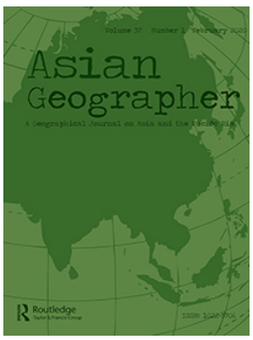

Asian Geographer

ISSN: 1022-5706 (Print) 2158-1762 (Online) Journal homepage: https://www.tandfonline.com/loi/rage20

Community adaptation and climate change in the Northern Mountainous Region of Vietnam: A case study of ethnic minority people in Bac Kan Province

Ho Son & Aaron Kingsbury

To cite this article: Ho Son & Aaron Kingsbury (2020) Community adaptation and climate change in the Northern Mountainous Region of Vietnam: A case study of ethnic minority people in Bac Kan Province, Asian Geographer, 37:1, 33-51, DOI: 10.1080/10225706.2019.1701507

To link to this article: https://doi.org/10.1080/10225706.2019.1701507

ASIAN GEOGRAPHER
2020, VOL. 37, NO. 1, 33–51
https://doi.org/10.1080/10225706.2019.1701507

Community adaptation and climate change in the Northern Mountainous Region of Vietnam: A case study of ethnic minority people in Bac Kan Province

Ho Son [a] and Aaron Kingsbury [b]

[a]Thai Nguyen University of Agriculture And Forestry, Thai Nguyen, Vietnam; [b]Marine Maritime Academy, Arts and Sciences, Castine, ME, USA

ABSTRACT

Vietnam is highly vulnerable to climate change, and those most severely affected tend to be members of ethnic minority groups living in poverty in marginalized areas. This paper focuses on the Tay, Dao, and Hmong ethnic minorities the Northern Mountainous Region (NMR) of the country, and employs a mixed-method qualitative approach to assess their adaptation to a changing climate in the region as a case study. The NMR is the poorest area of Vietnam, and each of these ethnic minority groups was found to be both vulnerable and adapt in different ways. Results show that adaptation strategies faced considerable barriers, often directly influenced by gender, age, ethnicity, wealth, and location. Many locally-employed coping strategies were also found to be conditional on the strength and foresight (or futility and the lack of foresight) of institutions and policymakers on the local, regional, and central levels. While local knowledge and social capital did ease pressures, policy failures more typically led to mal-adaptation and welfare dependence. Improving not only the quality but also the focus of and access to government resources would considerably enhance the capacity for communities to adapt to the impacts of a changing climate.

ARTICLE HISTORY
Received 28 April 2019
Accepted 20 September 2019

KEYWORDS
Climate change; adaptation; ethnic minority; Bac Kan Province; Vietnam

1. Introduction

Vietnam is one of the most vulnerable countries in the world to climate change (Dasgupta et al. 2007; MONRE 2016). The current state of exposure to climate impacts is best assessed by looking at past effects of climate-related disasters. For example, in Vietnam between 1953 and 2010, nearly 25,000 people were killed by natural disasters and 77 million were negatively affected in some way (World Bank 2010). Human losses to extreme weather events can serve as a reliable indicator of vulnerability to climate change (Patt et al. 2010). Key concerns associated with climate change in the Northern Mountainous Region (NMR) of Vietnam are drought in the dry season (winter); soil erosion, landslides, and flooding in the rainy season (summer); and changing temperature regimes such as additional cold spells (ISPONRE 2009; MONRE 2016). Experiences of climate variability, manifested in the increased length and frequency of droughts, floods

CONTACT Ho Son hongocson@tuaf.edu.vn

and cold spells, have increased the existing vulnerability of local communities. In recent years, a succession of crises precipitated by severe droughts (2009, 2010) and cold spells (2008, 2011) has led to widespread crop failure and livestock death, which in turn has forced large numbers of people to seek off-farm employment as laborers (Author 2013; Delisle and Turner 2016).

This study uses the Northern Mountainous Region (NMR) of Vietnam as a case study of adaptation to climate change. Every year in Vietnam the NMR is threatened by typhoons, storms, and landslides in the rainy season or drought in the dry season (Delisle and Turner 2016). In the NMR, agricultural crops are particularly vulnerable to climate incidents, as demonstrated by recent flooding, long periods of unusually cold weather in 2008 and 2011, and drought in many years. Climate change projections predicted that under most future scenarios Vietnam will have millions of people who will need to cope with these increased hazards (MONRE 2016). In addition to climate change, rural communities are vulnerable to multiple interacting stresses including food insecurity, rising inequality, limited access to government services, and environmental degradation (Chaudhry and Ruysschaert 2007; World Bank 2010; Author 2013). This study seeks to better understand as a case study how marginalized communities in the NMR adapt to and might be emboldened with the resources and agency to better adapt to climate change.

Adaptation in the context of climate change consists of adjustments in practices, processes, or structures performed in response to the actuality or threat of long-term climate change and leading to an evolving change in state (IPCC 2007). In this paper, adaptation is understood as a set of strategies and actions taken in reaction to or in anticipation of change by people to enhance or maintain their well-being; where well-being is used as the surrogate of community resilience from a local perspective. Climate change coping and adaptation strategies fall into three main categories. They include the diversification of livelihoods, the application of locally based knowledge of resource systems, and the use of existing and extending social networks to share risks (Goulden et al. 2009).

More generally, this study explores how communities in the past adapted to climate pressures and how they were able to increase their adaptive capacity. It focuses on the responses to specific climate shocks in the NMR in order to distill lessons for future adaptation. While it is impossible to quantify to what degree the climate shocks and stresses now being experienced are the direct results of climate change, recent studies reveal that such shocks and stresses will increase (e.g. IPCC 2012). It is therefore essential that human responses to these current events are studied. Furthermore, as climate change continues and accelerates, humans are transitioning into novel biophysical conditions where knowledge of the past will not always predictably guide what can be expected in the future, or even provide meaningful historical context on how to mitigate it. However, in this study, it is assumed that extreme events in the past are analogous to what will likely happen in the future, at least in the short- to medium-term, and that as a result humanity needs to learn from past coping strategies for climate variability and weather extremes to better adapt to future climate change (Ford et al. 2006). Examining experience and response to climate variability, change, and extremes can provide an empirical foundation for characterizing how communities manage and experience climate-related risks; identifying processes and conditions which determine the efficacy, availability, and success of adaptation; establishing a range of possible societal responses to future change; and

helping identify barriers to adaptation (Smit and Wandel 2006; Ford et al. 2007; Ford et al. 2008). Barriers to adaptation are likely to be important in determining vulnerability and adaptability to future change (Ford 2009).

1.1. Study areas

The NMR has been selected as the focus of this study. Given the place-based and localized impacts of climate change, the study did not attempt to cover the entire NMR, but rather provides a detailed and focused case study of the Nam Mau Commune in the Ba Be District of Bac Kan Province (Figure 1).

The NMR is home to 31 out of 54 officially recognized ethnic groups in Vietnam, accounting for more than 50% of the total population of the area. These include the Tay, Thai, Nung, Dao, and Hmong. Each group speaks different native languages belonging to several distinct linguistic branches such as Viet-Muong, Thai-Tay, or Hmong-Dao (Dien 2002; Son and Thuy 2005). Each group differs widely in ways of generating income, in kinship, in the complexity and manifestation of social organization, and in the degree and nature of their assimilation into Vietnamese society. In the NMR, ethnic minority distribution is divided into three sub-regions, usually based on elevation. The Muong, Thai, Tay and Nung live in the lower altitudes; the Dao live in the middle altitudes, and the Hmong live in the highest altitudes (Dien 2002; Vien 2003). Therefore, among the three ethnic minorities in this study, the Tay live in mountain valleys, practice paddy rice agriculture, have comparatively higher literacy rates, and perhaps most importantly, are viewed by the Kinh (i.e. the ethnic Vietnamese) as being the most advanced of the various minority groups. The Dao and Hmong live in scattered and more inaccessible settlements, have lower literacy rates, and are often negatively perceived by the Kinh and Tay as being culturally inferior.

Six villages of three ethnic groups in Nam Mau Commune were selected for this study.

Pac Ngoi and Ban Cam are Tay villages. Their location on the shore of the lake and on the wide alluvial plain is favorable for both agriculture and fishing, but is also disadvantageous because of annual floods which often destroy food crops. Almost all households in

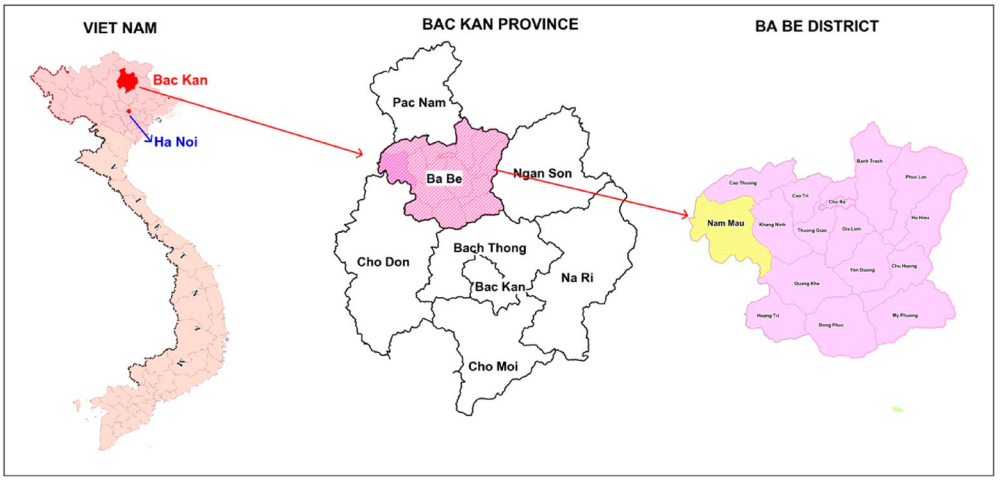

Figure 1. A map of the study location.

Pac Ngoi and Ban Cam are engaged in agriculture. Some also have additional sources of non-farm income. Boat driving, the running of tourist guesthouses, and jobs in the commune administration provide some of the families with a daily or monthly cash income.

Na Nghe and Na Vai are Dao villages. They lie on sloping land around terraced rice fields. The residents of Na Nghe are now resettled inside the strict protection zone of the Ba Be National Park. Na Vai Village was formed in the late 1950s and is located in the buffer zone of the Ba Be National Park. Therefore, the two villages have different socio-economic statuses. Na Vai has better access to local markets, other parts of the commune, and the district center and thus it has more opportunities to develop off-farm income activities.

Khau Qua and Nam Dai are two Hmong villages of Nam Mau Commune. Nam Dai is located at the altitudes 700–800 m asl. The village is surrounded by terraced rice fields and paddy rice at the bottom of the hill. Nam Dai is located at 500–600 m asl. Both villages are located within the boundary of the Ba Be National Park, far from main roads and the commune center. Their livelihoods derive mainly from paddy rice grown at the hill bottom, upland cultivation, cattle rearing, and the gathering of forest products. A few households earn some off-farm income from carpentry and cattle trading.

2. Research methods

2.1. Case study

At the core of the empirical portion of this article stands the case study of six village communities in the northern mountain district of Ba Be, Bac Kan Province. Place-based case studies are considered to be central to climate change research (Ford et al. 2008; Ford et al. 2010). Climate change provides a good example of a complex social-ecological system problem for which place-specific case studies and participatory methodologies are particularly suitable (Berkes and Jolly 2001). Such studies can illuminate how different factors, at different scales, can interact and affect the ability of households and even different individuals within households to cope and adapt (Eriksen, Brown, and Kelly 2005). Therefore, the case study approach provides an appropriate means of exploring coping and vulnerability (Yin 2003; Eriksen, Brown, and Kelly 2005).

2.2. Data collection strategy

Prior to conducting the main survey, 50 in-depth interviews were organized with representatives of the different social and economic groups identified in Bac Kan Province and Ba Be District in order to obtain a first impression of people's experiences with natural disasters, weather extremes, climate variability, and environmental change. The respondents in these interviews comprised members of the People's Committee, Communist Party officials, members of the district administration, village heads, merchants, and key farmers. Guided by the responses of these interviews, a first questionnaire was developed. This questionnaire was tested and continuously developed through pre-tests with a total of 40 completed face-to-face interviews in one village. Finally, the main survey was conducted on the basis of the revised questionnaire in six villages within Ba Be District

using a baseline survey, in-depth interviews, and focus group discussions. The total number of people visited at home or in the field was 237. Their ages ranged from 18 to 76. The number of female respondents was 72 (30.4%).

2.3. Data collection methods

A range of techniques was employed in order to generate information, to triangulate insights, and to build up an accurate and detailed picture of the dynamics of adaptation at both household and community levels. The techniques used included a baseline survey, semi-structured interviews, focus groups and community workshops (e.g. village meetings), and participant observation. Secondary data was obtained from existing statistical sources, published academic and consultancy work, internal documentation from governmental and non-governmental organizations, and policy documents.

2.3.1. Baseline survey

A baseline survey was carried out in the six village communities as a method to become acquainted with the local people and their livelihood contexts. A questionnaire was used to facilitate data collection of basic household characteristics such as household economy, agricultural production systems utilized, and membership in village organizations. Initially, the households for the baseline survey were chosen randomly. Later, a subsample was selected based on socio-economic indicators such as housing conditions and location of the household in the village.

The interview climate for the baseline survey was informal and time was allocated for further conversation and questions from respondents. Of the total number of 284 households in the six villages, 237 households were visited and interviewed (more specifically by village, Pac Ngoi 80% or 64 households, Ban Cam 80% or 58 households, Khau Qua 90% or 32 households, Nam Dai 100% or 19 households, Na Nghe 100% or 20 households, and Na Vai 80% or 44 households). For most villagers, this was not the first time they had answered questions, as government and development organizations frequently conduct surveys in their communities.

2.3.2. Interviews

In-depth, semi-structured interviews with community members were conducted in all study villages to identify ongoing climate-related risks and to provide insights into how these risks are experienced and managed. The language used during the interviews was Vietnamese. All of the Tay and Dao people could speak Vietnamese well, with the exception of a few elderly respondents. All the Hmong men, but only a few women, could speak Vietnamese well. Therefore, in some cases, the village head or head of the family being interviewed helped with translation. The interviews were transcribed and coded according to themes.

From the baseline survey and the interactions with the villagers, a sample of key respondents was established and they were subsequently interviewed in more detail. Key respondents were village and commune leaders, in office or retired, and were predominantly middle-aged and elderly men. An exception was the chairwomen of the Women's Union and a number of school teachers, who were chosen with respect to their knowledge and understanding of local issues. Both village and commune leaders were either met at

home or in their offices in the commune center. The second group of key respondents comprised government officials and development experts at the district and provincial levels. Semi-structured interviews were also conducted with local villagers in either their homes or agricultural fields.

2.3.3. Focus group discussion

Focus groups were conducted to gather information regarding climate hazards, impacts, and adaptation practices, and to tease out the role of community and group identity in adaptation choices. These focus groups were constituted from the most vulnerable groups in the communities and included the poor, women, youth, children, the landless, the elderly, and migrants. Both small and large focus groups were conducted in each study village. 18 small focus group discussions of 7–10 people were conducted, focusing on vulnerable groups including women, households in poverty, and households with agriculture as their only source of income. In addition, 6 large focus group discussions in the form of village meetings were conducted at the end of fieldwork in the communities.

2.4. Data analysis

Data were analyzed with a variety of different tools. For qualitative data, writing memos or notes helped prevent the loss of many relevant impressions, spontaneous ideas, evaluations, solutions, and thoughts during data collection. Data management and statistical packages, including Excel and SPSS, were used to process primary quantitative data collected from household surveys. Counts, percentages, means, and tables were used for presenting summary research results.

3. Results

3.1. Impacts of climatic risks in the study area

This study uses drought, flood, and cold snaps as the three foci for assessing the possible impacts of climate change on households and communities. They each have different impacts on local communities and elicit different responses. While drought and flood are related to hydrological factors, cold snaps are related to temperature variables. The choice of these factors as examples permits the investigation of how households and communities have responded to recent climatically-driven stress events, and provides a basis to explore what determines their adaptation responses.

3.1.1. Impacts of drought

Drought had substantial impacts on food production and local livelihoods. In the case study area, drought caused rice yield losses of 50% to 100%, depending on the proximity of rice fields to water sources. For example, the 2009 and 2010 drought economically affected 100% of the households in Dao and Hmong villages. Several Tay households were not badly affected as they had good non-farm income sources to mitigate economic effects. Drought impacts on crops and livestock put poorer households at risk of hunger and returned them to higher rates of poverty. To cope with food shortage, many people

consumed smaller portions and substituted vegetables for meat. This means that malnutrition among children is unavoidable.

As one village head reported,

> We eat mainly rice or maize with vegetables. We did not have meat as before as the poultry we keep had to be sold to purchase food or household items. We had to save money simply for basic food, not to buy or eat meat as before.

A poor farmer expressed a similar situation resulting from drought, "My children did not have food of the quality or quantity as before. They had no choice but to eat smaller portions, and very little meat."

Due to financial difficulties as a consequence of drought, many children, especially among the Hmong, were forced to stay home to help their families. This included searching for wild plants and animals that could be sold or eaten. During the school year, a local teacher reported that only 60% of children attend school as the others were needed at home to look after their younger brothers and sisters, thereby allowing their parents to find wage-paying seasonal work. Many families also had to withdraw their children from school to ease the financial burden. For example, the children of four families in Khau Qua Village and two in Nam Dai Village were required to stay home after finishing elementary due to financial difficulties resulting from the impacts of severe drought.

3.1.2. Impacts of floods

In the case study communities, floods directly or indirectly (e.g. through triggering landslides) damaged residential structures. Rather than property damage however, livelihood disruption was said to comprise the most problematic issue for local communities. Due to their location, all Tay villages in the Nam Mau Commune, including the two case study communities, experience near-annual crop loss or damage. Floods destroy crops, cause landslides, inundate rice fields, and overflow fish ponds. As a direct consequence of floods in 2008, 76 out of 79 households in Pac Ngoi Village (Tay) (about 95%) and 67 out of 75 households in Ban Cam Village (Tay) (about 90%) suffered crop and livestock losses. In addition to negative economic effects, floods also cause other social problems including health risks linked to water contamination and malnutrition caused by crop failure. For example, this study found that 45 out of 76 Tay households in the Pac Ngoi and 50 Tay households in the Ban Cam villages suffered from water contamination as the result of flooding. The remaining households were safe from water contamination as their houses were built at higher locations in the steeply sloped mountains. Malnutrition is also quite common among the children, especially of poor families in the NMR, and crop failures due to flooding only exacerbate the problem.

3.1.3. Impacts of cold snap

Nam Mau lost 32 head of cattle due to a cold spell in 2008 and 15 head in 2011. The total cattle loss of Ba Be District recorded in the district report in 2008 and 2011 was 2,000 and 1,300 head respectively (Ba Be Office of Statistics 2018). Therefore, the cattle loss in Nam Mau can be considered as small when compared with neighboring communes. The primary reasons for cattle deaths can be connected to both biophysical and social-cultural factors. First, the location of the villages, that is their physical geographies, matters. Those at higher altitudes, inhabited by the Dao and Hmong, experienced more intense cold

weather. Second, the social-cultural factors relate to ethnicity and related farming practices. For example, the Dao have more cattle and often practice free-range grazing. As a consequence, the Dao villages experienced a higher loss of cattle. For the poor in rural households in the NMR, cattle are the family's most valuable asset. Thus, cattle mortality represents a significant problem for families. Many households have to borrow money from banks or relatives to buy cattle, so if their cattle die, they face difficulties repaying their loans. Indeed, this study found that 15% of Dao and Hmong households had to borrow money from the social bank (i.e. bank for the poor) and relatives to purchase cattle. Only few Tay households borrowed money to buy cattle as they had more money and options to earn money elsewhere.

3.2. Adaptation to climate risks in the case study villages

3.2.1. Income and livelihood diversification

The rural poor in Vietnam, as in other countries in the Global South, are often the first to be affected by weather extremes and climate variability, and are likely to be more affected by climate change (Chaudhry and Ruysschaert 2007). Given that the poor are the most vulnerable to disruptive shocks and trends such as climate-related disasters and climate change, building their resilience requires an understanding of how their livelihoods are constructed. The biophysical conditions of the mountain environment have encouraged the mountain communities, including Tay, Dao, and Hmong people, to adopt livelihood diversification strategies (Table 1). The livelihoods of households in all six research sites are based on mountain agriculture. For the majority of households in Ba Be District, mountain agriculture is their main source of income and sustenance. Farming practices have been adapted to the mountain conditions and have shaped the environment to match livelihood requirements, as new fields were opened in the forests, hill faces were terraced, or fruit and forest tree plantations established.

The study found that Tay households earn more off-farm income than the Dao and Hmong. Non-farm income sources include wage income, self-employment, and remittances. They also have more diverse income sources to rely on in times of need. This reflects the fact that the Tay live near the commune centers and main roads, and are more fully integrated into the larger mainstream economy. Households across the NMR are often required to sell cattle and livestock to buy rice and food when crops fail. This highlights the primary role of cattle as an economic safety net in times of crisis. Of the Dao and Hmong people interviewed, 90% exclaimed that selling cattle was used as a

Table 1. Income sources in the study villages and ethnic groups.

	Study villages and approximate proportion of income (%)					
Income source	Pac Ngoi (Tay)	Ban Cam (Tay)	Na Nghe (Dao)	Na Vai (Dao)	Khau Qua (Hmong)	Nam Dai (Hmong)
Crops	35	35	40	35	60	70
Livestock	20	20	35	35	20	15
Forest	0	0	20	20	15	10
Non-farm	30	35	5	10	5	5
Others	15	10	0	0	0	0
Total	100	100	100	100	100	100

Source: Field survey (2018).

solution to deal with the impacts of the drought in 2009. Selling cattle can help households generate income to purchase food. It also helped some households to reduce the size of their cattle herd when fodder became scarce. It is also interesting to note that only 20% of Tay people interviewed said that they have had to sell livestock due to shortages of fodder and forage. This is because, on average, the Tay have fewer heads of livestock than the Dao or Hmong and more diverse income generation opportunities.

Seeking wage work within and outside their community is common in the case study area, and often incorporates patterns of temporal migration. Common opportunities locally consist of employment as carpenters, bricklayers, or day laborers. A smaller number of people, mainly Tay youths, regularly seek wage work away from their home villages. Seeking opportunities away from the home village to diversify and secure livelihoods in an attempt to limit risks or increase the income of rural households is also common in other countries (Mortreux and Barnett 2009). Despite this, opportunities for off-farm work remain very limited, particularly for the Dao and Hmong. These two groups typically have lower levels of education, and many (especially women) are illiterate. Overall, the Dao and Hmong were found to have far fewer connections outside their communities than the Tay, who benefit from their close relationship with the dominant Kinh group in the lowland. This has hampered the ability of the Dao and Hmong to secure off-farm work outside their village or commune. In this study, 50% of Hmong men and 90% of Hmong women (over the age of 20) were illiterate. All Hmong men could speak Vietnamese but were illiterate. Of the Dao respondents, 30% of men and 50% of women (over the age of 20) were illiterate. The low educational levels hamper their capacity to find wage work outside of their communities. More than 90% of Tay people can read and write Vietnamese properly. The Tay also often reside in lower elevation areas with the Kinh, and thus are better connected and integrated into the market economy.

3.2.2. Forest harvesting

This study found that the utilization of both timber and non-timber forest products provides a safety net and income for many households. For most Dao and Hmong, income from forests accounted for 10–20% of their total household income (Table 1). They harvest wild fruits (e.g. Canarium and Dracontomelon), medicinal plants, and other non-timber forest products (e.g. honey) to sell to traders. Some Tay people harvest herbal plants to sell to tourists who often stay in their villages. Forest products are extracted most during the off-peak crop season. Likewise, in times of crisis where drought or flood destroy crops and reduce household income, forest extraction increases significantly. Children and elderly people collect non-timber forest products regularly. Stronger youth cut timber and hunt animals illegally to sell to traders. This highlights the importance of the sale of forest products as a form of "natural insurance" for communities in the NMR. However, increased forest extraction in times of crisis also means increased pressure on the forests, which deepens conflicts between local communities and forest protection agencies as well as impacts adversely on environmental services. Under forest protection laws, communities living inside or near protection forests and special-use forests such as national parks or nature reserves have only very limited legal access to the non-timber forest products they contain. Due to the limited economic opportunities and options in mountainous areas, local communities, especially the poor, see forest extraction including illegal timber logging as a "viable" livelihood alternative. In

this sense, authorities at both the village and commune levels often shield their constituents from forest protection authorities whenever possible.

3.2.3. Using social networks and linkages

Seeking help from relatives and neighbors is an important coping strategy in times of crisis. This study found that social cohesion, kinship, and social networks are strong in the rural areas of the NMR. These social networks are further tightened by the proliferation of local and non-governmental organizations and alumni associations. As a result, social capital is higher in the north due to the high rate of village endogamy and the proliferation of non-governmental organizations (Luong 2003). Nearly everyone in every village studied were related to each other in some way, on either the husband's or wife's side. Seeking help from relatives and neighbors is an effective mechanism to deal with idiosyncratic shocks such as the illness of a family member, accidents, or funeral costs. However, it is less effective for covariate shocks such as drought or flood where many or all households within a community or an area are affected simultaneously. Under such circumstances, households may be forced to rely on self-insurance strategies that are particularly costly in terms of current and future welfare (Skoufias 2003). For example, malnutrition due to dietary adjustment has long-term consequences for the future welfare of children (Martorell 1999).

This emphasizes the importance of institutional support for cumulative effects. It also means households who have strong linkages and networks outside their community are more likely to cope with shocks by asking for help from those living outside the disaster area. In many cases, respondents noted that they could not ask for assistance from neighbors as they also faced the same problems. Again, during major shocks, social networks offer limited relief and are rapidly exhausted, because the providers of assistance might belong to equally poor households or even be exposed to the same livelihood risks or shocks (Devereux 1999). As a consequence, some had to borrow from private lenders at high interest rates, and in so doing, became even more vulnerable to future hazard events.

Social capital available in a local community for dealing with flood risk includes social bonds with neighbors, relatives, friends, and other larger organizations. It increases the responsiveness of local institutions such as village committees for flood and storm control (VCFSC), commune committees for flood and storm control (CCFSC), or larger organizations (e.g. Youth Union). A crisis usually led to the mobilization of organizations at all levels. The village and commune organizations become more active in organizing mutual support to help households. Pre-existing larger organizations effectively mobilize people to help each other build or repair houses, and villagers held numerous public meetings to establish ways of coping with the crisis after disastrous floods.

3.2.4. Farmers requesting to be classified as being "poor"

Discussions with village and commune leaders and extension officials revealed that many households were "fighting to be poor" in order to obtain government support. Currently, many government programs such as Programme 135 target only the poorest households. Households classified as average or above are not eligible to receive support. As a result, many households with average or above-average income are not happy with this policy, and argue that the actual differences between the "poor" and the "not poor" households are not substantial.

Households that are formally classified as being "poor" are eligible for many government support schemes, including access to credit, production support, and financial assistance for their children's education. Many average income households were found to pressure village heads, who have a strong voice in household poverty assessment. Village heads in the study communities therefore found it very difficult to satisfy the villagers. They also expressed concern that "*The implementation of pro-poor support programs is damaging community cohesion and solidarity by causing conflict between groups.*" For example, in some cases household members of extended families were trying to cooperate to vote for their family or to out-vote members of another family. In many cases, commune officials had to intervene in this process, but it was rarely easy or successful. The main problem is that the current approach of government support for the poor has decreased their self-reliance, in effect causing them to rely on or wait for government support.

3.2.5. Using local and traditional knowledge

In agricultural production, local knowledge-based responses include using local drought-resistant crops and switching from rice to other cash crops. For example, Tay people in Pac Ngoi and Ban Cam often used Bao Thai, a local rice variety, as a winter crop as it is cold-hardy and drought-resistant. Dao and Hmong people also grew their local crops such as Hmong peas, Hmong maize, or soybean at upland farms as these crops do not require much water. In addition, the use of bamboo pipes for moving water for irrigation or home use provides an example of an effective adaptation strategy. Bamboo pipes have been used for generations in the NMR to transfer water from a water source to a farm field or water tank for home use. The use of bamboo pipes helps farmers to irrigate their upland terraced rice fields as well as save time and energy for collecting water.

This study also found the use of local knowledge and experience to adapt to floods. Based on their knowledge and experience, farmers altered planting dates and times, and used local varieties to suit changing conditions. In the case study area, the Tay people in both Pac Ngoi and Ban Cam villages have altered planting times to avoid floods. In addition, they have learned to modify their behavior and their environment to manage and take advantage of their local climatic conditions. Returning to the above example of Bao Thai rice, local people were found to prepare rice seedlings in upland farms during the flooding time so they can transplant rice seedlings immediately following the receding of flood water. In addition, many Tay people in Pac Ngoi Village have built two-story houses to avoid the floods, using the living memories of the elders about the "heaviest" flood in 1968. By building two-story houses, when floods occur previously harvested rice, furniture, and other household items can be transported upstairs. They are also able to live upstairs during the flooding season. These examples illustrate the importance of local knowledge and experience for communities in the NMR of Vietnam in coping with and adapting to climate change impacts.

4. Discussion

4.1. Livelihood diversification and resilience

This study has found that livelihood diversification has been the main strategy adopted for living with climate variability and other stressors in the Ba Be area. The local population

cultivates staple crops predominantly for their own consumption, but some also sell a proportion of what they produce. Agriculture and animal husbandry generate approximately two-thirds of their cash income, and non-farm sources such as wage income, self-employment, and remittances generate the remainder.

Livelihood diversification has been recognized as having the potential to alleviate poverty as well as reduce vulnerability to shocks (Ellis 1998). It involves a range of livelihood activities and includes aspects of flexibility in livelihoods over time and space and the mobility of people (Goulden et al. 2009). Livelihood diversification includes farm and non-farm diversification, and other natural resource access diversification. The diversity of an economic portfolio can give greater flexibility to households for adjusting to change. In general, the biophysical factors of the mountainous environment have encouraged the Tay, Dao, and Hmong people to adopt multiple livelihood strategies and a variety of different agricultural production methods to support their subsistence. However, better and average income groups have more off-farm income, which comes from wage work and operating small businesses (e.g. providing transport services). Households with higher incomes have more opportunities to dominate the most lucrative rural non-farm activities (Ellis and Mdoe 2003). Households with more off-farm income are often less vulnerable to climate and other changes; in other words, they can cope better with shocks, whether drought, flood, or cold. Thus, enhancing access to resources and capacity building for the poorest groups is important for coping with climate and other stresses. Providing support for the poor in developing off-farm income activities also helps to reduce inequality in rural communities where households with more off-farm income have much higher total household incomes than those with no or less off-farm income.

Support for the poorest groups needs to focus on both capital and management skills, for which the latter requires a long-term strategy for using capital effectively. During interviews, respondents often raised concerns over their lack of capital, management skills, and the information necessary to develop off-farm income activities. For example, Tay households living near to Ba Be Lake could provide boat or/and guesthouse services for tourists. However, only a few households can afford to purchase a boat and/or to build a guesthouse, because the cost of a boat was about US$2,000 and that of a guesthouse near $6,000. These are very large sums, beyond the capacity of most households to raise. In addition, people who run the guesthouse service also have strong social networks and linkages with other members inside and outside their community. Their strong networks and linkages help them gain access to information and other resources which in turn keep their business operating smoothly.

4.2. Natural capital and resilience

There is a considerable need for better governance of resource use to safeguard natural resources as they function as safety nets for vulnerable groups. The harvesting of forest products, for example, is not sustainable. The depletion of natural resources (i.e. livelihood assets) increases local vulnerability and reduces resilience. Forest resources play a large role in livelihood security at the household and community level. Household subsistence and income are to a large extent derived from non-timber forest products, including bamboo shoots, rattan, wild vegetables, and fruits. A decline in forest ecosystem services reduces the ability of forest-dependent people to meet their basic needs for food, clean

water, and other necessities and can lead to deepening poverty, deteriorating public health, and social conflict (Seppala, Buck, and Katila 2009). Thus, environmental degradation and overexploitation of resources also threaten the economic viability of the NMR.

This study argues that forest income can be perceived as part of rural households' diversification strategies (Adedayo, Oyun, and Kadeba 2010). In the case study areas, forest products provide local communities with income, food, and building materials. Most households use natural resources to cater for their subsistence needs and to earn income. Sales of forest products contributed to about 10–20% of total income in more remote communities in villages such as Na Nghe, Na Vai, Khau Qua, and Nam Dai. In the past, the number was higher at around 30–40%. The reduction was a result of non-timber forest products becoming ever more limited due to unsustainable harvesting. However, income from the forest varies between seasons and households. People earn more of their income from the forests when they are under-employed, for example when they are not busy with agriculture activities. During off-season and over school holidays, both children and adults go and harvest non-timber forest products, thus the income from forest harvest could be four to five times the normal amount. Similarly, during fruit season (e.g. that of Canarium or Dracontomelon), both children and adults participated in harvesting fruits from the forest to sell to traders. In the same way, households with more members earn more from forest harvests.

4.3. Social capital: network, trust, and leadership

The central idea of social capital is that social networks comprise a valuable asset. Networks provide a basis for social cohesion because they enable people to cooperate with one another for mutual advantage (Field 2003). Social networks and institutions play a vital role in enhancing local adaptive capacity (Adger 2003). In this study, the presence of social networks and support was seen as a critical resilience factor across the six study villages. Such ties increased the responsiveness of local institutions and larger organizations at all levels. The pre-existence of larger organizations (e.g. the Farmer's Association, Women's Union, or Youth Union) helped to mobilize people and resources more effectively. Households contributed money to funds held by these organizations, which were redistributed to those most in need. Villagers held meetings to establish methods for coping with crises and helping one other. Respondents often noted that having a social network for support was a key element for community resilience. The village and commune organizations were also active in organizing mutual support. Following a crisis, community spirit grew as organizations helped households rebuild their livelihoods. The importance of having a social network for support provided by family, friends, or from networks based upon cultural or economic interests, was strongly emphasized as a foundation of both community and individual resilience. Links with relatives and friends are important for the adaptations used in each of the case study villages.

Tay people were found to have stronger external networks with the Kinh in the lowlands than the Dao and the Hmong. The Dao and Hmong do have some external networks beyond their villages, but often just with those from their own ethnic groups. Larger households were better able to establish a geographically wide network of ties, offering options for migrant work. Many households preferred to facilitate links outside the village to access temporary jobs both for themselves and their children. Maintaining

relationships outside the village has brought flexibility to livelihood coping strategies during times of difficulty (Osbahr et al. 2010). Indeed, the role of social networks is the key to successful adaptation to climate change and resilience building (Adger 2003). Another study in Vietnam found that social capital had a strong and positive contribution to a household's income, especially among poor households (Ha, Kant, and Maclaren 2004). This study shares these conclusions.

4.4. Social protection vs passive welfare

This study has also uncovered that a major problem with the current approach of government support to the poor is that it has decreased their self-reliance, causing them to rely on or wait for government support. This is similar to what has been called "passive welfare" by Pearson (2009). Pearson defines passive welfare as the transfer from the government budget to individuals and families without reciprocation. He argues that welfare programs are often used to manage marginalized groups without seeking a lasting solution to their problems and that dependency on passive welfare is the most urgent problem facing many indigenous societies. To this, he argues that passive welfare pacifies recipients rather than invigorating them into social, political, and economic actions to secure better solutions, and serves as a poor psychological, social, and economic substitute for participation in the real economy. As a result, a trans-generational economic stagnation develops, worsening the problem over time (Pearson 2009).

Social protection is essential, but passive welfare is harmful to the recipient community. There is clearly a need to create a space for local participation in identifying problems and solutions of climate change, and having agency and responsibility for self-improvement. A key means of achieving this is through capacity building. Welfare programs for the poor should focus on improving education, health, and other services that the community cannot manage by themselves. They should also be accompanied by capacity building programs for the entire community, in addition to targeting those most in poverty.

In the case of Vietnam, a major problem is that the focus tends to be centered only on the poorest, with little attention paid to other community members. Based on the misconstrued notion that only the most impoverished are in need of assistance, many communities in the NRM are now in cycles brought by passive welfare. While some of these communities have tried to initiate some form of livelihood improvement, a lack of skills or appropriate knowledge limits their success. In turn, other community members who have no received assistance are dissatisfied with how funds are allocated causing further social tension across groups (and in the NMR across ethnic groups).

4.5. Mal-adaptation

While many of the community responses or government interventions have helped local people to cope with current shocks and stresses, some of these strategies have reinforced many of the problems faced by the communities. Some responses employed by households were plausible short-term strategies, but can expose households to more vulnerability in the face of climatic variability and change. These responses are called mal-adaptive strategies (Barnett and O'Neill 2010). Mal-adaptation is a major reason for concern in climate change adaptation (Adger and Barnett 2009; Brooks, Grist, and Brown 2009). Some mal-

adaptive strategies were caused by economic and technological barriers to adaptation. For example, poverty and lack of livelihood opportunities drive local people to overexploit natural resource such as forests and fishes in the Ba Be lake, an act which will undermine their adaptive capacity in the future. In addition, insufficient information and knowledge on the impacts of climate change impacts are likely to hinder adaptation. However, some strategies were due to a lack of understanding of local socio-economic and cultural contexts by government officials. Some responses from the government created dependence on social welfare and reduced communities' self-reliance. For example, the government provides support for the poor households in terms of money, seedling and domestic goods for several years if they are still in poverty. This support incentivizes many households to rely on government support and work less hard to improve their livelihoods. This finding provides an important insight into how coping with immediate problems often results in households and communities being more vulnerable. Many strategies adopted by communities that are mal-adaptive actually set them up to be more vulnerable to future shocks. This supports the arguments of Eriksen et al. (2011) and Robinson and Berkes (2011), that creating one-off adaptation is not the same as building adaptive capacity, and that not every response to climate change is a good one. Mal-adaptive strategies pursued because of a lack of alternatives tend to be very costly as they involve running down productive assets, and can leave people poorer and more vulnerable than they were before. Therefore, the government of Vietnam needs to change its current approach to disaster risk management by shifting from crisis management to risk management, and focusing more on building adaptive capacity. Building resilience requires a balance between short-term priorities and long-term gains (Bardsley and Sweeney 2010). Focusing simply on short-term priorities will only undermine future adaptive capacity.

4.6. Integrating local knowledge into adaptation planning

Climate change further complicates existing problems such as poverty and limited access to governmental services and vulnerabilities. It renders the rural poor more vulnerable and their traditional knowledge less useful (Nyong, Adesina, and Osman Elasha 2007; Macchi et al. 2008). Therefore, technical and scientific knowledge assume elevated importance. However, this does not undermine the value of local knowledge in adapting to climate change. In fact, adaptation must build on insightful and in-depth understanding of how climate change impacts are felt in local contexts and draw on the knowledge of local people (Raihan et al. 2010; Eriksen et al. 2011). Traditional and local knowledge are essential principles for communities to cope with climate variability and change in the NMR of Vietnam.

Local people possess detailed knowledge of their environment developed from personal observation and experience, and from shared experience among community members. In the NMR of Vietnam, to cope with cold spells, the Hmong people often make earthen walls for buffalo stalls. They also feed buffalo with rice straw, or prepare rice/corn porridge for animals with *thao qua* (a local herb) and salt to "keep their bellies warm" in cold winter (World Bank 2010). A study in Tan Lac District of Hoa Binh Province in Vietnam found that IK was applied widely among local communities in climate change adaptation and disaster management (Duyen et al. 2011).

However, this knowledge tends to be more recognized and used among the elderly. Younger people in this study showed little enthusiasm for using and conserving traditional knowledge and skills, and tend to be more interested in scientific knowledge and modern technology. Many are also becoming less connected with farming practices, and typically seek wage work in cities whenever they have the opportunity. Therefore, land-based skills among young people are being eroded. For example, this study found that only a few young people knew which plants or herbs could be used as medicine for common injuries or illnesses. The erosion of traditional and local knowledge is likely to undermine the future adaptive capacity of local communities. As such, the integration of local knowledge into adaptation planning can help promote and thus conserve this useful knowledge.

5. Conclusions

The study has indicated that rural communities in the NMR of Vietnam have diverse ways of coping with and adapting to the impacts of climate risks. However, the availability of many of these activities is conditional on enabling institutions and policies, meaning support through institutions and policy is important for longer-term sustainability. The study has also revealed that there are real barriers to adaptation as a result of uneven access to livelihood assets, a problem influenced by gender, age, ethnicity, wealth, institutions of governance, and geography. Lack of capacity in governance systems, differing goals, and a lack of recognition of various types of knowledge are all additional factors that contribute barriers to adaptation.

One's ability to make changes does not imply one's ability to adapt to new kinds of changes, shocks and stresses, or unforeseen events (Folke et al. 2002). Supporting communities to increase their adaptive capacity is vital. This is achievable through improving access to resources and government services. Better access to education, health care, and development opportunities also reduces both vulnerability and enhances resilience. Therefore, adequate provision of government services must be a priority to ensure access to livelihood resources, markets, education, extension services, systems of early warning, and forecasting. Lack of access to resources is the main catalyst for communities adopting mal-adaptive strategies (Smit and Wandel 2006; Goulden et al. 2009).

Many of the factors that facilitate or constrain adaptation in the NMR shape local vulnerability to climatic risks and other stressors in the case study villages. Therefore, addressing local development issues that contribute to local vulnerability is an important consideration for climate adaptation policies in Vietnam. These policies must emphasize poverty reduction and address inequality in relation to resources. Governments at the local, regional, and national levels need to ensure more equitable access to livelihood resources.

Another important issue for all levels of government in Vietnam, and in the NMR in particular, is to avoid interventions and actions that undermine future adaptive capacity or create mal-adaptive strategies. Some policy interventions, such as the current support program for the poor, have resulted in welfare dependency among community members and decreased their self-reliance. A more concentrated focus on building capacity for those in poverty should be adopted. Additionally, some mal-adaptive strategies were adopted due to a lack of access to resources. While social protection is important for coping and adaptation, passive welfare is harmful. Improving access to resources

facilitates the building of adaptive capacity. In turn, this would further strengthen the potential of communities to cope, adapt, and thrive despite the considerable socio-economic and environmental stresses causes by changing climate regimes.

Acknowledgement

This work was conducted as part of the research program of the Agriculture and Forestry Research & Development Centre for Mountainous Region (ADC) at Thai Nguyen University of Agriculture and Forestry. Research was supported financially by the the Asia Pacific Network for Global Change Research (APN) through a project to Ho Ngoc Son (CBA 2017-01MY-Ho) and a funding from the International Foundation for Science (IFS), through a grant to Ho Ngoc Son (J-1-S-4868-2). The authors would like to thank them for their support.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was conducted as part of the research program of the Agriculture and Forestry Research & Development Centre for Mountainous Region (ADC) at Thai Nguyen University of Agriculture and Forestry. Research was supported financially by the the Asia Pacific Network for Global Change Research (APN) through a project to Ho Ngoc Son (CBA 2017-01MY-Ho) and a funding from the International Foundation for Science (IFS), through a grant to Ho Ngoc Son (J-1-S-4868-2).

ORCID

Ho Son http://orcid.org/0000-0002-5270-5577
Aaron Kingsbury http://orcid.org/0000-0002-2774-2499

Reference list

Adedayo, A. G., M. B. Oyun, and O. Kadeba. 2010. "Access of Rural Women to Forest Products and its Impacts on Rural Household Welfare in Northern Central Nigeria." *Forest Policy and Economics* 12 (6): 439–450.

Adger, W. N. 2003. "Social Capital, Collective Action, and Adaptation to Climate Change." *Economic Geography* 79 (4): 387–404.

Adger, W. N., and J. Barnett. 2009. "Four Reasons for Concern about Adaptation to Climate Change: A Commentary." *Environment and Planning A: Economy and Space* 41 (12): 2800–2805.

Author. 2013. "Vulnerability and Resilience to Climate Change in the Northern Mountainous Region of Vietnam." (PhD Dissertation). Australian National University.

Ba Be Office of Statistics. 2018. *Socio-Economic Report of Ba Be district*. unpublished report.

Bardsley, D. K., and S. M. Sweeney. 2010. "Guiding Climate Change Adaptation Within Vulnerable Natural Resource Management Systems." *Environmental Management* 45 (5): 1127–1141.

Barnett, J., and S. O'Neill. 2010. "Maladaptation." *Global Environmental Change* 20 (2): 211–213.

Berkes, F., and D. Jolly. 2001. "Adapting to Climate Change: Social-Ecological Resilience in a Canadian Western Arctic Community." *Conservation Ecology* 5 (2): 18.

Brooks, N., N. Grist, and K. Brown. 2009. "Development Futures in the Context of Climate Change: Challenging the Present and Learning from the Past." *Development Policy Review* 27 (6): 741–765.

Chaudhry, P., and G. Ruysschaert. 2007. "Climate Change and Human Development in Vietnam: A Case Study." *Human Development Report 2007*/2008. United Nations.
Dasgupta, S., B. Laplante, C. Meisner, D. Wheeler, and J. Yan. 2007. "The Impact of Sea Level Rise on Developing Countries: A Comparative Analysis." *World Bank Policy Research Working Paper* 4136, February 2007, World Bank.
Delisle, S., and S. Turner. 2016. "The Weather is Like the Game We Play': Coping and Adaptation Strategies for Extreme Weather Events among Ethnic Minority Groups in Upland Northern Vietnam." *Asia Pacific Viewpoint* 57 (3): 1–14.
Devereux, S. 1999. '*Making Less Last Longer': Informal Safety Nets in Malawi*. IDS Discussion Paper 373, Institute of Development Studies, Brighton.
Dien, K. 2002. *Population and Ethno-Demography in Vietnam*. Chiang Mai: Silkworm Books.
Duyen, N. V., H. H. Duong, N. X. Lam, and N. H. Thang. 2011. "*Assessment of Government Management and Coordination of Human and Ecosystem-Based Adaptation in Climate Change Initiatives of Vietnam*." Vietnam Climate Change Working Group, Hanoi.
Ellis, F. 1998. "Household Strategies and Rural Livelihood Diversification." *Journal of Development Studies* 35 (1): 1–38.
Ellis, F., and N. Mdoe. 2003. "Livelihoods and Rural Poverty Reduction in Tanzania." *World Development* 31 (8): 1367–1384.
Eriksen, S. H., P. Aldunce, C. S. Bahinipati, R. D. Martins, J. I. Molefe, C. Nhmachena, K. O'Brien, et al. 2011. "When not Every Response to Climate Change is a Good One: Identifying Principles for Sustainable Adaptation." *Development and Change* 3 (1): 7–20.
Eriksen, S. H., K. Brown, and P. M. Kelly. 2005. "The Dynamics of Vulnerability: Locating Coping Strategies in Kenya and Tanzania." *The Geographical Journal* 171 (4): 287–305.
Field, J. 2003. *Social Capital*. London: Routledge.
Folke, C., S. Carpenter, T. Elmqvist, L. Gunderson, C. S. Holling, and B. Walker. 2002. "Resilience and Sustainable Development: Building Adaptive Capacity in a World of Transformations." *AMBIO: A Journal of the Human Environment* 31 (5): 437–440.
Ford, JD. 2009. "Sea ice change in Arctic Canada: are there limits to Inuit adaptation." In *Adaptation to climate change: Thresholds, values, governance*, edited by WN Adger, I Lorenzoni, and KL O'Brien, 114–127. Cambridge: Cambridge University Press.
Ford, J. D., H. C. Keskitalo, T. Smith, T. Pearce, L. Berrang-Ford, F. Duerden, and B. Smit. 2010. "Case Study and Analogue Methodologies in Climate Change Vulnerability Research." *Wiley Interdisciplinary Reviews: Climate Change* 1 (3): 374–392.
Ford, J., T. Pearce, B. Smit, J. Wandel, M. Allurut, K. Shappa, H. Ittusujurat, and K. Qrunnut. 2007. "Reducing Vulnerability to Climate Change in the Arctic: The Case of Nunavut, Canada." *Arctic* 60 (2): 150–166.
Ford, J., B. Smit, J. Wandel, M. Allurut, K. Shappa, H. Ittusarjuat, and K. Qrunnut. 2008. "Climate Change in the Arctic: Current and Future Vulnerability in Two Communities in Canada." *The Geographical Journal* 174 (1): 45–62.
Ford, J. D., B. Smit, J. Wandel, and J. MacDonald. 2006. "Vulnerability to Climate Change in Igloolik, Nunavut: What We Can Learn from the Past and Present." *Polar Record* 42 (2): 127–138.
Goulden, M., L. O. Ness, K. Vincent, and W. N. Adger. 2009. "Accessing Diversification, Networks and Traditional Resource Management as Adaptations to Climate Extremes." In *Adapting to Climate Change: Thresholds, Values, Governance*, edited by W. N. Adger, I. Lorenzoni, and K. L. O'Brien, 448–464. Cambridge: Cambridge University Press.
Ha, N. V., S. Kant, and V. Maclaren. 2004. "The Contribution of Social Capital to Household Welfare in a Paper-Recycling Craft Village in Vietnam." *Journal of Environment & Development* 13 (4): 371–399.
Intergovernmental Panel on Climate Change. 2007. *Climate change 2007: Impact, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the IPCC*, 374. Cambridge and New York: Cambridge University Press.
IPCC. 2012. "Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation: Summary for Policymakers." In *A Special Report of Working Groups I and II of*

the Intergovernmental Panel on Climate Change, edited by C. B. Field, V. Barros, T. F. Stocker, D. Qin, D. J. Dokken, K. L. Ebi, M. D. Mastrandrea, K. J. Mach, G.-K. Plattner, and S. K. Allen, 1–582pp. Cambridge: Cambridge University Press.

ISPONRE. 2009. *Vietnam Assessment Report on Climate Change*. Institute of Strategy and Policy on Natural Resources and Environment (ISPONRE), Hanoi.

Luong, H. V. 2003. *Postwar Vietnam: Dynamics of a Transforming Society*. Lanham: Institute of Southeast Asian Studies.

Macchi, M., G. Oviedo, S. Gothei, K. Cross, A. Boedhihartono, C. Wolfangel, and M. Howell. 2008. "Indigenous and Traditional Peoples and Climate Change." *IUCN Issue Paper* IUCN.

Martorell, R. 1999. "The Nature of Child Malnutrition and Its Long-Term Implications." *Food and Nutrition Bulletin* 20 (3): 288–292.

MONRE. 2016. *Climate Change and Sea Level Rise Scenarios for Vietnam*. Hanoi: Ministry of Natural Resources and Environment.

Mortreux, C., and J. Barnett. 2009. "Climate Change, Migration and Adaptation in Funafuti, Tuvalu." *Global Environmental Change* 19: 105–112.

Nyong, A., F. Adesina, and B. Osman Elasha. 2007. "The Value of Indigenous Knowledge in Climate Change Mitigation and Adaptation Strategies in the African Sahel." *Mitigation and Adaptation Strategies for Global Change* 12 (5): 787–797.

Osbahr, H., C. Twyman, W. N. Adger, and D. S. G. Thomas. 2010. "Evaluating Successful Livelihood Adaptation to Climate Variability and Change in Southern Africa." *Ecology and Society* 15 (2): 27.

Patt, A. G., M. Tadross, P. Nussbaumer, K. Asante, M. Metzger, J. Rafael, A. Goujon, and G. Brundrit. 2010. "Estimating Least-Developed Countries' Vulnerability to Climate-Related Extreme Events Over the Next 50 Years." *Proceedings of the National Academy of Sciences* 107 (4): 1333–1337.

Pearson, N. 2009. *Up from the Mission: Selected Writings*. Melbourne: Schwartz Media Pty Ltd.

Raihan, M. S., M. J. Huq, N. G. Alsted, and M. H. Andreasen. 2010. *Understanding Climate Change from Below, Addressing Barriers from Above: Practical Experience and Learning from a Community-Based Adaptation Project in Bangladesh*. Dhaka: ActionAid Bangladesh.

Robinson, L. W., and F. Berkes. 2011. "Multi-Level Participation for Building Adaptive Capacity: Formal Agency-Community Interactions in Northern Kenya." *Global Environmental Change* 21 (4): 1185–1194.

Seppala, R., A. Buck, and P. Katila. 2009. *Adaptation of Forests and People to Climate Change – A Global Assessment Report*. IUFRO World Series Vo. 22.

Skoufias, E. 2003. "Economic Crises and Natural Disasters: Coping Strategies and Policy Implications." *World Development* 31 (7): 1087–1102.

Smit, B., and J. Wandel. 2006. "Adaptation, Adaptive Capacity and Vulnerability." *Global Environmental Change* 16 (3): 282–292.

Son, C. T., and T. T. T. Thuy. 2005. Nguoi H'mong [Hmong People.] Hanoi: Nha Xuat Ban Tre.

Vien, T. D. 2003. "Culture, Environment, and Farming Systems in Vietnam's Northern Mountain Region." *Southeast Asia Studies* 41 (2): 180–205.

World Bank. 2010. "The social Dimensions of Adaptation to Climate Change in Vietnam." *Discussion Paper number 12 December* 2010, Economics of Adaptation to Climate Change, Washington, DC.

Yin, R. K. 2003. *Case Study Research: Design and Methods*. California: Sage Publications.