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## RESEARCH ARTICLE

### FARMER'S PERCEPTION ON CLIMATE CHANGE AND ITS CONSEQUENCES IN KAPILVASTU DISTRICT, NEPAL

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#### ABSTRACT

Climate change is becoming an imminent threat to Nepalese agriculture. Climate change on farmer's view and their strategies to combat against it helps to make effective plan and policies for the anticipated weather and climate. Therefore, survey research was conducted in 2017 at Kapilvastu district of Nepal including sixty-three farmers to get informed with their knowledge on climate change and various adaptation mechanism they are currently practicing. Though only about one-third respondent was aware of the meaning of climate change, they felt the impact of climate change in various ways. Farmer experienced increased temperature in summer and winter season. The duration and magnitude of the rainfall have felt to decrease in recent years. Farmers have faced dry irrigation canals. The unusual delay of the rainfall onset delayed the time of rice transplanting by one to two weeks. They have noticed a higher incidence of insects and pests in their agricultural land than before. To combat against the various negative impact of climate change, farmer's were practicing some adaptive strategies like the cultivation of improved, abiotic resistant crop varieties as well as crop diversification. Therefore, there is still a need for an awareness program on climate change, its consequences and effective means to combat climate change to minimize the negative impact in Kapilvastu district.

#### INTRODUCTION

Nepal is experiencing climate change impact and categorized as one of the most vulnerable countries in the world (MoPE, 2016). Average annual temperature increased by 0.06°C between 1974-1994. However, the rate is higher (0.8°C/year) in the mountain region as compared to the Terai region (0.04°C/year) (Shrestha et al., 1999). Similarly, the total annual rainfall augmented from 1976 to 2005 by 4 mm/year with maximum increase during monsoon followed by pre-monsoon and post-monsoon (Practical Action, 2009). The projection of temperature above the baseline average is 1.2°C for 2030, 1.7°C for 2050 and 3°C for 2100 (Basnet and Tiwari, 2007). The extreme events (like drought, flood) frequency are increasing with loss of human life as well as the economy. Agriculture is one of the sectors to face the alarming trends of climate change impact (Karki et al. 2009). The fragile ecosystem and limited coping capacity are the primary reasons to exacerbate the negative impact of climate change (MoE, 2010). The increase in temperature in the future might damage the agriculture production in the Terai region (CBS, 2016) and also increases pest and diseases related problems (Joshi and Piya, 2011). Since the majority (76%) of the area is under rainfed conditions, the Nepalese agriculture is highly dependent on weather condition (Regmi, 2007) and the

intensity will be more provided limited irrigation facilities and increased weather abnormalities. The onset of monsoon rainfall (shares about 75-80% of annual rainfall) is more unpredictable than past (Malla, 2008). He further reported 12.5% lower production in crop production in Nepal due to the late start of the monsoon in 2005/06. The winter rainfall in Nepal shares about 3-5% of total annual rainfall. The winter drought during 2008/09 (50% lower precipitation from November 2008 to February 2009) resulted in 14.5% and 17.3% reduction in wheat and barley production in Nepal with 40% total production drop in mountain region followed by Hill (25%) and Terai (10%) (Joint Assessment Report, 2009). The climate/ weather impact is also experienced in the livestock sector. The bad weather has an impact on the farmer's decision making and risk taking ability for newer technologies. At the time of emergency, the price deflation was caused by farmers willing to sell their livestock at a time (Synnot, 2012). One of the most prominent challenge farmers facing in decision making in agriculture has been attributed to increased weather variability along with extreme weather events. On the other hand, climate change has a tremendous impact on agricultural gross domestic products in many ways. Therefore, it is imperative to assess the change in various spatial level to make an effective plan and policies to settle the negative consequences (Acharya and Bhatta, 2013). Moreover, the

information about how the farmers are perceiving the climate change and trying to adapt against it for better agriculture is vital for the active participation of the public. Also, the reliable data and information are posing the challenge to effective implementation of plan and policies at local or community levels. Therefore, research was conducted during 2017 in three former VDCs of Kapilvastu districts to know the farmer's perception of climate change, food security status and their coping strategies against climate change.

## MATERIALS AND METHODS

The perception study was conducted on the Kapilvastu district which is located represents the Western Terai ecological zone of Nepal. The district mainly has an altitude range from 93 to 1,491 meter above sea level. The rice, wheat, oilseed, sugarcane are the major crops grown in the Kapilvastu district (MoAD, 2016). This district was selected based on rainfall and temperature vulnerability index and ranked as moderately vulnerable in National Adaptation Programme of Action (NAPA) report (MoE, 2010). Moreover, it represents the western Terai ecological zone. Three former Village Development Committees (Pakadi, Baskhaur, and Gajehada) were selected based on consultation with former District Agriculture Development Office to represent overall farming practices. Farmers were randomly selected from the different regions of each rural municipality and interviewed with a semi-structured questionnaire. The response was, then, presented as the frequency to summarize the perception of individual farmers for both the districts separately.

## RESULTS AND DISCUSSION

**Change in timing of crop cultivation practices:** Several factors that directly and indirectly impact on the start of the crop season as well as the crop duration. Among them, the availability of agricultural inputs (like the seed, fertilizers, human workforce) and weather are the significant factors. The sowing time is mainly affected by the previous crop harvesting date as well as the field moisture level. Therefore, the onset of the monsoon is one of the biggest reasons in the change in the start date of the crop like rainfed rice, thereby affects the subsequent crop. The respondents of the survey agreed on the shift in cropping season timing in the recent ten years. Farmer's was found to perceive the change in rice sowing/transplanting time by one to two weeks mainly caused by delayed onset of monsoon by one to two weeks. They further revealed that the cultivation of hybrid pushed the harvesting time by two weeks further than ten years before. However, they have not felt any changes in the timing of cultivation practices of fruits and vegetables.

**Changes in disease, insect and weeds:** Any alteration in temperature, rainfall and other parameters of climate influences the growth and development of crop pests (Kambrekar *et al.*, 2015). The distribution and introduction of new insects are likely to be affected by the change in temperature and precipitation patterns. Katsaruware-Chapoto *et al.* (2017) have stated that increased heat stress impact on the selection of certain insects and might even cause extinction. Insect's likes aphids, whiteflies, and cereal stem borers infestation will increase in temperature regions (Sharma, 2014). The insects of crops; rice, wheat, and maize in the temperate zone could increase by ten to twenty-five percent

with an increase in 1°C temperature (Deutsch *et al.*, 2018). Similarly, the change in climatic factors alters the host and plant relationship in diseases cycles, thereby effects on the occurrence, the severity of the diseases of the plants (Elad and pertot, 2014). The farmers of the surveyed region in Kapilvastu region have noticed that considerable change in the insects, diseases and weeds incidences compared to the last ten years (Table 1). More than eighty percent of respondent agreed that insect and weed infestation had been increased in rice, wheat, and potato. Moreover, farmers took diseases incidences more seriously than insect and weed with more number of respondent agreed on rice, wheat and potato diseases has increased in recent years.

**Cropping pattern:** Climate change has a considerable impact on cropping patterns. The productive land fit for sequential cropping might be suitable only for the single cropping (Duku *et al.*, 2018). The major cropping patterns in Kapilvastu are rice-wheat, rice-vegetable, rice-pea + mustard and maize-wheat. None of the farmers has changed the cropping patterns as the direct influence due to consequences of climate change.

**Perception on climatic factors:** Climate change has its significant impact on the weather parameters like temperature, precipitation as well as other events as of result of the change in weather parameters and their variability over due course.

**Perception on temperature:** The increasing temperature or global warming is often synonymously used to explain climate change. Many research papers have indicated that maximum and minimum temperature is increasing over the years with different rates in Nepal. More than one-third respondent agreed that they felt increased heat during summer season (76%) and increased cooling during the winter season (64%). However, about one-third of the respondent (thirty-one percent) did not feel any changes in temperature during the winter season compared to 12% in the case of summer temperature. Very few (12% for the summer season and 5% for winter season) viewed the temperature was decreased in the last ten years due to climate change.

**Rainfall and related disaster:** Another major area the climate change impact has felt is the change in rainfall and precipitation patterns. The respondents have felt the changes in magnitude as well as the duration of the rainfall in their areas. Besides decreased amount of rainfall, farmers are more confident on reduced frequency of the rainfall during the monsoon season with more than eighty percent people agreement. Moreover, farmers experienced the narrow window of rainfall (eighty percent farmers) and reduced rainfall intensity (sixty-five percent). Similarly, all the respondents agreed that the duration of the rainfall has reduced during the winter season. They also experienced the reduced magnitude of the rainfall as well as the frequency of rainfall (eighty percent) during the last ten years.

**Coping strategies against climate change:** Though climate change could have an impact on the farmers in various ways, one of the best options to minimize its effects is choosing the appropriate technologies to negate the effects. Farmer's were also interviewed on strategies they have chosen against climate change. The respondent have a negative impression on the impact of climate change on agriculture sector and have adopted various methods to cope against it. The use of the hybrid or improved crop varieties was found the major coping strategies with adoption by more than eighty nice percent respondent.

**Table 1. Farmers' perception on diseases insects and weeds incidence in Kapilvastu, 2017**

Crops	Insects		Diseases		Weeds	
	Increases	Decreases	Increases	Decreases	Increases	Decreases
Rice	89	11	91	9	88	12
Wheat	87	13	90	10	84	16
Potato	86	14	95	5	89	11

**Table 2. Farmers' perception on seasonal temperature in Kapilvastu, 2017**

Farmer's Perception	Summer season	Farmer's Perception	Winter season
	Kapilvastu		Kapilvastu
hotter	76	cooler	64
Same	12	Same	31
colder	12	hotter	5

**Table 3. Farmers' perception on adaptation strategies in agricultural sector in Kapilvastu District, 2017**

Strategies	Farmer's response (in %)	
	Yes	No
Use of short duration variety of crops	70	30
Diversified to vegetable production instead of rice and cereals crops	85	15
Application of more chemical fertilizers and pesticides	74	26
Use of hybrid/improved crop varieties	89	11
Drought resistant crops	71	29

The diversification with vegetable production instead of rice and cereals crops become the second most adopted strategy (eighty-five percent) followed by application of more chemical fertilizers and pesticides, drought-resistant crops (seventy-one percent) and use of the short durational variety of the crops (seventy percent).

**Information on climate change:** About one-third respondent have reported that they were aware of the climate change and related issues and remaining were unknown about climate change. The respondents were keen to discuss climate change and related issues in agriculture. They want to know ways of minimizing the impact of climate change.

**Food security status of the farmers:** One of the major sectors the climate change hits is on food security and mainly to food insecure farmers. Farmer's were asked about their sufficiency of the food for five major categories (food sufficient for less than three months, three to six months, six to nine months, nine to twelve months and surplus). The result showed that forty percent people produce surplus food for the year followed by forty percent farmers for the nine to twelve months, eight percent from six to nine months, eleven percent from three to six months and one percent for the less than three months. In sum, sixty percent of the people were under the food deficit zone.

**Irrigation facility:** The irrigation facility could play a significant role to subdue the negative impacts of climate change. The farmers were asked about the irrigation facilities they have. Sixty-seven percent of the respondent replied that they have one or two irrigation canals to irrigate the crop at present. More than half (51%) responded that they had lost the irrigation canals in during the last 10 years. They took the decrease in the water table, urbanization, poor maintenance as major causes of loss of the irrigation canals.

### Conclusion

As the roars on climate change are becoming more loud and clear in Nepal, knowing the climate change and its impacts from the farmers' point of view is always a winning situation.

The information mainly beneficial to make effective plans for better adaptation and to encourage the farmers to modify their practices to minimize the loss and take advantage of the climate change on their own. This survey clearly shows the farmers of the Kapilvastu felt the climate changes with noticeable changes in the weather parameters as well as the impacts on agriculture as well as resources like ground and irrigation water.

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