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Knowledge and passive adaptation to climate change: An example from Indian farmers

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ABSTRACT

This study is an attempt to use group information collected on climate change from farmers in eastern Uttar Pradesh, India to address a key question related to climate change policy: *How to encourage farmers to adapt to climate change?* First, we investigate farmers' perception of and adaptation to climate change using content analysis and group information. The findings are then compared with climatic and agriculture information collected through secondary sources. Results suggest that though farmers are aware of long-term changes in climatic factors (temperature and rainfall, for example), they are unable to identify these changes as climate change. Farmers are also aware of risks generated by climate variability and extreme climatic events. However, farmers are not taking concrete steps in dealing with perceived climatic changes, although we find out that farmers are changing their agricultural and farming practices. These included changing sowing and harvesting timing, cultivation of crops of short duration varieties, inter-cropping, changing cropping pattern, investment in irrigation, and agroforestry. Note that these changes may be considered as passive response or adaptation strategies to climate change. Perhaps farmers are implicitly taking initiatives to adapt climate change. Finally, the paper suggests some policy interventions to scale up adaptation to climate change in Indian agriculture.

1. Introduction

Climate change is no more a distant problem. We have been experiencing changes in climatic variables, such as rising temperature, variable rainfall, frequent droughts, hurricane and typhoons (Lobell et al., 2012; Auffhammer et al., 2011), and have almost failed to reach a global consensus on the mitigation of greenhouse gas (GHG) emissions (Sharma, 2015). Additionally, policymakers in rich nations (for instance United States) have shrugged off the whole notion of climate change. However, countries such as members of European Union have recognized the effects of climate change and have adopted measures to reduce its impact.[1] As a result, response to climate change has not been addressed properly. Additionally, Füssel (2007) notes that slow mitigation response will not reduce adverse effects of GHGs that is already in the atmosphere,

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[1] The EU climate and energy package was adopted in 2009 to implement the 20-20-20 targets endorsed by EU leaders in 2007 – by 2020 there should be a 20% reduction of GHG emissions compared with 1990, a 20% share of renewables in EU energy consumption, and energy improvement by 20%. (*Source:* http://www.eea.europa.eu/themes/climate/policy-context.)

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but would significantly reduce the rate of growth in global warming. Therefore, along with fast response mitigation responses, we require adaptation to climate change. Adaptation is not a new phenomenon—it has been in practice since the beginning of life. The theory of evolution is its best example.

Adaptation to climate change refers to adjustments or changes in the system to minimize the negative impact and optimize the positive impacts of climate change (CC). Further, adaptation could be at different levels of government, for example, regional, national, sub-national and local levels. Adaptation at local level is the most critical issue as local actors are the ones that realize the severity of climate change (UNFCCC, 2009). Adaptation is a two-step process. First, one has to perceive climate change and associated risks; then steps taken to minimize the adverse effects of climate change. Perception should be more or less correct, otherwise steps taken based on wrong perception could have an adverse effect. Correct perception depends on the knowledge and access to information. However, knowledge depends on the educational attainment and experience of the person. Perception is a cognitive process that involves receiving sensory information and interpreting it. Despite perceiving the phenomenon correctly, sometimes people do not respond to effects of CC due to constraints, including lack of capacity, lack of resources, and lack of information. Apart from these constraints, people do not respond to perceived CC because of their orientation or beliefs. For example, farmers are aware of adverse effect of overuse of groundwater, inspite of this they continue with overuse of water—their focus is on sustaining their income rather than environmental sustainability. Hence, it is important to understand the level of people's perception, its correctness, and how perception of CC motivates adaptation.

Adaptation strategies vary from sector to sector and each sector faces specific challenges in adaptation to CC. In this study, the primary focus is on the agricultural sector because it is the most vulnerable sector to CC (Porter, 2014). Adapting agriculture to CC is a major challenge, especially in a developing country like India, where a vast majority of farmers are marginal and smallholder farmers, less educated, and have significantly lower adaptive capacity. As a result, one cannot expect autonomous adaptation. Even if it were possible, it would not be sufficient to offset losses from CC (McCarthy, 2001). Perhaps the only way out is a planned or policy-driven and incentivized adaptation strategies.

Using three villages in eastern Uttar Pradesh (UP), India and applying focused group research method (FGR), this study attempts to identify farmers' perceptions of both CC and climate risks and assess the accuracy of such perceptions by comparing the observed perceptions with changes in the observed in climate and agricultural data collected from different sources. Findings from FGR are then compared with available studies conducted in both India and abroad. The selected villages (Sariyawa, Gauhaniya, and Kinauli) are located in Faizabad district, a district in the eastern part of UP, India. This district was chosen because they are more likely to be affected by CC and are characterized by low per capita income, high population density, and the dominance of small and marginal resource-poor farmers (Tripathi, 2016).

The remainder of this paper is organized as follows. Section 2 discusses the inter-relationship between climate change and agriculture, and also highlights initiatives taken by the Government of India (GoI) to address issues in agriculture as it relates to climate change. This section also reviews relevant studies that focus on the impact of climate change on Indian agriculture. Section 3 describes the study area and methods used in data collection and analyses. Section 4 presents the results of our study and Section 5 concludes the paper and discusses policy implications.

2. Climate change, agriculture, and policy initiatives

Climate change and agriculture are interrelated. The interrelationship between the two is depicted in Fig. 1. The figure shows that on the one hand, agriculture and changes in land cover, food system, emit greenhouse gases (GHGs) that contributes to climate change and on other hand, climate change affects agriculture. Several studies (for example, EPA (2014) and Vermeulen et al. (2012) suggest that the food system contributes about 19–29 percent of the total GHG emissions. Direct emissions from crop cultivation and livestock account for about 10–12 percent of the total GHG emissions (Solomon et al., 2007). Not only the magnitude of agricultural emissions but also its trend is alarming. Recent data released by the Food and Agriculture Organization (FAO), shows that emissions from agriculture, forestry, and fisheries have nearly doubled over the past 50 years. The report also suggests that it could increase to an additional 30 percent by 2050 if greater efforts are not made to reduce them.

Climate change affects agriculture in two ways—direct and indirect. Changes in climatic factors (for example, temperature, and rainfall) affect agricultural productivity through physiological changes in crops (Chakraborty et al., 2000). In addition, climate change also affects other factors of production agriculture, such as water availability, soil fertility, and pests (Porter, 2014). The overall effect of climate change on agriculture could be positive or negative; the magnitude of impact can also vary from very low to very high, depending on regional or geographical location and status of socioeconomic development (Mendelsohn et al., 2006; Tol, 1995; Tol et al., 2004; Tripathi, 2016). These studies suggest that whether a little change in climate is bad or good depends on one's location. For instance, Tol (1995 and 2004) found that a 1 °C increase in temperature and a 0.2-meter rise in sea-level had a positive impact in member-countries of the Organization for Economic Co-operation and Development (OECD), Middle East countries, and China, but a negative impact in other regions.

In another study Mendelsohn et al. (2006) provided empirical support for the distributional impact of climate change by examining the impacts of climate change between poor and rich countries. Findings from this study revealed that the poorest half of the world's nations suffer the bulk of the damages from climate change, whereas the wealthiest nations experience