



# Farmers coping strategies for climate shock: Is it differentiated by gender?



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## ABSTRACT

Several studies have recognized that the agriculture sector is one of the major contributor to climate change, as well as largely affected adversely by climate change. Agricultural productivity is known to be sensitive to climate change induced effects and it has impact on livelihood of families linked with farming. Thus it is important to understand what are the existing coping strategies that farmer deploy in case of climate shocks like flood and drought and who is involved in making decision relating to these coping strategies. This paper uses the household level data of 641 households from 12 randomly selected villages in Vaishali district of Bihar to understand the household coping mechanisms with emphasis on role of gender. This study has moved away from the conventional division of households by male and female-headed households and thus capturing the intra-household gender dynamics by understanding the role of men and women within the household as decision makers of the coping strategy to manage climate shock. The study uses a multivariate probit model and the results suggest that there is a higher probability that the male farmers will make the decision on choice of the coping strategy. The most prominent coping mechanism is to find alternative employment in urban locations; however, when consumption levels have to be reduced because of climate shock, all family members then contribute to the decision-making process collectively. The results show that exposure to agriculture extension and training programs have a positive influence on choosing appropriate coping mechanisms, but female farmers have poor access to these resources. These policies should look into providing outreach to both male and female farmers in any given locality.

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## 1. Introduction

Increasing temperature extremes and warming trends are observed across most of the Asian region over the past century, as per the reports of inter-governmental Panel on Climate Change (IPCC). The report further documents that impact of climate change on food production and food security in Asia will vary by region, many regions will experience a decline in crop productivity (IPCC, 2014). These changes will result in increase in water stress, occurrence of disease and thereby effecting crop production that will further have impact on overall total food availability (Cline, 2007; Fraser et al., 2012; FAO, 2011; Panda et al., 2013; Sinha and

Swaminathan, 1991). Several studies (Cline, 2007; Fraser et al., 2012; Rathore et al., 2001; Sinha and Swaminathan, 1991) have recognized that the agriculture sector is one of the major contributor to climate change, as well as largely affected adversely by climate change. Agricultural productivity is known to be sensitive to two broad climate-induced effects: the direct effects from the changes in temperature, precipitation, and carbon dioxide concentration, and the indirect effects because of the changes in soil moisture and distribution, and the frequency of pest infestation and disease outbreaks (Panda et al., 2013). The recent report of working group two of the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report highlights that Asia experienced the highest number of weather and climate-related disasters in the world during the period 2000–2008 and suffered huge economic loss, accounting for the second highest proportion (27.5 per cent) of the total global economic loss. The report also mentions that in the Indo-Gangetic Plains of South Asia there could be a decrease of

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about 50 per cent in the most favorable and high-yielding wheat area as a result of heat stress (CO<sub>2</sub>) (IPCC, 2014).

Regionally, the effect of climate change may vary by climatic zones. For example, in India, the decline in production of wheat by 4–5 million tons is projected with a rise in temperature of 1 °C (Agrawal, 2008) and maize yields are projected to decrease by 50% for irrigated maize in the coastal districts and 35% for rain-fed maize (GOI, 2010). Given the lack of resources and access to technology and finances, developing countries such as India has a limited capacity to develop and adopt agricultural strategies to reduce its vulnerability to climate change. Vulnerability is a subjective term and is largely dependent on the capability of the recipient who is facing the risk and has to cope with the vulnerability. In this context, when climate change is inevitable, adaptation strategies are not an option but an obligation for the affected farmer. Thus, the type of climate shocks that farm households face in a given location and how the farmers have responded to similar shocks in the past is crucial to understand their adaptation or coping strategies<sup>1</sup> and to draw a road map for future strategies to help the farmers cope and manage the risks from the policy stand point. A crucial dimension of climate change mitigation and adaptation is to see if it has a differentiated effect on male and female farmers. In addition, do they choose different coping strategies. In natural resource-dependent communities, more specifically in agrarian economies, men and women have distinct roles and responsibilities; thus, there will be differences in their vulnerability and ability to cope with change. Recent studies (Demetriades and Esplen, 2010; Masika, 2002; Mitchell et al., 2007) have shown that women and men experience climate change differently, and that gender inequalities often worsen women's coping capability. Therefore, it is important to understand gender perception in relation climate shock, the impact of these shocks on them and the coping strategies adopted by them. In India, Patel et al. (1995) also found that solely men made decisions relating to choice of cropping pattern and marketing of produce. Lambrou and Piana (2006) argued that women's ability to adapt to climate change depends on their control over land and money; access to credit and safeguards; low dependency ratios; good health; personal mobility; and household entitlements. Bayard et al. (2007) study showed that male farmers were more responsive to adaptation to environmental degradation by planting alley crops in Haiti. Other similar studies are Hassan and Nhemachena (2008) and Deressa et al. (2008, 2010) indicated that male members of the farming households were more responsive to adapting to climate change. Hassan and Nhemachena (2008) also indicated that farmers shifted away from mono-cropping system as a way of adapting to climate change during changes in temperatures.

Another interesting aspect that is studied in the paper is to understand who makes the decision to choose the coping strategy. In context of Bihar, usually the climate risk is in form of climatic shocks like drought and floods, (Disaster Management Department, 2015; Kishore et al., 2014; Sehgal et al., 2013), thus, we assume that in these cases, these shocks have an effect on the entire family and consequently coping strategies are usually jointly discussed. However, studies has documented that it is usually a male member makes the final decision.

On this pretext, this paper has the following objectives:

- a) to analyze the role of male and female farmers in making decisions that help them to cope with climate shocks;
- b) to understanding the socio-economic factors that influence the decision-making capability of member of the farming households.

The hypothesis of the study is that the male and female farmers have different coping strategies and that the differences in socio-economic factors influence the decision-making capability.

## 2. The study area

The study focuses on Vaishali district in the Indian state of Bihar which has 88.7% of its population dependent on agriculture (Census of India, 2011) for their major source of livelihood (refer Fig. 1). As per the study by Sehgal et al. (2013), Vaishali district ranks 48 out of 161 districts in India, and is listed as among one of the most vulnerable to climate risk with high exposure and sensitivity to climate change, but low adaptive capacity. Almost 93% of the farmers are small and marginal landholders (NSSO, 2005) and rely on the monsoon for their irrigation needs. We chose Bihar for our study as it is extremely vulnerable to climate change and often faces climate shocks such as floods and droughts. Since 2009, Bihar has experienced four major droughts; consequently, the government of Bihar has initiated a number of district-level drought-relief programs to mitigate the impact of drought. Moreover, the survey data also found similar arguments for the occurrence of droughts and floods. In Bihar, 24 districts (out of 37) are extremely vulnerable to climate change (Sehgal et al., 2013). Women form an important part of the work force in Bihar; thereby facilitating the study of the gender dimension, about 22% of the agricultural workforce in Bihar (Census, 2011)<sup>2</sup> is women. However, their share of the workforce is even higher, if their indirect involvement in their own fields is accounted. Bihar, along with many other regions in India, experiences an migration of male members of agricultural families in search of employment and, thus, women's involvement in the agricultural workforce is even more as the de facto female head of the households (Ghosh, 2004; Rao, 2006). This is often mentioned in the literature as the feminization of agriculture (Binswanger et al., 2012; Gillespie et al., 2012).

## 3. Sampling procedure and data

The study uses the subset of a large primary household survey that was undertaken under the CCAFS (Climate Change, Agriculture and Food Security funded) project for selected locations in South Asia. The survey was undertaken between April 2013 and November 2013 and the data pertains to the agricultural year Kharif and summer (2012) and Rabi 2013. The households were selected based on a multi-stage sampling method. Within Vaishali districts, twelve villages were randomly selected using the state census around the targeted location of the project. The selection of households within villages is based on random stratified sampling. For selecting the households in the villages, a quick census of about 75% of the households in the village was conducted to gather basic information about the household such as the crop(s) grown, size of land holding, gender and age of head of the household. This information is used to identify the sample households in the village, taking into consideration households that grow at least one crop of

<sup>1</sup> People often use "coping" and "adapting" interchangeably in the context of disaster response. However 'coping' is a "way of responding to an experienced impact with a shorter-term vision (for example, one season), and adaptation is the process of adjusting to change (both experienced and expected), which is longer term (for example, over a decade or longer)." (IPCC).

<sup>2</sup> Source: FAOSTAT. Note: The female share of the agriculture labor force is calculated as the total number of women economically active in agriculture divided by the total population economically active in agriculture.

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