

Health Impacts of Climate and Environmental Change: Awareness and Challenges to Adaptation

Peter Furu and Duong Khanh Van

Abstract Taking a point of departure in current knowledge about the existing health situation in Vietnam and insights into interrelationships between social, environmental and institutional risk factors and health, this chapter reports on small-scale health surveys conducted in purposely selected communities of the Thang Binh district of Quang Nam province. The surveys aimed at exploring awareness of and coping to environmental and climate change induced health problems. In the surveys most respondents associated climate change with abnormal weather conditions and typically mentioned seawater level rise, storms, floods and increase in temperature. Generally, respondents had observed considerable changes in health patterns in recent years however, without linking these clearly to climate change or climate factors but rather to a change in environmental determinants of health such as food, water and air quality. The observations are consistent with a wider socio-economic household survey, reporting a worsening of the health condition by a majority of households. A range of coping mechanisms were highlighted by community members and local authorities as ways and means of protecting each other and individual households and their members in times of increased extreme weather events and general environmental change. Future new actions should ideally be informed by parallel research initiatives and the present small-scale survey may stimulate more in-depth and broader studies that may help to identify proper, sustainable solutions for future adaptation and coping to climate and environmental change.

Keywords Health impact of climate change • Perceived impact • Fatalities • Vulnerability

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1 Introduction

This chapter will highlight some of the overall global relationships between development, environment, climate and health as a basis for understanding the present health situation in Vietnam in general and in Quang Nam province in particular. The Government of Vietnam is much aware of the challenges facing society from the combined forces of anthropogenic and development-induced climate and environmental change. This is for example reflected in the *National Target Program to Respond to Climate Change* (NTPRCC) (GOVN 2008a) approved by the Vietnam Government in 2008 (GOVN 2008b) as well as in the National Climate Change Strategy (GOVN 2011).

Table 1 illustrates the level of sector-specific climate change impacts as estimated by the Government in connection with its response planning. However, the NTPRCC recognizes that there is a need for continuously establishing new evidence on the extent of climate change and its impacts on every sector, area and locality (GOVN 2008b). It is envisaged that the health sector will experience medium-to-high impacts, demanding concerted efforts in addressing the health challenges that particularly vulnerable population groups will be confronted with. As a consequence, the Ministry of Health (MOH) has agreed on an action plan specifically to protect community health from the adverse impacts of global climate change (GOVN 2010).

As a contribution to increasing the knowledge base for climate change related decision-making, we conducted preliminary surveys on awareness and coping mechanism in relation to climate change impacts on health in selected communities and local authorities in Quang Nam province. The results should be seen as an encouragement for further studies on the complex interactions between environmental, social and institutional determinants of health.

Table 1 Potential Impacts of climate change and sea level rise

Sector, area, object	Impact factors					
	Temperature rise	Sea level rise	Tropical cyclones	Flood	Drought	Other climatic extremes
Agriculture and food security	High	High	High	High	High	High
Aquaculture	High	High	High	High	Medium	Medium
Energy	High	Medium	Medium	Medium	High	Medium
Industry	High	High	Medium	Medium	Medium	Medium
Transportation	High	High	High	High	Medium	Medium
Construction	High	High	High	High	Medium	High
Tourism	Medium	High	High	High	Medium	Medium
Health care	High	Medium	Medium	High	High	High
Natural ecosystems and biodiversity	High	High	Medium	Medium	Medium	Medium
Water resources	High	High	Medium	High	High	Medium
Residential area	Medium	High	High	High	Medium	Medium

Source GOVN (2008a)

2 Global Development, Environment, Climate and Health Inter-linkages

Overall interfaces between determinants of health are generally elucidated as part of epidemiological investigations and development studies. The World Health Organization (WHO 1997) has established a model (the so-called DPSEEA model) explaining the causal relationships between development, environment and health. In this model the global earth and human systems are considered constantly under pressure by the population growth and economic development, which is experienced in most parts of the world (including Vietnam). Production and manufacturing systems as well as consumption patterns and the resulting waste released, exert a tremendous pressure on global climate and environment. As a consequence, the state of the environment is characterized by interacting natural and man-made hazards, resource scarcity and high pollution levels.

Depending on the level of human exposure to, and resilience to, existing and new hazards, health effects may be seen in terms of changes in well-being, disease and deaths. The DPSEEA model as shown in Fig. 1 illustrates this cause-and-effect relationship between development, environment and health. Various adaptation and mitigation actions may be targeted at various entry points in this hierarchy of interrelatedness (WHO 1997).

Climate change is only one of several human-induced environmental changes caused by the fast increasing human pressure on the global and local environments. Transformations include land cover changes (including forests), land degradation, desertification, wetlands loss, biodiversity loss and others as established by the Millennium Ecosystem Assessment (2005) and illustrated in Fig. 2.

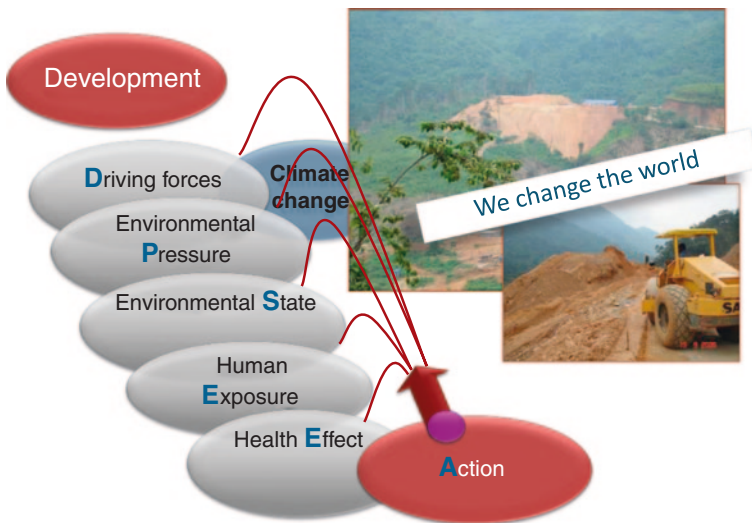
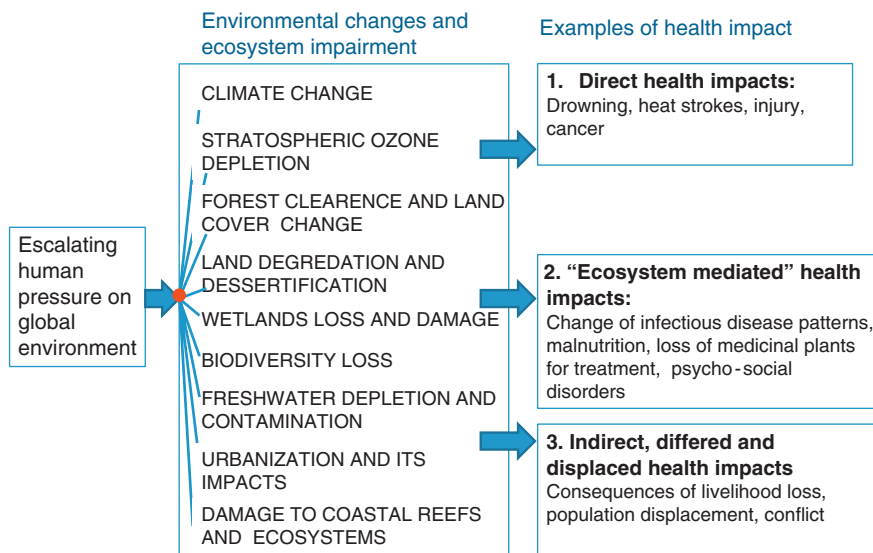


Fig. 1 The DPSEEA model (modified from WHO 1997)

It is important to note that health is influenced not only by climate change, but also by common weather and climate variability as well as by overall social and environmental change. Identifying the causal relationships furthermore remains a challenge because most human health conditions are multi-factorial, and the underlying socioeconomic, demographic, and environmental context changes significantly over time (IPCC 2001). In particular, the local development-related changes may confound the changes seen from climate change. Similarly, economic globalisation represents a double exposure in synergy with climate change (O'Brien and Leichenko 2000).

2.1 Types of Climate Change Related Health Impacts

When attempting to establish the linkages between health and climate related factors some definitions are considered important. *Climate* is the average state of the atmosphere and the underlying land or water in a particular region over a specific time period; *weather* is the day-to-day manifestation of climate in a particular place at a particular time; *climate change* is a statistically significant variation in either the mean state of the climate or in its variability persisting over an extended period (typically decades or longer); and *climate variability* refers to variations around the mean state, including the occurrence of extreme weather events (Kovats et al. 2003). With reference to the Intergovernmental Panel on Climate



NB: Not exhaustive lists

Fig. 2 Examples of health impacts of environmental change (modified from Millennium Ecosystem Assessment 2005)

Change (IPCC 2001) WHO states that “*broadly, a change in climatic conditions can have three kinds of health impacts:*

- *Those that are relatively direct, usually caused by weather extremes.*
- *The health consequences of various processes of environmental change and ecological disruption that occur in response to climate change.*
- *The diverse health consequences—traumatic, infectious, nutritional, psychological and other—that occur in demoralized and displaced populations in the wake of climate-induced economic dislocation, environmental decline, and conflict situations”*(WHO 2003).

Peoples’ livelihoods, community vulnerability and the risk of suffering the above three types of health impacts are likely to be determined by a number of factors linked to climate-related environmental conditions. These include changes of for example temperature, water availability (floods, droughts), breeding potential for vector mosquitoes, soil condition and its suitability for agricultural productions, as well as the capacity of the health systems to cope with prevailing health conditions at local levels. Thus, vulnerability is considered partly a measure of the functionality of programs and instruments in place to reduce the burden of disease, and partly a measure of the success of traditional public health functions, such as providing safe water and sanitation and responding to outbreaks of infectious diseases (e.g. malaria). Furthermore, general poor accessibility to primary health care services contributes to high levels of vulnerability and low adaptive capacity of millions of people (Confalonieri et al. 2007).

Some of the considered health effects of climate change in Southeast Asia include morbidity and mortality due to heat stress; vector-borne infectious diseases (for example malaria and dengue); diarrheal diseases; and malnutrition. The effects of extreme weather events such as cyclones, flooding and landslides after heavy rainfall may include injuries and deaths. Respiratory tract diseases caused by increased air pollution and psycho-social disorders related to social dislocation and migration could be attributed indirectly to climate change (ADB 2009).

3 National Health Trends in Vietnam

The health status of the Vietnamese population has changed dramatically in recent years, primarily as a result of the economic reform or renovation program known as *Doi Moi*, introduced in 1986 (see “[Paradoxes in Adaptation: Economic Growth And Socio-Economic Differentiation. A case Study of Mid-Central Vietnam](#)”). This led to a considerable poverty reduction including improved livelihoods, better living conditions and better environmental and health services (GOVN 2006; WHO 2011a). According to WHO, the maternal mortality ratio decreased significantly from 130/100,000 live births in 1990 to 69/100,000 live births in 2009. Also the under-five mortality rate has fallen dramatically from 55.4 % in 1990 to 24.1 % in 2008 (WHO 2011a). Other selected key health indicators are presented

in Table 2. Vietnam has witnessed an average growth rate of approximately 7 % over the last decade, which is reflected in changing demographic patterns, declining fertility declining, and a gradually increasing share of elderly people.

However, the above positive changes in health indicators are accompanied by negative changes in disease patterns of a range of health conditions. Thus, like many other low and middle-income countries, Vietnam is undergoing an epidemiological transition from the dominance of communicable diseases (CDs) to the increased prevalence of chronic, non-communicable diseases (NCDs) (Minh et al. 2009; Ha and Chisholm 2011). Over the last three decades, NCDs have shown a consistent trend of increase to become dominant against CDs and injuries, seen in Table 3. This is comparable to the overall trend in the Southeast Asian region, in which mortality from NCDs is expected to further increase by 21 % over the next 10 years (Narain et al. 2011).

This dominance of NCDs is reflected in Table 4, showing the ten leading causes of death in Vietnam in 2008.

3.1 Communicable Diseases

For some selected health issues in this category of diseases the continuous efforts by government and private sector health institutions have witnessed good reductions in morbidity and mortality with diarrhea and dengue fever as exceptions.

HIV/AIDS

Since HIV was first discovered in Vietnam in 1990 transmission has remained high in three high-risk groups: men who inject drugs, men who have sex with men and female sex workers. Since records began in the early 1990s, 249,660 cases have been reported with 52,325 AIDS-related deaths and 197,335 people presently living

Table 2 Selected national health and health risk indicators, Vietnam

		1990	2000	2009	
Life expectancy at birth (years)	Males	63	68	70	
	Females	67	72	74	
Total fertility rate		3.7	2.3	2.0	
Maternal mortality ratio/per 100,000 live births		170	91	56	
Infant mortality rate (%)	Males	39	23	19	
	Females	40	24	20	
Under-five mortality rate (%)	Males	58	31	25	
	Females	53	28	23	
		Urban		Rural	
		1990	2008	1990	2008
Access to improved water source	88	99	51	92	
Access to improved sanitation	61	94	29	67	

Source WHO (2011b)

Table 3 Mortality in percent of total deaths (*Source* GOVN 2006; ^a) data from verbal autopsy (*Source* MOH 2010)

	1976	1986	1996	2003	2004	2008 ^a
Communicable diseases	55.51	59.10	37.63	27.44	26.13	12
Non-communicable diseases	42.65	39.05	50.02	60.61	60.80	75
Injuries and accidents	1.84	1.85	12.35	11.95	13.00	13

Table 4 Top 10 causes of death in males and females in Vietnam in 2008

Male				Female		
Rank	Disease category	Deaths	%	Disease category	Deaths	%
1	Stroke	53,217	18	Stroke	56,771	23
2	Liver cancer	19,915	7	COPD	14,941	6
3	Road traffic accidents	17,330	6	Pneumonia	11,175	4
4	Lung cancer	15,720	5	Ischemic heart disease	11,015	4
5	COPD	14,355	5	Diabetes	9,858	4
6	Ischemic heart disease	13,504	5	Liver cancer	8,587	3
7	Tuberculosis	11,450	4	Lung cancers	7,869	3
8	Pneumonia	9,470	3	Tuberculosis	6,798	3
9	HIV/AIDS	9,417	3	Road traffic accidents	5,750	2
10	Stomach cancer	8,469	3	Stomach cancer	5,470	2
Total		290,624			250,605	

Source Nhung et al. (2011)

with HIV/AIDS. The number of new HIV cases decreased between 2007 and 2009 and leveled out at about 14,000 new cases in 2010 and in 2011. HIV prevalence among the adult population (age 15–49) was 0.45 % in 2011 (NCADPPC 2012).

Tuberculosis

From 2005 to 2009 a small decrease has been observed in number of TB cases, from 95,970 reported cases in 2005 to 95,036 cases in 2009. The number of TB related deaths reportedly decreased from 1,936 in 2005 to 1,689 in 2009 (WHO 2011).

Diarrhea

Diarrhea remains one of the leading causes of morbidity in the country, particular in areas with inadequate access to safe water and appropriate sanitation. Table 2 points to the fact that in spite of progress in recent years, especially in rural areas sanitation coverage is still a challenge since more than 30 % of the population are without proper sanitary conditions. Cholera, typhoid fever and dysentery are the main causes of diarrhea. In 2008 there were 853 positive cases of cholera recorded in 22 provinces/cities, which was a 55.3 % reduction from 2007 (WHO 2010).

Dengue

The mosquito-borne dengue and dengue hemorrhagic fevers are considered large and increasing public health problems in Vietnam, with 128,831 cases of dengue in 2010 and 109 related deaths (MOH 2010b; WHO 2011a). There are currently indications that a potential geographic expansion in dengue activity is taking place from southern Vietnam, where 70 % of cases are reported, to central and highland areas. Within the region Vietnam is among the five countries with the highest dengue-related burden of disease.

Malaria

The national health authorities have ambitious plans to eradicate malaria in the country by 2015, reflecting that malaria morbidity continues to decrease: from 19,497 reported cases in 2005 to 17,515 in 2010. In the same period, however, mortality increased slightly from 18 cases in 2005 to 21 cases in 2010 (WHO 2011a).

Avian influenza

Avian influenza virus A (H5N1) has been recorded in poultry populations in Vietnam since 2003. Most human infections are linked to close contact to infected poultry. As per mid-2012 there have been 123 laboratory confirmed human cases of H5N1 with 61 fatalities (WHO 2012). Table 5 shows reporting to WHO on human cases of avian influenza by Vietnam and neighboring countries.

3.2 Non-Communicable Diseases/Conditions

As reflected in Table 2, Non-communicable Diseases (NCDs) dominate the current disease patterns. An increase in NCDs is seen in recent decennia with total morbidity rising from 39.0 % in 1986 to 66.32 % in 2009, and in mortality from 41.1 to 63.32 % (WHO 2011a). The leading causes for the epidemiological shift are the general economic growth and related life style changes as well as the fact that life expectancy has increased considerably. The main diseases are cardiovascular disease, diabetes, cancer, and asthma.

Cardiovascular disease

As seen in Table 4 stroke is the leading cause of death in both males and females, and ischemic heart disease is an important contributor to cardiovascular disease in both sexes. Furthermore CVD accounts for 40 % of total deaths for all age groups (WHO 2011c).

Diabetes

The obesity risk factor for diabetes is increasing throughout the country. In 2002, 2.7 % of the Vietnam population were estimated to have diabetes, of which 90 % were

Table 5 Cumulative number of laboratory confirmed human cases (C) and deaths (D) of Avian Influenza A (H5N1) reported to WHO

Country	2003		2004		2005		2006		2007		2008		2009		2010		2011		2012		Total		
	C	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D	
Cambodia	0	0	0	4	4	2	2	1	1	1	1	1	0	1	0	1	1	8	8	3	3	21	19
China	1	1	0	8	5	13	8	5	3	4	4	4	7	4	2	1	1	1	1	2	1	43	28
Lao PDR	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	2	2
Vietnam	3	3	29	20	61	19	0	0	8	5	6	5	5	5	7	2	0	0	4	4	2	123	61

Source WHO (2012)

type 2 (Baumann et al. 2006), and with an expected increase of diabetes type 2 to 3.5 % by 2025 (Beran et al. 2009). Overall the burden of disease with diabetes is highest in females, but peaks in the 60–69 age group for both sexes (Nhung et al. 2011).

Cancer

The cancer incidence rate is currently increasing with more than 100,000 new cases per year (WHO 2011a). In a national survey covering 2005–2006, liver cancer was ranked as most common (31.04 % for males and 19.91 % for females), followed by lung cancer (26.69 % for males and 18.21 % for females) and stomach cancer (14.42 % for males and 14.26 % for females). Among females, cervix and other female genital cancers had a prevalence of 9.13 % and breast cancer 5.69 % (Ngoan et al. 2007).

Injuries

Morbidity related to accidents, injuries and poisonings has seen an increase in the period 2002–2009, rising from 9.2 to 10.8 % of all hospital admissions. Similarly, mortality related to the above has increased from 18.5 to 22.6 % of all deaths in hospitals. Transport accidents represent the ninth leading cause of morbidity (WHO 2010) and the sixth leading cause of mortality (WHO 2011a). Drowning accounts for 17 % of total injury mortality and second to traffic accidents. Children is a particular vulnerable group with respect to drowning, with an average 22/100,000 children (age 0–4) drowning per year (Lan et al. 2011).

Malnutrition

According to WHO (2011a) protein energy malnutrition and micronutrient deficiencies among under-five children have seen a significant decline recently. Thus, malnutrition in the age group under-5 years was reduced from 33.8 to 18.9 % from 2000 to 2008. However, in the urban context and in more economically developed rural areas overweight and obesity are increasing in children with the potential, if uncontrolled, to develop into diabetes and cardiovascular diseases.

Table 6 Prevalence of 10 common mental disorders in Vietnam

Mental disorder	Prev. (%)
Alcohol abuse	5.3
Depression	2.8
Anxiety	2.6
Juvenile behavioural disorder	0.9
Old age amnesia	0.9
Slow mental development	0.6
Cerebro cranial trauma	0.5
Schizophrenia	0.5
Epilepsy	0.3
Drug use	0.3

Source Vuong et al. (2011)

Mental health

Although Vietnam has witnessed considerable economic and social progress, resulting in improvement in the general health status, the fast and sometimes uncontrolled development may lead to a series of negative impacts on the mental health status. Similarly, the increasing frequency of extreme weather events and resulting damage to infrastructure, housing, personal property and individuals may be conducive to a series of psycho-social disorders, such as post-traumatic stress.

Some of the key mental health issues prevalent in Vietnam are shown in Table 6 (please note that in a Vietnamese context these are identified as psycho-social aberrations).

Berry et al. (2010) suggest three pathways for mental health impacts of adverse weather events. First, mental health may be affected directly by the effects of more frequent and serious natural disasters on human settlements which, typically, cause serious anxiety-related conditions, and later, severe and chronic mental health problems. Next, extreme weather events may increase the risk of injuries and associated physical health problems, which eventually may lead to mental health problems. Third, climate change related events may change the natural and social environment on which people depend for their livelihoods and wellbeing, thereby potentially leading to mental health problems in vulnerable community groups. In a study on the social dimensions of vulnerability in Vietnam by Few and Tran (2010), increased anxiety from flooding-related hazards and resulting impacts on livelihoods was reported at household levels.

According to Vuong et al. (2011) about 12 million people are currently in need of mental health services. A nationally representative epidemiological survey on 10 common mental disorders in the period 2001–2003 showed that the 10 most common mental disorders had a combined prevalence of approximately 14.9 % of the population, corresponding to the above (see also “[Rural Households: Socio-Economic Characteristics, Community Organizing and Adaptation Abilities](#)”).

4 Main Health Issues Relevant to Climate and Environmental Change

Vietnam is ranked as one of the countries in South East Asia particularly vulnerable to climate related hazards such as tropical cyclones, floods, landslides, droughts and sea level rise (Yusuf and Francisco 2009; ISPONRE 2009, see also “[Impediments to Climate-Induced Disaster Management: Evidence from Quang Nam, Central Vietnam](#)”). With a climate change related sea level rise of 1 m, and no adaptation measures, Vietnam would lose 28 % of its wetlands and over 10 % of its urban areas would be affected (World Bank 2008), inevitably having health implications.

Figure 3 represents the trend of impacts of natural disasters experienced in Viet Nam in the past decade. Millions of people are affected and the society suffers tremendous losses of lives and income generation. For example in the period

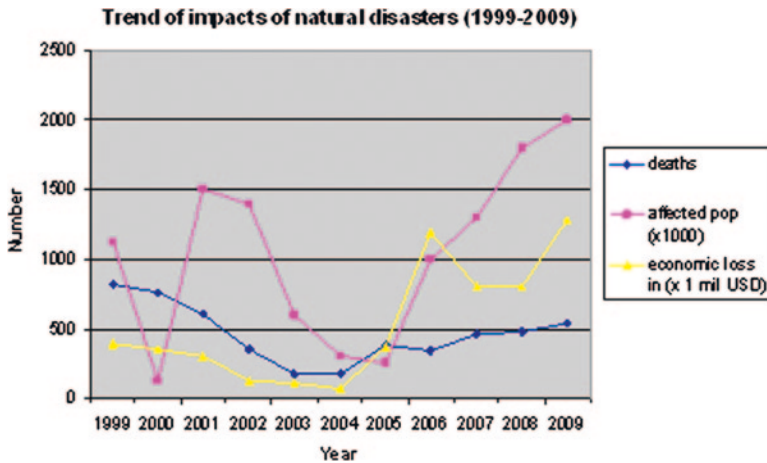


Fig. 3 Trends of impacts of natural disasters, 1999–2009, Vietnam (Binh et al. 2011)

2002–2006 1,700 people died in natural disasters and economic loss were estimated to VND 75,000 billion (GOVN 2007). As seen in “[Impediments to Climate-Induced Disaster Management: Evidence from Quang Nam, Central Vietnam](#)”, Quang Nam ranks as one of the most vulnerable provinces to natural disasters, with more than half of the fatalities related to flooding events.

The broader potentially adverse impacts of climate change include effects on ecosystems, socio-economic conditions and human health, which are superimposed on the already serious effects of the overall development process on the natural and social environments. Based on comparative risk assessment, evidence synthesis and expert evaluations for regional exposure as well as on WHO country health statistics for 2004, WHO (2009) has estimated that about 21 % of the total burden of disease in Vietnam is related to environmental risk factors, equal to 122,500 deaths per year.

Diseases and health conditions relevant to climatic factors and climate change are those with climate sensitive determinants of health (both risk factors and health opportunities), i.e. where transmission would be related to climate and weather factors (e.g. precipitation, temperature, wind). Using time series of climate and disease variables and applying statistical and GIS spatial analyses, Kien et al. (2010) write in a recent study on linkages between climate change and variability and rates and distribution of certain infectious diseases in Vietnam, that there is good epidemiological evidence of associations between climate factors such as temperature, rainfall and climate variability on the one hand, and burden of disease of major infectious diseases such as malaria, diarrheal diseases and dysentery on the other hand. There were clear linkages between climate factors and the changes in disease patterns over the last 25 years, although for other communicable diseases like influenza, cholera and typhoid correlations were less obvious than those above. Additionally and indirectly, however, socio-economic factors sensitive to climate change and climate variability may also influence vulnerability, disease prevalence and distribution (e.g. income, accessibility to health services).

Vulnerable community groups

According to a review by Ahn (2009), with the existing pattern of gender discrimination in Vietnam women are more likely than men to die from the direct and indirect results of natural disasters. Women and girls also suffer more health impacts during, and in the aftermath of, natural disasters. For example, there are more drowning incidents among women because of lack of knowledge on how to swim (Vu Minh Hai 2004 cited in Ahn 2009). Furthermore, pregnant women and small children are particularly vulnerable to water-borne diseases such as diarrhea and cholera. As another vulnerable group, the elderly and people with poor health are at risk from climate change impacts like heat stress and malnutrition (Ahn 2009). People with disabilities are also vulnerable because of poor access to e.g. disaster risk reduction measures like preparedness training and early warning signals (Jørgensen 2011).

5 Awareness of Climate and Environmental Change in Thang Binh District, Quang Nam Province

Among its objectives for proper responses to climate change the Government of Vietnam has emphasized ‘the need to promote scientific and technological activities to establish scientific and practical foundation for climate change responding measures’ (GOVN 2008a, b). It is within this context that a small-scale survey was initiated in Quang Nam Province in order to establish the perceptions of climate and environmental sensitive health issues. In consultation with the Quang Nam Preventive Medicine Centre (PMC), a number of communities were selected in Thang Binh, a coastal district already prone to extreme weather events and flooding and vulnerable to climate change impacts.

5.1 The Survey Area

Thang Binh is a district in the eastern part of the Quang Nam province. The area is 3,847,507 ha with a population of 186,964 people (2006). The district has 21 communes and the District capital is Ha Lam. Thang Binh is bordered on the east by the China Sea, to the west by Hiep Duc District and Que Son District, to the south by Tam Ky town, and to the north Que Son District and Duy Xuyen District. The district has a tropical monsoon climate, with average annual humidity above 80 % and average annual rainfall reaching 2,000 mm. The climate here is divided into two distinct seasons of the year. The rainy season begins in September and lasts to February. The dry season begins in February and ends in August with hot sunshine, low humidity and generally dry conditions.

In Thang Binh land is divided into different regions, with mountainous and hilly areas occupying 2/5 of the district’s land area: the coastal area is mainly sandy soil and the mountainous areas consist of dense forests and arid lands. Binh

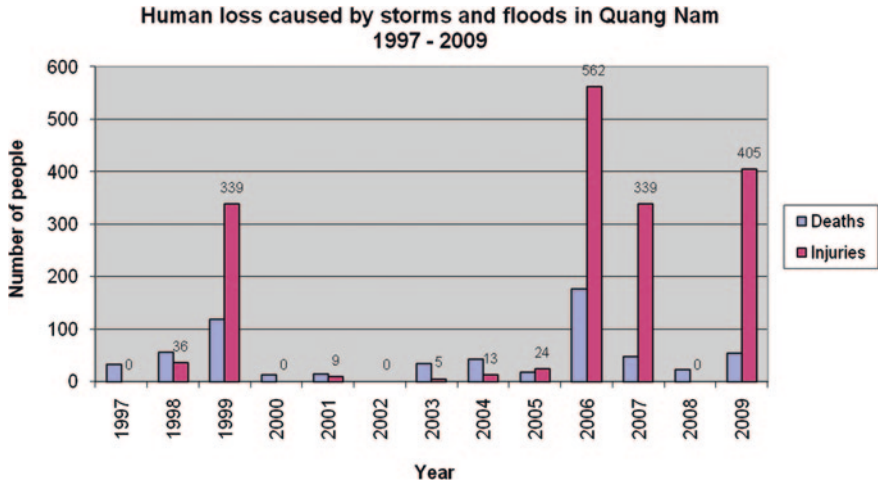


Fig. 4 Human loss caused by storms and floods in Quang Nam 1997–2009 (Binh et al. 2011)

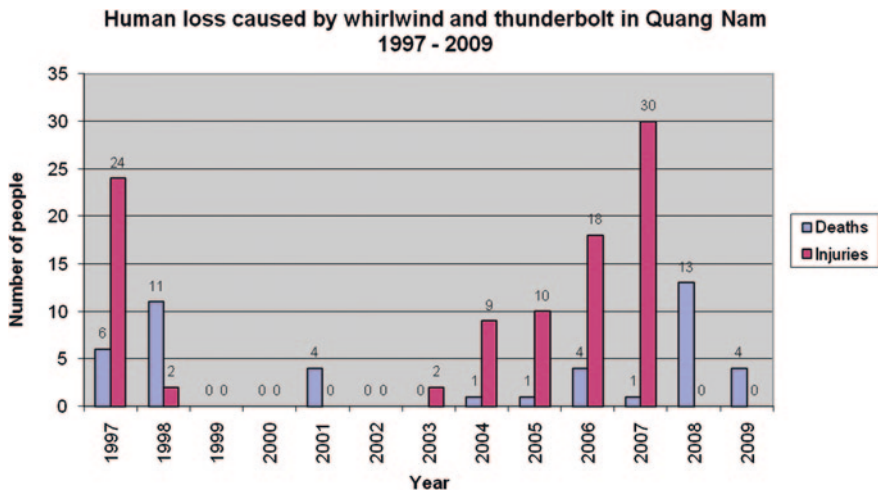


Fig. 5 Human loss caused by whirlwind and thunderbolt in Quang Nam 1997–2009 (Binh et al. 2011)

Minh commune has been selected as a study area out of the 21 communes emphasizing a coastal area with past history of extreme weather events (see map Fig. 7). Binh Minh covers an area of 1,180 ha and has a population of approx. 7,100.

The entire province of Quang Nam has witnessed a series of storms and floods in recent years. Particularly the years 1999, 2006, 2007 and 2009 saw considerable numbers of fatalities and injuries from weather events, as seen in Fig. 4.

Other extreme weather events have impacted local communities in Quang Nam Province. Figure 5 illustrates the impacts of whirlwind and thunderbolt in the

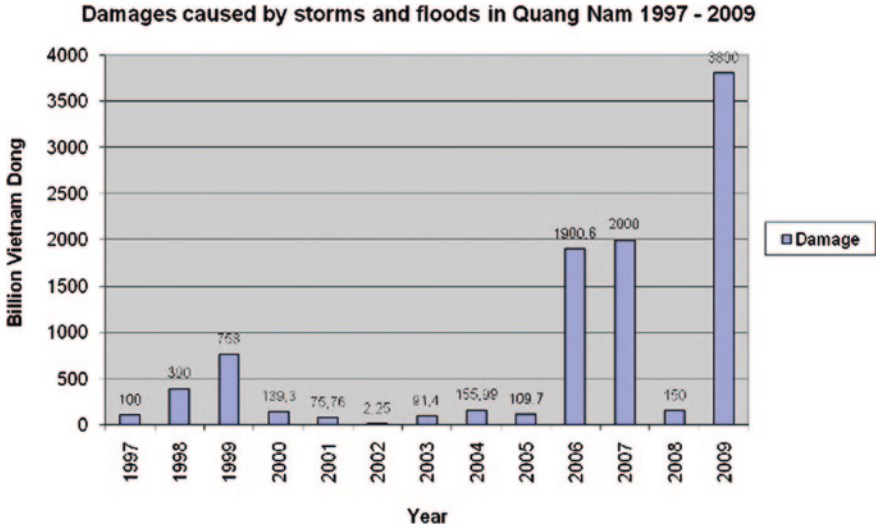


Fig. 6 Damages caused by storms and floods in Quang Nam 1997–2009 (Binh et al. 2011)



Fig. 11.7 Map of Quang Nam province indicating location of Binh Minh

same period of 1997–2009. Fatalities have occurred in nine out of 12 years, and increasing injuries were particularly seen from 2002 to 2007.

Similarly, tremendous losses have been sustained due to physical damages caused by storms and floods in Quang Nam. Figure 6 shows that damage experienced in particular in connection with storms and floods in 2006, 2007 and 2009 (Fig. 4).

Ly Ly River and Truong Giang River are the two major rivers flowing in the district. Ly Ly River line is constantly changing by the impact of major floods and often dry-in during the dry season. The part of Truong Giang River, which flows through the district, is shored for feeding shrimp by the local people, thereby diminishing the flow considerably. Thang Binh has 25 km coastline with many high quality beaches—however, not yet exploited for tourism development.

Key informants

Key informants for in-depth interviews were recruited among local health authorities, the Peoples' Committee's disaster prevention authority, village-based Red Cross, and a village representative from small-scale business and fisheries sectors. Interviews were conducted by means of guides with structured questions related to climate change awareness, health impacts and adaptation. At the time of the survey in July 2010, a series of focus group discussions were also performed.

Key observations

Awareness of climate change

Most of the respondents associated climate change with abnormal weather conditions and typically mention seawater level rise, storms, floods and increase in temperature. Typical replies by respondents reflected the opinion that climate change is a phenomena of weather that is not associated with the known natural regime: *“Climate change means the impact of the weather without a rule”, “Irregular rainfall, it is not cyclical”, “Generally it is unexpected rain or sun and more severe”*. In the daily life of the fishing community the unpredictable storms mean that it becomes difficult for fishermen to properly schedule their work. A female respondent noted that *“Before the beach was far away when we went to collect snails, but now the shore is moving very close”*. Another interviewee shared this view: *“Sea water level is now rising and it has caused flooding and broken dykes. The dyke was built in 1965—now water is close to the dyke”*. Some respondents claimed they did not know about climate change, but were nevertheless able to list a number of associated phenomena such as more severe storms and higher temperatures. Some respondents clearly mentioned linkages to environmental and habitat destruction, to deforestation, and to global warming causing ice melting and a rise in the sea level. A rise in temperature and a decline in precipitation were mentioned by several respondents, resulting in more drought periods: *“It dries the body, it is formidable impact that people cannot bear. It is hotter than usual, making it more difficult to breathe and so on”*.

Impact on health

Generally, respondents had observed considerable changes in health patterns in recent years. However, these were not immediately linked to climate or weather

factors, but rather linked to changes in environmental determinants of health such as food, water and air quality. Of much concern was the apparent increase in instances of cancer: *“Many people have started to look at the reasons for more cancers in recent years in the village. From 1984 to 1990 it was not much. It has occurred a lot more since 1990... I saw many cases of cancer this year; the main cause is well-water quality. Some people have been affected by alum”*. Another respondent stated: *“Compared with the earlier period, there has been a big change and now there is too much cancer—there are nearly 100 cases”*.

Although it cannot be concluded that the cancer cases mentioned by respondents are climate change related, it may indirectly be a possibility. According to Minh et al. (2008), in agriculture there has been widespread use of organochlorine insecticides, in particular DDTs (so-called ‘persistent organic pollutants’ or POPs) in Vietnam and high concentrations have been found in samples. A review by UNEP/AMAP (2011) confirms the linkage between DDT and a series of population health effects, including various cancer types such as breast, prostate and testicular cancer. The review furthermore highlights relationships between climate change, weather variability and POP levels. Extreme weather events such as flooding may release and re-distribute high amounts of pollutants to the environment with subsequent accumulation in food chains. Here children represent a particular vulnerable group due to their developing physiology and immune system as well as due to their comparable higher exposure to POPs relative to weight during eating, drinking and breathing. However, a potentially confounding factor to climate change is the evidence of an association between herbicides, including the widely used Agent Orange during the Vietnam War, and various types of cancers such as sarcomas, lymphomas, Hodgkin disease and leukemia (American Cancer Society 2012).

Of similar concern is the situation for diarrheal diseases. Several informants mentioned cholera as among the top five health concerns possibly related to climate and/or environmental change: *“Some diseases are very unusual and have not been seen before, for example a strange epidemic disease causing diarrhea in the whole community, and it is also strange to the Ministry of Health”*; *“There are many reports about strange cases of illness, which cannot be diagnosed. I think it is more or less due to climate change—a direct impact to health”*; and *“Just recently diarrhea cases have developed all over the district”*. Particularly in relation to problems of overflowing latrines during flooding, a possible risk factor in relation to cholera, studies need to be carried out. Other water-related diseases mentioned included skin and eye diseases, usually having lack of water for personal hygiene as an important risk factor.

Dengue fever was referred to by several key informants as a rising health issue. An interviewee mentioned that, *“The second most important climate change related disease (after cholera) is dengue fever—it spreads so fast, and if not treated in time it is very dangerous, and in crowded communities it is a special concern”*. One recalled that, *“The dandy (dengue) fever was epidemic in the rainy season about 3 years ago”*.

Fatalities caused by drowning and severe injuries were also of much concern to the interviewees. The consequences of such for households’ economy and

employment as well as the derived mental problems in the form of post-traumatic stress were mentioned in several interviews. For instance, “*The Chan Chu storm was at first predicted to go in a southwest direction, and the fishermen believed so. When it went to the north and stroke, 86 people were killed in Binh Minh commune. There is a household where both father and son died*”. Others stated, “*As for storm no. 9 (Ketsana), I am now 60 years old and I never seen so huge waves—there are storms every year, but not with such big waves. Its severity caused huge accidents—boats were pushed up and broken*”; “*Death matters the most, it has consequences for the parentless children*”. Overall the impacts of extreme weather events are strongly recognized as being of major importance for peoples’ life, livelihoods and living conditions. As one informant stated, “*Climate change affects health—but it also affects the lives of 90 % of the fishermen here. Climate change makes life harder, because there are sea temperature changes that make it more difficult to catch fish*”.

Other observations

Referring to the wider socio-economic household survey undertaken in 2010 in selected coastal and mountainous districts in Quang Nam province (see “[Impediments to Climate-Induced Disaster Management: Evidence from Quang Nam, Central Vietnam](#)”, “[Livelihood Stresses Under the Constraints of Climate Change Vulnerability in Quang Nam](#)” and “[Rural households: Socio-Economic Characteristics, Community Organizing and Adaptation Abilities](#)”), the above statements are affirmed by the health status of the respondents. Table 7 shows a

Table 7 Health today compared to 10 years back by district

District		Health today compared to 10 years back			Total
		Worse	Same as before	Better	
Bac Tra My		18	3	5	26
Dai Loc	Count	12	2	3	17
Hoi An	Count	12	10	3	25
Nui Thanh	Count	23	8	7	38
Que Son	Count	28	6	3	37
Total	Count	93	29	21	143

Source Household survey

Table 8 Prioritization of factors with perceived impact on livelihoods in study communities

	Importance of bad weather/natural disasters for livelihood	Importance of pests for livelihood	Importance of diseases for livelihood	Importance of agr. prices for livelihood	Importance of agr. input prices for livelihood	Importance of poor health
N Valid	135	47	67	96	64	52
Missing	31	119	99	70	102	114
Mean	2,11	3,26	3,34	2,92	3,17	3,13
Std. Deviation	1,201	1,310	1,200	1,262	1,292	1,314

Source Household survey

Table 9 Pay for health services?

			Pay for health services?			Total	
			No answer	Na.	No		Yes
District	Bac Tra My	Count	7	11	7	7	32
	Dai Loc	Count	9	7	1	7	24
	Hoi An	Count	0	6	1	18	25
	Nui Thanh	Count	10	5	14	19	48
	Que Son	Count	0	8	15	14	37
Total			26	37	38	65	166

Source Household survey

worsening of health conditions reported by a total of 93 households, an improvement reported by 21 households, and no change reported by 29 households.

Questions about stress factors considered to impact livelihoods were also addressed to households. Table 8 shows that in a ranking of the five most important factors, weather conditions and natural disasters were considered of the highest importance (mean 2.11) and poor health was ranked in third place (mean 3.13).

The results, although not fully representative, may indicate a higher confidence in the availability of health services than in the existing systems for weather forecasts, disaster warnings and disaster risk management. The section below will elaborate on some coping mechanisms as seen in the coastal district of Thang Binh.

Health equality and coping with changes in health and environment

Universal accessibility to health services is crucial for safeguarding human health, particularly in the context of uncontrolled development and climate change. It represents a challenge when health systems and services are put under stress. The socio-economic household survey mentioned above indicated that a considerable number of households pay for health services (Table 9).

Although the survey had a considerable number of non-respondents on health issues, the results may reflect a general problem since an estimated 55.5 % of the sources of total health expenditure in Vietnam are covered by private

out-of-the-pocket (OOP) payments (Tien et al. 2011). During the implementation of the *Doi Moi* policies, the health financing mechanisms were reformed and a transition was made from a tax-based system to a system with multiple sources of funding, including government revenues, social health insurance, and out-of-the-pocket (OOP) payments (Tien et al. 2011). The results indicate that health inequality is still an important issue, potentially to be increased by a climate change induced burden to the health system and services.

When interviewing local residents in Thang Binh about their coping mechanisms, there was a sense of great social cohesion and willingness to help each other when threatened by bad weather or climate change impacts: “*When flooding occurs, most neighbors help each other*”; “*I think local people are enthusiastic and eager to help—uploading sand bags on roofs to keep them from blowing away*”.

A whole range of coping mechanisms were highlighted in times of increased extreme weather events and general environmental change. The building of new strong houses and reinforcement of old houses were mentioned as key to disaster prevention (see “[Climate Change, Adaptation and the Environment in Central Vietnam](#)” and “[Rural households: Socio-Economic Characteristics, Community Organizing and Adaptation Abilities](#)”). Underground shelters for use by several households were emphasized in some localities, and the need for proper sanitation facilities and safe water supply to maintain good hygiene in protection against e.g. diarrheal diseases, were mentioned in other places. Planting trees for protection and shade were also considered important, just as were the dredging and maintenance of ditches to allow for proper water management. Finally, a wish for an efficient early warning system was mentioned, including reliable weather forecasts, in order to ensure overall disaster preparedness.

Health system responses to climate change

The health clinics at communal level have a major responsibility for the annual planning of flood and storm prevention measures. They have established mobile emergency teams as well as systems for monitoring the local health situation. There are good linkages to higher-level health facilities and authorities, which provide the necessary guidance and assistance such as for water treatment and environmental sanitation. Some of the challenges reported relate to understaffing in the health sector and lack of specific drugs, materials and equipment.

Local communes have put considerable work into the establishment of Flood Control Committees. These have an important role in creating awareness about climate change and disaster related issues and they participate in collaborative actions with the Youth Association and the Marine Corps, in order to assist fishing communities, for example, with rescue operations and teaching swimming skills. Such activities are in line with the overall National Target Program in Response to Climate Change (2008) and the action plan developed by the Ministry of Health in response to climate change (GOVN 2010). The action plan has among its objectives the evaluation of climate change impacts on health and the broadening of awareness among health staff and communities on health protection and climate change adaptation.

6 Conclusion

‘There is no lack of well thought out policies on climate change and disaster risk management in Vietnam—over 200 laws, policies and strategies exist! The overriding challenge being faced by Vietnam is implementing these policies effectively.’ This is one of the key findings of a recent review of the existing policy framework on climate change and disaster risk reduction by AMDI and TPGC (2011). Even though this chapter has only presented very preliminary, small-scale studies not necessarily representative for the broader Vietnamese society, the main conclusion remains the same as above: for community-based climate change adaptation initiatives to be sound and sustainable, there is a need to implement existing policies, strategies and action plans effectively through joint, inter-sectoral action. The latter is a challenge in itself, because most people seem to associate risk management actions with the state sector rather than with the local community (see “[Impediments to Climate-Induced Disaster Management: Evidence from Quang Nam, Central Vietnam](#)”). This challenge may be overcome if action is first taken at community level that is capable of demonstrating positive and viable results. This may eventually benefit the most vulnerable population groups, who still show little awareness of the inter-linkages between health and development-induced environmental and social change. Ideally, new initiatives should be informed by more substantial research; the present material may serve to stimulate both more in-depth and broader studies to identify proper, sustainable measures to cope with climate and environmental change.

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