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A study on awareness of farm women regarding climate change and its coping strategies

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Abstract
The impact of climate change on mountain agriculture include reduced availability of water for irrigation, shift in rainfall, hail storms leading to failure of crop/fruit production, increased insect-pest mainfestation, decline in crop yield, shortening of maturity periods of crops and so on. Present study was conducted to know the awraeness of farm women on indicators, effects and causes of climate change and to know the adaptation strategies practiced by them. Study reveals that more than half farm women were aware of only a few indicators of climate change i.e. increase in temperature, changes in water level, irregular and erratic rainfall. Farm women perceived that summer temerature has increased whereas rainfall has decreased over past five years. Farm families had adopted diversification of crop type and crop varieties as the major coping strategies. Rest of the practices were adopted by a few farm women only. Thus, there is need to create awareness and motivate farm families to adapt climate smart agaricultural practices.

Keywords: Climate change, awareness, perception, causes, adaptation

Introduction
Climate change is a major global environmental problem affecting livelihood security. Adverse impact of climate change includes extreme weather, floods, droughts, submergence of coastal areas due to rise in sea level and extreme climate variability. Dash and Hunt (2007) [3] in their studies reported large differences in trends in minimum temperature and cloud cover between north and south India and asymmetry in increasing temperature trends between different seasons. They also found a reduction in the summer monsoon (June–September) rainfall over India.

Climate change affects agriculture by inducing changes on quantity and quality of farm produce, cost of production, price, trade patterns along with changes in market responses at local and global level. Various studies indicate that climate change influences forest vegetation in various ways (Ravindranath, *et al*., 2006) [2]. Even small changes in rainfall pattern in the growing season can lead to a marked change in productivity of crops (Lobell and Bruke 2008) [4], short term temperature extremes especially in the phases of plant development can also result in reduction of yield (Wheeler *et al*., 2000) [1]. Heavy rainfall events on the other hand may completely wipe out entire crops over wide areas or excess water can lead to soil water logging, anaerobicity and reduced plant growth (Gronall, 2010) [5].

Mountain regions are highly vulnerable to climate change and it has direct impact on their livelihood. In Uttarakhand rugged mountains, steep slopes, undulated topography is highly vulnerable to landslides. Marginal and small farmers are worst sufferers of climate change. The impact of climate change on mountain agriculture include reduced availability of water for irrigation, extreme events, shift in rainfall, hail storms leading to failure of crop/fruit production, increased insect-pest mainfestation, decline in crop yield, shortening of maturity periods of crops and so on which adversely affect the livelihood of farm families. There is need to study the changes in climatic conditions over the past few years, impact of climate change in agriculture and the coping strategies as adopted by farml families so that suitable strategies could be formed to bring livelihood security.

Objectives
1. To study the extent of awareness farm women regarding climate change.

2. To know the effect of climate change in farming as perceived by farm women.
3. To know the situation specific coping strategies followed by farm women.

Methodology: The study was conducted in both the zones i.e.Tarai and Bhabhar zone and Hill zone of Uttarakhand state. From Tarai zone, Kanakpur, Maharajpur villages and from Hill zone Suryajala, Lamjala and Dogra village were selected for data collection. Study was purposively conducted on farm women as majority of the farm activities in Uttarakhand, except ploughing are performed by women. Data was collected from a total of 100 farm women of 5 villages of Uttarakhand state. Semi-structured interview schedule was used for data collection. Three-point scale was develpoed to know the extent of level of awareness on indiator and causes of climate change.

Result and Discussion

Results of the study have been discussed under various subheadings:

Indicators of climate change

Data on indicators of climate change was collected to know the respondents' awareness about various indicators of climate change and the extent to which they were aware of these whether fully, partially or not.

Table 1: Distribution of respondents according to the level of Awareness on indicators on climate change

S. No.	Indicators /Phenomenon	Level of awareness		
		Fully aware	Somewhat	Not aware
1.	Increase in melting of glacier	5.00	27.00	68.00
2.	Increase in temperature	91.00	9.00	-
3.	Changes in water level	77.00	23.00	-
4.	Irregular and erratic rainfall	69.00	31.00	-
5.	Short winter/Long summer	11.00	56.00	33.00
6.	Change in intensity and frequency of storm	22.00	65.00	13.00
7.	Decline of soil productivity	56.00	41.00	3.00
8.	Occurrence of extreme event			
a.	Cold wave	-	86.00	14.00
b.	Heat wave	36.00	64.00	-
c.	Heavy fog	50.00	44.00	6.00
d.	Frequent flood	54.00	42.00	4.00

Table 1 reveals that 91.00 percent farm women were fully aware of increase in temperature, changes in water level (77.00%) and irregular and erratic rainfall (69.0%) as the indicators of climate change. Half of the farm women were also fully aware of decline in soil productivity (56.00%), frequent floods (54.00%) and heavy fog (50.00%). On the other hand 41.00-65.00% farm women were partially aware of heavy fog, short winters/long sunners, heat wave, change in intensity and frequency of storm. Overall it can be said that majority of the farm women were aware of various indicators of change whether fully or partially.

Study conducted by Raghvanshi *et al.* (2017) [8] also reveals that all the farmers were aware of the climate change and majority of them reported "erratic rainfall, diminishing agricultural yield and increase in temperature" as the indicators of climate change. Sogani (2011) [6] in a study of documentation of climate change perceptions and adaptation practices in Uttarakhand reported that communities in the mountain areas are well aware that the weather is changing.

Changes in climate variables

Information on type of changes in climate variables as perceived by rural women was collected to know how farm women perceive the changes in climate variables in their area during last five years.

Table 2: Perception of respondents towards type of changes in climate variables

S. No	Climate variables	Increasing	Decreasing	Constant
1.	Annual Rainfall	17.00	74.00	9.00
2.	Summer Rainfall	21.00	70.00	9.00
3.	Winter Rainfall	7.00	80.00	13.00
4.	Summer Temperature	91.00	4.00	5.00
5.	Wind Storm	44.00	15.00	51.00
6.	Hailstorm	49.00	8.00	43.00

Table 2 shows that 91.00 per cent farm women perceive that summer temperature has incresed. Regarding rainfall, farm women perceive that summer as well as winter rainfall has decreased (70.00% and 80.00%, respectively). Almost half of the farm women (49.00%) perceive that hail storm are increasing which is damaging their crop whereas 43.00 per cent perceive that it is constant. Regarding wind srtorm, 51.00 per cent farm women perceive that it is constant whereas 44.00 percent perceive that it has increased during last five years.

Adverse effect of climate change

Data on perception of farm women towards adverse effect of climate change on farm production was collected to know whether farm women are aware of adverse effect of climate cahnge and what they perceive towards it.

Table 3: Distribution of respondents according to perception towards adverse effects of climate change

S. No.	Adverse effect of climate change	Percentage
1.	Farming not profitable	38.00
2.	Labor problem	21.00
3.	Insufficient irrigation facility	25.00
4.	Less production due to climate change	55.00
5.	Crop failure	59.00
6.	Increase in disease of crops	93.00
7.	Insect-pest manifestation	82.00

Table 3 reveals that majority of the rural women were aware of adverse effects of climate change in farm productivity i.e. increase in disease of crop due to extreme weather conditions (93.00%), increase in insect-pest manifestation due to climate change (82.00%), crop failure (59.00%) and less production due to climate change (55.00%). One third (38.00%) farm women perceive that farming has become non-profitable in present climatic condition and a lareg number of farm families are selling their land. Study conducted by Raghuvanshi *et al*., 2017 [8] also reveals that most of the farmers reported crop failures, migration to other places and flooding as three major consequences of climate change.

Causes of climate change

Data on awareness of farm women regarding causes of climate change was collected to know whether they are aware of the factors responsible for climate change. Level of awareness on causes of climate change was studied on 3 point scale as complete fully aware, somewhat aware and not aware.

Table 4: Distribution of respondents according to level of awareness about causes of climate change

S. No.	Statement	Level of awareness		
		Fully aware	Somewhat	Not aware
1.	Deforestation	57.00	43.00	-
2.	Increase in number of vehicles	11.00	56.00	33.00
3.	Overpopulation	20.00	16.00	64.00
4.	Industries and factories	56.00	34.00	10.00
5.	Use of Pesticides	-	63.00	37.00
6.	Burning of fossils and farm waste	19.00	15.00	66.00
7.	Use of electrical appliances	-	6.00	94.00
8.	Pollution	27.00	70.00	3.00
9.	Global warming	5.00	14.00	81.00
10.	Natural disaster	5.00	10.00	85.00
11.	Rapid urbanization	11.00	71.00	18.00

Table 4 reveals that a little more than half of the farm women were fully aware of deforestation and industries and factories as the main causes of climate change (57.00% and 56.00%, respectively). More than half farm women were partially aware of rapid urbanization (71.00%), pollution (70.00%), use of pesticides (63.00%) and increased number of vehicle (56.00%) as the causes of climate change.

A large number of farm women were not having awareness of use of electrical appliances (94.00%), natural disasters (85.00%), global warming (81.00%), burning of fossil fuels and farm waste (66.00%) and overpopulation (64.00%) as the causes of climate change.

It can be inferred from the findings that farm women had partial awareness that too of only a few causes of climate change, their effect on their life (personal health, crop production and animal health). Thus there is need to create awareness and motivate them to mitigate these causes like not to cut forest, tree plantation, limit the use of pesticide, reduce/ avoid burning of fossils and farm waste in order to avoid further aggregation of climate change.

Adaptation practices for coping with climate change

Information on adaptation practices followed by the farm women to cop up with climate change and increase their production was collected to know what practices they are adapting so that suitable practices could be introduce to them for increasing their farm production.

Table 5: Distribution of respondents according to the adaptation of practices for climate change

S. No.	Climate friendly farm practices	Percentage
1.	Diversification of crop type	59.00
2.	Diversification of crop varieties	61.00
3.	Change in planting calendar	13.00
4.	Change in use of chemical fertilizers	32.00
5.	Change in use of chemical pesticides	38.00
6.	Implementing soil conservation methods	8.00
7.	Adopting water harvesting techniques	18.00
8.	Change in agronomic practices-mulching of soil	26.00
9.	Changing the traditional irrigation method	10.00
10.	Switching from mono cropping to integrated farming system	41.00
11.	Crop rotation	14.00
12.	Intercropping	21.00

13.	Use of soil health cards	15.00
14.	Preventing/reducing soil erosion	8.00

Table 5 depicts that a little more than half of the respondents had adapted diversification of crop type (59.00%) and diversification of crop varieties (61.00%) in order to increase their farm production. Few farm women have switched from mono cropping to integrated farming (41.00%), increased use of chemical pesticides (38.00%), chemical fertilizer (32.00%), agronomic practices-mulching of crop (26.00%) and intercropping (21.00%). Study conducted by Raghvanshi *et al*, 2017 [8] also reported that majority of the respondents(71.81%) had changed their crop varieties, made changes in use of chemicals and fertilizers (50.90%), diversification of crop types and varieties (26.36%) and implementation of soil conservation schemes (22.72%).

It can be inferred from the findings that farm families had adapted only a few pratices may be because they do not have knowledge of other climate friendly farm practices. Thus there is need of creating awareness, imparting knowledge and motivationg them to adopt climatte friendly farm practices

Conclusion

Climate change is the biggest threat to agriculture still the farmers are not fully aware of climate change, its causes, consequences and adaptation stategies. Study reveals that farm women had medium level of awareness climate change, its influence on farm productivity. Farm women had partial awareness of only a few causes of climate change and their effect on their life. They have adopted only diversification of crop type and crop varieties as the major coping strategies. Almost one third have also adopted integrated farming system, agronomic mulching of crops and inter-cropping. Thus, there is need to formulate appropriate programmes and policies for creating awareness of farm families on climate change, imparting knowledge and motivating them for adaptation of climate friendly practices along with some incentives to cope up with climate change.

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