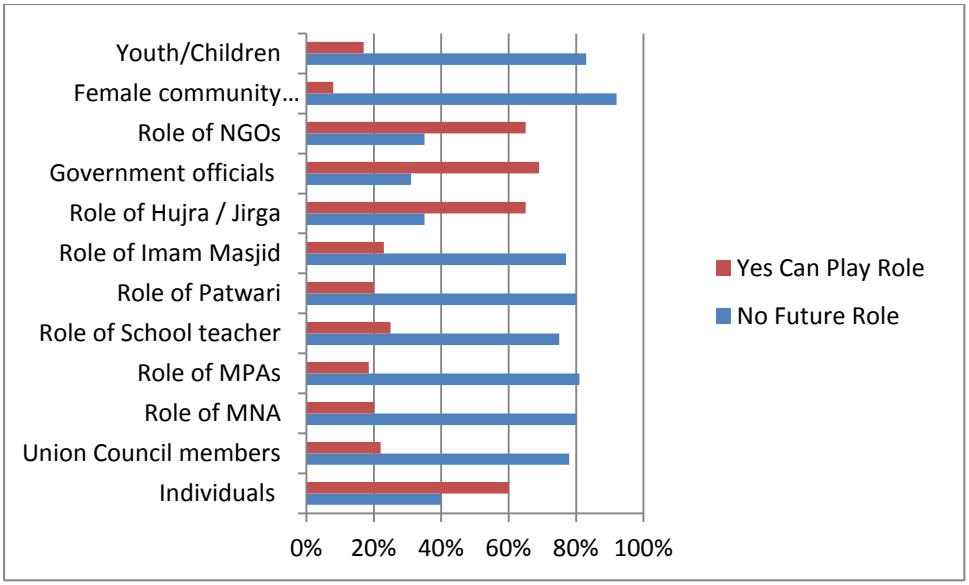


Figure 16: Future Roles of Stakeholders in Adaptation

4.3 Decision Making Processed Adopted for Strategy Formulation

Responding to the question on the decision making process adopted for strategy formulation for community-based response to climate change, 95% respondents that Democratic process is adopted for decision making. While, 5% respondents told that other decision making processes like decision by elders and participatory method as adopted by the NGOs in this area are also used.

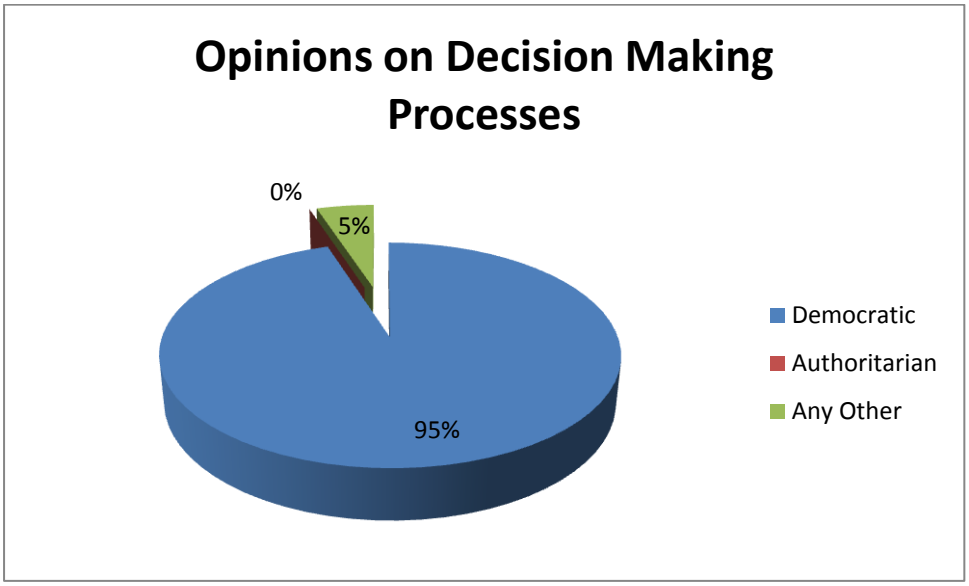


Figure 17: Decision Making Process in Communities

4.4 Female Representation in the Decision Making Process

Discussing about the permission for the female representation in the decision making process, 86% respondents said that females are not allowed to participate in any community decision making.

While, 14% said that females are only allowed to participate in the decision making related to family matters, but even then the authority for the final decision lies with the male members of the family.

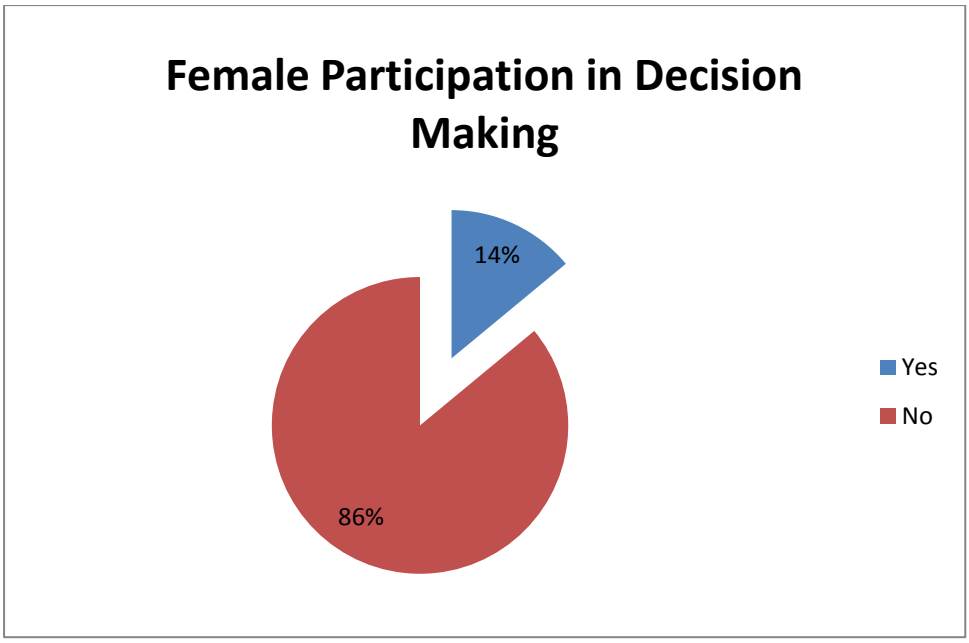


Figure 18: Role of Women in Decision Making

4.5 Reasons for not Allowing the Female Representation in the Decision Making Process

The 100% respondents agreed that females may not be allowed to participate in the community-based decision making, due to various reasons, like:

- Religious and cultural constraints, such as purda system and a limited role given to the women as the house keeper and custodian of children;
- Males have given authority over females by religion and tribal norms;
- Male dominated society;
- Lack of female mobility,
- Socio-cultural barriers;
- Customs and rituals of tribal society;
- Customary laws of the tribal society;
- Almost 100% females in these areas are illiterate;
- Females have no awareness about the community affairs.

So it is not the democratic decision making in its true sense. Participation of females in the decision making is very low and it is linked to the capacity of the females to participate in the economic activities within the family.

4.6 Community based Strategies Adopted

In response to the question about the experienced changes in the area with regard to climate change and the community-strategies adopted or suggested to respond the effects of the disasters, like floods following responses were recorded:

Table 25: Community based Strategies Adopted or Suggested during Disasters

No.	Climate Changes and Calamities	Adaptation Strategies
1.	Floods and Flood Losses	1. Life saving efforts, like migration to safe places. 2. Safeguarding livestock, property and food grains and fodder for animals. 3. Disaster preparedness needed. 4. In time identification of safe places for migration. 5. Community-based self help measures may be taken to safeguard lives and properties. 6. Relevant Government Departments should be involved to help the communities before, during and after floods. 7. Risk management and reduction measures needed. 8. Constructing pakka houses on the higher and safer locations. 9. Lack of awareness should be removed through education of affected people. 10. NGOs has played role in educating people and training them to face the flood challenges. 11. Relief and rehabilitation works done by the NGOs. 12. Early warning and information system needed. 13. Local media, especially, Newspapers and Radio should be involved in provision of flood information. 14. Warnings and announcements through mosques for alerting people about flood threats. 15. Local police stations may be involved in early warning process and announcements. 16. Water cleaning facilities required. 17. After floods water channels and sewerage systems need cleaning of silting and repair of damages. 18. Stopping tree cuttings. 19. More tree plantation needed.
2.	Increased Pest Attacks and Diseases of Crops	1. Adopting new technologies and pest and disease control methods.
3.	Livestock Diseases	1. Adopting new treatment methods.
4.	Water Logging	1. Government actions like SCARP Scheme were initiated for land reclamation. 2. Plantation ratio has been increased.
5.	Human Diseases	1. Take care of personal and domestic hygiene.

5. RECOMMENDATIONS

Analysis of men and women farmers led us towards the following conclusions and recommendations. It was found that women farmers were aware of their local climate and the changes in the recent past. These climate changes have also led in changes in livelihoods options without having any knowledge support and systematic analysis of different livelihoods options available. There were hardly any institutions, both men and women farmers believe, that they can rely on for getting climate related information. Thus, there is very little information available to them that can help them adapt their livelihoods decisions to the changing climate.

1. **Climate Change Education and Awareness.**
    - In the entire flood affected, villages especially such as Manzoori, which are located on the riverside, the women and children were seriously hit by the flood damages. Special measures are needed to educate and aware the children and women to safeguard them from the future floods.
    - People of the area have very little awareness about climatic change and its impacts and risks. There is a need to provide them knowledge about climatic changes and their impacts.

2. **Disaster Risk Reduction and Management**
    - Community-based self help measures and mechanisms are needed to safeguard lives and properties before the disasters. Risk management and reduction measures should be introduced among the affected communities, with particular emphasis on women and children needs.
    - Communities need education and support to design and construct flood resistant houses on the higher and safer locations.
    - Community-based local early warning systems could help reduce the losses. Local Imams and school teacher should be involved in education and for early warnings and announcements through mosques and schools for alerting people about flood threats.
    - Some specific awareness raising steps are also required to enhance the knowledge of the people about the disaster preparedness, management and adaptation strategies.
3. **Community Preparedness**
    - Communities need help and guidance for repair of damaged water channels and sewerage systems. For that purpose the communities need silt cleaning facilities.
    - Since during flood the communities faced shortage of drinking water so water cleaning facilities may be provided to them during and after floods.
    - Communities should be motivated to stop tree cuttings and for more tree plantation to reduce the land erosion and intensity of water flow during floods.
    - Health and hygiene education may be provided to reduce the human diseases.

4. **Adaptation of Food Production Systems**
    - It was found that temperature and rainfall changes result in serious adaptation in food production systems as it alters production environment. New crops are added in and some crops have been dropped from the system. As the climate change requires adaptation in production technologies, public and private institutions need to adapt their research and extension agenda to the changing climate.
    - Local and provincial governments need to make strenuous efforts to take the climate related information to the farming communities, particularly women farmers.
    - Public sector departments and NGOs should introduce new initiatives to help farmers reclaim water logged soils.
    - Women farmers, with little training and support, can adapt their vegetable production systems that can sustain minor floods. Development NGOs can help women farmers in this regard.
    - Local Imams and school teacher should be involved in education and for early warnings and announcements through mosques and schools for alerting people about flood threats.

5. **Food Security During Emergencies**
    - Women farmers' felt the need to construct safer and better grain storage bins in the houses and other safer community places. Construction of small shelters on the roof tops of schools and mosques can help store adequate food during the emergencies.
    - It was found that women farmers' faced a great deal of difficulties to feed the livestock that they could save from the floods. Provision of dry feed/ration for the livestock could have saved the precious livestock that survived the floods.
    - Communities should be provided with services for control of crop and livestock diseases.

6. **Role of Government organizations**
    - Relevant Government Departments should be involved to help the communities before, during and after floods.
    - Local police stations may be involved in early warning process and announcements.
    - Public research and education institutions need to generate needed information for the farming communities to help them control of crop and livestock diseases.

7. **Role of NGOs**
    - Since NGOs has already played a role in educating people and training them to face the flood challenges. So NGOs should be involved in the awareness raising and education of communities on the regular basis.

8. **Collaboration between GOs and NGOs**
    - A collaboration mechanism between GOs and NGOs may be established for relief and rehabilitation works.

9. **Role of Media**
    - Early warning and information system should be established. In this regard, local media, especially, newspapers and local radio can provide very useful support for provision of flood information to the communities.

10. Need for Research Studies

- It has been realized that more studies on the Climate Change and Adaptation are needed in the vulnerable areas to address the problems and hazards resulting from the climate changes.
- In order to understand the women farmers' needs of knowledge and technologies in the changing climate, more detailed and focused studies are also needed. Public research institutions should also revisit their research agenda to accommodate women farmers' demand for new knowledge and technology.

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