

OVERCOMING BARRIERS TO CLIMATE CHANGE ADAPTATION IN NORTH MOUNTAINOUS REGION OF VIETNAM

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Abstract

This study was conducted with supporting by the Food and Agriculture Organization (FAO), International Fund for Agricultural Development (IFAD), Ministry of Agriculture and Rural Development (MARD) and Institute for Agricultural Environment (IAE). The study has used rapid rural appraisal (RRA) participatory rural appraisal (PRA) and face-to-face individual interview and group discussion in Bac Kan and Ha Giang provinces (the Northern mountainous region of Vietnam). Bottleneck and Weakness, Opportunities and Threaten (SWOT) have been used to analyze and determine the barriers of policies and recommend policies to support farmers to overcome impact of climate change and improve livelihood in the NMR. The result shows that climate change have brought seriously negative impacts to farmers for both agriculture and livelihood while farmers and local authorities are facing to difficulties and need tackling such as poor infrastructure and high investment requirements; limited provincial funding to response climate change; weak market organization and low net benefits for agriculture. The study recommended on key policy development such as infrastructure development (irrigation, transportayion); financial support; improving awareness on climate change and marketing for agricultural products to help farmers overcoming barriers and enhancing capacity to cope with negative impacts of climate change on agriculture and livelihoods.

Keywords: Agriculture, barriers, climate change, impact, livelihoods and the northern mountainous region, Vietnam

INTRODUCTION

Farmers in Vietnam's Northern Mountainous Region (NMR) are facing the big challenges to negative climate change (Tran Van The and *et al.*, 2012). Changes in temperatture and rainfall, coupled with extreme weather events have negatively impacted the area's agriculture and the farmer's livelihoods. This case study examines Bac Kan and Ha Giang provinces in the NMR in Vietnam. Agriculture and farmer's livelihood have suffered droughts, flash floods and unusual cold spells due to cause of climate change. During the past 50 years, temperatures in NMR in general, in Ha Giang and Bac Kan provinces in particular have increased by an average of 0.5°C, with an average rise of 1.40-1.5°C in January and 0.30-0.5°C in July (Ministry of Natural Resource and Environmnet (MONRE), 2012). Meanwhile, rainfall has decreased by an average of 2 percent annually, with a fall of 6 percent in wet season from May to October, but an increase of 6 percent in dry season from November to April in the year through 2100. The area is marked by complicated topography and suffers from poor transportation systems, and overexploitation of natural resources. More than 70 percent of its people are members of ethnic minorities who are low education and limited knowledge. This

study aimed at to building capacity for pro-poor farmers to eradicate hunger, food insecurity and malnutrition, increase resilience of rural livelihood to threats and crises from climate change through overcoming barriers to climate change adaptation in Northern mountainous region of Vietnam.

METHODOLOGY

Related documents, reports and publication were collected from various sources of Ministry of Agriculture and Rural Development (MARD), MONRE, International Non-Government Organizations (INGO) and national research and development institutes, universities on related issues on climate change.

Rapid Rural Appraisal (RRA) was used to collect data directly from key stakeholders (20 farmers/village, 10 local officers/district) through face-to-fact individual interview by standardized data collection form. Participatory Rural Appraisal (PRA) was used to collect related data from focal group discussion and mini-workshops with local people in Ha Giang and Bac Kan provinces for the relevant issues of climate change and adaptive capacity.

Bottleneck and Weakness, Opportunities and Threaten (SWOT) were used to analyze and determine

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the barriers of policies to cope with impact of climate change and recommend appropriate policies to support farmers to overcome impact of climate change and improve livelihood for ethnic minority people in the NMR.

RESULTS AND DISCUSSION

The future in the aftermath of climate change in Vietnam

On the global, extreme drought, excessive rains, typhoons, floods and other natural disasters are constantly reported in all parts of the world in recent years due to increasing GHG emissions from high human intrusion through economic development and exploration of resources. Climate change has evidently brought many vulnerabilities and risks to ecological systems, directly affecting production and value added economic activities. The World Bank projects that global GDP will drop 1% annually and that human consumption demand will soon fall by 20%. Consequently, the global economy will lose over US\$300 billion due to natural disasters and extreme climate change.

Table 1. Affected areas and people by sea levels rising at 1 m within East Asia and South Asia

Item	East Asia	South Asia
Natural Areas Affected (km ²)	74,020	12,362
Urban Areas Affected (km ²)	6,648	809
Agricultural Land Affected (km ²)	45,393	3,442
Submerged Areas (km ²)	36,463	9,184
Population Affected (1000 person)	37,193	5,870
GDP losses (million USD)	158,399	18,021

Sources: World Bank (2010)

Vietnam is considered to be highly vulnerable to climate change due to its long seashores, various river basins and complicated landscape. Flood, landslide, drought, chili colds and extreme climate events are serious impacts by climate change in the North mountainous region (MONRE, 2012). The agriculture sector is predicted that will be the most affected by climate change as it is susceptible to even the slightest change in the environment, with losses nearly reaching US\$54.9 millions per year on average, accounting for approximately 0.67% of the GDP. Agricultural damage will result in a long and painful recovery in comparison with other sectors (Tran Van The *et al.*, 2010).

Not like other agroecological zone, parts of the Vietnamese North mountainous region have experienced climate change over the years. The Bac Kan and Ha Giang provinces have seen an increased rainfall in the past several decades. Rainfalls in the dry season (November-April) has seen a slight increase although it has reduced by 5-20% in the wet season (May-October). Thus, coupled with the change in forest and land use, the dry season minor increase in rainfall and the wet season decline will lead to difficulties in agricultural production in both aforesaid provinces. Hence, climate change effects on farmers' livelihoods include (1) direct damage to agricultural production due to extreme weather (droughts, floods, natural disasters); (2) changes in production conditions leading to changes in productivity (excessive or insufficient water, temperature extremes); (3) declining production capacity (land loss, salt water incursion, soil erosion, soil scratches); (4) decaying biodiversity (plant disease epidemics); and (5) an increased need in responding investment (adaptation, mitigation and restoration). This reemphasizes the need for mitigation and adaptation measures to protect against climate change.

Table 2. Climate change vulnerability index on agriculture

No.	Region	Vulnerability index (VI)	Rank	Classified
1	Red River Delta	0.465	5	Medium
2	North Mountainous Region	0.224	7	Medium
3	North Coastal Region	0.520	4	Medium
4	South Coastal Region	0.536	3	Medium
5	Central Highland	0.405	6	Medium
6	South East	0.602	2	High
7	Mekong River Delta	0.679	1	High

Source: Pham Quang Ha *et al.* (2013)

Impact of climate change on agriculture in Northern mountainous region

In Bac Kan province

Damages and losses to household's income are main impacts from climate change including increase in costs for implementing adaptive measures to response to climate change consequences such as natural disasters, extreme climate events with approximately 80% of farmers in both Bach Thong and Ba Be districts. Increase in costs of irrigation due to exhausted water in dry season and too much water in raining season also are impacts of climate change on agriculture and farmer's livelihood. The survey result showed that more than 50% of farmers in Bach Thong district perceived irrigation and drainage has become big problem for farmers to maintain cropping pattern in Bach Thong district. More than 46.3% farmers in Bac Thong district also indicated that cropping pattern has changed rather than before due to irregulated water irrigation in raining season and drainage in dry season because of negative impact of climate change. A large rice cultivation had change to maize and groundnut due to no rain in dry season.

The field survey also showed the major different

perception between farmers and local officers on animal livestock and forest... Officers from Department of Agriculture and Rural Development (DARD), Bach Thong and Ba Be districts evenly showed that new insect and pest were appeared and affected to forest in recent years due to impact of climate change. However, very few farmers recorgnized beause they thought that deaths of cow, buffalo and new pest on forest tree are normal and do not think of negative impacts of climate change.

In Ha Giang province

Both farmers and local officers from DARD, Dong Van and Bac Quang districts in Ha Giang province supposed that climate change has brought seriously negative impacts on increasing difficulties of transportation, agriculture and livelihoods to farmers (35% of farmers in surveyed villages of Dong Van district and 53.0% of them in the villages of Bac Quang district), especially in poor infrastructure villages in Dong Van district. Hence, government and local province are requested to support more and high priority to improve infrastructure systems (road, water supply, irrigated works) especially in Ma Le and Lung Cu communes in Dong Van district.

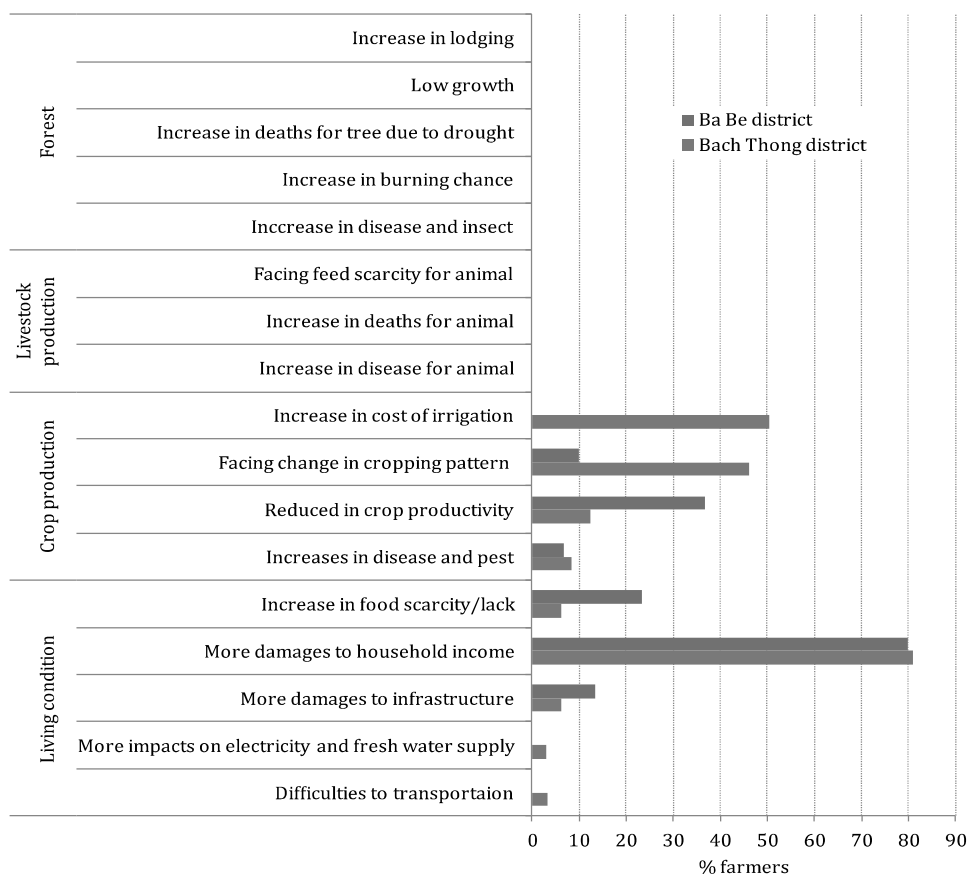


Figure 1. Facing to impacts of climate change by farmers in Bac Kan province

In crop production, according to surveyed results, farmers supposed extreme climate events (damaged cold, extreme hot) have been main causes of reducing crop productivity in the villages of both Dong Van and Bac Quang districts (33.3% of farmers) and 34.1% of them indicated that too heavy rains and much humidity in blooming and growing period than 10 years before had brought seriously damages to the oranges, tea and other fruits (pest, disease, broke pollination) in villages of Bac Quang district. Crop varieties and cultivated procedures are requested to be improved to cope with impacts of climate change

in these villages to help farmers to cope with impacts of climate change.

In animal livestock, 81.8% of farmers in Bac Quang district indicated that extreme climate events (chili cold in winter with dried and humidity with iced in winter) were main causes of disease and deaths for animal livestock in high mountainous villages of Dong Van district. Chili cold are main causes of animal deaths (11000 cows and buffaloes) while hot and dry temperature were main cause of reducing grass field and domestic feed sources for cattle in these villages in winter season.

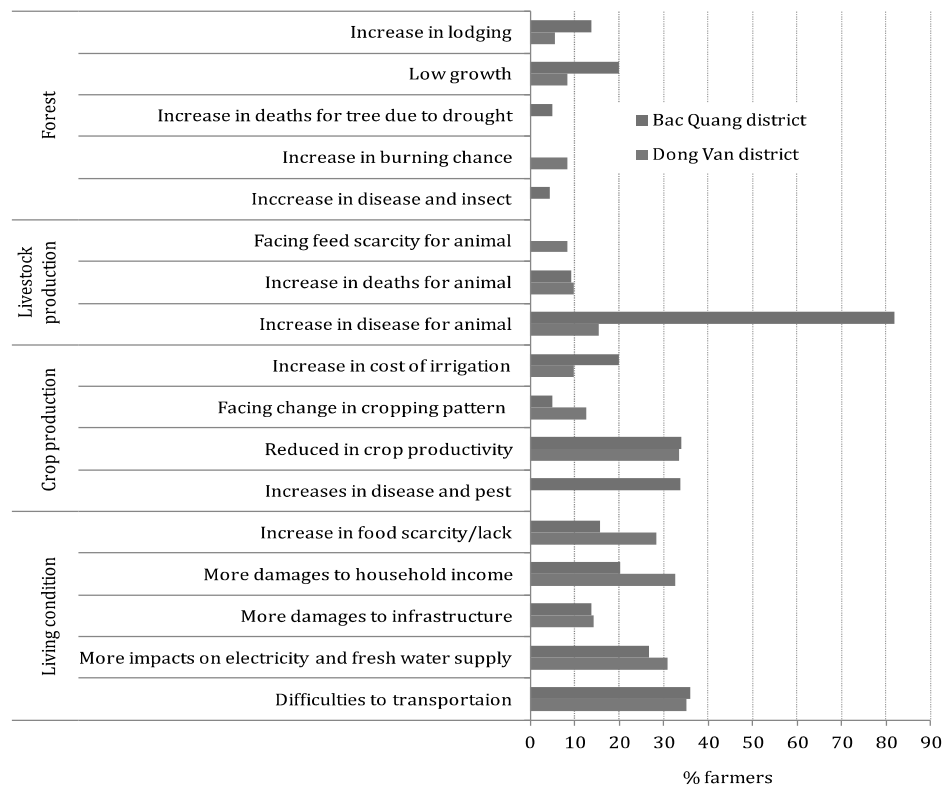


Figure 2. Facing to impacts of climate change by farmers in Ha Giang province

Barriers of climate change adaptation in the mountainous region

The field survey and group discussion with farmers, local officers in Bac Kan and Ha Goang provinces showed that both farmers and local authorities have been facing severe difficulties in responding to climate change for sustainable agriculture and food security. Although Central Government has transferred some adaptation measures to combat risks and cope with impacts of climate change but it has very limited financial resources to support farmers. The barriers of climate change adaptation have been determined as the followings:

Poor infrastructure and high investment requirements:

Although agriculture and livelihoods have been serious impacts of climate change but infrastructure facilities which support for improving agriculture and farmer's livelihood in the mountainous region are still limited due to poor transportation, healthcare, education and other services. Furthermore, studies show that farmers have meager access to fresh water and water storage to sustain livelihoods. Farmers in the Dong Van district have to travel great distances to find water and spend exorbitant amounts on construction to maintain water pipelines due to its topography. Moreover, the irrigation system is

underdeveloped and cement channels are rare. Thus, barriers in adopting measures against climate change restrict improving living conditions and agricultural production in the area.

Limited provincial funding to respond to climate change:

Funds allocated for production development is more common than direct funds for agriculture from local provincial authorities which are sparse. There is a large gap between the supply and demand of finance for the development of the agriculture sector in the mountains which instantly reduces the funds available to take the necessary steps to respond to climate change. This barrier restricts and directly affects climate change adaptive capacity for both local authorities, farmers and communities.

Limited knowledge and education by farmers and local officers on climate change:

The ethnic minority with minimal education make up the remote mountainous region. Some of them cannot speak the widely used Kinh language (national language) and this act as a huge deterrent in transferring new technologies in fighting climate change. It is not just the people who suffer from limited educational resources but also local authority officials who have little training on climate change adaptation measures, which adversely affect the region's agriculture sector. This barrier restrict the absorbance of new and modern technologies (hybrid varieties, high biotechnologies, intensive cultivation, good agriculture practices) as well as knowledge on climate change by ethnic minority farmers in north mountainous region.

Weak market organization and low net benefits for agriculture:

Commodity supply is the one of the highest paid chains to farmers, only a small percentage of farmers unfortunately have access to it (over 65% of perception by farmers in select locales of the Bac Kan province and 40% in the Ha Giang province). The barriers of market organization for agriculture include (i) transportation difficulties resulting in costly alternative modes of transport amounting to a huge expense in comparison with the price of production; (ii) The presence of wholesalers in the chain minimizes profits made by farmers; (iii) as commercial companies are buying the market of agricultural produce, the participation of local enterprises is weak, forcing farmers to take disadvantageous acts of survival such as selling at higher prices; (iv) the absence of contracting with

farming companies, selling products and buying inputs at reasonable prices, poses obstacles in transferring information on new improved crop and animal varieties with high harvesting productivity.

Weak agricultural extension services

More than 80% of farmers are ethnic minority people with low educational level, even, hence, it is very big challenge for agricultural extension workers to train and guide for them the agricultural techniques and new crops. Small farmers shifted non-traditional crops (soybean, groundnut, bean) to replace rice to respond extreme climate events but farmers confirmed poor receiving technical supports from agricultural extension services.

Overcoming barriers to climate change adaptation in Northern mountainous region

- *On infrastructure development and financial aids:*

Government support for improving infrastructure (particularly irrigation systems, transportation systems and interior field infrastructure); expanding fresh water supply for farmers in remote and distant hills; re-review and reevaluate the efficiency of water tanks to provide water to farmers for both agriculture and livelihood; strengthen the efficacy of irrigation and water storage systems for farmers. The central government has the chief responsibility in allocating funds for quantifying economic, ecological and environmental bearings of climate change for each district in the mountainous region in collaboration with local authorities; conducting national level programs for responding to climate change under MARD; developing a separate program for high risk and vulnerable zones to tackle climate change.

- *On improving awareness on climate change:*

Developing communication campaigns for local authorities, agricultural officers, members of mass organizations and farmers on climate change, its occurrence and impacts to fit provincial sub-ecological zones; providing guidance to local officers, farmers in selecting suitable crops; building capacity to strengthen farmers' requests promptly and to boost acquirements of technological transfer for the mountainous regions; and reinforcing indigenous knowledge and adaptive traditional practices.

- *On marketing and extension service for agriculture:*

restructuring the market to ensure that farmers gain benefits from agricultural products; strengthening market organization and providing support sales of agricultural products at reasonable prices. Government strengthens capacity (both human sources,

knowledge, information) for agricultural extension workers in Northern mountainous region for ethnic minority farmers such as developing agricultural voluntary extension; transferring suitable technologies (high tolerated maize, local varieties, high quality animals); field and village level study, performances and trainings, climate change and traditional culture festivals

CONCLUSION AND RECOMENDATION

Conclusion

- Climate change has affected seriously to agriculture and livelihood and brought big challenges to ethnic minority farmers in high villages of Bac Kan and Ha Giang provinces.

- The main barriers to climate change adaptation for the ethnic minority farmers in high villages of Bac Kan and Ha Giang provinces are (i) Poor infrastructure and high investment requirements; (ii) Limited provincial funding to respond to climate change; (iii) Limited knowledge and education by farmers and local officers on climate change; (iv) Weak market organization and low net benefits for agriculture and (v) Weak agricultural extension services.

Recommendation

Government should be high prior investment and financial aids for developing infrastructures, capacity building, communication campaign, extension services and technological transfer, field performance and training for ethnic minority farmers and local officers on climate change adaptation, market organization.

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GREENHOUSE GAS EMISSION IN AGRICULTURE SECTOR IN KY ANH DISTRICT, HA TINH PROVINCE

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Abstract

The study on Green House Gas (GHG) inventories was carried out in Ky Anh district, Ha Tinh province. The Agriculture and Land Use National Greenhouse Gas Inventory Software (ALU) version 4.5.2 (ALU, 2015) was used to simulate GHG emission based on district activity data in 2010 and 2014 and to predict GHG emission for the year 2020 based on agricultural development plan data of that year. The results showed that the highest GHG emission (80.59% of total agricultural emission) came from rice cultivation. Emissions from agricultural residue burning and from agricultural soil accounted for 0.8% and 7.8% of total GHG emission correspondently. Enteric fermentation and manure management were also high with 7.4% and 3.3% respectively of total GHG emissions from agriculture.

Keywords: GHG inventory, Climate change, ALU software, Ha Tinh

INTRODUCTION

Greenhouse gas (GHG) emissions contribute to climate change, which is recognised as one of the most imminent global problems. Countries such as Vietnam will be seriously affected by climate change, at the same time total GHG emissions in Vietnam were 246.8 Tg of carbon dioxide (CO₂) equivalents in 2010. Agricultural production activities emitted 88,3 Tg CO₂ equivalents, accounting for 33.2 % of total national GHG emissions in which rice cultivation considered to be the greatest source of agricultural GHG emissions in Vietnam, estimated emissions of 44.6 Tg CO₂ equivalents, accounting for 50.5 % of total agricultural GHG emissions, reported by Vietnam Ministry of Nature Resource and Environment (MONRE, 2014).

Agriculture releases to the atmosphere significant amounts of CO₂, CH₄ and N₂O (IPCC, 2001; Paustian *et al.*, 2004). Carbon dioxide is released largely from microbial decay or burning of plant litter and soil organic matter (Janzen, 2004; Smith, 2004). Methane is produced when organic materials decompose in oxygen-deprived conditions, notably from fermentative digestion by ruminant livestock, stored manures and rice grown under flooded conditions (Mosier *et al.*, 1998). Nitrous oxide is generated by the microbial transformation of nitrogen in soils and manures, and is often enhanced where available N exceeds plant requirements, especially under wet conditions (Smith and Conen, 2004). Agricultural greenhouse gas (GHG) fluxes are complex and heterogeneous, but the active management of agricultural systems offers possibilities for mitigation. Ky Anh district is located in the South of Ha Tinh

province, latitude from 17° 57' 10" to 18° 10' 19" N, and longitudes from 106° 11' 34" đến 106° 28' 33" E. Total natural land area of 104,186.73 ha, accounted for 17.48% total natural land area of Ha Tinh province (People's Committee in Ky Anh district, 2014), Ky Anh district affected directly by monsoon climate with two seasons in year. The cold season from October to March next year, the hot season from April to September. Ky Anh has high average temperature with 25°C. These factors great influence to crop pattern and crop management. Ky Anh is one of districts with much rainfall than that in other districts in Ha Tinh province except for a small part in the north, with an average annual rainfall of 2000mm, while some parts is about 3000mm. Agricultural land area in Ky Anh district is the biggest compared to others type of land with 82,772.33 ha accounted for 79.45% natural land area (People's Committee in Ky Anh district, 2014).

The objectives of this study aim to calculate GHG from agricultural activities in 2010, 2014 and predict GHG emission in 2020, and then some potential mitigation options are proposed for reducing GHG emission for this sector in Ky Anh district, Ha Tinh Province.

MATERIALS AND METHODS

GHG emissions were calculated by Agriculture and Land Use National Greenhouse Gas Inventory Software (ALU) version 4.5.2 (ALU, and it was used for calculating GHG emission in agriculture sector for Ky Anh district according Intergovernmental Panel on Climate Change (IPCC, 1996).

Input data for ALU model are activity data in agriculture and include:

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