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Farmer Perceptions to Climate Variability and Adaption Strategies in Nangrahar Province

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ABSTRACT
Climate change is a major obstacal for farmers in the least developed countries such as Afghanistan and adaptation care is extremely scarce. This paper provides evience on the farmers' perceptions regarding climate change, its impact and identification of best coping strategies in Nangarhar province. To do this end, we collected primary data from 384 farmers whom we interviewd across the three most affected district in the province. We employ percent analysis and Garrett rankingmethods to estimate the farmers perceptions, impact and coping strategies regarding climate change in the area. Farthermore, farmers percieved increased change in temperature (92.22%) and occurrence of drought (91.39%) respectively. Based on study findings, drying of water resources (96.46%), crop failure (85.32%) and making sarounding dring (82,03%) were observed as major impacts on farmers livelihoods of climate change. Therefore, drilling new bore well, change in time of farm operations and farm diversification were percieved and recommended as top ranked strategies to cope with climate change in Nangarhar.

Keywords: Perception, Climate Change, Impact, Adaptation, Farmers

INTRODUCTION
Afghanistan is frequently affected by drought and other climate change related hazards. The trend analysis indicated that precipitation was decreased over most parts of the country. Climate change is recognized as one of the leading challenges affecting the performance of agriculture and the livelihood of people. Farmers are the hardest hit as they have to continuously respond to climatic variations (Dhanya. and Ramachandran. 2015). Afghanistan climatic changes were mainly characterized by a mean temperature increase above global level of 1.8°C from 1950 to 2010 leads the situation will be serious in the future, particularly in regard to water management and agriculture (Aich *et al*., 2017). Farmers' perception of climate change is a crucial element in adaptation process (Amadou *et al*., 2021). Farmers, mostly in least developed countries (such as Afghanistan), are relatively more affected by the impacts of climate change and extreme weather events (Mendelsohn, *et al.*, 2006). Afghanistan is frequently affected by drought and other climate change related hazards. Mean annual rainfall decreased at 2 per cent per decade and temperature increased by 0.13°C during the period from 1960 to 2008 (Reddy *et al*,. 2017). Changing cropping pattern (74%) followed by receiving technical information from experts (70%) and keeping the land as fallow (60%) were rated as very high to high preparedness measures to mitigate the climate change impacts (Sarwary *et al.* 2020). Thus, perception is a necessary prerequisite for adaption (Maddison, 2006). Therefore, to enhance policy towards tackling the challenges that climate change poses to farmers, it is important to have full knowledge of farmers' perception on climate change, potential adaptation measures, and factors affecting adaptation to climate change (Fosu-Mensah e*t al.*, 2010). Therefore, the purposes of this investigation were to recognize farmer's perceptions and coping strategies against climate change and variability. The specific objectives of the study are: (i) to identify farmer's perceptions regarding the climate change and variability, (ii) measure its impact on their social life, and (iii) to identify the best appropriate adaptation strategies as valuable solutions to climate change and variability.

MATERIALS AND METHODS

Study Area

The Eastern Region is comprising Kunar, Laghman, Nuristan, and Nangarhar provinces. Eastern Region is prone to natural hazards and man-made disasters largely dominated by seasonal floods, earthquakes, landslides and droughts as well as conflicts (Ismail, 2022). This study was conducted purposefully in three districts namely Surkh Rod, Chaperhar and Rodat of Nangarhar province where drought and other climate variability related hazards seriously affected the livelihood, agriculture and water availability in the area.

Figure1. Shows Study Area in Nangarhar Province

Samples Collection

A total of 384 farmers from the purposefully selected districts were selected by the support of district extension officers, village level extension workers and Community Development Council (CDC) members. All the selected farmers were interviewed by the structured questionnaire in their household areas. The study area selected non probability and sample size was selected according the Krejcie and Morga, (1970) from each district 128 sample collected.

Statistical Analysis

Percentage Analysis

Percentage analysis was employed to estimate the farmer's perception to climate change impact on the study area.

Garrett Ranking Technique

The questionnaire was designed in a method which is an effective instrument for identifying the perception about the climate change impacts and adaptation strategies followed by farmers through conducting the primary survey. To prioritize the responses from the farmers, the Garrett's ranking technique used as follows.

$$\text{Percent position} = \frac{100\ (R_{ij} - 0.5)}{N_j}$$

Where,

R_{ij} = Rank given for i^{th} factor by j^{th} respondents

N_j = Number of factors ranked by j^{th} respondents (Vijayasarathy & Ashok, 2015).

By using Garrett's score table, the percent positions of each rank was converted into scores and for each factor, the score of each individual respondent was added together and was divided by the total number of respondents for whom scores were added. The mean scores of all the factors were arrived and ranks will be given. The factors having the highest mean value were considered to be the most important response.

RESULTS

Farmer's perception to climate change and variability

The findings from the farmer's perceptions regarding climate induces are presented in Table. 1.

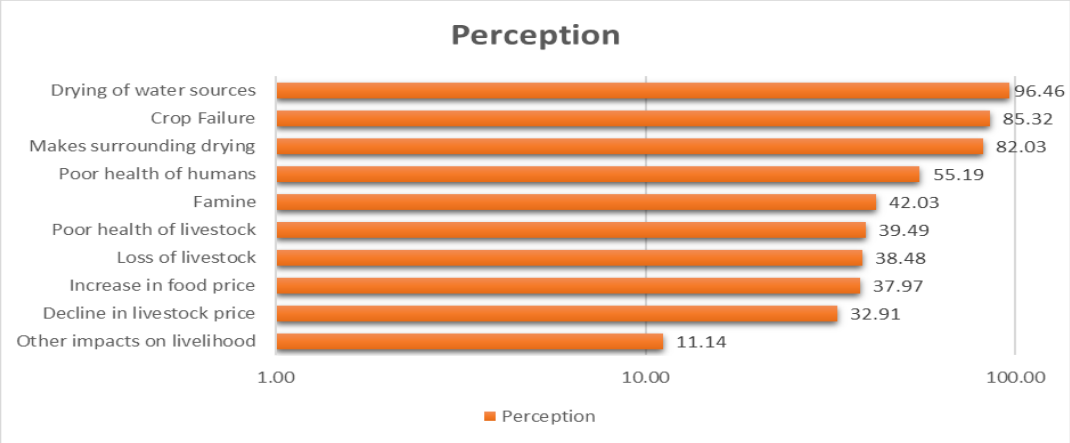
Table 1. Farmers Perception to climate induces in Nangarhar Province

Perception to climate induces	Percentage		
	Increased	**Decreased**	**No Change**
Temperature	92.66	4.30	3.04
Summer Temperature	97.22	1.01	1.77
Winter Temperature	57.22	37.22	5.57
Rainfall	0.76	96.46	2.78
Early rainfall coming	2.28	79.49	18.23
Late rainfall Coming	31.65	35.95	32.41
Occurrence drought	91.39	4.81	3.80
Uneven distribution rainfall	26.33	40.00	33.67
Unpredictable rainfall	26.33	35.44	38.23
Occurrence wind	39.24	43.80	16.96

To investigate this, farmer's responses were categorized by increased, decreased and no change conditions. Majority of the farmers observed increased about (92.66%) in temperature, (97.22%) in summer temperature, (57.22%) in winter temperature and (91.39%) occurrence of drought. Likewise, majority of the farmers perceived decreased about (96.46%) in rainfall, (79.49%) in early rainfall coming, (35.95%) in late rainfall coming, around (40%) in uneven distribution of rainfall and (43.80%) in occurrence of wind respectively.

Farmer's Perception to climate change impact

According to the fast studies, farmers, mostly in least developed countries (such as Afghanistan), are relatively more affected by the impacts of climate change and extreme weather events (Mendelsohn, et al., 2006). The results from the farmer's perceptions regarding climate change impact are presented in Graph. 1. To investigate this impact on environment, human, livestock, price and livelihood, majority (96.46%) farmers perceived drying of water sources followed by (85.32%) crop failure, (82.03%) makes surrounding drying, (55.19%) poor health of humans, (42.03%) famine, (39.49%) poor health of livestock, (38.48%) loos of livestock, (37.97%) increase in food price, (32.91%) decline in livestock price and (11.14%) other impacts on livelihood respectively.



Graph 1. Farmer's Perception to climate change impact in Nangarhar Province

Coping strategies to climate change impacts

Table 2. Farmers adapted coping strategies to climate change impacts		
Adapted Strategies	Respondents	
	Mean Score	Mean Score
Drilling new bore well	60	I
Change in time of farm operation	57	II
Farm diversification	54	III
Migration for employment from non-agricultural sectors	53	IV
Receiving the technical guidance from experts	52	V
Drought tolerant varieties	49	VI
Changing traditional irrigation system into modern irrigation system (drip irrigation)	40	VII
Use of water conservation technology	32	VII

Adaptation to climate change requires that farmers first notice that the climate is altered. Farmer then need to identify potentially useful adaptations strategies and implementation of them (Dhaka et al,. 2010). Table 3. Indicate farmers adapted coping strategies to climate change impacts. To investigate this, farmers were asked to rank eight most relevant strategies to cope with climate change and variability. Among these relevant strategies who received high (above 50) mean score were considered as best adapted coping strategies in area. In the middle of them, drilling new bore well strategy was ranked 1st, followed by change in time of farm operation ranked 2nd, farm diversification ranked 3rd, migration for employment from non-agricultural sector ranked 4th and receiving technical guidance from experts was ranked 5th.

DISCUSSION

This study investigates that the farmer's perceptions and awareness regarding increased temperature, decrease, early and late coming of rainfall and occurrence of drought are the signs of climate change altered and strongly affected the area. Reddy et al,. (2017). also revealed similar finding in this regard. Drying water resources, failure of crop and makes surrounding drying are also the very important findings of the study which investigates the serious impact of the climate change in the study area. This finding are also accepted by Mendelsohn, et al., 2006 in his study regarding less developed countries such as Afghanistan. Furthermore, considering the current condition of the area, the study identified some of the best appropriate climate change coping strategies where drilling new bore well was the first ranked strategy in the area. As the reduce of water resources seriously affected the study area so, drilling new bore well is one of the best useful solution because of incorporating of solar based running water pump system with low running cost and environmentally friendly technology. Drilling bore well strategy was not recommended strategy in other similar study which may be because of the specific condition of the area. To maintain ground water table, farther investigations are needed.

CONCLUSION

Farmers are gradually becoming sensible of local climate variability and change as evidenced by their perceived changes in temperature, rainfall and occurrence of wind which are consistent with weather and climate change records. Majority of them are aware of the significances of the climate changes. Overall projected marginal climate impacts show that among other factors drying water resources, crop failure, makes surrounding drying, poor health of humans, famine, poor health and loos of livestock are the major perceived climate change impacts. To adapt with the climate variability, farmers perceived drilling new bore well, change in time of farm operation, farm diversification, migration for employment from non-agricultural sector and receiving technical guidance from experts were perceived to be the best strategies to cope with climate change and its bad impacts on the area. Therefore, to save agriculture, livestock and secure the smallholder farmers' livelihood it is mandatory for the government to equip farmers with knowledge and capacity to adapt to the climate change and its variability. To put these in practice, we strongly recommend the ministries of Agriculture, rural development and other national and international rural developmental organizations to liaise with the ministry of higher education and through them their allied institutions to develop short term courses,

outreach programs, research-extension linkage and farmers' groups and associations encouragement strategy that can enhance adaptive capacity of the farmers.

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