

**INDICATORS OF SOCIAL AND
ECONOMIC VULNERABILITY TO
CLIMATE CHANGE IN VIETNAM**

by

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Abstract

This paper outlines a framework for analysing social vulnerability to the impacts of global warming-induced climate change in the context of an agrarian centrally planned country in transition to a market economy. This approach explicitly highlights the winners and losers in adaptation, based on the concepts of entitlements and social vulnerability. An approach to defining and observing social vulnerability is proposed and an illustration of the approach is outlined for the impacts of climate extremes in rural Vietnam. Vulnerability is the exposure of individuals or collective groups to livelihood stress as a result of the impacts of climate extremes and climate change. The framework therefore suggests that social vulnerability to climate change is made up of individual and collective aspects which can be disaggregated, but are linked through the political economy of markets and institutions. The indicators of individual vulnerability are the incidence of poverty and the riskiness of income sources to extreme events. Changes in collective vulnerability are indicated through changes, in distribution of resources within a population, and by institutional changes which can either enhance security or exacerbate vulnerability.

Field based research in one agricultural District in northern Vietnam gives an empirical example of the implementation of this theoretical framework. Results show that baseline social vulnerability is enhanced by some institutional and economic factors associated with Vietnam's economic transition from central planning, known as *Doi Moi* or renovation, namely the breakdown of collective action on protection from extreme events; increasingly skewed income; and increasing non-farm investment in aquaculture and other resources. Poverty, as measured through poverty severity and other composite indices, is falling in the case study area, and hence economic growth is shown to be enhancing security through reducing individual risk. A model of changes in inequality parameters and decomposition of these by income source, shows that increasing reliance on aquaculture in coastal Districts Vietnam is both driving income inequality and increasing livelihood risk. Offsetting these trends are other institutional changes associated with the dynamic nature of the economic restructuring and evolution of the market transition in Vietnam, which enhance security and decrease baseline vulnerability. The paper concludes that the economic structural causes of vulnerability can be determined within such a framework which expands on the present analysis of vulnerability within climate impact analysis. It further suggests policy lessons for economies in transition in the areas of public policy for poverty alleviation and environmental management.

1. Introduction

This paper outlines a conceptual model of social vulnerability to climate change in order to better understand the processes of social adaptation to climate change impacts, particularly in rural agrarian societies by examining present day vulnerability to extreme events. Social vulnerability is the exposure of groups or individuals to stress as a result of social and environmental change, where stress refers to unexpected changes and disruption to livelihoods. This definition emphasises the social dimensions of vulnerability, in contrast to the predominant views on vulnerability to the impacts of climate change which concentrate on the physical dimensions of the issue. A set of indicators is developed to examine the relative vulnerability of any given set of individuals or social situation. These concepts are applied to a case study District in northern Vietnam, demonstrating that present day climate extremes as well as social and economic change result in an evolving state of vulnerability with offsetting and interlocking social, economic and institutional facets.

There is a critical need to understand the processes by which adaptation to global environmental change comes about, and the implications of these processes for present day vulnerability to these changes. Such enhanced understanding informs both the scientific community and policy-makers of the underlying causes of vulnerability, and the potential policy for ameliorating such vulnerability. The political and environmental context is that of global climate change, through examining present day vulnerability to climate extremes.

At present there is agreement, at least in principle, by the world's governments that human impacts on the global climate system are significant. They further agree that these impacts are important enough to demand co-ordinated international action. However, the five years since the signing of the UN Framework Convention on Climate Change at the Earth Summit in 1992 have resulted only in frustration that this apparent scientific consensus is undermined by inaction demonstrated at the Kyoto Agreement of the Convention in December 1997. The continued global rise in greenhouse gas emissions projected for the remainder of the 1990s and the early part of the next century will ensure that global climate change will not be avoided (Bolin, 1998; Wigley *et al.*, 1996). Even if there were concerted international action, however, the projected impacts of the enhanced greenhouse effect, namely changes in the global climate system, will occur. The world is therefore committed to adapting to a changed climate system in all its manifestations. This makes the understanding of adaptation and coping mechanisms, and hence the state of vulnerability, one of the most important research issues within the area of global environmental change.

The central insight brought by social scientists to the process of adaptation is that vulnerability is socially differentiated. Vulnerability is not the same for different populations living under different environmental conditions or faced with complex interactions of social norms, political institutions and resource endowments, technologies and inequalities. The causes of vulnerability are related to the environmental threat and fundamentally to the economic and institutional context. Indeed changes in the social causes of vulnerability often happen at much more rapid temporal scales than some of the environmental changes.

The impacts of extreme climate events are therefore the principal climate phenomenon enhancing vulnerability: hence understanding of vulnerability to climate change should be based on the analysis of present day vulnerability informed by historical perspectives (Adger, 1996). High and uncertain impacts from extreme climate events are a global phenomenon. These impacts can only be ameliorated to a limited extent by technological advance and resources and income. Indeed, the institutional context of vulnerability to extreme events is a dominant determinant of vulnerability. As Ben Wisner wrote almost twenty years ago, in the context of hazards more generally:

‘The systematic comparison of individual and societal response to disaster in social formations dominated by different modes of production (e.g. feudal, capitalist, socialist) is a potentially rich scientific undertaking, but one largely neglected’ (Wisner, 1978, p.80).

The area has indeed remained largely neglected in the twenty years since then, as evidenced by recent assessments of physical vulnerability to climate change. The evidence assembled for the IPCC’s 1995 Second Assessment Reports, examines the potential climatic threats, but does so by concentrating on the regions or ecosystems which are threatened: forests, agriculture, and coastal regions for example. This approach, making both physical and social systems the object of analysis, is applied in the Second Assessment Report (Watson *et al.*, 1996) to impacts on human health, water resources, ecosystems and physical infrastructure. For example, the IPCC report estimates that 46 million people per year are currently at risk from flooding due to storm surges in the world’s coastal zones, and that climate change induced sea level rise, in the absence of adaptation, could double this figure (IPCC, 1996, p.12). The IPCC assessment provides generic guidelines for appraising multiple threats in a single region, but does not, however, address what Wisner (1978) was alluding to: namely differentiated social vulnerability under different threats and under different economic and institutional circumstances; and the coevolution of those economies, institutions and social orders with the climate system.

2. Origins and Theoretical Perspectives on Vulnerability

The idea of social vulnerability to external change and stress is at the centre of much research into human adaptation and interaction with the physical environment. This is particularly the case where social and natural scientists have attempted to explain the role of hazards and of periodic and extreme events within the cycle of resource use. Human life and livelihood is at risk from natural phenomena such as earthquakes, volcanoes, floods, droughts, tsunamis and other hazards with human origins (e.g. Varley, 1994; Smith, 1996; Hewitt, 1997). In these cases vulnerability has been used to describe the state of risk, usually associated with a geographical location rather than with individuals or social groups.

There have been three major approaches to the study of natural hazards. Firstly there are engineering approaches to hazard management which stress objective risk (summarised in Smith, 1996 for example). Secondly a related social science approach stresses the management of such risks by institutions such as governments and markets. A third approach is a critique of both of the previous technical natural and social science approaches, which stresses structural social causes of vulnerability to hazards. Hewitt (1983) and colleagues initiated this third approach in the 1980s, providing a challenge to what they regarded as a dominant view which described the causality of risk from hazards as ‘running from the physical environment to its social impacts’ (Hewitt, 1983, p.5). Thus even social science analysis of hazards, up to that point, were primarily ‘technocratic’ and prescriptive, by incorporating the human element in hazards as an input to designing planning, warning and coping systems. The radical reversal suggested by Hewitt (1983) and others, was to emphasise economic and social structure as a *cause* of vulnerability, rather than as a contribution to hazard mitigation. The causes of vulnerability to hazards under the Hewitt (1983) approach are therefore lack of access to resources: poverty and marginalisation translate into vulnerability through the mechanisms of coping behaviour and stress.

Within the social sciences, at least within geographical approaches to hazards, this third conceptualisation of hazards has gained greater credence. This credence is reflected in later work by Kaspersen *et al.* (1995), who review the concepts surrounding vulnerability in the context of an assessment of critical ‘regions at risk’ from environmental change. They conclude that vulnerability ‘appears to be emerging as the most common term in ... discussions of the differential susceptibility of social groups and individuals to losses from environmental change’ (Kaspersen *et al.*, 1995, p.11).

The origins of the use of vulnerability to describe the state of society environment interactions under stress lead to a number of general observations on vulnerability which can be applied in the climate change context. Vulnerability has an historical and time dimension; is related to economic aspects of livelihood and land use; power and political dimensions are important in contextualising vulnerability; individuals and groups exhibit differential vulnerability; and extreme events are the key climate change context. Thus vulnerability for individuals or groups can change over time; is differentiated between and within groups through their institutional and economic position; and is affected by environmental change. Existing policies and practices in agriculture, forestry and coastal resource management, as well as the inequitable distribution of productive resources, in themselves can have perverse effects of increasing vulnerability, and hence can be 'maladaptive' (Burton, 1997). Stress, under this definition, is associated with unplanned disruption and can incorporate the coping and recovery aspects of vulnerability.

The social vulnerability approach developed in this paper integrates both economic and other social science perspectives to vulnerability. It is also novel in applying these concepts in the context of long term environmental change associated with climate change. The empirical research is based on present day risk rather than scenarios of future risks. Hence the model is relevant for climate risk assessment, and represents a departure from the approaches within assessments of the impacts of global climate change to date.

3. Defining and Operationalising Vulnerability to Climate Change

The essential features of a model of social vulnerability to climate change is firstly that it focuses on social aspects of the phenomenon. Ultimately, understanding of present climate variability on society will reduce the impacts of climate change on individuals and society. An approach to vulnerability based on human welfare leads to environmental changes associated with climate change gaining significance when they impact on the relative and absolute well being of individuals and groups: in the words of O'Keefe and colleagues (1976), 'without people, there is no disaster'.

A theory of vulnerability to climate change must also encompass the collective nature of vulnerability of a group or community to the impacts of climate change, involving a complex set of factors, including the institutional arrangements for preparedness for hazards. With greater numbers of social factors involved in collective vulnerability (gender, ethnic and other differentials of vulnerability - see Blaikie *et al.* (1994)), as well as the nature of different climate-related hazards, an exclusive focus on economic and material aspects of vulnerability has been argued to be misplaced. For example, while Cannon (1994) agrees that assets tend to be redistributed after a flood or drought in accordance with the pre-existing patterns of ownership (hence income and assets are a suitable indicator of vulnerability), some impacts of events such as floods are not correlated with wealth (Cannon, 1994, p.28), and economic criteria do not exactly reflect vulnerability. These diverse aspects determining vulnerability can be conceptualised as a set of entitlements: it is the structure or architecture of these entitlements which underpins both security and vulnerability (Adger and Kelly, 1998). Both resource availability and entitlements are difficult to observe and quantify because of their temporal dimensions and because they involve transactions and exchanges between different members of households. These potential rights and reciprocal social coping mechanisms and informal social security are fluid and often only exactly determined in times of crisis (Platteau, 1991; Moser, 1998).

Social vulnerability to climate change is therefore defined in this paper as *the exposure of groups or individuals to stress as a result of the impacts of climate change and related climate extremes*. Stress encompasses disruption to groups or individuals' livelihoods and forced adaptation to the changing physical environment. Vulnerability can therefore be explained by a combination of social factors and environmental risk, where risk are those physical aspects of climate related hazards exogenous to the social system. Vulnerability to climate change involves changes in these parameters over time. Change in social vulnerability from its baseline level incorporates notions of economic development, as well as adjustments to livelihoods based on adaptation to climatic conditions, and

changes in institutional and political structures. If institutions fail to plan for changing climatic conditions and risks, social vulnerability increases. It is helpful to disaggregate social vulnerability into the two distinct aspects of individual and collective vulnerability in order to clarify the scale issue and the unit of analysis.

Table 1: Collective and individual vulnerability to climate change: determinants and indicators

Type of vulnerability	Causes in relation to climate extremes	Indicators of vulnerability
Individual vulnerability	Relative and absolute poverty; entitlement failure; resource dependency.	Poverty indices; distribution and proportion of income dependent on risky resources; dependency and stability.
Collective vulnerability	Absolute levels of infrastructure, market development; institutional and political factors -insurance and formal and informal social security.	GDP per capita; relative inequality; qualitative indicators of institutional arrangements.

Individual (or household) vulnerability is determined by access to resources and the diversity of income sources, as well as by social status of individuals or households within a community. *Collective vulnerability* of a nation, region or community is determined by institutional and market structures, such as the prevalence of informal and formal social security and insurance, and by infrastructure and income (Table 1). Collective vulnerability is exacerbated by ‘exogenous’ environmental changes which will occur through climate change. The two aspects of vulnerability are obviously interlinked. At the community level social vulnerability is affected by relative distribution of income, access to and diversity of economic assets; and by the operation of informal social security arrangements. Further, vulnerability to climate extremes is determined by the institutional arrangements which organise warning, planning and other services summarised as ‘collective’ vulnerability in Table 1.

4. Indicators of Vulnerability

4.1 Poverty and vulnerability

Poverty is an important aspect of vulnerability because of its direct association with *access* to resources which affects both baseline vulnerability and coping from the impacts of extreme events. It is argued here that the incidence of poverty, as observed through the quantifiable indicator of income, is a relevant proxy for access to resources, in its multi-faceted forms. Resources and wealth in themselves do not constitute security since resources are mediated through property rights and access to them. Access in this context can be taken to mean 'involving the ability of an individual, family, group or community to use resources which are directly required to secure a livelihood. Access to those resources is always based on social and economic relations' (Blaikie *et al.*, 1994, p.48).

However, access to resources is difficult to observe and measure directly, and in that respect is similar to the concept of entitlements to resources (Sen, 1981; Fine, 1997; Leach *et al.*, 1997). Both are difficult to measure because of their temporal and seasonal dimensions and because they involve transactions and exchanges between different members of households. So, for example, households have the right to obtain credit in flood years in coastal Vietnam as long as they have maintained economic contributions to the agricultural co-operative. However, this right or entitlement is only observable when those circumstances arise because it is, more often than not, only a customary or verbal agreement. Similarly, the informal assistance between Communes in Vietnam may be concentrated among war veterans or other specific groups or associations. Again, these potential rights and reciprocal social coping mechanisms are fluid and often only exactly determined in times of crisis.

In addition, some aspects of access certainly are spatially manifest, but again are correlated with poverty. Poorer people tend to live in more 'marginal' and more hazardous areas, though the causality in this relationship is difficult to determine. Location affects the elements of poverty: in economic terms marginal areas have higher marginal costs of access. Transport to centres of distribution of government social security at times of hazard impacts, and the higher risk of marginal areas to hazards, such as poor housing susceptible to earthquake damage or land prone to flooding, are both elements in this spatial vulnerability-poverty interaction.

Access and entitlement to resources also have temporal dimensions, in that access to resources is a pre-requisite for recovery from the impacts of hazards. In addition, entitlements to resources extend the period before which a hazard results in emergency coping strategies, such as migration or the selling of non-productive assets. Access is secured through rights and responsibilities which themselves

change over time. The impacts of hazards on households include injury or mortality; temporary or permanent migration due to perceived risk or actual loss of land or other resources; and the loss of other capital and infra-structure. The net result of all these impacts is therefore on changes in poverty, through resulting lack of labour or capital. Such temporal changes in access to resources lead to a ‘ratchet effect’ (Chambers, 1983) in poverty, translating ultimately to changes in baseline social vulnerability over time.

Given certain conditions, poverty is a meaningful proxy for access to resources, and income is a good proxy for poverty. The state of income or consumption reflects, but is not exactly correlated with, the access to, or entitlement to, resources in most circumstances. The limits to this relationship are dependent on what Sen (1984) defined as entitlements, ‘the set of commodity bundles that a person *can* command in a society using the totality of rights and opportunities that he or she faces’, and which are in fact bound by legality or custom. In other words, opportunities to avoid poverty (such as by raising income) are often constrained by rights to buy or sell resources. As an example, households in coastal areas may have rights to subsistence use of products extracted from mangroves, but are legally barred from trading in these commercially. The household’s apparent income poverty does not in this case reflect lack of access to the resources, but rather lack of access to markets. Nevertheless, lack of income or lack of consumption in many cases captures many aspects of lack of resources, particularly where many goods and services are exchanged in markets.

Poverty is used in this study as an important indicator of individual vulnerability to climate extremes and to climate change, because poverty can be directly related to marginalisation and lack of access to resources which are critical when faced with the risk of hazards and the resultant stress on livelihoods. Income is taken as an economic indicator of poverty, recognising that this is an external measure of poverty but one which correlates with other aspects of poverty relevant for vulnerability, such as health indicators (Glewwe and van der Gaag, 1990). Poverty is evidently a multi-faceted phenomenon which can be distinguished by subjective, collective and objective definitions. Poverty definitions can encapsulate ‘basic needs’ in some absolute objective sense at one extreme, with ‘relative deprivation’ as a subjective measure at the other extreme (e.g. Baulch, 1996; Blackwood and Lynch, 1994). However, income is replicable and comparable across differing groups, and over time in particular locations, thus giving a picture of how baseline vulnerability changes over time and space. Recognising that this aspect of individual vulnerability deals only with entitlements to resources, other aspects of perceptions of risk and access or entitlement to resources are captured in the analysis of the institutional causes and interactions with vulnerability outlined under the heading of institutional adaptation below.

Poverty is therefore one aspect of vulnerability which, given the assumptions here, can be quantified and to which the perceptions of risk can be grounded. In the words of Blaikie and colleagues:

‘Vulnerability is a relative and specific term, always implying vulnerability to a particular hazard. A person may be vulnerable to loss of property or life from floods but not to drought. Poverty may or may not be a relative term, but there are not varying “poverties” for any one individual or family’ (Blaikie *et al.*, 1994, p.61).

Poverty affects vulnerability through individuals’ expectations of the impacts of hazards and their ability to invest to alleviate risks; and affects the coping and recovery from extreme events through directly constraining opportunities for coping and reducing the resilience to impacts.

4.2 Resource dependency, social resilience and vulnerability

Resource dependency is an element of individual vulnerability and is constituted by reliance on a narrow range of resources leading to social and economic stresses within livelihood systems. These stresses are manifest in instability and increased variance in income and risk of failure of particular sources; and social instability as manifest through for example the impacts of migration. Resource dependency, in this sense, demonstrates the coevolutionary nature of the social and natural systems being examined, with social and economic systems themselves being resilient to their apparent vulnerability.

Resource dependency relates to communities and individuals whose social order, livelihood and stability are a direct function of its resource production and localised economy (Machlis *et al.*, 1990; Adger, 1997b). But for individuals, choices in livelihoods and social investments are more likely to be observed through income and other variables such as migration, which indicate stability at the household level. So, for example, Machlis *et al.* (1990) find correlations at the community level between social variables and resource production for forestry and mining resource dependent communities in the US. Yet they conclude that it is equally important to examine ‘coping strategies employed both by communities and individual members to mitigate the influence of production systems on the social order’ (Machlis *et al.*, 1990, p.421).

Migration is an important factor in resource dependency, but is a phenomenon the presence of which, confusingly, is cited both as evidence for instability and a component of enhanced stability, depending on the *type* of migration examined. This confusion arises because migration occurs for a plethora of reasons, which

are often classified as ‘push’ and ‘pull’ factors. Push migration is that movement of people caused by a deleterious state of affairs in the home locality (such as loss of assets), where pull migration is the demand to move caused by attractive circumstances elsewhere (often in urban areas).

Resource dependency in this context can be characterised as dependent on the structure and diversity of income, social stability and resilience. Dependency and its implications can be observed through a combination of proportion of reliance on climate dependent resources; variability in those income sources; and migration and other social variables associated with stability and resilience. The diversity of income sources, and the variability of those income sources across time, can be used as an indicator of vulnerability at the household level, where it is hypothesised that the greater the diversity of income the greater resilience of livelihood to disruption of particular sources. The variability of income sources due to climatic or other environmental variables can be incorporated through classifying the income sources by ‘climatic dependence’, thus giving an indicator of the importance of climate to household level income.

The cause of migration within a region or household is a key determinant of resource dependency. As discussed above, migration of part of the available labour in a household which results in remittances to the household are generally undertaken for the purpose of *reducing dependency* and enhancing livelihood security and opportunities (Ellis, 1997; Stark, 1991). Where a whole household migrates, such action is often associated with coping with extreme events, and often occurs as a last resort (Davies, 1996). Such migration is not easily captured within a study of baseline vulnerability as the households have moved from the location, thereby, in certain circumstances, masking the true extent of vulnerability of a community by biasing any sample towards remaining households. Livelihood stability can be enhanced through remittances associated with migration and paid employment. A feature of remittance income is that it is generally not dependent on local environmental conditions: remittance income is usually derived from urban sources or sometimes from agricultural, forestry or fisheries income in some other region.

Those parts of a population who are resource dependent tend to be poorer and also politically marginalised (Bailey and Pomeroy, 1996). Diversifying income sources is a strategy for reducing dependency and vulnerability of individuals at the household level. Observing dependency therefore requires examination of the links between diversification and poverty, through for example distinguishing household characteristics of the poor; presenting information on informal economic activities and their intra-household aspects; and by reference to demographic factors. Thus social vulnerability to climate extremes at the individual

or household level involves all aspects of resource use dependency and political economy associated with access to resources and ultimately to livelihood entitlements. A key issue in observing vulnerability is that the dynamic nature of the phenomenon is difficult, but not impossible, to capture.

4.3 Inequality as an indicator of collective social vulnerability

At the collective level, social vulnerability is determined by relative distribution of income; access to and diversity of economic assets; and by the operation of formal and informal institutional coping mechanisms. Specifically, vulnerability to climate extremes is determined by the formal institutional arrangements which organise warning, planning and other services but also by the institutions of the wider political economy.

This relationship between inequality and vulnerability is however, not unidirectional, since it is argued that under certain circumstances inequality facilitates provision of services for the good of communities by those with cumulated assets (see Baland and Platteau, 1997 for example). Examples here are where a set of wealthy actors can provide and maintain irrigation and water management services in agricultural communities which given absolute equality would not exist. Similarly arguments surrounding the existence of moral economy within agrarian societies focus on the reciprocal provision of the means of survival by landlords and wealthier individuals in times of stress. Many of these arguments however, presuppose that the public goods which are provided come about through provision by some for the benefit of all. In the lexicon of public goods provision, these are known as ‘best shot technologies’, an example at the global scale being that of rich countries acting to save the stratospheric ozone hole for the benefit of the global community (see Sandler, 1997 for a review). However, many public goods which are associated with environmental risks are ‘weakest-link technologies’, in that the non-provision of these goods jeopardises all collective security. An example here is the non-adoption of inoculations against disease which rely on near-complete compliance by everyone in the relevant population, or the protection of a sea-dike where only one breach is only needed to cause significant damage. Thus inequality and collective vulnerability are directly or indirectly linked as outlined below, in a manner that is dependent on the type of risk involved, but also mediated by the institutional arrangements for coping with such risks.

The collective aspects of vulnerability involve interaction at various scales, from a single community to a nation. The level of infrastructure, institutional preparedness, and other factors important in the implicit collective vulnerability of a nation, region or community may not be accurately reflected in measures of economic activity. Increasing inequality over time within a population, or between different parts of the population, increases collective vulnerability to climate change. Such

changes in inequality are linked to the reduction of communal allocation of resources and the pooling of risk, and other social phenomena associated with the 'moral economy'. In addition, inequality and vulnerability linkages are associated with relationships between inequality, diversification of income sources and poverty. In other words, inequality affects vulnerability *directly* through constraining the options of households and individuals when faced with external shock; and *indirectly* through its links to poverty and other factors.

The direct links between inequality and vulnerability, as demonstrated in the upper part of Figure 1, concern the concentration of resources in fewer hands, constraining coping strategies based on private resources for households faced with external stresses. As has been shown under conditions of drought in agricultural societies, both income (immediately accessible resources) and wealth (disposable capital assets) are important in coping strategies (Watts, 1991; Davies, 1996). Hence distribution directly affects the ability of households as part of the community, to cope with the impacts of extreme events. The impact of skewed access to resources can be ameliorated in all social situations by the effectiveness of institutions.

The indirect link between inequality and vulnerability, in the lower part of Figure 1, is through skewed accumulation being associated with increased levels of poverty, and hence insecurity. Once again this is a complex issue whereby rising inequality does not necessarily *cause* poverty, but both poverty and inequality are jointly associated with *constraints* on coping strategies. An example of such constraints is where wealth concentration confines access to credit to certain sectors of the population, thereby *reinforcing* income poverty and enhancing vulnerability.

The importance of the indirect link between inequality and vulnerability is illustrated by the common argument that reducing inequality in the long term reduces poverty. However, despite the large body of research on the Kuznets (1955) hypothesis, which states that inequality first rises then falls as income increases in an economy over time, there is no underlying theory which *predicts* the relationship between inequality and poverty (Bowman, 1997). In terms of the ability of households within a population to cope with external stresses and the causes of vulnerability, the diversity of income sources is also an important factor. Again, at the micro-level, there is no fundamental pre-determined relationship between inequality, poverty and income diversification. Inequality in the economic sense is usually conceptualised in terms of the distribution of wealth or in terms of the distribution of income.

Figure 1: Direct and indirect links between inequality and vulnerability

The reasons for investigating poverty, inequality and institutional adaptation, and the connections between them, is to identify barriers and strategies for alleviating vulnerability to external shocks. When poverty and inequality are determined by a common constraint, such as access to labour markets, then there is a ‘natural complementarity in policies to reduce poverty and inequality’ (Reardon and Taylor, 1996, p.902). By contrast if vulnerability, diversity of income sources and inequality move in opposing directions, then different strategies are required

to reduce different aspects of vulnerability. In summary, inequality of income within a population is an important indicator of collective vulnerability, though the relationship is complex, involving direct and indirect linkages. Inequality can be relatively easily measured, with the various indicators having their own characteristics. But the important issue in vulnerability analysis is determining the causes of the observed inequality, thereby informing the nature of the collective vulnerability.

4.4 Indicators of institutional effectiveness in ameliorating vulnerability

All the indicators of vulnerability to climate extremes discussed so far are predicated by the influence of institutions on their operation. Poverty, the use of resources, and the distribution of assets and income within a population are all institutionally determined, and hence central to a political economy analysis of vulnerability. Since it is formal political institutions that devise and implement the legal enforcement of property rights, all economic structures can be conceptualised as dependent on the institutional structure (e.g. North, 1990).

In a wider sense, institutions incorporate structures of political power and legitimacy; standard operating procedures; as well as pre-determined social commitments and worldviews (see Jordan and O’Riordan, 1995; March and Olsen, 1996). These characteristics of institutions allow examination of how adaptation occurs at the various levels. Adaptation can therefore be observed through changing formal institutional structures and through examination of the perceived legitimacy, or lack of legitimacy, of institutions and institutional changes. These characteristics therefore rely on examination of structures of institutions and constraints on their evolution, and on the constraints they exert on individuals and have been termed the ‘institutional architecture’ (Sanderson, 1994). The scale of institutional analysis is obviously important within this domain - although individuals are constrained by institutions within the dominant political economy, Thompson (1997) stresses the diversity of adaptation of both individuals and formal institutions in reaction to external stresses.

The most difficult aspect of the observation of institutional change is the assessment of whether the change is appropriate for the external threat or environmental change. Appropriateness can be examined by whether institutional changes are legitimised within the internal or external constituencies and stakeholders of the institutions, and whether they are timely or even anticipatory. So, for example, is decentralisation of the responsibility for collective action for coastal defence from Province to District level in Vietnam, an appropriate institutional response to changing risk? In the case of hazard impacts this may only be judged when the institutions are put to the test through the real events. The appropriateness of formal institutional arrangements for collective action in

circumstances where hazards are a threat may themselves be undermined by reduced 'keenness of perception' (Burton *et al.*, 1993, p.150) of hazards depending on the period since previous impact. The fundamental motivation for collective security enhancement and vulnerability reduction is highlighted by Thompson (1997) as an organising principle for the examination of cultural attitudes within institutions.

The issue of the appropriateness of institutional change is addressed in the framework proposed in this paper with reference to the economic implications of institutional change - how some institutional change affects the environment for the other economic indicators of vulnerability. Thus, for example, changes to government structure in Vietnam can be examined for changes in power and resulting responsibility for common security and vulnerability. They can also be examined for their impact on poverty, inequality and other social goals and factors. Secondly, institutional inertia and rent-seeking in the face of demands for change can be observed. Protection of the status quo is a major barometer of inappropriate institutional change, particularly when the social political and physical environments are demanding changes in institutions, bureaucracies and structures.

Institutional *change* within formal power structures has significant policy implications in the amelioration and adaptation to environmental stress. Environmental issues in general tend to be downplayed within institutions. They do not fit easily into reorganisation of operating cultures and procedures; and for a number of reasons the inherent nature of periodicity and threshold non-marginal changes of many environmental stresses ensures that the costs of institutional learning from one event to the next are high. Thus the reorientation of formal institutions in the face of evolving risk is a significant challenge, but, due to the pervasive role of institutions in determining vulnerability, this is the arena where impacts on all facets of vulnerability are made.

Institutional *inertia* is also examined assuming that inertia is often an active rather than passive strategy for retaining power, and hence constrains externally forced changes in a dynamic physical and political environment. Part of the structural inertia can alternatively be observed through rent-seeking behaviour, defined as the expansion of formal institutions for their own welfare maximisation.

The purpose of this analysis of institutions is to draw out how formal institutional changes impacts on social vulnerability. But the quantitative and qualitative aspects of individual and collective vulnerability all have institutional dimensions. Thus, for example, poverty and resource dependency are institutionally

determined. Hence simply reporting quantitative indicators of the poverty and dependency phenomena and their change over time, excludes information on the structural causes of vulnerability. Thus those institutional aspects of individual and collective vulnerability are explained in greater depth through qualitative analysis of institutional changes, and their direct impact on vulnerability for each indicator of vulnerability, and separately in terms of formal institutions themselves.

In summary, social vulnerability to climate change is made up of the elements of individual and collective vulnerability and can be observed through both quantitative and qualitative indicators of the causes and consequences of such vulnerability. Social vulnerability in general encompasses disruption to livelihoods and loss of security, and for vulnerable groups is often pervasive and is related to the underlying economic and social situation. But vulnerability also encompasses access and entitlement to resources, the power relationships in the relevant institutions in state and markets, and the cultural and historical context.

5. A Case Study in Vietnam

5.1 Methods and data

Since Vietnam incorporates large fertile low lying and densely populated deltas of the Mekong and the Red Rivers and is subject to present day climatic extremes surrounding the impact of landfall typhoons, Vietnam would be classified as a region vulnerable to present day climate extremes and potentially to changes in the typhoon regime as a result of increased interannual climate variability in future. But Vietnam has diverse coastal regions, and an analysis of the climatic regime itself does not reveal the processes by which different sections of the population may become or remain vulnerable to the impacts of climate extremes. Hence the analysis presented here focuses on a single District to analyse these processes leading to vulnerability in a systematic manner.

Xuan Thuy is an agricultural District in Nam Dinh Province on the fringe of the Red River Delta in northern Vietnam. The District is physically vulnerable to climatic changes due to its topography, proximity to the coast, and the present condition of its physical infrastructure. The Red River Delta, along with the Mekong Delta in the south of Vietnam, have the highest level of agricultural commodity export from their regions, and in line with national trends (Pingali *et al.*, 1997), Xuan Thuy has almost doubled its agricultural output since the mid 1980s. The agrarian economy of Vietnam operates through a formal and sophisticated system social security facilitated, even in the post-collectivisation era, through local level government institutions. Vulnerability is therefore shaped by a complex set of relationships between the underlying economic and social situation and the dynamics of change in both these and the physical environment.

Fieldwork was carried out in Xuan Thuy District during 1995 and 1996, through collection of secondary archive data and through household survey and semi-structured interviewing of key informants. A survey of households in eleven Communes based on a stratified area sample. Secondary data on Xuan Thuy District for agricultural production, income, population and other variables and on 80 coastal aquaculture enterprises were collated. These data sources form the basis of the quantitative analysis of household level vulnerability through resource dependency and poverty; and quantitative analysis of distributional issues.

Table 2 summarises the sample survey of 60 households, designed to elicit information concerning ownership and access to resources, and household income. The results show that mean per capita income for the sample is approximately VND three million per year, equivalent to US\$ 290 per person in 1995. The survey questions on income related to the historical period of the 12

months or growing seasons within the last 12 months, or were extrapolated from the recall period to the prior 12 months. Hence the figures are relevant for 1994-1995 for year round activities such as aquaculture, or relate exclusively to the 1995 season for most agricultural activities.

Table 2: Summary of income sources, household size and land allocation for Xuan Thuy sample survey

	Total	Mean	Percentage of total households involved
Number of households	60		
Number of individuals	308		
Family membership		5.13	
Mean household income (000 VND/year)		14973	
Income per capita (000 VND/year)		3180	
(in US\$)		289	
<i>By income source (000 VND/year)*</i>			
Rice		5213	85
Other agriculture		5390	95
Salt making		1874	13
Aquaculture‡		10446	25
Open access fishing		4315	20
Wages and gifts		3512	48
Number of income sources per household		3.22	
Land allocation per household (hectares)		0.29	
Number of separate plots per household†		2.77	

Notes: * The average income from separate sources are based on the proportion of the households engaged in that activity.

‡ Aquaculture is exclusively coastal aquaculture and does not include income associated with fishponds, usually at residences. Fishpond income is included in 'Other agriculture'.

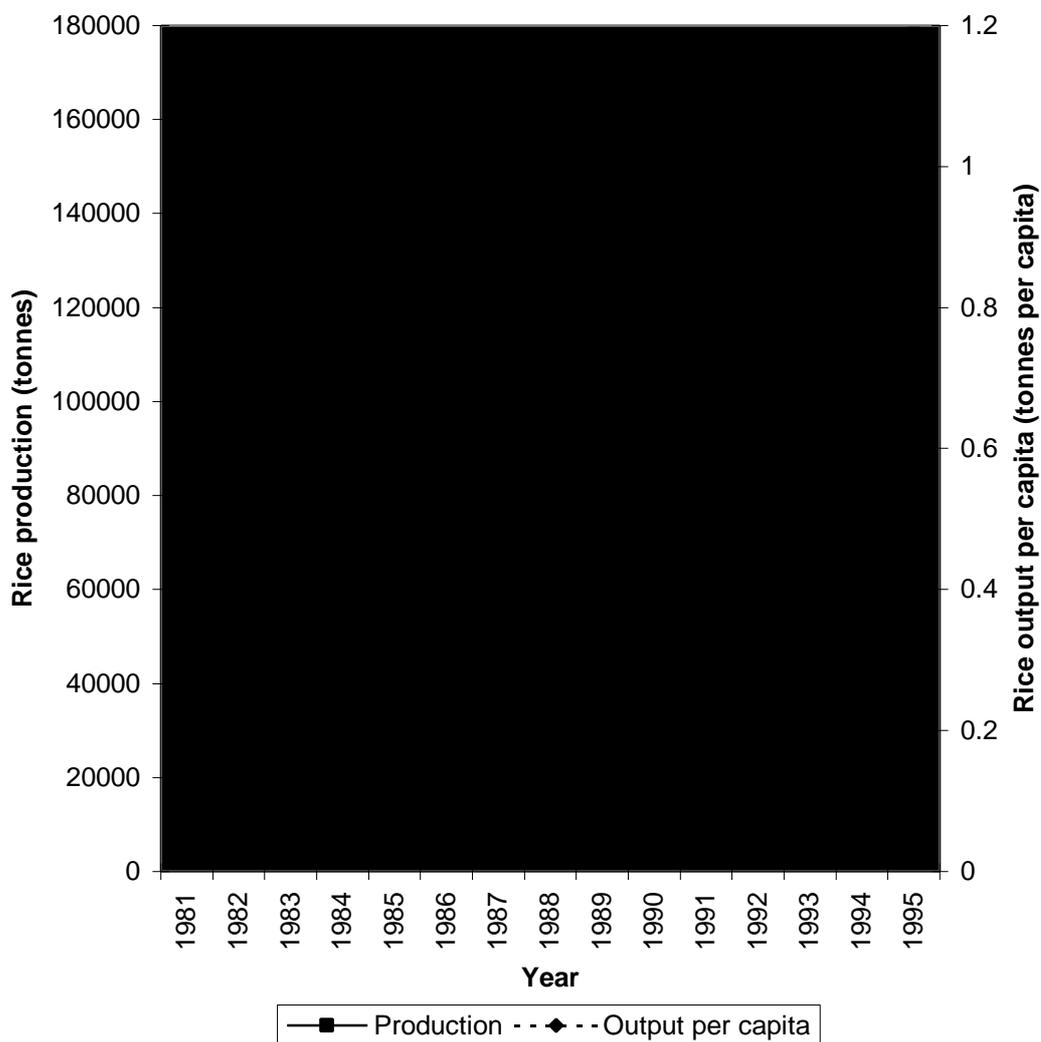
† Number of plots reflects land allocation of different quality as well as home gardens. This estimate also includes those households which have salt-making areas as substitutes for rice fields.

The income of each household is made up of a range of activities, from rice growing to gifts received from relatives in south Vietnam or abroad. The disaggregated income sources in Table 2. show that most households are involved in rice and other agricultural activities, principally growing vegetables and keeping livestock such as pigs and chickens in their home gardens. One quarter of the households surveyed are involved in coastal aquaculture, which is a lucrative income source for those involved. Salt-making does not provide the households involved with high income returns, but this is often the single most important economic activity in those Communes involved, and the households often have no access to land suitable for rice growing. Indeed, the leases on salt making areas are allocated by Commune co-operatives in those Communes to act as a substitute for rice land, and hence exhibit a low variation in income among those households involved.

In Xuan Thuy aquaculture is carried out at the coast and involves several different activities including prawn, shrimp and crab culture, each with different seasons. A small number of those households involved in aquaculture have interests outside the District as far away as the neighbouring Thai Binh Province and even Haiphong. Commercial aquaculture is distinguished in the survey from those associated with fishponds within residential areas or in homegardens, in which fish are kept for own consumption and occasional sale, and which is integrated into the agroecosystem, as discussed in the section below, and which are counted as part of the 'other agriculture and livestock' income source. Some households also use these ponds for commercial activities such as breeding edible turtles (*ba ba*), and other crops include silkworms.

Rice production remains the single most important agricultural activity within the District. Double cropping of rice is possible on virtually all available land within the District, leading to high yields compared to the Red River Delta average, and significant exports from the District. Figure 2 shows the doubling of recorded rice output in Xuan Thuy in the period since the output-contract system in the early 1980s. There is little doubt that the majority of this increase from the late 1980s is associated with positive supply response to increased price incentives as well as to other efficiency gains within the District, rather than to changes in yield or physical productivity. It is argued by Pingali and Xuan (1992), that these are the causes of doubled marketed output of rice at the national agricultural sector.

Figure 2: Aggregate rice production and production per capita for Xuan Thuy (1981-1995)



Source: Xuan Thuy District archives.

Commercial agricultural activity (as differentiated from food growing and subsistence activities) is increasing in significance and the range of activities within the household sample (each making an entry in Table 2 as a separate income source) include private agricultural businesses, such as renting of buffaloes for draft power, private threshing machines, and agricultural engineering works. Most of these activities have gained legal status as private businesses only in the past five years. Wage income sources include pensions associated with military service, or war widows pensions; salaries paid, sometimes in kind, to local administrators; and gifts sent from relatives who have migrated to southern Vietnam or abroad.

Table 3: Summary of data sources for analysis of vulnerability in Xuan Thuy

Data Source	Scope	Purpose
Quantitative household survey	60 households randomly selected from 11 Communes. Income and economic activities; limited questions on historical storm impact.	Analysis of poverty, resource dependency and distribution of income.
Qualitative household survey	21 households subset identified from historical storm impact questions from previous survey. Qualitative survey on details of historical impacts, present collective action and perceptions of risk.	Analysis of institutional adaptation and perceptions of institutional change.
Commune and District officials: interviews	Officials from 11 Communes in semi-structured interviews. Vice chairs of Village Council or Head of co-operative. Qualitative survey of historical impacts, present storm protection organisation and funding.	Analysis of institutional adaptation and the wider political economy of Doi Moi.
Secondary District-level data	Historical quantitative data on agricultural production and structure of economic activity at District level and by Commune. Census survey of aquaculture.	Analysis of resource dependency and the role of aquaculture in past and present income distribution.

Data for analysis of institutional adaptation and of institutional inertia in the treatment of present climate extremes in Xuan Thuy District were collected through empirical observation of Commune level officials and from households within these Communes, as well as discussions at the District level. This involved semi-structured interviews with Commune officials in eleven Communes in Xuan Thuy and with households within those Communes in April and May 1996. The same Communes were used as for the quantitative house-hold survey: all of the coastal as well as two inland Communes were covered for both officials and household respondents. This strategy aims to produce qualitative data on Commune level institutional practices; on household level adaptation; and underlying views on the hazardous nature of the physical environment. The research is therefore based on a mixture of key

informants, for the trends in social institutions; and of comprehensive quantitative and qualitative information for the coastal dike maintenance system. Informants at the Commune level tended to be Village Committee Chairs or Vice-Chairs, or the manager of the Commune agricultural co-operative.

The data collected to explain historical and present social vulnerability are summarised in Table 3. This shows that both time series and cross-section data are necessary to develop a rich understanding of the phenomenon of social vulnerability. Data are also collected at various levels of the institutional hierarchy to validate and triangulate the analysis of power relationships, which are also central to the political economy of vulnerability.

5.2 Individual vulnerability in Xuan Thuy District

An indicator of absolute poverty gives scope to measure this aspect of social vulnerability in a relatively simple manner. The choice of poverty indicator is determined by the objective of the study: whether this is to relieve poverty in the short or long term, the importance of inequality and the social context of the deprivation. Such considerations for each measure are reviewed by Blackwood and Lynch (1994), who illustrate the trade-offs in simplicity, data requirements and relevance for policy-making for each of the indicators. A poverty measure relevant for vulnerability to climate change needs to be sensitive to the availability of state assistance in alleviating the impacts of extreme climatic events when they occur. Evidence suggests that it is the poor who are discriminated in access to such resources in disaster situations, making them inherently more vulnerable. Thus individuals at the lower end of the distribution of income are more susceptible to the impacts of extreme events because they have little diversity in their income sources and fewer 'reserves' to absorb shocks. These are added to the institutional factors which act to disempower the poorer sections of populations and prevent their access to resources for recovery. Thus these two issues of inequality within the poor part of the population and the role of policy in influencing poverty severity, leads to the adoption of composite poverty indices (which incorporate these aspects) for the examination of poverty as an element of vulnerability in Xuan Thuy. The measures used are therefore the poverty severity measures (P_0 , P_1 and P_2) developed by Foster *et al.* (1984) and widely used for quantitative analysis of income poverty.

Table 4 shows that the poverty indicators which are available for the Red River Delta (RRD) area and for Vietnam, as a whole, are much higher than those derived from the household survey for Xuan Thuy at both of the poverty lines. Thus for the poverty line which excludes most of the population (the food poverty line), Xuan Thuy is seen to have one quarter the headcount ratio of either the RRD or of rural Vietnam (column 2). Estimates by the World Bank (1995)

are that almost one in four of the population of rural Vietnam do not come up to this food poverty line. The average poverty gap for the Xuan Thuy population is much higher than average for RRD or rural Vietnam. Similarly for the basic needs poverty line, the proportion of Xuan Thuy now classified as poor is less than half of that of RRD or rural Vietnam, with a similar larger poverty gap than average for the country (column 3). These differences between Xuan Thuy and the remainder of Vietnam interpreted as Xuan Thuy having a smaller proportion of poor people, but those who are poor fall well behind the average of the population.

Table 4: Estimates of absolute poverty and their sensitivity to poverty line estimates for Xuan Thuy, Red River Delta, and rural Vietnam

(1) Basis for Poverty Line	(2) Food poverty line*			(3) Basic needs poverty line†		
	Xuan Thuy	Red River Delta	Rural Vietnam	Xuan Thuy	Red River Delta	Rural Vietnam
Poverty Line (VND 000 per capita)	708	708	708	1003	1003	1003
Headcount ratio (P_0)	0.06	0.24	0.28	0.18	0.49	0.57
Poverty gap ratio (P_1)	0.21	0.04	0.06	0.31	0.14	0.17
Average poverty gap (VND 000 per capita)	151			309		
Poverty severity (P_2)	0.3	1.0	2.1	1.9	2.9	4.7

Notes: Xuan Thuy estimates based on household survey. Red River Delta and Rural Vietnam results reported from World Bank (1995). US\$ 1 = VND 11,000. Poverty measures P_0 , P_1 , P_2 are following Foster *et al.* (1984).

* Food poverty line is defined as the cost per capita of purchasing food to yield 2100 calories intake per day, calibrated for regional variations in food prices.

† Basic needs poverty line is defined as cost per capita of this minimum food purchase plus the mean costs incurred for non-food expenditure for households at this income level. Thus basic needs represent, in this case, culturally necessary minimum expenditure (see Malik, 1993 for example).

These comparisons of poverty indicators for the incidence of poverty in Xuan Thuy, and the comparisons with the wider situation in Vietnam lead to several

conclusions and observations. Xuan Thuy is relatively prosperous area of northern Vietnam, in terms of the small numbers of people classified as poor by these criteria. The mean levels of incomes are higher for Xuan Thuy than for the RRD. This relative prosperity reflects the access to fertile agricultural land, and productive coastal resources of the population in general. The data focus on income based measures of poverty. Income is used here as a proxy for other aspects of poverty, such as inaccessibility, lack of human infrastructure and other variables. Some social mechanisms, particularly of land allocation and social security at the Commune, ensure relatively low numbers of marginalised landless households in this District.

Dependency is defined as reliance on a range of resources which leads to stress within livelihoods and is made up of reliance on risky resources, especially among the poor. But such reliance is ameliorated through adaptation, so the concept also requires examination of social phenomena such as social stability. Dependency can be observed through proxy indicators at the household level where these are available. In Xuan Thuy, dependency can be examined by reference to the household characteristics of the poor; by reference to information on informal economic activities; and with reference to demographic factors associated with resource dependency. These indicators of dependency add depth to the discussions on poverty above in explaining social vulnerability at the individual level.

For coastal communities almost all sources of income could be characterised as being 'climate dependent' in some sense. The primary resource dependent activities are those associated with agriculture, fisheries and aquaculture. Other sources, particularly those associated with waged labour and remittances from family members living elsewhere, are less or only indirectly 'climate dependent', and indeed household investment in such activities is often motivated by risk minimising strategies within households. In Xuan Thuy, historic data on climate extremes shows that the seasonal incidence of landfall typhoons results in greatest impact on rice agriculture, with less impact on salt-making and other activities. An early season typhoon in July tends to result in greatest damage as it coincides with the period before harvest of the first of two rice crops. Such storms disrupt harvest as well as impacting on the rice seed-lings being germinated for transplanting for the second crop. The other major agricultural activities, crops of vegetables and fruits, tend not to be impacted by landfall typhoons. Salt making, another important economic activity in coastal Communes, is dependent on favourable weather, relying on high temperatures and periods without rain. The process relies on the capturing of tidal sea water and evaporating the water with sand in a continuous process till, after four concentrations, marketable salt is

obtained. For those households involved salt-making, it is often the primary economic activity.

The dependency of household income on climate dependent income sources is shown for households in Table 5a, as a series of correlations between household characteristics and income sources. In this case, climate dependent income (Y(ClimDep)) is taken as being the sum of rice, aquaculture and salt production income for each household. The results show that total household income is positively correlated with the greater diversity of sources of income for the household; with remittance and wage income; and with climate dependent income (Table 5a). Remittance and wage income would appear to be utilised as a diversification strategy, but not necessarily by the larger households (negative correlation between diversity and household size) since lower per capita income itself is negatively correlated with household size.

Table 5: Correlation coefficients for Xuan Thuy sample for a) house-hold characteristics including ‘climate dependent income’ and b) household characteristics with disaggregated income sources

	Income	Diversity	Household size	Remittances	Y(ClimDep)
Income	1				
Diversity	0.226	1			
Household size	-0.338**	-0.079	1		
Remittances	0.228	0.345**	-0.118	1	
Y(ClimDep)	0.693**	0.160	-0.068	0.012	1

	Income	Diversity	Household size	Remittances	Aquaculture	Salt	Rice
Income	1						
Diversity	0.226	1					
Household size	-0.338**	-0.079	1				
Remittances	0.228	0.345**	-0.118	1			
Aquaculture	0.350**	0.105	0.015	-0.127	1		
Salt	-0.245	-0.069	0.261*	-0.068	-0.159	1	
Rice	0.659**	0.123	-0.164	0.191	-0.044	-0.345**	1

Source: Xuan Thuy household survey.

Notes: * = Significant at 5% level; ** = Significant at 1% level

Y(ClimDep) defined as income from rice + aquaculture + salt-making.

Remittances = remittance income and wage income.

Diversity = number of different income sources reported by households.

In disaggregating climate dependent income in Table 5b, it can be seen that aquaculture and rice income are positively correlated with income while salt-making is negatively correlated with both income and with diversity and remittance and wage income. Table 5b therefore demonstrates that salt making is associated with poor, heavily constrained households, who have particular characteristic resource dependencies. The sources of income for the poor and non-poor sections of Xuan Thuy's population have significantly different profiles. The poor section of the population has a much greater proportion of its mean income derived from salt-making, reflecting not the greater access to salt making areas, but rather a greater incidence of poverty in the coastal Communes of the south of the District where there is a major agricultural land scarcity. Poor households rely to a slightly greater extent on rice and agriculture for their mean income, and from the household survey data are shown to not presently be engaged in commercial aquaculture at all.

Diversity should characterise the livelihood strategies of households in coastal areas, because of the physical availability of traditionally commonly managed resources such as coastal fisheries or mangroves (Bailey and Pomeroy, 1996). This is demonstrated for all but the poorest households in Xuan Thuy. Households tend not to be dependent on a single resource. But can still be effectively dependent on a single ecosystem, where the various income sources are interrelated. For example, if mangrove forests are converted to private aquaculture, then both the access to honey production, fuelwood and other resources will be affected, and the impact on coastal fisheries will be detrimentally impacted. Thus the resilience of livelihoods in coastal areas are directly correlated with the resilience of the coastal ecosystems on which they are dependent. This aspect is only indirectly observable in the formal poverty and dependency indicators examined, partly because of the role of intra-household strategies in alleviating dependency. In Xuan Thuy both women and children collect a wide range of material from coastal mudflats and from the mangrove areas. Many of these resources are for domestic consumption and cannot therefore be easily quantified, but demonstrate the paradox of diversity of livelihood strategies while still being essentially dependent on a single ecosystem.

One further aspect of resource dependency is its link to demographic instability. Lack of access to alternative economic opportunities, both within the poorer part of the population and because of geographical reasons can force migration and other demographic strategies into effect. Diversifying income sources through migration enhances security, in the formal sense identified in the indicators above, but has also implications for household integrity. Many households therefore disappear in vulnerability assessment when migration occurs, in the absence of allocated land or a house.

The striking difference between migration strategies in different parts of Xuan Thuy illustrates the role of the coastal ecosystems in this process. Inland Communes have traditionally had high rates of migration, whereas coastal Communes have had low rates. Migration to Hanoi for work in the recycling industry is concentrated in two villages in the north of the District (DiGregorio, 1997). Almost half of the total recycling industry for the whole metropolitan area of Hanoi is undertaken by residents from these two Xuan Thuy villages.

Part of the explanation for migration from the northern Communes of the District is to do with the lack of access to coastal resources for those Communes. Traditionally managed common property resources associated with fisheries and mangroves previously formed a significant asset for the coastal Communes in Xuan Thuy, explaining the relative lack of out-migration for employment sources. Under the present market liberalisation, where the mangroves have been allocated to private leaseholds, the migration patterns are already beginning to be radically altered, based on observations in Xuan Thuy in the period since 1995. Seasonal migration to Hanoi and the Provincial capital of Nam Dinh, and the remittances they contribute to the resident household, is increasing in Coastal Communes where traditionally migration was low. This, it could be argued, reduces vulnerability by increasing total household livelihood sources, and by increasing the proportion of non ‘climate-dependent’ income. In this case temporary and seasonal migration is part of a strategy to reduce vulnerability at the household level. Increased migration and diversification enhances household security and resilience.

5.3 Implications for assessing individual vulnerability

The purpose of estimating indicators of poverty and dependency in Xuan Thuy is that these form one element in vulnerability to climate change. The justification for the focus on absolute poverty are that poverty exacerbates vulnerability through the mechanisms of lack of resources for handling external shocks; correlation of poverty to disempowerment and lack of access to resources when shocks occur; and the reliance of the poor on communal and other resources which may be more physically vulnerable to external shocks.

Historically, centrally planned economies with well developed state apparatus for distribution of resources and social security systems have relatively low income inequality. The reduction in the influence of the state, however, has led increased incidence of poverty in many former centrally planned economies. The results in this section have illustrated that at present, poverty is confined to a minority of the population in Xuan Thuy (18 percent), and that the incidence of poverty coincides with lower land allocation and the non-participation in coastal aquaculture, and possibly with the reliance on communally managed or open

access resources. The results for Xuan Thuy show the redistribution or transfer required to bring that part of the population out of poverty. The targeting of poor households through poverty alleviation is a difficult task, on which there is copious experience in rural areas throughout the world. The pitfalls of poverty alleviation include finding the poor households; the effects of poverty alleviation (such as employment, schemes, land allocation, food for work schemes and others) on the non-beneficiaries; and the identification of sustainable sources of economic activities or employment (see Ravallion and Sen, 1994 for example).

The change in resource use, particularly that into aquaculture at the expense of mangrove forests in coastal areas, can be demonstrated to be offsetting the positive impacts of falling absolute poverty. Increased vulnerability is brought about by increasing dependency on aquaculture and other resources with high risk of failure from natural hazards, and uncertain returns in volatile markets. In Xuan Thuy migration and remittances form an important part of the livelihood risk minimising household strategies, with migration in northern coastal Vietnam to both regional urban centres, principally to Hanoi.

5.4 Inequality and collective vulnerability in Xuan Thuy District

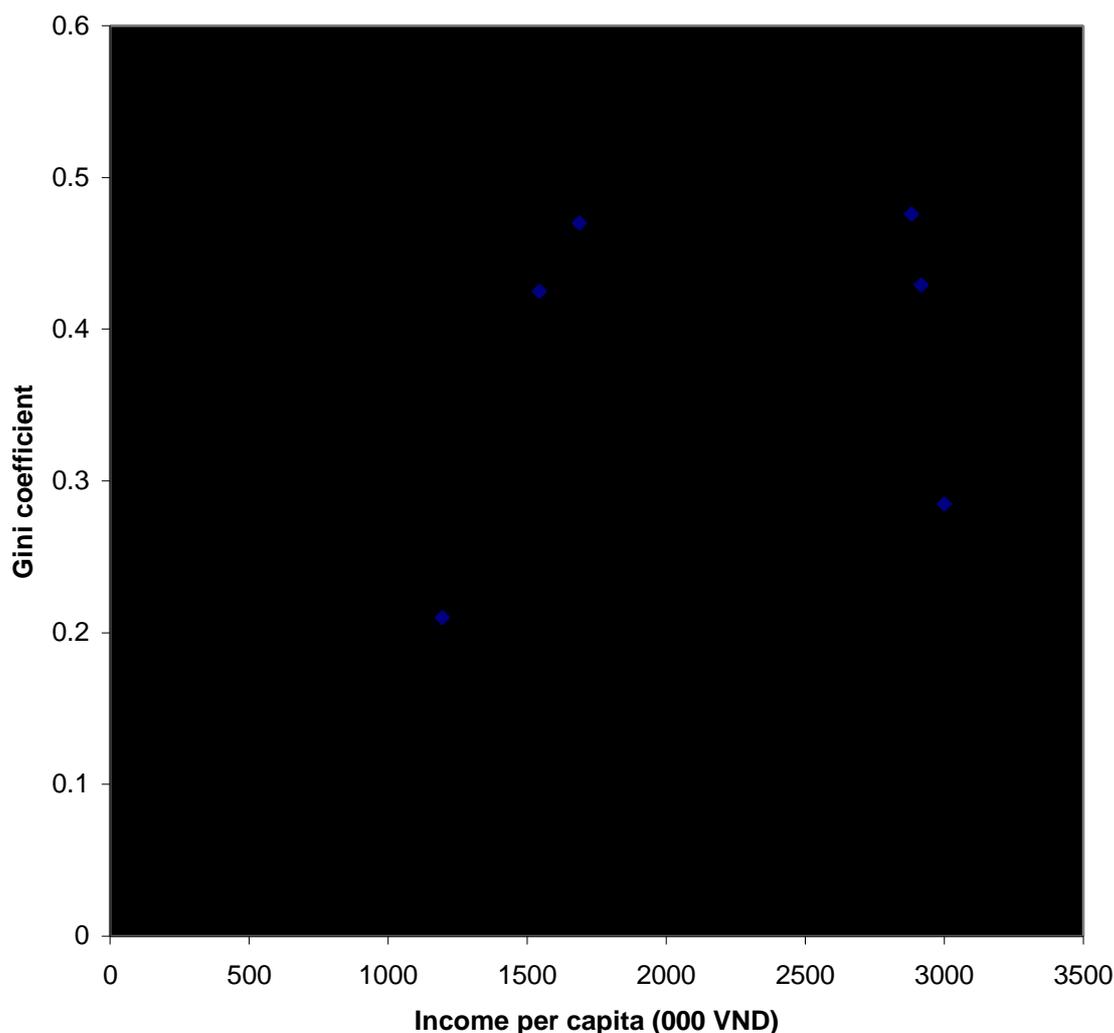
Xuan Thuy has relatively high income inequality compared to Vietnam in general, and that this has been exacerbated by the emergence of aquaculture in the Xuan Thuy economy. In the observed rising inequality in the centrally planned economies, the issue of the causality of these changes in inequality remains unresolved. However, as argued above, changes in the distribution of income are related to the phenomenon of collective vulnerability. Income inequality is a *proxy* for general inequality of access to resources, with increasing income inequality directly correlated to, if not caused by, a concentration of the ownership of productive assets in a smaller proportion of the population. Thus the opportunities for the enhancement of resilience and robustness of livelihoods through general raising of income levels is being forfeited, through an increased concentration of productive resources.

If the differences between Inland and Coastal Xuan Thuy are examined, it is clear that inequality rises more over time in Coastal Xuan Thuy, than in the inland Communes as shown in Figure 3, where the Gini coefficient for Coastal Xuan Thuy rises by 0.075 (0.285-0.210) in five years. The indicators therefore show inter-regional (between Coastal and Inland) differences in the changes exhibited in income structure. The extent to which such inter-regional differences occur is constrained and facilitated by the operation and mechanisms of rural labour and commodity markets. In the Xuan Thuy case there is considerable intervention in agricultural input and output markets, and the

planned allocation of labour persisting in the Doi Moi period has been a constraining force on inter-regional increases in inequality.

Income inequality indicator is a proxy for some aspects of collective vulnerability, such as those associated with access to private and communal resources, which are important in recovering from external shocks to livelihoods. They are also closely related to social hierarchies and distribution of formal political power within communities. Rising inequality in Xuan Thuy has direct effects on baseline vulnerability. The concentration of capital in the aquaculture sector is having significant impacts in the further accumulation of wealth and productive assets in the coastal Communes, the residents of which are benefiting disproportionately from market liberalisation and the legalisation of private aquaculture enterprises in particular.

Figure 3: Change in Incomes and Inequality for Xuan Thuy and by sub-sample simulated for 1989 and observed for 1994.



Source: from Adger (1997a) based on field survey and archive data.

In the case of Xuan Thuy, the most striking feature of the rise in inequality, in terms of vulnerability, is that the ‘diversification’ from agricultural incomes, primarily by better-off households, has been into sources of non-agricultural incomes which are in fact at greater risk from external shocks associated with environmental change. In addition, the indicators of inequality show that inequality differentials are increasing between Inland and Coastal Xuan Thuy, and increasing for the District as a whole, at rates which are extremely high compared to slow change in inequality observed in most agrarian economies (see Adger, 1997a).

The rising inequality in Xuan Thuy is not associated with factors which lead to increasing poverty. Rather they are associated with rising incomes for most of the population. The inequality-vulnerability link is therefore not the indirect hypothesised link (rising inequality causing poverty), but rather the direct link: that of the concentration of wealth and capital restricting access of a larger proportion of the population from resources for buffering the impact of external shocks.

5.5 Institutions, adaptation and vulnerability

A key issue raised in the empirical application of this approach is the appraisal of institutional adaptation at various levels within Vietnam. At the national level the political economy aspects of increasing regional autonomy in Vietnam since Doi Moi, and the retrenchment of government are paramount. This is particularly apparent when considering the civil defence mechanisms which have evolved over centuries of common property resource management, as well as through war-time institutions. These different scales of analysis are tackled by defining the relevant attributes of institutions. The adaptation of different types of institution are observed through their influence on structures of political power and legitimacy, as evidenced by pro-active changes in the face of social change as well as by their inertia and ‘non-decision making’.

An example of the interaction of climate vulnerability and institutions is their role in local level hazard planning and coastal defence. Sea dikes constructed for coastal defence in Xuan Thuy District are the principal physical infrastructure investment to ameliorate the threat of climatic hazards associated with typhoons and coastal storms, and are the major responsibility of the coastal Communes and Districts. Communes officially employ a variety of strategies for use of the revenue they raise for storm protection, depending on whether they have sea dikes within their jurisdiction. Communes next to each other also inevitably have long-standing social reciprocity with their neighbours.

Protection against present day climatic extremes in the form of landfall typhoons is the primary responsibility of the Communes. During the collectivisation period, each adult allocated ten days labour to the task of repairing and maintaining the sea dike system. Since the decollectivisation of agriculture, this collective action role of the agricultural co-operatives has largely been made redundant and been replaced by a tax for coastal protection. This evolution of institutional responsibilities provides a striking example of inertia and rent-seeking by institutions which directly exacerbates vulnerability to present day climatic extremes.

Information provided by Commune officials for 1996 shows that collective maintenance of the dikes remains an ongoing element of hazard mitigation, but only for certain Communes. The actual resources flows in demonstrate the tendency for Communes to maximise their own individual interests, through capturing the greatest share of District resources. This is facilitated in the coastal Communes by flows of resources being of actual labour, rather than funds. Allocating their own labour to dike repair ensures that the coastal Communes limit their input into the system, particularly in years where few repairs are required and avoid paying monetary resources to the District government. In the dike protection season following a year with little storm damage, such as 1995, those Communes who do not directly allocate labour (the inland Communes) still have to pay full tax rates. By contrast, in those years with little storm damage, the coastal Communes can simply undertake their own repairs.

Further, the 'hypothecated' tax collected by the District government is not spent annually solely on coastal protection: the tax actually collected is at least four times that spent on coastal protection in years such as 1996. Indeed, the rich coastal Communes receive a 'double dividend' of paying lower effective tax rate than inland Communes, along with receiving disproportionate investment in other infrastructure projects. In effect, the coastal Communes are creating a 'core' of powerful Communes which capture District level resources, to the detriment of 'peripheral' inland Communes.

Such action constitutes an example of non-decision-making which keeps the political playing field tilted in favour of the coastal Communes. Furthermore, some Commune level officials appeal to the locally held perceptions that storm impact is a major constraint on economic performance. Hence, they argue that it is legitimate, as a reflection of local knowledge, to maintain tax collection for sea dike maintenance. When it is convenient to downplay potential storm impacts and other environmental change, however, the officials of the coastal Communes do so. When Commune officials wish to promote economic growth to the exclusion of other policy objectives they trivialise hazard mitigation.

The dike protection system is only one aspect of the radical institutional changes observable in Xuan Thuy, many of which may be reducing the potential vulnerability of the population to extreme climatic events. Many of the institutional changes are part of the economic transition process, though these changes are underpinned by attitudes towards the subjective riskiness of the environment. The crucial factor in terms of perception of risk, is that a severe storm (with widespread damage on a District-wide basis) has not occurred since 1986. The private property resolutions of the 1992 Constitution, and the subsequent reform of the land allocation system under the 1993 Land Law, have been paralleled by a relaxation in the legality of private credit systems in rural areas. In the collectivised period, formal credit was only permissible through the Commune co-operative (Luong, 1992, p.184). Yet even in that period, private credit did operate and played an important role in coping strategies in Xuan Thuy, for example after the storm impact of August 1986.

The role of credit in recovery from stress and disruption of livelihoods, is particularly important where external assistance is not available for immediate injection of resources. Informal, but illegal, credit systems have been an integral part of the coastal fishing economy in Xuan Thuy. This phenomenon is common to many artisanal fishing communities (see Dow, 1996 for example). Street Associations are informal associations of neighbours within hamlets who have traditionally maintained religious buildings, funeral and marriage ceremonies. Associations, along with reciprocal feasting and gift-exchange have become revitalised in Xuan Thuy, with Luong (1993 pp.270-284) observing that these processes play a role in sustaining kinship and lineage ties which are necessary for security in times of crisis. The 'nascent' civil society is seen by some commentators are making significant inroads into formal political structures (Malarney, 1997) and hence reinforcing collective decision-making, which would otherwise be lost with the decollectivisation.

The most significant factor affecting both the politics of collective action and individual livelihoods is land reform. The role of the Commune institutions as harmonious and efficient allocators of Commune resources is contested. Kerkvliet (1995), for example, argues that the impetus for agricultural reform in the 1980s arose from tensions between the agricultural co-operatives and some households. Many villagers, although recognising the social security benefits of collectivisation, remained sceptical concerning the centralisation of power within the national hierarchical system, preferring local level autonomy in resource management, it is argued. Whatever the 'everyday politics' of resistance to collectivisation (Kerkvliet, 1995; Scott, 1985), the agricultural co-operatives retain a central role in all resource allocation and collective action at the Commune level.

The present land allocation system, following the legislation of 1988 and 1993, is fundamentally different from what has gone before, in that it permits land to be leased, inherited and mortgaged, thereby effectively restricting the role of many co-operatives in any further reform. An assessment of the impacts of the present land reform by Kolko (1997) argue that some co-operatives now 'exist in name only' (p.92) and that even the Communist Party in some areas have 'all but disappeared' (p.92). Although the institutionalisation of tradeable land use rights has proceeded rapidly in the Mekong Delta, the role of Co-operatives remains, however, more significant in the Red River Delta. The 1993 Land Law initially limits individual households to three hectares of agricultural land, with tenure for 20 years for annual crops and up to 50 years for forestry and longer term crops. The legitimate emergence of rental markets in land and other agricultural factors of production has been observed widely in the agricultural producing areas in Vietnam.

In summary, the revealed 'everyday politics' of decollectivisation associated with dike protection system of Xuan Thuy provides insights into hazard mitigation and institutional adaptation to social and environmental change. The Communes essentially use the sea dike resource allocation system to maximise their own budgets, often through unaccountable actions through which the collective vulnerability to the impacts of storms may be increased. At the same time, the system is adapting to the increasing specialisation of labour and higher opportunity costs of time for households, who can no longer afford to spend time on labour intensive actions. In general, the enhancement of the institutions of civil society within the Communes documented in this section enhance security and potentially reduce the recovery time after the impact of a major storm. Similarly the re-emergence of local level institutions tends to enhance collective security.

6. Conclusions

This paper has explored the causal factors of social vulnerability to climate change and present day climate extremes for one District in northern Vietnam. They have concentrated on the individual level and collective level vulnerability indicators to determine the vulnerability of the population of this District. In general the population exhibits resilience through its use of available natural resources, but the liberalisation process has had, at best, an ambivalent impact on vulnerability as a whole by undermining some institutional practices which acted as security and coping mechanisms in times of stress.

Inequality in income and the incidence of poverty appears to be driven by the market liberalisation process, particularly in Xuan Thuy through the privatisation of formerly commonly managed or reserved mangrove areas and their conversion into aquaculture is the major cause of increasing inequality over time. It is hypothesised that inequality is linked to vulnerability in two ways: directly through concentrating the resources of a population in fewer hands, thereby constraining entitlements for use and disposal of assets under coping strategies in times of stress; and indirectly through the enhancement of poverty and marginalisation. In the Xuan Thuy case, only the direct link with vulnerability appears to be important. The concentration of aquaculture resources does not directly enhance poverty, and further, the agricultural land allocation process by which absolute poverty levels are effectively avoided, appears to be relative equitable.

Institutional adaptation appears to have offsetting influences on the vulnerability of Xuan Thuy District given present patterns of land use, land ownership and control and the role of the state in resource and risk management. The reduction in power and autonomy of state institutions associated with collective measures for protection from the impacts of coastal storms is one major accentuation of vulnerability observed in the case study. The agricultural co-operatives have effectively been emasculated in their role of allocating labour and resources towards collective action, of water and irrigation management, as well as in coastal defence. The atomisation of agricultural decision-making has, however, contributed to increased marketed production of agricultural commodities, thereby contributing to the rising incomes in the District. But this has been at some cost to collective security. Offsetting these impacts associated with the rolling back of the state, has been the re-emergence of informal social coping mechanisms associated with both entrepreneurial and community activities.

This paper demonstrates the complex nature of social vulnerability and the importance of the political economy context. However, it is not meaningful to

generalise from the analysis presented to the climate change threat over the next century at a global scale. Different societies face different threats, and have different coping mechanisms and resources with which to implement these (e.g. Ribot *et al.*, 1996). The approach here is applicable, however, to other circumstances, hypothesising that these can be investigated empirically for other social and climate risk situations. The vulnerability concept developed here attempts to address the issue of scale within coping mechanisms of environmental change by examining the role of vulnerability of individuals and of collective vulnerability to extreme events. However the delineation between what constitutes adaptation and what is observed as coping with the extraordinary or hazardous events remains a central unresolved issue in analysing vulnerability within society environment interactions (see discussion by Dow, 1997).

These general factors which lead to social vulnerability are the characteristics of the climatic threat; the political economy context in which the institutions of decision-making, primarily the state in all its manifestations, attempt to minimise or manage threat for the benefit of society but also the benefit of the institutions themselves; and the economic structure and cultural context of adaptation at the individual level. By addressing vulnerability in a comprehensive manner current populations are enabled to address today's climatic extremes and other threats and are better equipped to cope with future uncertainties.

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