

CLIMATE CHANGE AND ITS IMPACT ON AGRICULTURE IN VIETNAM

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INTRODUCTION

Climate change, which includes increases in temperature, changes in rainfall patterns, sea level rise, salt-water intrusion and a higher probability of extreme weather events such as flooding and droughts, is recognised as a global issue (Bates *et al.* 2008). The negative effects of these changes are likely to be felt more strongly in the less developed world compared to developed countries, as a large share of the population live in exposed areas, depend directly on natural resources for their livelihood and have limited institutional capacities to take proactive measures (Adger, 1999). Climate change poses a serious impact on agriculture, environment and health over the world. It is predicted that by 2080 the cereal production could be reduced down as 2-4% meanwhile the price will increase up to 13-45%, and about 36-50% of population being affected by hunger.

According to a report by the World Bank (2009), Vietnam is one of the five countries predicted to be among the most affected by climate change due to its long coastlines, the high concentration of population and economic activity in coastal areas, and a heavy reliance on agriculture, natural resources and forestry. Recently, National Center for Hydro-Meteorological Forecasting (2009) reported that salt-water intrusion has approached almost area of the Mekong river event with some province the salt-water got in about 70 km with an intensity of 13-30%. In Bac Lieu province, drought and salt-water intrusion affected almost 2,000 ha out of 7,000 ha of paddy rice. Same problem is occurring with Soc Trang province with 40,000 ha of rice (Monre, 2009). It is estimated that the sea level raises each one meter, there will have about 10% of population being affected and causing a loss of 10% GDP.

Climate change is expected to have a considerable impact on Viet Nam's fishery and aquaculture sectors, which accounted for 3.9 percent of GDP in 2005. The numbers of tropical fish with a low commercial value (except for tuna) would increase and the numbers of sub-tropical fish with a higher commercial value would decrease. Coral reefs are expected to degenerate and fish living in these habitats are expected to disappear. Moreover, sharp decreases in plankton would lead to migration of fish and reductions in fish body mass. As a result, it is estimated that the economic sea production capacity of Vietnam would be reduced by at least one third. Due to a rise in seawater level, aquaculture farms will have to be relocated and saline water intrusion and reduction of the mangrove area will create loss of habitat for fresh water creatures (MONRE, 2003).

Climate change is also expected to affect people's health as increasing temperatures facilitate the growth and development of various viruses and disease carriers, resulting in higher incidence of infectious diseases such as malaria and dengue. Moreover, extreme weather and increased frequency and/or intensity of natural disasters, such as typhoons and floods, will threaten people's lives and may lead to more fatalities, if significant mitigation and adaptation measures are not put in place.

Climate change scenario in Vietnam

According to the climate change scenario officially approved by the Minister of Natural Resource and Environment in June 2006, it is estimated that 3 climate change scenario are identified: a) A1F1 (High emission scenario); b) B2 (Medium emission scenario); c) B1 (Low emission scenario). Based on these scenarios, a number of measures and plan activities to cope with climate

change were developed from each ministry and province. There are number of studies predicted sea level raise and its impact in Vietnam. For instance, the sea level increased 10-20cm in the last 50 years based on the reports of Vietnam Ministry Natural Resources and Environment (MONRE, 2008). Some models predict sea level would increase by about 5cm per decade, in a total of about 69 cm in 2070 and up to 100 cm relative to 2100 (Thanh *et al.*, 2004).

One study estimates that a 100 cm rise in sea level by 2100 would affect approximately 9.3 percent of Viet Nam's land area and 10 percent of the population (Dasgupta *et al.*, 2007). Other studies project faster sea level rises and, consequently, that larger parts of the country are submerged (Bahuet, 2008). Also associated with sea level rise is saltwater intrusion. In 2004, saltwater intruded into 30-50km in the Red river and 60-70 km in the Mekong rivers (Thanh *et al.*, 2004), resulting in more than 1.7 million ha of land has been affected. Climate change, however, extends beyond sea level rise and includes extreme weather events such as floods, drought and typhoon (Chauhdry *et al.*, 2007).

The causes of climate change

After long-lasting debate, scientists over the world have strongly agreed that in recent decades, socio-economic development is very fast in most sectors such as energy, industrial, transportation, agriculture and forestry. This leads to an increase in emissions of green house gas (N₂O, CH₄, H₂S, and specially CO₂) in the atmosphere, make the earth warmer, change climate system and affect the global environment.

Currently, global average temperature is higher 0.74 °C compared to it in the year of 1850 and is estimated to increase 1.4 - 6.4°C in 2100, and estimated as the highest temperature recorded over the past 10,000 years. Rainfall has increased by 5-10%. Consequently, ice melting leading to sea level rises presents about 70-100 cm during 100 years and may increase 1-3 meters in 2100. Nature disasters like storm, flood, drought, Tsunami would occur with higher intensity, frequency. Due to these reasons, climate change have been affecting on all natural and economic sectors over the world as well as affect seriously the process of sustainable development, implementation of millennium targets/goals in all countries, especially in developing ones.

Impact of climate change and adaptive strategies in Vietnam

In Vietnam, the impacts of climate change vary widely by region depending on the type of agriculture. The deltas of Mekong and Red river are the largest areas which suffered the severe impact of climate change due to their low surface, high population density and high dependency of local settlers on agriculture (Monre, 2008). There is much to learn from rural people in these deltas who always have lived with floods, droughts, typhoons, and extremes of heat and cold and have developed many effective adaptation strategies to such risks over the centuries. However, global climate change is likely to change the risk environment in new ways that may result in more frequent and severe impacts and challenge the adaptive capacity of rural households and communities. Preparing for such changes and taking proactive measures, require a dramatic increase in the capability to respond to these changes more quickly and more effectively at every level from individual households to the community and national government.

Disaster experience in Vietnam especially in the recent decade, and the release of reports on global climate change impacts (i.e., IPCC 2008), have made Vietnamese governments and scientists acutely aware that the country's natural resources base is highly susceptible to severe impacts of climate change. The government has responded swiftly and thoroughly by promulgating the National Target Programme to Respond to Climate Change (Decision No.158/2008/QD-TTg issued on December 2, 2008), requiring all sectors and ministries to device and formulate action plans for

climate change adaptation and mitigation. The Ministry of Agriculture and Rural Development (MARD) finished the sector's framework action plan to respond to climate change for the period 2008-2010. However, the implementation of these action plans faces many difficulties due to financial shortages, inexperience, poor institutional coordination and lack of holistic approach (Heine, 2009).

There is a high consensus among scientists (Bruckles, 1999; Warner, 2005, Westcoat and White, 2003) that multi-stakeholder participation is the most appropriate institutional form for achieving the adaptive management and problem solving related to environmental issues and climate change. The links between different knowledge frameworks in the policy planning, implementation, in parallel with the sustainable agricultural development are keys to solve the climate change related problems. Therefore, the top priority in Vietnam is now to concretise the National Target Programme into an integrated practical strategy with the participation of all stakeholders. It is important to note that some of the most vulnerable people are the rural poor with limited access to information and financial and technical supports in order to adapt to the best of their abilities (Chauhdry *et al.*, 2007). Future adaptive strategies need to learn from, and integrate, local indigenous adaptive experiences into the response measures. This requires the participation of the poor and the most vulnerable people in the planning and implementing processes of climate change adaptation projects. The participation of these stakeholders is especially important in the project as it concerns their current and future livelihoods.

While the uncertainties of impacts related to climate change and their inter-linkages with other environmental and economic changes are still poorly understood (O'Brien and Leichenko, 2000), it is essential to facilitate participation at the local level in the development of adaptive strategies in order to have a more effective response.

Recent research from Hanoi University of Agriculture

Hanoi University of Agriculture (HUA) is a leading university of agriculture and related natural sciences in Vietnam. HUA provides society with well-prepared individuals who will improve the productivity and efficiency of agriculture and related natural resources. Recently, Hanoi University of Agriculture planned its future as a research-based university for higher quality of education. Dealing with the adverse impact of climate change in agriculture, HUA will focus on three dimensions of green education, research oriented to climate change adaptation, and technology transfer.

Green Education Program: environmental friendly model, green summer campaign for volunteer students and establishment of plants garden, green and clean environment of university. In the context of climate change adaptation, HUA's researches focus both on fundamental and applied researches such as breeding new drought and saline resistant rice varieties, collaborative research with JICA on reduced emission of CH₄ from paddy field, development of garden, pond and animal raising (VAC), water resources management.

Meanwhile, HUA also takes into account empowering its institutional and research centers for technology transfer such as high yield and quality hybrid rice varieties in adaptation to the changing environment, Management of Mangrove Information System in the coastal zone of the northern region of Vietnam, and adapting DSSAT (*Discussion Support System for Agrotechnology Transfer*) to assess the impact of climate change on rice production, etc. For instance, in the Red River Delta, rice growth and development in the second half of the XXI century are estimated to shortened rice growing period as well as reduction of leaf area indicator (LAI). The change is gradually increasing with the assumption of increased green house gases emission. With the high emission scenario, spring rice yield is estimated to reduce from 41.8% in 2020 to 71% in 2100. Those

initiatives carried out by Hanoi University of Agriculture have played an important role in the rural development in Vietnam under the changing environment where climate change poses a serious concern to the local people.

CONCLUSIONS AND RECOMMENDATIONS

Climate change has a clear impact on all sectors including economic, social and human health. Increasingly erratic and variable rainfall, higher temperatures, more intense extreme weather events like typhoons, droughts and heavy rainfall causing floods, and the rising sea level will all have significant impacts across sectors, regions, and income groups, and particularly on livelihood security of the poorest rural people.

Recently, the government has promoted the national climate change adaptation framework which emphasizes the role of all sectors to combat the adverse impact of climate change from a large scale to local activities. The local people are aware that they should start to adapt to the gradual change (different climate change scenarios) of environment themselves with the change in crop selection to such a shortened length of growing season, shifting the time for planting and harvesting to deal with the environmental uncertainty.

From the scientific point of view, fundamental researches need to be invested adequately such as breeding of new varieties which could tolerate salinized soil or resistant varieties against diseases, or modification of fertilization to reduce nutrient loss from which those initiatives will be applied on specific ecological zone to maximize the productivity and reduce the loss.

Meeting the challenges of the uncertainty of such environmental changes needs to have good human resources, therefore, capacity building in the field of environmental assessment, climate change, natural resources management and related field need to be promoted at an earlier stage of education such as at Hanoi university of agriculture as well as at other levels. This will help build a strong network for those who will handle the role of planning and decision making related to climate change adaptation and environmental policies.

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