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Determinants of farmers' adaptation to climate change in agricultural production in the central region of Vietnam

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ABSTRACT

This paper discusses the likely changes in farm cultural practices that farmers would adopt to minimize agricultural production losses as a response to the increasing occurrence of extreme weather conditions due to climate change in the Central Region of Viet Nam. Using binary logit model and multivariate probit model, this paper examined different factors influencing farmersTiO_2-N' decision on adaptation to climate change in their agricultural production. Training attendance, farm size, damage level, educational level, farming experience, access to credit, and gender were the factors that influenced significantly the probability that farmers would adapt to climate change. Of these factors, attendance in climate change training and farm size were the most important factors affecting the farmersTiO_2-N' decision on adaptation to climate change, while labor availability and membership in local organizations were not. Three policy recommendations were proposed to enhance small-scale farmersTiO_2-N' adaptive capacity to climate change in the region. These include: iTiO_2-N). broadening of training courses on climate change; iiTiO_2-N). institute policies that would promote consolidation of farmlands; and, iiiTiO_2-N). integrate concepts of climate change and climate change adaptation into the operation of the local organizations.

1. Introduction

Climate change has become a threat to human society (Ramirez-villegas et al., 2012; Kibue et al., 2015), particularly in developing countries where smallholder farmers are greatly affected and are becoming increasingly vulnerable to extreme weather events caused by climate change (Lotze-Campen and Schellnhuber, 2009; Esham and Garforth, 2013; Altieri and Nicholls, 2017; Comoé and Siegrist, 2015). Thus, adaptation to climate change is now gaining wide recognition and is a focal concern around the world (Smit and Skinner, 2002; Wilbanks et al., 2007; Thornton and Comberti, 2013). However, developing countries have lower adaptive capacity and do not have the essential technology for adaptation to climate change (Lotze-Campen and Schellnhuber, 2009).

Agriculture as the major sustainable source of food is highly dependent on and strongly affected by weather and extreme climatic events (Mjelde et al., 1989; Das, 2005; Motha and Murthy, 2007; Sivakumar, 2011; CIE, 2014). In recent decades, climate change has adversely affected crop production and yields in important agricultural regions of the world (Almaraz et al., 2008; Reidsma et al., 2009). In addition, the adverse impacts of climate change on agricultural production has led to high poverty incidence (Mendelsohn et al., 2006) and food insecurity in the world (Das, 2005; Rosenzweig and Tubiello, 2007; Nelson et al., 2009; Misra, 2012; Connoly-Boutin and Smit, 2015). However, few smallholder farmers have enough resources or capacity to adapt to climate variability and change (Verchot et al., 2007; Nyamadzawo et al., 2013). Thus, most countries in the world have increasingly considered improving farmers' adaptive capacity to climate change in agriculture to ensure food security and secure livelihood of smallholder farmers (Smit and Skinner, 2002; Verchot et al., 2007; Nelson et al., 2009; Kibue et al., 2015).

Agriculture is an important sector for Vietnam since it accounts for one-fifth of the GDP, employs nearly half of the country's labor force (GFDRR, 2011), and provides an income source for three-quarters of the population of the country (Cooke and Toda, 2008; Shrestha et al., 2014). Thus, the Vietnamese Government has intensified its efforts to reduce vulnerability and improve its adaptive capacity in addressing the impacts of climate change in agricultural production (Trinh et al., 2013; Schmidt-Thomé et al., 2015). Furthermore, farmers have initiated a number of autonomous and

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planned adaptive practices, such as changes in sowing dates, switching to drought-tolerant crops, changing crop varieties (e.g., salinity-tolerant varieties of rice), and switching to rice-fish rotations (World Bank, 2010). However, farmers in Vietnam still have limited understanding of the importance of climate change adaptation to their livelihoods (Le et al., 2014a).

The Central Region of Vietnam has been highly vulnerable to extreme weather events such as flood, typhoon and drought (Boateng, 2012). In addition, the frequent occurrence of extreme weather events serves as a challenge to agricultural production in the region (ISPONRE, 2009; Bruun and Casse, 2013). Given the importance of this issue, several studies were undertaken in an attempt to determine the impacts of climate change on agricultural production and describe farmersTiO_2-N' adaptive practices to climate change in the region. Shrestha et al. (2014) analyzed the impacts of climate change on winter and summer paddy yield, and evaluated several adaptive practices to climate change in the central region. The results of this study indicated that the plausible adaptive strategies for rice cultivation in the region include changing planting dates, supplementary irrigation, proper nutrient management and switching to new rice varieties. Shrestha and Bui (2015) listed some adaptive practices of farmers in the region as a response to climate change such as altering transplanting dates and introducing supplementary irrigation. Tran et al. (2015) compared the adaptation behavior between poor and non-poor farmers of the central region and concluded that non-poor farmers were more likely to adopt more sophisticated responses compared to the poor farmers.

An understanding of the factors affecting farmersTiO_2-N' decision in applying a particular adaptive practice among the available strategies may provide a very basis for formulating policy recommendations that would be responsive to climatic changes (Piya et al., 2013). However, despite the high occurrence of climate-induced agriculture risks, no studies have identified the factors affecting farmersTiO_2-N' adaptive choices in their agricultural production under changed climate condition in the Central Region of Vietnam. Hence, the purpose of this paper is to examine if, and how the factors that relate to household's livelihood assets influence farmersTiO_2-N' adaptive strategies for climate change in the region.

2. Methodology

2.1. The study site and method of data collection

This study was conducted as part of a project on climate-smart agriculture and climate services, in Ky Son commune, Ky Anh district, Ha Tinh province in the northcentral Vietnam (Fig. 1). The study site included My Loi village, one of the first CCAFS climate-smart villages in Southeast Asia. The commune was chosen as the study area due to its exposure to multiple extreme weather events such as temperature and water stress, flood, storm and typhoon (Le et al., 2014b).

This paper used both primary and secondary data. The secondary data included information on the socio-economic conditions of the study area. The annual reports of the local government in the study sites, baseline ICRAF's reports and other published documents were major sources of secondary data for this study. Personal interviews with 400 farmers in My Loi and other villages of Ky Son commune were undertaken using prepared questionnaires. The stratified random sampling method with stratum is village was used in determining the respondents. The sample size included respondents in all villages of Ky Son commune. The number of respondents in each village was selected based on its percentage of households in total household of the whole commune. In addition, the study randomly selected respondents in each stratum (village). Respondents were mainly farmers whose livelihood mostly depends on the agriculture and forestry sector.

A pilot survey of 20 respondents in My Loi (project site) and My Lac village (non-project site) of Ky Son commune was also conducted to test the suitability of the questionnaire. The primary data collected in this study included information regarding all livelihood assets of the households. It also included information about damage level due to extreme weather events in household's agricultural production and farmersTiO_2-N' adaptive strategies to these events.

2.2. Conceptual framework

Conceptually, extreme weather events due to climate change (e.g., droughts, floods, cold spells, etc.) could adversely affect household's livelihood. Therefore, farmers would adopt different adaptive practices

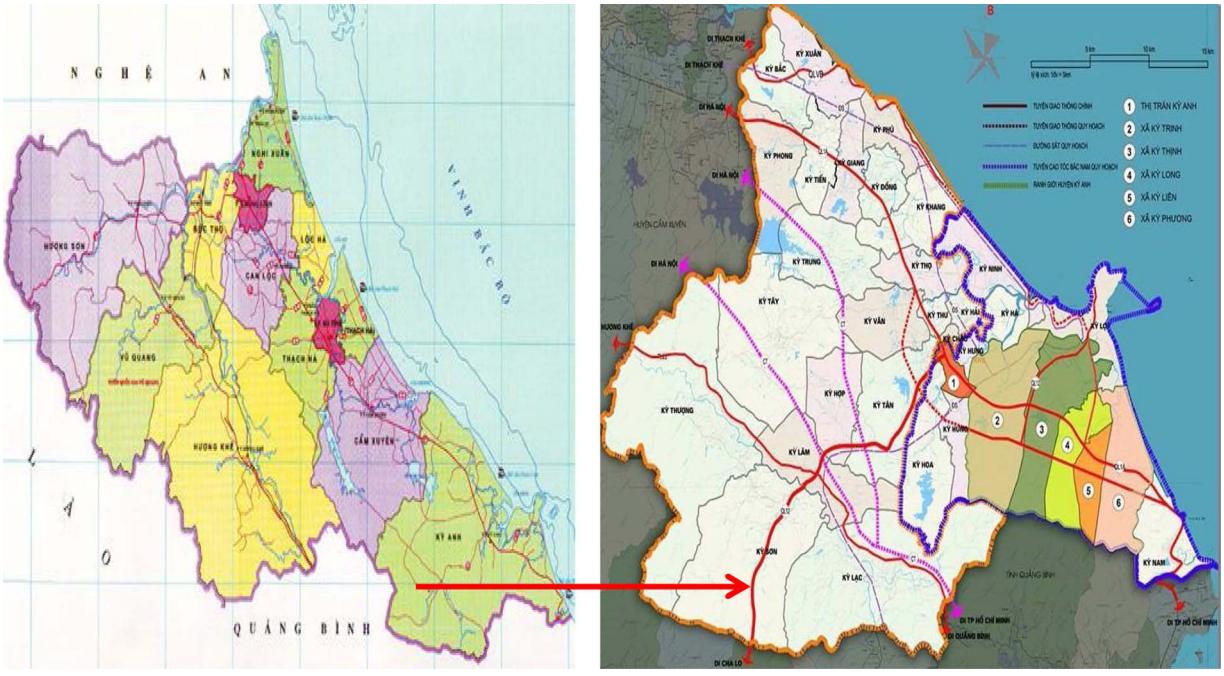

Fig. 1. Map of the study site.