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CLIMATE CHANGE & HUMAN DEVELOPMENT IN VIET NAM: A CASE STUDY

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1. Introduction: Poverty, Natural Disasters & Climate Change

1. Viet Nam is a low-income country, but has recently made spectacular progress in terms of both economic growth and poverty reduction. The official poverty rate has fallen from 58% in 1993, to 19.5% in 2004 (VASS 2006). Strong economic growth is likely to continue following recent accession to the World Trade Organisation, with increased international trade and direct foreign investment reinforcing Viet Nam's progress towards middle-income country status. As Viet Nam continues to be transformed from a highly centralised command economy, to a more market-based one, the urgent challenge is to ensure that the relatively equitable growth that has taken place to date is sustained. Inequality is already increasing, with growth and poverty reduction rates in remote areas markedly lower than those in and around the growth poles of Ho Chi Minh City and Hanoi, and this may have significant long term consequences for Viet Nam's future ability to respond collectively to climate related vulnerabilities.

2. Viet Nam has a long history of coping with natural disasters and mitigating their effects in many ways. Natural disasters affect particularly the coastal regions but also include flash floods in upland areas, for example following landfall of typhoons associated with heavy rainfall, as the typology in Box 1 shows. The ability to cope with disasters and mitigate risks should increase as national and individual wealth grows, but to increase institutional capacities remains a challenge, at a time when climate change is increasing the risks.

3. Poverty in the typhoon and drought prone central coast region stood at 25.5% in 2004, against 5% for the region around Ho Chi Minh City (VASS 2006). Between 1991 and 2000 more than 8,000 people were killed by natural disasters (storms, floods, flash floods, land slides). In addition, an estimated 9,000 boats were sunk and 6 million houses were destroyed. The total economic value of losses for this period was estimated at USD 2.8 billion (CCFSC 2001). Disaster-affected regions span the length of Viet Nam's coast, as the list in the annex of major recent natural disasters and their impacts demonstrates.

Box 1: Typology of Climate Related Natural Hazards by Region in Viet Nam

Region of Viet Nam	Disaster Zone	Principle Disaster Hazards
North	Northern Uplands	Flash floods, landslides, earthquakes
	Red River Delta	Monsoon river floods, typhoons, coastal storm surges
Centre	Central Coast Provinces	Typhoons, storm surges, flash floods, drought, saline water intrusion
	Central Highlands	Flash floods, landslides
South	Mekong River Delta	River flooding, typhoons, high tides and storm surges, salt water intrusion

(Source: CCFSC)

4. Coastal districts of Viet Nam have a population of about 18 million people, which is nearly a quarter of the total population, though they cover only sixteen per cent of the national land area. Approximately 58% of coastal zone livelihoods are based on agriculture, fishing and aquaculture. River floods cause major crop losses and devastate infrastructure, especially in the Mekong Delta, but also bring wild fish stocks for survival during floods, and increased soil fertility. Livelihoods that depend on marine resources are particularly vulnerable to typhoons and storm surges. Approximately 480,000 people are engaged directly in fishing, 100,000 in seafood processing and 2,140,000 in providing 'fishery related services'. Aquaculture in the coastal region is seen as an important growth sector, and is providing an alternative to reliance on wild fish stocks that are increasingly under pressure from over-exploitation (MoNRE 2006). The value of fisheries' exports has increased from USD 621.4 to 2,739

million between 1994 and 2005, but the share in total national export remained around ten per cent during this period.

5. A recent study on the potential impacts of sea level rise on 84 coastal developing countries shows that a 1-metre rise in sea level would affect approximately five per cent of Viet Nam's land area, affect eleven per cent of the population, impact on seven per cent of agriculture, and reduce GDP by ten per cent (Dasgupta et al. 2007)⁴. The projections for 3 and 5-metre sea level rise scenarios for Viet Nam are described as 'potentially catastrophic'⁵. The study suggests that Viet Nam would rank among the top five most affected countries in the study, considering all sea level rise impact indicators. Furthermore, vulnerability to climate change extends beyond sea level rise, to include extreme weather events. Section 2 describes the changing climate patterns that are currently expected, and how those changes relate to agriculture, aquaculture and fisheries.

6. Whilst the threat of climate change will impact all across Viet Nam, it is the rural poor who face the challenge of coping with and adapting to climate change most immediately and directly within the context of Viet Nam's changing social-economic and institutional context. They are heavily reliant upon agriculture, aquaculture and fisheries for income and food security, often in marginal environments, but have increasingly seen many of the safety nets that existed under the centrally planned economy removed, leaving them extremely vulnerable when climate-related disasters such as drought, floods or typhoons, occur. This is discussed further in section 3. Sections 4 and 5 present institutional arrangements and policies in disaster management and provide practical examples of climate change adaptation. Conclusions on reducing climate change vulnerabilities are drawn in section 6.

2. Trends & Predictions for Physical Vulnerability to Climate Change

2.1 Land and Climate

7. Viet Nam has a land area of 320,000 km² and a coastline of 3,260 km. Three quarters of its territory is covered by hills and mountains with elevations between 100 and 3400m, while the plain areas include two major river deltas; the Red River Delta in the north and the Mekong River Delta in the south. The lowlands are extremely fertile and densely populated, and most of Viet Nam's agriculture and industry are concentrated there.

8. Viet Nam has a tropical monsoon climate, although regional climate variations are considerable due to the length of the country and the diverse topography. Annual mean temperature ranges between 18°C to 29°C, while mean temperatures during the coldest months vary between 13°C and 20°C in the northern mountains and between 20°C and 28°C in the tropical south. In most parts of the country annual rainfall ranges between 1400 mm and 2400 mm, but can be as high as 5000 mm or as low as 600 mm on average in some regions. Rainfall is unevenly distributed throughout the year, with about eighty or ninety per cent of the rainfall concentrated in the rainy season, causing floods and frequent landslides. The number of rainy days in the year is also very different between the regions and ranges from 60 to 200 (MoNRE 2003).

9. In several regions floods are common during the rainy season. In the dry season drought is often recorded, for example in the central highlands and especially in the south central coast region, including Ninh Thuan and Binh Thuan provinces, where rainfall is on average

⁴ The sectors considered were land area, population, GDP, urban extent, agriculture extent, and wetlands. Viet Nam topped the global list in four of the six, and was second in the remaining two. (Dasgupta et al. 2007)

⁵ These are not predictions but model studies. Whilst even for the highest greenhouse gas emissions scenarios by the IPCC the predictions are that sea level rise is likely to remain below 0.6m by 2100, this excludes the effects of major changes in ice flow. In the longer term, the melting of the Greenland and Antarctic ice sheets may cause 4-6 metre of sea level rise in future centuries (IPCC 2007).

500-700 mm but can drop as low as 350 mm in some years. This region frequently suffers from prolonged droughts, which contribute to desertification processes, and droughts are predicted to increase under current climate change scenarios. Viet Nam is located along the northwest Pacific Ocean's typhoon route and is one of the ten countries worldwide considered most vulnerable to tropical cyclones (UNDP 2003). On average, 6.9 typhoons/tropical cyclones a year hit Viet Nam's coast, especially in the northern and central parts of the country (based on 1954-2000 period; MoNRE 2003).

10. A preliminary assessment of the impact of climate change on Viet Nam was carried out for the Initial National Communication to the United Nations Framework Convention on Climate Change (UNFCCC) (MoNRE 2003) and coastal zone vulnerability to sea level rise was investigated in the 1990s (MHC 1996). Work is ongoing for the Second National Communication to the UNFCCC too, but assessments to date have been predominantly qualitative in nature. Nevertheless, climate change impacts are clearly emerging in Viet Nam today, with weather conditions set to become both more extreme and more unpredictable.

2.2 Changes in Temperature and Rainfall

11. Between 1900 and 2000, annual average temperatures increased by 0.1°C per decade. Summers are becoming hotter with average summer month temperatures increasing by 0.1°C to 0.3°C per decade. It is expected that, compared to 1990, temperatures will increase in the range 1.4-1.5°C by 2050 and 2.5-2.8°C by 2100 (Hoang & Tran 2006) – and the highest temperature increases will be inland. Changes in rainfall patterns are complex and season- and region-specific. Monthly rainfall is already decreasing in most of the country in July and August and increasing in September, October and November (MoNRE 2003), and rainfall intensity is increasing considerably (Nguyen 2006). Compared to 1990, annual total rainfall is expected to increase in the range 2.5% to 4.8% by 2050 and by 4.7% to 8.8% by 2100. The increase will be largest in the north of Viet Nam and least in the southern plains (Hoang & Tran 2006). It is expected that rainfall will be concentrated, even more than now, in the rainy season months, leading to an exacerbation of drought problems in the dry season. Climate change, then, is set to make precipitation more uneven and variable over time and space (Schaefer 2003).

2.3 Changes in Floods and Drought

12. Even before future climate change is factored in, Viet Nam is at risk from extreme weather events. In 1996, more than 2,000 km² of the country's coastal zones were estimated to be at risk from annual flooding, with the Mekong River Delta accounting for seventy-five per cent of this total and the Red River Delta a further ten per cent (MHC 1996). In some areas, such as the central provinces and the Mekong River Delta, floods appear to be increasing in intensity compared with those in the first half of the 20th century (Nguyen, 2006) though whether this simply reflects increased human settlement, cultivation, and infrastructure development is unclear. Flood damage is expected to be aggravated by an increase in daily rainfall of 12-19% by 2070 in some areas, affecting both flood peak discharges and the return period of floods (MoNRE 2003). Drought problems will intensify through increased variation in rainfall and increased evaporation (three per cent in coastal zones and eight per cent in inland areas by 2070) triggered by rising temperatures (MoNRE 2003).

2.4 Changes in Typhoon Patterns

13. The number of typhoons that Viet Nam experienced increased between the 1950s and the 1980s but subsequently decreased in the 1990s. The peak month of typhoon landfalls has shifted from August in the 1950s to November in the 1990s, and considerable uncertainty exists about the expected frequency of typhoons in the coming century. The trajectory of typhoons appears to have moved southwards in recent years (EU/MWH 2006)

though it is widely expected that due to a rise in temperatures, the north will become more subject to typhoon activity and the intensity of storms will increase, resulting in higher peak wind speeds and more intense precipitation (CCFSC 2001; IPCC 2007). Coastal zones will suffer from more intense typhoons, posing higher threats to people's lives, livelihoods, infrastructure and agricultural production. Upland communities will be faced with increasing risks of flash floods and landslides from heavy rainfall. An estimated eighty to ninety per cent of Viet Nam's population are potentially directly affected by typhoons (CCFSC 2001).

2.5 Sea Level Rise

14. Several studies have reported sea level rise in Viet Nam. According to the United Nations Environment Programme (UNEP 1993) sea levels around Viet Nam increased by 5cm between the 1960s and 1990s and the Hydro-meteorological General Department estimates that the seawater level is rising at an average rate of 2mm per year. Coastal erosion has also been reported, such as in the Cau Mau area where more than 600 hectares of land have been eroded, with 200m wide strips of land lost in some locations. Predictions for the extent of sea level rise in the future differ, with national publications asserting a rise of up to 1m by 2100 (e.g. MoNRE 2003; Hoang 2005). The IPCC estimates that the global average sea level rose between 1900 and 2000 by about 15 cm, and predicts that with different greenhouse gas emission scenarios this will at least double in the period 2000 to 2100, i.e. rise by 28-58 cm (3-6 mm/yr) This is lower than previously expected but many uncertainties still exist and a 1m rise cannot be ruled out (IPCC 2007). Sea level rise will overwhelmingly impact on the low-lying Mekong River Delta, which could be almost completely inundated for some periods of the year.

2.6 Impacts on Agriculture

15. A rise in seawater level will worsen saline water intrusion in coastal zones too, which is already a problem in some areas due to fresh water extraction for irrigation and drinking water and the construction of canals in the deltas and upstream dams (MHC 1996). The Mekong River Delta will be the most affected region with 1.77 million ha of salinised land, accounting for forty-five per cent of the land (CCFSC 2001). A sea level rise of 30 centimetres (a scenario for 2050) would increase the salinity of the main tributaries of the Mekong River as far as 10 kilometres inland (Raksakulthai 2002). Inundation and the resulting loss of land, and saline water intrusion in the Mekong Delta and parts of the Red River Delta, the country's most important agricultural areas, will pose serious threats to farmers as well as to agricultural exports such as rice (of which Viet Nam is the second largest exporter in the world), and possibly to national food security.

16. Besides inundation, more frequent flooding, saline water intrusion, drought, and typhoons, both agriculture and natural ecosystems will suffer from increased minimum temperatures, a decreasing number of days with temperatures under 20°C (0-50 days by 2070) and an increasing number of days with temperatures above 25°C (0-80 days by 2070). This will affect growing periods, crop calendars and crop distribution, increase pest and virus activity and cause migration of tropical trees and crops northwards by 100-200 kilometres and to higher altitudes in the mountains by 100-550 meters where they will replace sub-tropical species (MoNRE 2003). Some species too may become extinct as a result of changing climatic conditions, and it is predicted that yields of summer rice will decrease by three to six per cent by 2070 compared to the 1960-1998 period. The impact on spring rice may be more serious especially in the north where yields are expected to decrease by seventeen per cent by 2070 in contrast with the south of the country where yield would decrease by eight per cent. Yields of spring maize may decrease by four per cent in central Viet Nam and by nine per cent in the south, whereas climate change would have a positive impact in the north where spring maize yields could increase by seven per cent (Nguyen et al. 2005).

2.7 Fisheries & Aquaculture

17. Climate change is expected to have a considerable impact on Viet Nam's fishery and aquaculture sectors, which accounted for 3.9% of GDP in 2005 (GSO 2006). The numbers of tropical fish with a low commercial value (except for tuna) would increase and the numbers of sub-tropical fish with a higher commercial value would decrease. Coral reefs are expected to degenerate and fish living in these habitats are expected to disappear. Moreover, sharp decreases in plankton would lead to migration of fish and reductions in fish body mass. As a result, it is estimated that the economic sea production capacity of Viet Nam would be reduced by at least one third. Due to a rise in seawater level, aquaculture farms will have to be relocated and saline water intrusion and reduction of the mangrove area will create loss of habitat for fresh water creatures. However, increased rainfall intensity might temporarily reduce the salt concentration of seawater, affecting some species, such as bivalve molluscs, living in coastal areas (MoNRE 2003).

2.8 Climate Change and Human Health

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

3. Climate Change Vulnerability in a Changing Socio-Economic Context

3.1 Poverty, Vulnerability and a Changing Role for the State

19. Vulnerability can relate to physical and environmental threat, particularly to changes to climate patterns and the ecosystems on which people depend. But vulnerability is also a social condition, shaped by prevailing economic and institutional contexts, land use patterns, agriculture and forestry policies, and particularly the distribution of productive resources.⁶ From a human development perspective, vulnerability can be conceptualised as a set of entitlements and '*it is the structure or architecture of these entitlements which underpins both security and vulnerability.*' (Adger 2002, p5). This architecture is changing rapidly in Viet Nam. The *doi moi* ('renovation') process launched in 1986 began the transition from a centrally planned, command economy to a market economy. The central role that the state has played in collective security in the past is changing as a result, and this has important consequences for the poor, who lack the resources and ability to invest to absorb climate related risks, or to recover from extreme events once they take place. The poor are also most at risk from climate extremes because they have little diversity in their income sources, with migration an increasingly important coping strategy to mitigate these risks.

3.2 Rising Inequality and Collective Protection

20. The sweeping reforms associated with the *doi moi* process have dramatically increased average household incomes in Viet Nam, and resulted in far greater levels of economic security through which to respond to climate-related disasters. However, income inequality gaps are also becoming prevalent, and there is some evidence that this is affecting long-standing practices of communal risk management which provided a bulwark for the poor against climate threats (Adger 2002). Collective building and maintenance of sea dykes is a traditional risk reduction activity. In the past, agricultural collectives mobilised ten days of

⁶ Vulnerability has been described as: '*the capacity of individuals and social groups to respond to, that is, to cope with, recover from or adapt to, any external stress placed on their livelihoods and well-being*' (Adger & Kelly 2000, p325).

household labour to repair dykes, but this has now been replaced by a tax for coastal protection, with better-off households no longer able or willing to afford the opportunity cost (in terms of lost income potential) of collective labour protection. There is no evidence that this has weakened sea defences, in fact quite the opposite, infrastructure for sea defences is widely perceived to have improved in recent years with increased national wealth and infrastructure investment. But those that remain poor lack better-off households' newfound individual ability to exploit economic opportunities, or to cope individually with disasters and absorb risks, and can be more vulnerable to shocks as a result of increasing hazards and fewer livelihood opportunities, as the following examples demonstrate.

3.3 Privatisation of the Commons, the Rise of Aquaculture and the Impact on the Poor

21. Economic reform has fundamentally altered property rights, with access for the poor to common property resources severely curtailed. Mangrove in particular has suffered as a result, though it is a highly effective form of defence against storm surges. The poor are particularly dependent upon mangroves for livelihood and food, but the privatisation of coastal lands has resulted in vast swathes of mangrove disappearing, especially for aquaculture, with consequences both for the livelihoods of the poor and for coastal zone protection: *'The rehabilitation of mangrove areas can provide a dual benefit in improving the livelihood of local users as well as enhancing sea defences, providing a precautionary, win-win approach to climate impact mitigation'* (Kelly et al. Undated, p342).

22. The development of commercial aquaculture in coastal areas is also structurally changing the nature of local economies and social relations, and increasing vulnerability to climate change. Aquaculture is capital-intensive and is consequently not an avenue readily open to the poor. As aquaculture increases in scale, increasing income inequalities emerge which further undermines communal solidarity and the 'old' traditions of collective protection. Aquaculture is also accelerating the trend towards commercialisation of formerly common property resources, with Adger observing that in the former district of Xuan Thuy in the Red River Delta: *'the concentration of wealth and capital [is] restricting [the] access of a larger proportion of the population from resources for buffering the impact of external [climate change-related] shocks.'* (Adger 2002, p30)

4. The Institutional & Policy Environment for Climate Change Response

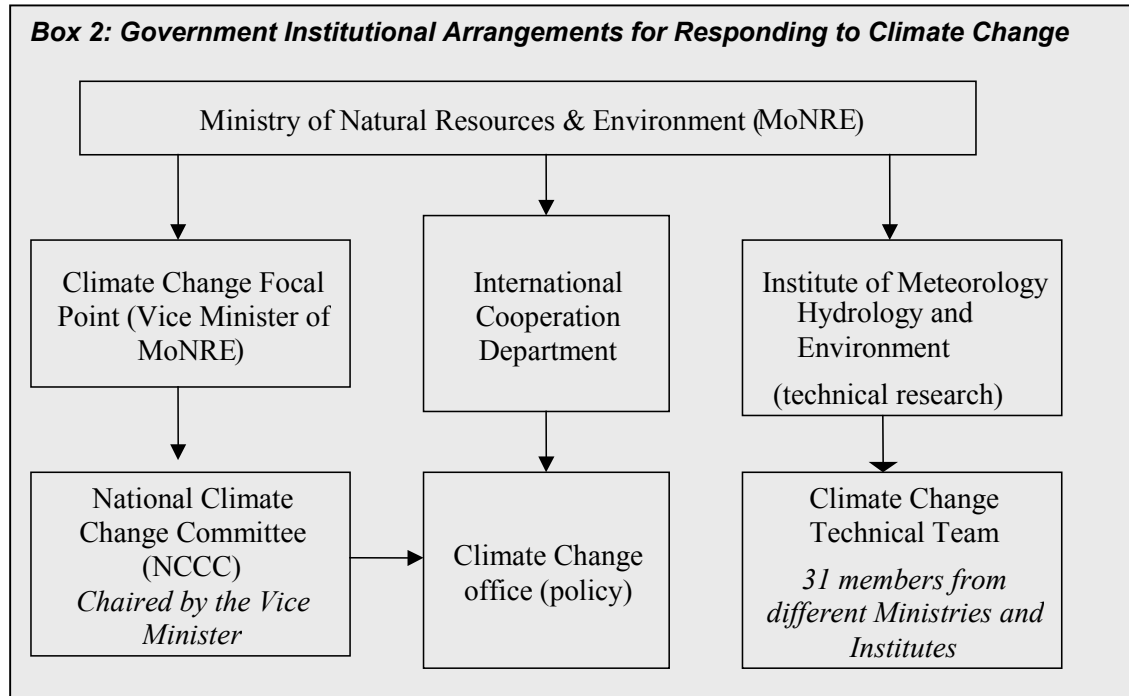
4.1 International Agreements and the Initial National Communication to the UNFCCC

23. Viet Nam recognized the threat posed by human-induced climate change by ratifying the UNFCCC in 1994 and the Kyoto Protocol in 2002. To date, the Government has mainly focused on inventories and the reduction of greenhouse gas emissions. The Initial National Communication (INC) to the UNFCCC (MoNRE 2003) only explored climate change impacts and necessary adaptation measures in a preliminary and qualitative way. A series of sector assessments were made and adaptation options identified, but these did not include socio-economic analysis, and they have not yet been followed by specific programmes. More in-depth vulnerability and adaptation assessments and the preparation of a policy framework for implementing adaptation measures are currently being undertaken for the Second National Communication (SNC) to the UNFCCC, which should be completed by 2009.

4.2 Responsibility for Climate Change Response

24. The Ministry of Natural Resources and Environment (MoNRE) is the national focal agency for climate change related activities, and an organogramme of MoNRE's climate change-related offices is presented in Box 2. Groups of technical experts from several sectors, including one for vulnerability and adaptation to climate change, have been established to assist in the implementation of climate change projects. Climate change adaptation measures have been included in a number of recent laws and strategies, such as

the National Strategy for Environmental Protection (2005), which includes measures for reducing the impact from sea level rise in coastal zones. In early 2006, the MoNRE-based International Support Group on Natural Resources and Environment (ISGE) established a climate change adaptation working group, which provides a forum for dialogue and should promote coordination for climate change adaptation measures.



4.3 Institutional Arrangements for Disaster Risk Management and Response

25. Viet Nam already has an extensive long-standing institutional response system for natural disasters such as floods and typhoons, reflecting the country's vulnerability to these events. Disaster risk management activities are coordinated primarily by the Central Committee for Flood and Storm Control (CCFSC, founded in 1955), chaired by the Minister of Agriculture and Rural Development. Other members of the CCFSC include relevant line ministries, the Department of Floods and Storm Control and Dyke Management, the Disaster Management Centre, the Hydro-meteorological Service, and the Viet Nam Red Cross (VNRC). The Natural Disaster Mitigation Partnership (NDM-P) is made up of Government, NGOs and donors to promote dialogue and common ways of working, and support coordination for implementation of the Second National Strategy and Action Plan for Disaster Mitigation and Management (discussed below).

26. The CCFSC is responsible for gathering data, monitoring flood and storm events, issuing official warnings and coordinating disaster response and mitigation measures. The authorities in all localities and each sector ministry also have committees for flood and storm control (CFSCs). Local CFSCs at the provincial, district and commune levels are responsible for coordination of flood and storm measures; organising dyke protection, flood and storm preparedness and mitigation; and flood recovery and rehabilitation (EU/MWH 2006). Sector committees support with technical assistance, materials and equipment. The system of CFSCs is important for sharing information on damage and also relief needs, communicating early warning information, damage assessments, co-ordinating rescue during floods, and protecting dykes and other infrastructure. Viet Nam's mass organisations are also crucial in disaster response, with the Fatherland Front raising and dispersing considerable relief funds and supplies, for example during the 2000 and 2001 floods in the Mekong Delta (IFRC 2002). The VNRC is operating throughout the country from national to commune level and works on awareness raising, disaster preparedness, response and prevention.

4.4 The Policy Framework for Disaster Risk Management

27. Viet Nam's policy framework for disaster management is set out in the Second National Strategy and Action Plan for Disaster Mitigation and Management 2001-2020. This Strategy prioritises increased awareness-raising and participation, minimizing loss of life and assets, and stresses the importance of co-existence with floods in situations which demand it. Other key initiatives of the Second National Strategy include: establishment of disaster forecast centres in the north, centre and south of the country (for different disasters); construction of flood corridors and flood retention areas in southern Viet Nam; the use of advanced information and communication technology; strengthening the role of schools and the media in awareness-raising; maintaining and upgrading equipment for local Flood and Storm Control Committees; and a proposal for a national disaster fund for projects on disaster mitigation and preparedness, and setting up a disaster insurance company.

28. The Second National Strategy is still, however, designed principally to address short-term climate extremes rather than to respond to future climate change, and focuses on emergency response and reconstruction, rather than risk prevention and adaptation. There is also a marked lack of integration between disaster risk reduction policies and wider policies for rural development and poverty reduction, with little cross-sectoral integration or coordination, either in policy, or practice. A recent study of institutional arrangements for climate change response concludes that: *'Integration of institutions engaged in disaster management, climate risk and development remains a weakness in Viet Nam, but there are positive examples of coordination to build upon, including the multi-scale framework provided by the CFSC system and the NDM partnership for Central Viet Nam'* (EU/MWH 2006, p27). There is limited Government ownership yet of an adaptive approach to future climate-related risks, and limited financing available for climate change adaptation.

5. Viet Nam's Current Climate Change Responses & Adaptation

5.1 Coastal Defences: Dyke Management and Mangrove Restoration

29. Physical protection from typhoons and rising sea water levels is provided by Viet Nam's extensive system of dykes – 5,000 km of river dykes and 3,000 km of sea dykes. Dykes and levees have existed for over 1000 years. Local government remains responsible for sea dyke protection. In the past there was an extensive system of labour contributions for building and maintaining dykes, but this has increasingly been replaced by a system of hired labour and local taxes. An Oxfam GB programme in Ky Anh district, Ha Tinh province in the 1990s showed that support provided to local communities in organising and mobilising for sea dyke strengthening and maintenance improved collective security and enabled local people to invest in improving the productivity of their land. This provided a viable alternative to out-migration for vulnerable coastal communities. Coastal mangrove plantation is also an important and highly effective form of coastal protection from storm surges following tropical storms and cyclones. As an illustration, it is estimated that in Kien Thuy District, a 4-metre high storm surge from storm number 7 in 2005 (typhoon *Damrey* – see annex) was reduced to a 0.5m wave by extensive restored mangroves (Jegillos et al. 2005, in EU/MWH 2006). Both international donors and NGOs have successfully supported coastal communities in mangrove restoration.

5.2 Disaster Early Warning Systems

30. Disaster warning and preparedness is a key aspect of Viet Nam's response to climate related threats and disasters. UNDP has long supported Viet Nam in improving early warning for disasters, gathering and reporting damage data, and in connecting Viet Nam's hydro-meteorological data services and CCFSC to the national media in order to make information more readily and more widely available. The Government is continually upgrading capacity in

this regard and satellite data are expected to be available in 2008 from Viet Nam's own satellite, Vinasat. Real time meteorological information is also available from China and Japan's meteorological agencies, but improvements in information collection and communication are especially needed to prevent the large loss of life through the sinking of boats as occurred in the East Sea in 2006 during typhoon *Chanchu* (see annex). The national typhoon warning system delivers a 48-hour warning, broadcast through the media and locally via loudspeakers, and during the typhoon season dykes are monitored 24 hours a day (EU/MWH 2006). The CCFSC also disseminates reports by electronic mail. However, despite recent improvements the system is still in need of improvement.

5.3 Vulnerability and Climate Change in the Mekong Delta

31. Devastating floods hit the Mekong Delta in 2000 and 2001, and were some of the worst in living memory. 481 people were killed in 2000 and 393 in 2001, the majority children, and in total, 900,000 houses were damaged in 2000, and 350,000 in 2001 (see annex). A similar number of people died in 2001, but lessons were learnt between the two floods and measures were implemented, which ensured that other impacts in 2001 were not as severe as those of the previous year, even though the two floods were very similar. With the experience of the 2000 floods, Government departments and mass organisations mobilised staff, distributed literature, organised meetings, visited households and warned of rising flood waters. Fewer pupils missed school for extended periods, as new schools were made flood-proof. Awareness-raising after the 2000 floods concentrated on schools to reduce child fatalities, but many of the poorest children could not attend school as they had to work (in fishing and agriculture) and thus remained extremely vulnerable during floods. Day time child care centres were established which improved infant safety for some during the floods, including some poor parents who are reliant upon a daily wage to feed their families. Women volunteers through the Women's Union were key in staffing these centres, with several reporting that their prestige increased as a result. Safe water campaigns were launched, and people were also mobilised to clean up their local environments once the flood waters receded, in order to avoid epidemics. Also important is that following the 2000 floods several aid organisations distributed boats, which are used as a means of transport and for fishing during floods and in normal times (IFRC 2002). Such programmes were also implemented after the 2001 floods, with a focus on the poorest people.

32. The policy slogan during and after this time was 'living with the floods', which reflects a realisation that ever higher dykes in the Mekong Delta are not the answer to seasonal floods, that fields and forests must store flood water instead, and that people's livelihoods must adapt. Government has subsequently launched a programme of safe settlement areas for home relocation and the raising of homes above flood levels so that evacuation will no longer be necessary (IFRC 2002). However, there have been delays with this large-scale construction and relocation programme, and some resistance to moving, especially because the settlements limit people's access to canals and their fields, in non-flood times as well as during floods; moving would limit the access to fishing, which is a critical survival and livelihood strategy.

33. The risks, both of Mekong Delta floods and also of droughts, are increasing with expected higher intensity rains in the rainy season and intensified dry spells. Rice crops, and therefore farmers' livelihoods are expected to be seriously vulnerable to these risks, but many mitigation measures are also already known and being tried, at the farm level (e.g. changing seed varieties and crops, diversifying to non-farm techniques and seasonal migration), at the community level (e.g. enhancing, protecting common resources such as fish ponds, developing village funds and shared processing facilities) and at the national level (e.g. infrastructure investments, research & development, strengthened information systems) (Suppakorn et al. 2006).

5.4 Climate Change Adaptation in the Central Coast Region

34. Research on the impacts of climate change in central coastal zones and the Red River and Mekong River Deltas was already initiated some time ago (MHC et al., 1996 and CERED), and more is underway. Climate change adaptation projects are particularly emerging in the Central Coast Region. Most project activities focus on local levels (province, district or commune) and are linked to or integrated within ongoing support by donors and international NGOs to national entities and communities for drought, flood and typhoon preparedness and response. Recent initiatives include projects on safer housing (see Box 3),⁷ projects for safer villages and safer production in high risk communities (by CECI), and integration of risk reduction and mitigation in local development planning and reduction of vulnerability to climate change through ecosystem management (by IUCN). The VNRC with support from the Netherlands Red Cross (NRC) implemented a climate change project in five coastal provinces over the period 2003-2005. This project developed documents on climate change impacts and adaptation, and helped assess vulnerabilities and capacities in thirty of the most vulnerable communes and also raised awareness and built capacities of local people. It also trained VNRC staff and volunteers at different levels, and raised awareness amongst decision-makers. The VNRC with NRC support have also embarked upon a *Reforestation for Adaptation to Climate Change* project in Quang Binh province, to stabilise coastal sand dunes with casuarina trees and to support poor people's livelihoods. The SNV (Netherlands Development Organisation) with the VNRC are exploring further work in the same province with financing through the Clean Development Mechanism.

35. Other efforts to adapt to climate change include a forum to improve capacity in water resource management in the light of increased weather variability hosted by the CPWC, and work on developing effective ways for farmers in Quang Tri province to use seasonal climate

Box 3: Promoting Appropriate Storm Resistant Housing in Central Viet Nam

Development Workshop (DW) has helped communities in Central Viet Nam since 1999 to reduce their vulnerability to climate-related hazards, including whirlwinds, floods and tropical storms and typhoons. Cyclone *intensity* appears to be increasing and at grass-roots level various social and economic factors have contributed to increased vulnerability of urban and rural communities to the impact of climate-related disasters.

Two social groups are particularly at risk: the extreme poor, who live in extremely fragile conditions which the Government attempts to alleviate through its temporary house replacement programme; and those who have improved their housing through their own efforts. The risk of loss and damage to housing is however increasing because families do not apply the basic rules of storm-resistant construction – so that costly materials and structures are easily destroyed – and the trend towards a more urban form of house with very flat roofs with a high risk of damage.

With support from the European Commission, DW promotes the application of storm-resistant principles in existing and new housing in Central Viet Nam. Typhoon Xangsane in October 2006 caused extensive damage to property but many families were quick to apply DW principles in their reconstruction work. The Thua Thien Hue provincial authorities issued a decision in October 2006 instructing local authorities and the population to apply the ten key storm-resistant construction principles introduced by DW.

This initiative highlights how disaster prevention has to start at the community level, and that for projects to have a broad impact families need both financial and technical assistance. Such support needs to be underpinned by Government to have a real and large-scale impact.

<http://www.dwf.org/vietnam/phongchongbao/index.htm>

⁷ Development Workshop's ten key points for typhoon-resistant construction are: choose the location carefully to avoid the full force of the wind or flood; build a house with a simple shape to avoid negative pressure; build the roof at an angle of 30° to 45° to prevent it from lifting off; avoid wide roof overhangs and separate the veranda structure from the house; make sure the foundations, walls, roof structure and roof covering are all firmly fixed together; reinforce the triangular bracing in the structure, strengthen walls to increase stiffness; make sure the roof covering is attached to the roof structure to prevent it from lifting; match opposing openings; use doors and windows that can be closed; plant trees around the house as wind breaks and to reduce flow of water.

information (by ADPC). Research is ongoing on how to mainstream climate change vulnerability and adaptation into socio-economic development, drought response and mitigation projects, and on measures to adapt to climate change impacts on water systems and river flow in the Huong River Basin (by IMH and NCAP). The latter includes research on needs and possible support to livelihoods for vulnerable fishing communities, including livelihood diversification through training and micro-finance programmes, and improving fishing rights and regulations and the restoration of mangroves (Trap 2006).

36. Both Oxfam GB and UNDP-VN's GEF-Small Grants Programme support livelihoods in Ninh Thuan province, which is one of the poorest provinces in Viet Nam's south central coast. It is affected more than any other part by drought, and also by typhoons and floods (see also Box 4). Small, community-based projects have registered some successes, for example in improving land management in the face of desertification that is intensified by climatic drought. The awareness of climate change adaptation within the local authorities has increased and they are allocating funds to several activities. They also have further plans to mitigate the impacts of drought through extending irrigation facilities by establishing deep wells and open wells, and other longer-term adaptation measures, which include: the preparation of hazard vulnerability maps; training farmers in better water management practices and in promoting higher crop productivity; the introduction of high-yielding, quick-growing and temperature-resistant seeds; extensive small-scale irrigation schemes; micro-finance support for women's small-scale enterprises as a diversification measure away from agriculture; and training on new, temperature-resistant shrimp breeds.

Box 4: Community Perceptions of Climate Change in Ninh Thuan Province

The central coast region is most severely affected by drought, with an estimated 1 – 1.3 million people classified as drought-affected in the nine central provinces of the country. Ninh Thuan province is situated in the typhoon belt of Viet Nam and has the lowest average rainfall in the country, with the highest temperatures.

Recent research work into community perceptions and adaptation responses to climate change in Ninh Thuan shows that, despite popular perceptions of declining rainfall, in fact there is an overall increase in mean annual rainfall, as well as in mean annual minimum temperatures in Ninh Thuan. Higher rainfall variability is the main issue, both between years, and within individual years.

The research found that the drought conditions impact on crops and livestock, and women, children and old people were perceived to be most at risk, through extreme heat and malnourishment. The research also highlighted how increasing human demands on the environment are exacerbating climate change impacts. Groundwater extraction for agriculture has spiraled in recent years, with maize production increasing year on year between 1992 and 2005. Forested areas in the study sites declined. Aquaculture production has mushroomed, with an enormous increase in both area for production, and yield, between 1995 and 2001, but recent steep declines are attributed to drought, pollution and decreased profitability.

(Source: Kyoto University & Oxfam GB 2007)

37. Recent research in Ninh Thuan shows indeed how communities are adapting to climate change, for example by using more drought-resistant seed varieties, and making changes in the cropping calendar to deal with the effects of drought. They are adapting animal husbandry practices too, through changing animal breeds and exploring drought-resistant fodder sources (Kyoto University 2007). However, especially some of the poor ethnic minority communities (e.g. the Cham group) have been strongly affected by recent droughts and also floods (for example in late 2005). Options for climate change adaptation are shaped by people's entitlements to access and use resources, and the unequal allocation of resource rights and opportunities remains a primary constraint to effective adaptation to climate change for the poor. There is a need for strongly increased investment in support of their livelihoods and the natural resources on which they depend, especially in the face of increased risks from climate change. But there are national interests that may add to

pressure on local land and water, for example long term plans to develop nuclear power, with a nuclear power plant planned for Ninh Thuan province.

6. Conclusion: Responding to the Climate Change Challenge

38. Climate change is a very real threat to Viet Nam's continued socio-economic development. Increasingly erratic and variable rainfall, higher temperatures, more intense extreme weather events like typhoons, droughts and heavy rainfall causing floods, and the rising seawater level will all have significant impacts across sectors, regions, and income groups, and particularly on livelihood security of the poorest rural people. The threat of climate change is beginning to be acknowledged but information and awareness remains at a low level. Viet Nam does not yet have national or local climate change adaptation strategies, and national and local capacity-building is urgently needed to ensure that policy responses are adequate and effective. Coordination between line ministries also needs to be urgently improved, and cooperation with international agencies and NGOs enhanced so that climate change can be addressed in an integrated way with long-term socio-economic and poverty reduction efforts. Crucially, those most at risk from climate change, the rural poor living in provinces most affected by climate change have limited information or financial and technical support to adapt to their changing world, despite some localised successes. Their direct experience of climate change impacts should be incorporated into future responses, and solutions sought that build upon existing local adaptation practices, where appropriate. The 'at risk' poor should also be key participants in the planning and implementation of future climate change adaptation measures, particularly where these require relocation or significant dislocation of existing livelihood practices.

39. Vulnerability to climate change is intimately linked to poverty, and the best long-term adaptation measure for the most vulnerable remains reducing poverty in all its forms. Urgent measures that would increase incomes and strengthen livelihood resilience include encouraging risk-spreading through income diversification; respecting common property management rights; and promoting collective security, for example by enabling local vulnerability and capacity assessments and strengthening disaster preparedness, including early warning systems and mitigation measures such as dyke reinforcement and forestation.

40. The concept of climate change, its potential impacts and the need for adaptation are not yet well known in Viet Nam beyond a small community of experts and development workers, some concerned state management agencies, and some localities (which have benefited from climate change-related projects). To improve on this requires strengthened communication, and comprehensive research on the possible impacts of climate change on the Vietnamese economy and key development goals, particularly poverty reduction. And little is known yet about the potential social and economic implications of, for example, sea level rise on settlements and agriculture, or changes in climate conditions that could result in significant numbers of 'climate refugees'. Research is needed on the most effective long-term adaptation measures and strategies to ensure human well-being and continued economic growth and poverty reduction.

List of Acronyms

ADPC	Asian Disaster Preparedness Centre (based in Bangkok)
CCFSC	Central Committee for Flood and Storm Control
CFSC	(local) Committee for Flood and Storm Control
CECI	Canadian Centre for International Studies and Cooperation
CERED	Centre for Environment Research Education and Development (an NGO)
CPWC	Cooperative Programme on Water and Climate (hosted in the Netherlands)
DW	Development Workshop
GEF	Global Environment Facility
IFRC	International Federation of the Red Cross and Red Crescent
IMH	Institute for Meteorology and Hydrology (under MoNRE)
INC	Initial National Communication (to the UNFCCC)
IPCC	Intergovernmental Panel on Climate Change
ISGE	International Support Group – Environment and Natural Resources (MoNRE)
IUCN	World Conservation Union
MDGs	Millennium Development Goals
MHC	Marine Hydrometeorology Centre
MoNRE	Ministry of Natural Resources and Environment
NCAP	Netherlands Climate Assistance Programme
NDM-P	Natural Disaster Mitigation Partnership
NRC	Netherlands Red Cross
Oxfam GB	Oxfam Great Britain
SGP	Small Grants Project
SNC	Second National Communication (to the UNFCCC)
SNC	Netherlands Development Organisation
UEA	University of East Anglia (UK)
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
VASS	Viet Nam Academy of Social Sciences
VNRC	Viet Nam Red Cross

Annex Major recent natural disasters in Viet Nam & their impacts

Natural disaster	No. people killed, missing / injured	Major impacts <i>(official data supplied by the CCFSC)</i>	Estimated loss (USDm)
Floods in the Red River Delta region, 1996	89, 0 / 82	<ul style="list-style-type: none"> - 84,265 houses collapsed and flooded - 1,313 class rooms damaged - 57,900 ha of rice paddy flooded - 11,675 ha of farmland damaged - 806 ha of fish and shrimp ponds flooded - 178 tons of fish and shrimps destroyed 	30
Typhoon Linda in Ca Mau province, 1997	778, 2123 / 1232	<ul style="list-style-type: none"> - 312,456 houses collapsed and damaged - 7,151 schools damaged - 348 hospitals and health centres flooded and damaged - 323,050 ha of rice fields damaged - 57,751 ha of farmland flooded and damaged - 136,334 ha of fish ponds flooded - 7,753 ships and boats damaged 	450
Droughts in 1997, 1998		<ul style="list-style-type: none"> - heavy crop losses in especially the central regions 	NA
Floods in the Central Region, 1999	721, 35 / 476	<ul style="list-style-type: none"> - More than 1 million houses damaged - 5,915 class rooms damaged - 701 hospitals and health centres flooded/damaged - 67,354 ha of rice fields flooded - 98,109 ha of farmland damaged - 41,508 ha of fish and shrimp ponds flooded - 1,335 tons of fish and shrimps destroyed - 2,232 ships and boats sunk 	300
River floods in the Mekong Delta, 2000	481, 1 / 6	<ul style="list-style-type: none"> - 895,499 houses damaged - 12,909 class rooms damaged - 379 hospitals and health centres flooded/damaged - 401,342 ha of rice fields flooded and damaged - 85,234 ha of farmland damaged - 16,215 ha of fish and shrimp ponds flooded - 2,484 tons of fish and shrimps destroyed 	250
River floods in the Mekong Delta, 2001	393, 1 / 0	<ul style="list-style-type: none"> - 345,238 houses damaged - 5,315 class rooms damaged - 20,690 ha of rice fields flooded and damaged - 1,872 ha of farmland damaged - 4,580 ha of fish and shrimp ponds flooded - 969 tons of fish and shrimps destroyed 	100
Damrey typhoon in Northern and North Central Coast regions, 2005	10, 0 / 11	<ul style="list-style-type: none"> - 113,431 houses damaged - 3,922 class rooms damaged - 2,227,627 ha of rice fields flooded and damaged - 55,216 ha of farmland damaged - 21,193 ha of fish and shrimp ponds flooded - 1,300 tons of fish and shrimps destroyed 	200
Chanchu typhoon in the Central Region, 2006	19, 249 / 1	<ul style="list-style-type: none"> - fishing boats sunk in the East Sea (=South China Sea) 	2
Xangsane Typhoon in the Central Region, 2006	72, 4 / 532	<ul style="list-style-type: none"> - 349,348 houses collapsed and damaged - 5,236 class rooms damaged - 21,548 ha of rice fields flooded and damaged - 3,974 ha of fish and shrimp ponds damaged - 494 tons of fish and shrimps destroyed - 951 ships and boats sunk 	650

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