Adaptation of Community and Households to Climate – Related Disaster

The Case of Storm Surge and Flooding Experience in Ormoc and Cabalian Bay, Philippines

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ADAPTATION OF COMMUNITY AND HOUSEHOLDS TO CLIMATE-RELATED DISASTER: THE CASE OF STORM SURGE AND FLOODING EXPERIENCE IN ORMOC AND CABALIAN BAY, PHILIPPINES

Canesio D. Predo and Buenaventura B. Dargantes

EXECUTIVE SUMMARY

This study aimed to document the actual experience of the community and households in Ormoc, Leyte and selected municipalities along Cabalian Bay in Southern Leyte to flooding brought about by extreme climatic events and their perception, preparedness, and planned adaptation for the potential threat posed by climate change-induced sea level rise. Primary data collected through survey, key informant interviews, and focus group discussions, and secondary data were used in the study. Interviewed were 141 respondents from Ormoc (60), Hinundayan (62), and St Bernard (19). The respondents were selected using simple random sampling from the list of affected households.

The flash flood in Ormoc and the flooding event in coastal areas along Cabalian Bay in Southern Leyte due to storm surge/sea level rise brought tremendous damage and significant impacts to households and the community. Historical data for Ormoc flash flood showed that the estimated damage cost was about PhP620 million plus other non-quantified damages. Apart from physical impacts, the disasters also brought significant perceived impacts on the households' welfare. Comparison of pre-disaster and post-disaster changes in impact indicators showed that climate-induced disaster decreased the households' access to land for crop cultivation as well as to coastal and fishery resources, hence affecting their socioeconomic conditions and livelihood systems. The disaster also significantly decreased the overall state of natural resources and environment. Nevertheless, climate-related disaster brought better access to credit and financial grants after the disaster, which seemed to help households in coping with the situation.

Households that experienced flooding tended to perceive a high level of vulnerability to risks and threats from flooding and storm surge/sea level rise. Vulnerability regression estimates for flooding showed that households' vulnerability to flooding increased with house size and decreased with access to grant and credit facilities. This is probably because households with bigger houses would have greater exposure to the risks and threats from flooding, which makes them more vulnerable to such event. Increasing households' access to grant and credit may reduce their vulnerability to flooding and eventually help them to recover, adapt, and cope with the impacts. On the other hand, the households' vulnerability to storm surge/sea level rise was significantly influenced by their education level, household annual income, and total landholdings. Results suggest that households with higher educational attainment and annual income, and bigger total landholdings tended to be less vulnerable to the risks and threats from storm surge/sea level rise. Overall, the factors that signicantly and inversely affected the households' vulnerability to natural disasters were household annual income and access to grant and credit facilities after the disaster.

Despite having low socioeconomic status, most respondents were prepared for possible threats from natural disaster occurrence in the community. In actual preparation and plans, however, most of the respondents just wanted to follow the early warning system to minimize the disaster's potential impacts. More households implemented these three adaptation strategies: (i) transfer to evacuation area temporarily, (ii) restructuring of housing unit, and (iii) relocation of residence to a safe place permanently. A few households built stone breakwaters, improved the dike or canal near their residence, and changed their land use system to fit new conditions.

The use of family savings, of grants received/requested, and of loans from friends were the most important coping strategies of households during and immediately after the disaster. This suggests that the provision of immediate financial assistance to households and the community in disaster-prone areas would enhance their coping capacity in the short term. However, long-term coping strategies need to be linked with sustainable livelihood and sources of income.

The most preferred adaptation options of the respondents involved individual household responses rather than those that required community cooperation as needed in broader strategies or major defensive engineering works. This finding indicated that some households in the community lacked confidence to rely on cooperative solutions or would just depend on local government units for defensive strategies and actions. Another interesting finding was that the households' most preferred option of temporary relocation seemed to be based on their perception that the impacts were only short-lived and that life would return to normal after such disasters. This suggests that in reality, the households did not appreciate the fact that sea level rise is a permanent or irreversible process. Hence, a more effective pro-active planning approach involving the affected households and the community is necessary to improve their understanding of the situation and to enable them to make informed decisions.

Similar findings were found regarding the adaptation strategies implemented by the local government unit. Its current efforts appeared to have concentrated on disaster relief rather than on long-term strategic planning and pro-active measures, although it had some long-term investment strategies in its development plans.

All of the above findings highlight the strong need for capacity-building activities with local government units, planning agencies, and local communities. Some of the practical approaches and tools such as benefit cost analysis (BCA), decision support systems, and risk assessment methodologies could be incorporated in a capacity-building program for local government units, other government planning agencies, research institutions, and the community. In this respect, EEPSEA and other funding institutions could contribute significantly in capacity building. Such initiatives could help in the development of action plans and other pro-active measures to prevent or minimize the worst impacts of climate change.

1.0 INTRODUCTION

1.1 Background of the Study

The Philippines is an archipelago with a total discontinuous coastline of 32,400 kilometers. About 70% of the country's 1,500 towns and cities share the coast, deriving numerous benefits and opportunities offered by the coastal zone and near-shore areas. Coastal fishing accounts for 40 to 60% of the total fish catch and represents about 4% of the GNP. The country's coastal and marine resources are varied and diverse, providing food and employment to over one million Filipinos, half of whom are engaged in small-scale fishing.

There are approximately 50 million people in the Philippines living in coastal areas and are at risk from the impacts of natural hazards and extreme climatic events. Since the Philippines is also one of the countries vulnerable to climate change-induced sea level rise (SLR), there is imminent threat to both human and natural resources in the coastal areas. Aside from the inundation of low-lying areas, SLR also results in increased erosion, salt-water intrusion, and increased risk of flooding and storm damage, all of which may lead to substantial economic losses (IPCC, 2001). Being in the Pacific Rim, the Philippines is a hot spot for natural hazard occurrences. It is highly prone to storm surges and riverine flooding, caused by storms and other environmental degradation. This is because there are about 11 to 32 or an average of 20 tropical cyclones passing yearly through the Philippine area of responsibility; about nine cyclones crossed the country from 1948 to 2007 (CAB, 1995). Further, the frequency of occurrence of tropical cyclones is more erratic in the past decade (Fig. 1) possibly as a result of the effects of climate change.

1.2 The Manifestation of Climate-Related Disaster

In November 1991, a devastating flood brought by Typhoon Uring hit Ormoc City in Leyte, Philippines. Large quantities of drift timber and debris evidently increased the flood's force. The calamity caused tremendous damage: 4,922 deaths and 3,000 missing persons, and an estimated PhP620 million (more than US$12 million at that time) worth of damage to residential houses, commercial establishments, agriculture, livestock and fishery production, and public infrastructure. It was one of the greatest natural disasters in the Philippines and is known as the "Ormoc Tragedy of 1991."

In response to this tragedy, the local government unit of Ormoc city formulated a master plan and a feasibility study to prevent similar incidents in the future. In 1998, the project was implemented to improve the channel of the two rivers and to construct three slit dams based on the detailed design (CTI Engineering International Co., Ltd., 2007). Construction was completed in August 2001, making the city safe for residents from another flash flood. However, it was not clear whether the design of this project has taken into consideration the vulnerability of the city property and residents from flooding due to storm surge and the potential impacts of sea-level rise. Besides the numerous rivers and streams that traverse it, Ormoc city is also a port city located along Ormoc bay. This makes the city vulnerable not only to flooding from inland water resources but also from storm surges and rising sea level due to climate change.

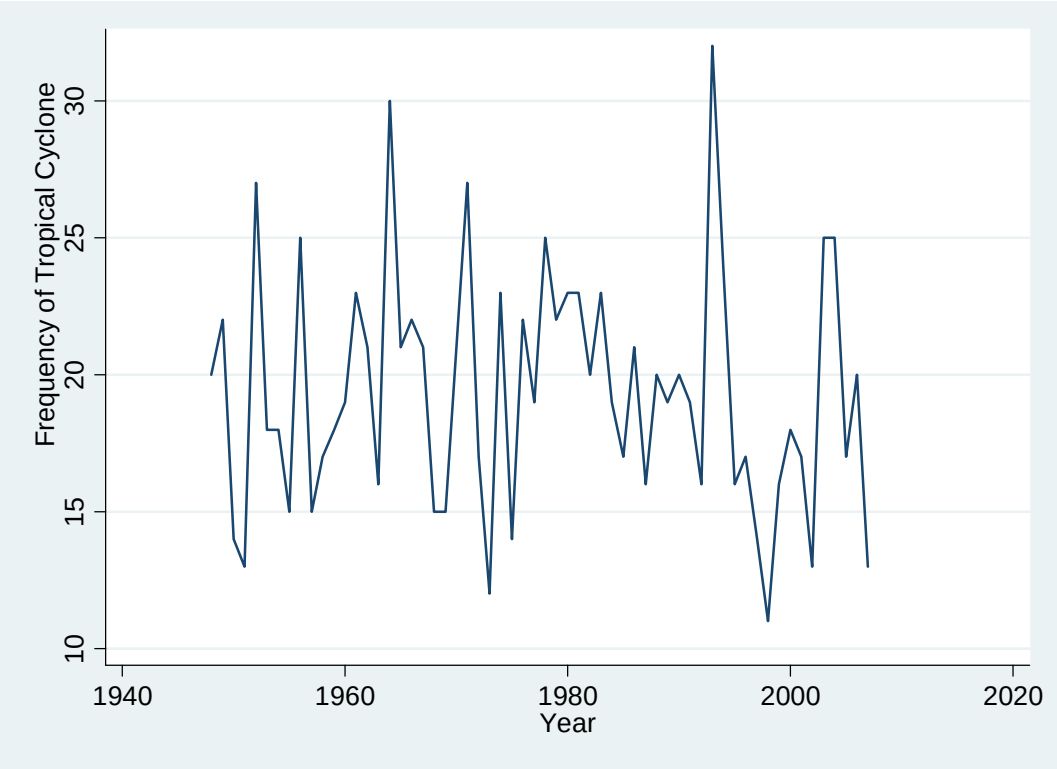

Figure 1. Frequency of tropical cyclones in the Philippines for the period 1948-2007 (Source: CAB, 2005).

The coastal municipalities along Cabalian Bay in Southern Leyte were experiencing the same natural disasters like flooding and landslides. Flooding had twofold causes: (1) continuous heavy rainfall and (2) coastal storm surge. The excessive and continuous rainfall also triggered geologic hazard that often resulted to mass movement or landslide in the area. For instance, in a matter of seconds, the homes and families in the barangay of Guinsaugon were wiped out, buried under a mountain of soil and rock.

1.3 Actions Undertaken by the Government After the Disaster

It is interesting to learn what the local government of Ormoc did to help the community and the households in the aftermath of the flooding disaster. Based on secondary information, the government both at the local and national levels undertook some rehabilitation works immediately after the flooding event. However, these were limited to the construction of damaged structures such as bridges and dikes (DPWH, 1997). Disaster relief operations such as the provision of temporary dwelling units to affected households, and the distribution of food, clothing, medicines and other social services, were also done.

In Hinundayan and coastal zones of St. Bernard along Cabalian Bay, it was the local government at the municipal and barangay levels that handled most of the rehabilitation efforts and disaster relief operations caused by flooding events due to storm surge. This is because these events were less popular in the national and international scenes. Nevertheless, in both Ormoc and the above locations, disaster

relief operations for the affected community and households were done immediately after the flooding events. The municipal local government units conducted damage assessment. They also constructed some damaged infrastructures such as roads, bridges, and dikes and improved drainage. Based on the focus group discussion and key-informant interviews, the local government released the calamity funds for relief assistance such as food, clothing, and other household needs to the barangay.

1.4 The Research Problem

In response to the Ormoc tragedy, the Ormoc Task Force Scientific Study Group (1991) was created to assess the problems and investigate the causes of flash floods. Likewise, because of the frequent occurrence of storm surge and flooding along Cabalian bay and ensuing landslides, a systematic geohazard assessment and mapping study (Gomez, 2004) was conducted to generate information on the vulnerability of the selected areas to natural hazards like flooding, subsidence, coastal degradation, earthquakes, and similar geologic events.

More recently, Ormoc and Cabalian Bay were included in the project "Hazard Mapping and Assessment for Effective Community-based Disaster Risk Management" (also known as READY project) jointly implemented by the government of the Philippines and the United Nations Development Programme (UNDP, 2006). The READY project attempted to develop a database and to generate more information that would address major barriers in disaster risk management. While these information are valuable to policy and decision makers, all existing studies focused mostly on biophysical impacts. Thus, this study was conducted to document the flooding experience and assess the socio-economic dimensions of climate-related disaster impacts on communities and households in the disaster-prone areas. The study attempted to answer the following questions:

1. What are the socio-economic characteristics of households and the community in the selected disaster-prone areas in Leyte and Southern Leyte;

2. How vulnerable are the community and households in the selected disaster-prone areas to flooding due to storm surge and sea level rise;

3. What adaptation measures and coping mechanisms have been adopted by the community and households to address the natural disaster they have experienced;

4. What are the households' and local government units' perceptions on and preparedness for natural disaster occurrence like flooding and storm surge potentially resulting from the threat of climate-change induced sea level rise; and

5. What strategies and options are being formulated and likely to be implemented by households and local government units in the study areas to address the potential impacts from sea level rise.

1.5 Research Objectives

The overall objective of the study was to document the actual experiences of the community and households in Ormoc, Leyte and selected municipalities along Cabalian Bay in Southern Leyte to flooding and landslide due to extreme climatic events as well as their perception on, preparedness for, and planned adaptation for the potential threat posed by climate change-induced sea level rise.

Specifically, the study aims to:

1. Determine the socio-economic characteristics of the community in general and of the households in particular in selected disaster-prone area (or hotspots) in Leyte and Southern Leyte;

2. Assess the vulnerability levels to flooding of the community and households in the selected disaster-prone areas in Leyte and Southern Leyte;

3. Identify and analyze the adaptation measures/strategies and coping mechanisms being formulated and implemented by the households, communities, and local government units to mitigate the impacts from natural disaster;

4. Determine the level of awareness, perception on, and preparedness for natural disaster occurrence such as flooding and storm surge due to climate-change induced sea level rise among households, the community, and local government units; and

5. Draw policy insights and recommendations for improving adaptive management responses of households and local government units to natural disasters in general and to sea level rise in particular.

2.0 METHODOLOGY

2.1 The Study Areas

The study was conducted in the coastal communities and households of Ormoc City in Leyte, St. Bernard and in Hinundayan of Southern Leyte (Fig. 2). These sites were purposively selected because these areas experienced climate-related disaster – flash flood for Ormoc City and storm surge for the coastal areas of Ormoc, St. Bernard, and Hinundayan.

Ormoc City is situated in the northwestern part of Leyte. It is a coastal city facing Ormoc Bay but the city's terrain is mostly of gently rolling plains. Approximately one-half of Ormoc is mountainous and hilly (CPDO, 2006). The city has a total land area of 464.30 square kilometers with agriculture (56.64%) as the dominant land use. The place experiences intense rain period that usually occurs during the months of June to February (CPDO, 2006).

The municipality of St. Bernard is strategically situated in the southern portion of the island of Leyte. It is a coastal town bounded on the north by the town of Hinunangan and by two big bodies of water (i.e., Panaon Strait and Cabalian Bay) on the south (CLUP, undated). Although St Bernard is a coastal town, agriculture plays the

most significant factor in the people's economic and social life. Guinsaugon, a barangay in this municipality that was totally covered by a landslide, is one of the productive agricultural areas in St. Bernard.

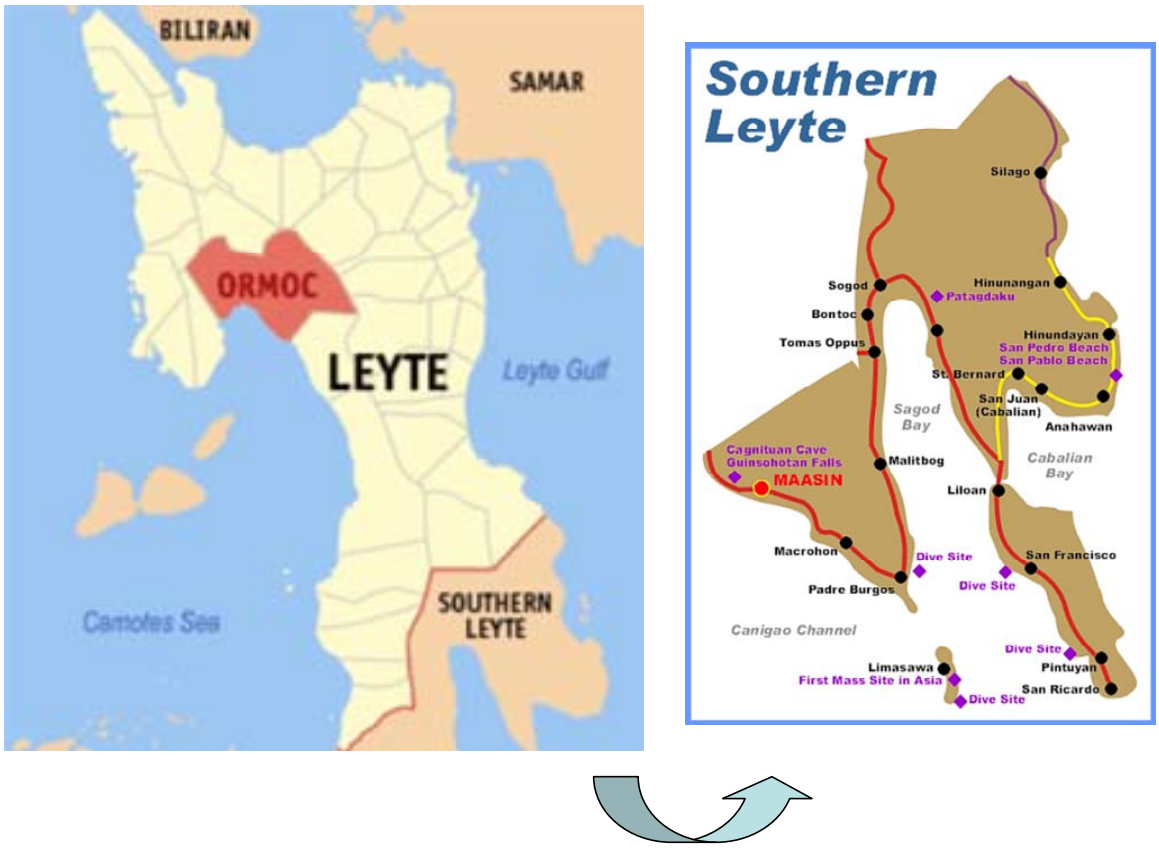

Figure 2. Map of Leyte and Southern Leyte showing the study sites.

The municipality of Hinundayan, on the other hand, is located in the southeastern coast of the province of Southern Leyte. It directly faces the Surigao Strait and the vast expanse of the Pacific Ocean. It is bounded in the northwest by the municipality of Hinunangan, in the South by the municipality of Anahawan, and in the East by Surigao Strait (CLUP, 2000). Being a coastal town with a total area of 6,108 hectares, Hinundayan extends from the shorelines towards the upper hinterlands.

The climate of Hinundayan belongs to Type II, characterized by a dry season in the months of March to September and a pronounced rainfall from October to February. Generally, maximum rainfall occurs during the months of November, December, and January. Typhoons in the area accounts for an estimated 7% of the total number of typhoons in the Philippines (CLUP, 2000).

2.2 Sources of Data

The study used both primary and secondary data. Primary data were collected through survey, key informant interviews, and focus group discussions. These included the following information: socio-economic characteristics of affected households; adaptation behaviour and coping mechanisms to flooding, storm surge, and sea level

rise impacts; and perceptions on and awareness level of households, community leaders, and local government unit officials regarding the potential threat of climate change particularly on sea level rise on coastal resources and properties.

Secondary data, on the other hand, such as existing reports, publications, agricultural production data, climatic data, and other relevant information were obtained from different sources, namely: the Department of Agriculture (DA), Department of Environment and Natural Resources (DENR), Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), academic institutions, private sectors, local government units, and others.

2.3 Sampling and Household Survey Instruments

The household survey was conducted in Ormoc City, Leyte and in the towns of Hinundayan and St. Bernard of Southern Leyte. These sites experienced flooding due to flash flood and storm surge events. The researchers interviewed 60 households from Ormoc, 62 from Hinundayan, and 19 from the St. Bernard coastal zones to make a total of 141 household-respondents. These respondents were randomly sampled from the list of affected households.

The survey questionnaire consisted of 12 sections as follows: (1) general and background information, (2) demographic characteristics, (3) socioeconomic characteristics, (4) ownership of assets and indices of living, (5) social affiliation, (6) access to credit and financial grants, (7) awareness, perception, and preparedness of households on climate change-induced sea level rise and natural disaster, (8) extent and nature of the impacts of natural disaster, (9) adaptation strategies and coping mechanisms of households to mitigate the impacts from climate change and natural disaster, and (10) perceived impacts of natural disaster.

2.4 Data Analysis

The study employed descriptive statistics such as means, standard deviations, and frequency distribution to summarize the survey results and other relevant data. A paired comparison t-test was also conducted to assess the statistical significance of the difference between the pre-disaster and post-disaster changes on selected impact indicators. An ordinary least squares regression was conducted to identify the factors affecting the level of vulnerability of households to the risks and threats from climate-related disasters.

Selected adaptations strategies and coping mechanisms being adopted by the households and community were documented to generate insights and lessons.

3.0 RESULTS AND DISCUSSIONS

3.1 Nature and Extent of the Impacts of Climate-Related Disaster

Climate-related disasters are expected to bring havoc to people and to their property in the affected community. The flash flood in Ormoc caused by typhoon Uring damaged the area tremendously – destroying approximately 14,000 houses and killing or leaving as missing 8,000 persons (Table 1). Total damages was estimated to be PhP620.9 million (DPWH, 1997).

On the other hand, although there was no official figure documenting the flooding event in Hinundayan due to storm surge and flash flood in December 2005, damage was also significant. Key informant interviewees cited the significant damage to agriculture (e.g., rice production) and aquaculture production (e.g., fish pond) in the area. Damages to household property and appliances were also reported.

The nature and extent of the impacts of climate-related disaster depended on the type and intensity of the disaster and on the vulnerability and preparedness of people in the affected community. Survey results showed that majority of the household respondents (70.2%) in the case study sites experienced as a major impact, damage to their properties – such as residential and agricultural properties (Table 2).

Other respondents mentioned that the natural disaster caused illness (8.5%), loss of livelihood (7.8%), damage to agricultural lands (6.4%), loss of life (5.0%), and family inconvenience and conflicts (5.0%). Despite the major observable impacts of natural disasters, however, about one-fifth of the respondents (19.9%) said that they were not affected at all by the disaster (Table 2).

Table 1. Flood damage by typhoon Uring at Ormoc in 1991, Leyte, Philippines.

Item	Damage/Amount (PhP million)
A. Monetary Damage Cost	
1) Commercial establishment damage	49.0
2) Livestock damage	6.0
4) Fishery damage	0.9
5) Public infrastructure	
5.1 Road	286.0
5.2 Rivers/Drainage	188.0
5.3 Bridges	48.0
Total	**620.9**
B. Non-monetary Damage	
1) Person	
1.1 Dead	4,922 Persons
1.2 Missing	3,000 Persons
2) House/Building	
2.1 Completely destroyed	2,850 Houses
2.2 Destroyed partially	10,910 Houses

Source: DPWH, 1997

Table 2. Nature of impacts from climate-related disaster on the households and community, Leyte, Philippines, 2007.

Nature of Impact	Frequency	Percent
Damage to property	99	70.2
Cause of illness	12	8.5
Loss of livelihood	11	7.8
Damage to agricultural lands	9	6.4
Cause of poverty	8	5.7
Loss of life	7	5.0
Cause of family inconvenience and conflicts	7	5.0
None	28	19.9

Note: Multiple responses

Translating the impacts into monetary terms was limited only to the types of damage enumerated by the respondents such as the damages on (i) household property and appliances, (ii) agricultural lands and animals, and (iii) loss of livelihood/business establishment (Table 3). The total estimated cost of damage was about PhP36,015, which was approximately 46% of their average household annual income. The cost of damage to household property and appliances (PhP31,093) contributed a bigger share to the total damage cost. The total damage cost reflected herein was considered an underestimate of the actual damage cost registered during the flash flood in Ormoc and during the storm surge/flooding in Hinundayan and St Bernard. This is because there were other affected sectors (e.g., business sector, service, infrastructure, etc.) not included in the survey.

3.2 Perceived Impacts of Climate-Related Disaster

The impacts of climate-induced disaster as perceived by the respondents on selected socioeconomics, resource access, and natural resource indicators were assessed using a baseline-independent approach through the 10-step ladder diagram (Pomeroy *et al*., 2006). The impact indicators included the following: (1) overall well-being of individual household, (2) access to land for crop cultivation, (3) access to water resources for drinking and other household use, (4) access to coastal and fishery resources, (5) access to credit and financial grants, (6) household income, (7) employment opportunity, (8) household risk and vulnerability, and (9) overall state of natural resources and the environment.

Table 3. Estimated cost of damage incurred by the household-respondents from natural disaster experienced in the community, Leyte, Philippines, 2007.

Type of Damage	Mean	Standard Deviation
Household property and appliances	31,093	102,810
Agricultural lands and animals	24,450	29,639
Loss of livelihood/business establishment	8,167	6,047
Total Cost	36,015	110,468
% of Household Annual Income	45.5%	

A ladder diagram was shown to the respondents, and they were asked to choose a step on the ladder that realistically described the situation (any step from 1 to 10) of the selected indicators before the disaster and at the time of the survey. For each indicator, the respondents were told that the first step on the ladder described the worst possible situation; as the step went higher, the situation got better and the highest step on the ladder represented the best possible situation they could have. A paired comparison t-test was calculated to determine whether the mean differences between the two time periods were statistically significant. The analysis was done separately for each site because the climate-related events occurred at different periods. The results of this analysis are presented in Table 4.

Results showed a statistically significant decrease in the overall well-being of individual households in St Bernard. Although not statistically significant, Ormoc and Hinundayan respondents perceived the overall well-being of individual household to be worse off at the time of the survey than before the disaster. This was perhaps because the households had inadequate capacity to adapt, cope, and recover from the impact of a natural hazard.

The indicator on access to land for crop cultivation decreased significantly at 10% level in Ormoc (p<0.10>) and at 1% level in Hinundayan and St. Bernard (p<0.10>). This can be explained largely by the disappearance of agricultural land affected by the disaster and change in land use. Likewise, access to water resources for drinking and household use was lower at the time of the survey than before the disaster although the figure was not statistically significant. Results also showed a statistically significant decrease in access to coastal and fishery resources (p<0.01> among the respondents in the three sites. This finding implies that climate-related disaster had adversely affected coastal households more than those living inland.

Table 4. Perceived pre-disaster to post-disaster changes in impact indicators, Leyte, Philippines, 2007.

Indicator	Ormoc		Hinundayan		St Bernard		All	
	T_2-T_1	Sig.+	T_2-T_1	Sig.+	T_2-T_1	Sig.+	T_2-T_1	Sig.+
Overall well-being of individual households	-0.08	0.812	-0.08	0.600	-0.74	**0.001**	-0.17	0.303
Access to land for crop cultivation	-0.32	**0.097**	-0.63	**0.001**	-1.42	**0.001**	-0.60	**0.000**
Access to water resources for drinking and other household use	-0.27	0.312	-0.11	0.034	0.11	0.667	-0.15	0.208
Access to coastal and fishery resources	-0.58	**0.005**	-0.76	**0.000**	-1.74	**0.000**	-0.82	**0.000**
Access to credit and financial grants	1.28	**0.000**	0.10	0.531	0.47	**0.025**	0.65	**0.000**
Household income	-0.22	0.494	0.21	0.294	-0.74	0.158	-0.10	0.569
Employment opportunity	0.25	0.379	0.18	0.369	-0.42	0.297	0.13	0.417
Household risk and vulnerability	0.28	0.479	0.11	0.468	0.42	0.163	0.23	0.224
Overall state of natural resources and the environment	-1.25	**0.000**	-1.10	**0.000**	-1.74	**0.000**	-1.25	**0.000**

+ Significance level (2-tailed)

On the other hand, access to credit and financial grants showed a statistically significant increase ($p<0.01$ and $p<0.05$ for Ormoc and St Bernard, respectively) except for the Hindundayan respondents (Table 4). This increase can be attributed to the influx of contributions and donations from different funding agencies, corporations, and individuals at the local, national, and international levels for the rehabilitation and relief operations of affected communities. The perceived impact on household income was not statistically significant, but the respondents believed that household income was lower during the survey period than before the disaster happened in their community, as indicated by a negative difference in household income (Table 4).

Similar to household income, the difference in employment opportunity during the survey and before the disaster was not statistically significant from zero, and it was positive. This indicated that the households in the study sites were able to recover from employment difficulties brought about by the disaster (Table 4). Suprisingly, the perceived change in household risk and vulnerability before the disaster and at the time of the survey was insignificant statistically, although it was perceived to be higher after the disaster as indicated by a positive difference. This result implied that the respondents were still anxious about the possible flooding risk and vulnerability. Finally, the results also indicated a statistically significant decrease ($p<0.01$) in the overall state of natural resources and the environment. This suggests that the households perceived a better overall status of natural resources and environment before they experienced flooding and storm surge in the area.

3.3 Awareness of Households on Climate Change-Induced Disaster

The households survey showed that almost all of the respondents (94.3%) were aware of the global climate change phenomenon (Table 5). In terms of level of awareness measured using a scale of 1 to 10, the respondents exhibited an above average score (7.40) of awareness towards climate change. This finding indicated the households may have already noticed the effects of climate change in their locality because of the flooding events they personally experienced.

Table 5. Awareness of households on the climate change phenomenon, sea level rise, and the risks and threats from natural disaster, Leyte, Philippines, 2007.

Item	Frequency	Percent
Climate change phenomenon		
Aware	133	94.3
Not aware	8	5.7
Total	141	100.0
Mean level of awareness (Std. Deviation)	7.40 (1.79)	
Sea level rise		
Aware	126	89.4
Not aware	15	10.6
Total	141	100.0
Risks and threats from natural disaster		
Aware	132	93.6
Not aware	9	6.4
Total	141	100.0

Likewise, results showed (Table 5) that majority of the respondents were aware of the risks and threats from natural disaster (93.6%) and of the sea level rise phenomenon (89.4%). These findings implied that the community and the households may have already felt the impacts of these localized effects of climate change.

Table 6 shows that the respondents also had above average level of awareness on the risks and threats from specific climate-induced disasters, such as flooding, landslide, storm surge/sea level rise, and coastal eroson. Based on a scale of 1 to 10, the highest level of awareness was on flooding (8.02). This is understandable considering that the households in the study sites experienced flooding, most notably the flash flood of Ormoc in 1991. Hinundayan also experienced flooding in 2005 caused by storm surge/sea level rise and inland flow of water from the river systems.

The respondents likewise demonstrated high levels of awareness about storm surge/sea level rise (7.37), landslide (6.47), and coastal erosion (6.07). Again, their high awareness levels could be attributed to their past experiences and to their more recent frequent experiences of such events at low intensity (Table 6).

Table 6. Respondents' average level of awareness to the risks and threats from natural disaster, Leyte, Philippines, 2007.

Natural Disaster	Mean	Standard Deviation
Flooding	8.02	2.03
Landslide	6.47	3.14
Storm surge/sea level rise	7.37	1.97
Coastal erosion	6.07	2.09

3.4 Vulnerability and Preparedness of Households and the Community to Climate-related Disaster

3.4.1 Level of Vulnerability

Using a scale of 1 to 10, the study assessed the respondents' level of vulnerability to the risks and threats from various specific climate-induced disasters. Results showed that the respondents exhibited different levels of vulnerability to the risks and threats from various specific natural disasters (Table 7). Specifically, the respondents believed that they were most vulnerable to flooding (6.92) possibly because they have already experienced this disastrous event, and this might recur in the future. Vulnerability to storm surge/sea level rise (6.66) obtained the second highest rating maybe because the respondents have observed this especially in coastal communities, or they hear about it often enough from adequate media coverage(Table 7). .

Like flooding and storm surge/sea level rise, the respondents considered themselves to have a little above medium level of vulnerability to landside (5.31) and a medium level of vulnerability to storm surge/sea level rise. This may be because the respondents were living in a relatively safe place although the latter's geographic characteristics make it also sensitive to landslides (Table 7).

Table 7. Respondents' average perceived level of vulnerability to the risks and threats from natural disaster, Leyte, Philippines, 2007.

Natural Disaster	Mean	Standard Deviation
Flooding	6.92	2.21
Landslide	5.31	3.48
Storm surge/sea level rise	6.66	1.99
Coastal erosion	5.00	2.42

3.4.2 Factors Influencing Vulnerability of Households and Community to Climate-related Disasters

Vulnerability to climate-related disasters depends on several factors including the resilience to hazards associated with the calamity and the capacity of the people to cope with extreme events. Reducing vulnerability against or increasing resilience to natural disasters may involve a suite of approaches including increasing food sufficiency, strengthening people's livelihood, improving awareness and capacity, and increasing readiness or preparedness during the occurrence of natural calamities or disasters.

In this study, a simple approach was adopted to explore the factors affecting the level of vulnerability of households to the risks and threats from climate-related disasters, specifically flooding and storm surge/sea level rise. The vulnerability level (V_k) of household *i* was specified as a function of socioeconomic characteristics (S_j), wealth or asset ownership (W_k), access to grant and credit (A), and random error term (ε):

$$V_k = f(S_{ji}, W_{ki}, A_i; \varepsilon)$$

Socioeconomic characteristics included education level (years) and age (years) of the respondents, household size, and household annual income (PhP). Total landholdings (ha) and house size (m^2) represented wealth or asset ownership of households. A dummy or indicator variable on households' access to grant and credit facilities (1=yes, 0 otherwise) was also included in the model. The model was estimated using ordinary least squares.

Prior to the regression results, let us examine the descriptive statistics of the independent variables included in the household vulnerability model. As shown in Table 8, the average educational attainment of the respondents was about eight years, which implied that they had at least high school of formal education. The respondents reached an average age of 48 years. The average household size was about five members while the average household annual income was about of PhP79,104.11 (Table 8). In terms of assets, the respondents' average total landholdings was less than one-fourth of a hectare (0.22 ha) and these consisted of agricultural, residential, and commercial lands. On the other hand, the respondents had an average house size of about 123 m^2 in terms of floor area.

The ability of the households and community to recover and adapt to the changing physical environment after the occurrence of climate-related disaster depended on their access to credit, financial grants, and assistance in the locality. About

67% of the respondents reported having access to grants and credit facilities after the occurrence of natural disaster in their locality (Table 8). Access to grant and credit after the disaster was easy for the respondents. Because of the popularity of the flooding event in Ormoc, many local and foreign donors and funding agencies provided financial grants and assistance to the victims and to the local government units. For the less popular flooding event in Hinundayan and for the storm surge/sea level rise in the coastal barangays of St. Bernard, many respondents still reported having access to grants and credit after the disaster, possibly because local government units provided in-kind and financial assistance to the affected households.

Table 8. Descriptive statistics of independent variables used in the vulnerability model, Leyte, Philippines, 2007.

Variable	Mean	Std Deviation
Education level (years)	8.06	3.30
Age (years)	48.31	14.05
Household size	4.71	2.08
Household annual income (PhP) (1 US$=PhP41.80)	79,104.11	101,591.87
Total landholdings (ha)	0.22	0.73
House size (m^2)	126.66	130.12
Access to grant and credit	0.67	0.47

The vulnerability regression estimates for flooding showed that house size (used as a proxy for household wealth) and access to grant and credit facilities after the disaster significantly influenced vulnerability of households to the risks and threats from flooding (Table 9).

Contrary to expectations, a positive and significant coefficient for house size implied that vulnerability of households to flooding increased with house size. The expectation that households with high incomes had large houses may have caused the seeming inconsistency of results. However, household income was not statistically significant with households perceived vulnerability to flooding. Further, collinearity diagnostics found no multicollinearity problems among the independent variables in the model. Further, households whose members had high educational qualifications did not necessarily have high levels of income; consequently, they did not own large houses as presumed. In fact, those households with large houses either had a household member married to a foreigner or working overseas. The plausible explanation is that households with bigger houses, being a fixed and immobile asset, would have greater exposure to the risks and threats from flooding, hence making them more vulnerable to such events.

Households' access to grant and credit was inversely and significantly related to their level of vulnerability to flooding risks and threats. This indicates that households with access to grants and credit facilities tended to be less vulnerable to flooding risks and threats. Alternatively, increasing households' access to grant and credit may reduce their vulnerability to flooding and eventually help them to recover, adapt, and cope with the impacts from the disaster.

The households' vulnerability to storm surge/sea level rise was significantly influenced by their education level, household annual income, and total landholdings (Table 9). All the three variables were found to have an inverse relationship with the

households' vulnerability to storm surge/sea level rise. These results suggest that households with higher educational attainment and annual income and bigger total landholdings tended to be less vulnerable to the risks and threats from storm surge/sea level rise. This is probably because they have more options in dealing with storm surge/sea level rise.

For the overall vulnerability regression, household annual income and access to grant and credit facilities after the disaster were the factors that signicantly and inversely affected the households' vulnerability to natural disaster (Table 9). Similar to flooding, households with access to grant and credit were less vulnerable to the risks and threats from natural disaster compared to those without access. Households with high access to financial assistance were less vulnerable to such calamity simply because they were flexible, and they had more options to be able to adapt and cope with the impacts of natural disaster. In the same manner, households with higher annual incomes tended to be less vulnerable to the risks and threats from natural disaster.

Table 9. Factors influencing the perceived vulnerability of the respondents to climate-related disaster, Leyte, Philippines.

	Flooding		Storm Surge/Sea Level Rise		Overall Vulnerability	
	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value
Constant	2.355***	4.122	7.427***	5.685	2.339**	2.327
Education level (years)	0.016	0.636	-0.123#	-1.634	-0.050	-0.914
Age (years)	0.010	1.318	-0.004	-0.210	0.019	1.389
Household size	-0.036	-0.785	-0.043	-0.352	0.068	0.725
Household annual income (PhP)	-4.45E-07	-0.496	-7.26E-06**	-2.285	-5.0E-06*	-1.990
Total landholdings (ha)	-7.52E-06	-0.794	-7.58E-05**	-2.098	-1.2E-05	-0.479
House size (m^2)	0.001*	1.778	-0.002	-0.568	-4.0E-04	-0.230
Access to grant and credit	-0.410**	-2.402	0.443	0.806	-1.337***	-3.793
R^2	0.209		0.216		0.255	
F-value	1.740#		2.381**		3.367***	
N	53		55		76	

***,**,* = significant at 1%, 5% and 10% level, respectively; #=significant at 15% level

3.4.3 Preparedness and Plans Considered by the Households

Preparedness of households and the community in natural disaster occurrence is considered of utmost importance for disaster risk management. When asked about how prepared were the households for the possible threats from natural disasters, almost all of the respondents (96.5%) positively indicated that they were (Table 10). In fact, many of the respondents reported being prepared (38.3%) to being highly prepared (55.3%) for the hazards associated with natural disasters.

Table 10. Perceived preparedness of households for the possible threats from natural disaster occurrence in the community, Leyte, Philippines, 2007.

	Frequency	Percent
Preparation of Households		
Yes	136	96.5
No	5	3.5
Total	141	100.0
Status of Preparedness		
Less prepared	4	2.8
Prepared	54	38.3
Highly prepared	78	55.3
Not applicable	5	3.5
Total	141	100.0

To prevent or minimize the potential impacts from natural disaster occurrence in the future, the respondents were asked what preparations and plans their households were considering. Majority of the respondents said they would follow the early warning system established in the community (88.7%) (Table 11). The rest of the respondents planned to relocate residence (18.4%), modify their house structures (14.2%)%), construct protective measures (8.5%), and change their land use (3.5%). However, there were about 17% of the respondents who did not make preparations or plans for such eventuality (Table 11).

Table 11. Preparations and plans being considered by households to prevent or minimize the potential impacts from natural disaster occurrence in the future, Leyte, Philippines, 2007.

Preparation/Plan	Frequency	Percent
Follow early warning system	125	88.7
Modify house structure	20	14.2
Construct protective structures	12	8.5
Plan to relocate residence	26	18.4
Change land use	5	3.5
None	24	17.0

Note: Multiple responses

3.5 Adaptation Measures/Strategies and Coping Mechanisms of Households and Community

An important question posed in this study was: "What adaptation measures/strategies were being implemented by the households, the community in general, and the local government units to address the impacts of climate-related disasters?" Household survey results (Table 12) showed that majority of the respondents

(77.3%) indicated having adaptation measures to address vulnerability, risk reduction, and coping mechanisms for climate-related disasters.

Table 12. Adaptation measures/strategies being implemented by households to minimize the impacts of climate-related disasters, Leyte, Philippines, 2007.

Item	Frequency	Percent
Household with Adaptation Measures		
Yes	109	77.3
No	32	22.7
Total	141	100.0
Adaptation Measure/Strategy		
Relocate residence to a safe place permanently	15	13.8
Transfer to an evacuation area temporarily	43	39.4
Restructure housing unit	41	37.6
Build stone breakwaters	17	15.6
Improve dike system or canal near residence	21	19.3
Change land use to fit new condition	3	2.8
Change livelihood and sources of income	5	4.6
Prepare household needs and safety precautions	14	12.8

Note: Multiple responses

The top five adaptation measures/strategies implemented by many of the respondents included the following: transfer of households to evacuation area temporarily (39.4%); restructuring of housing units to fit the new condition (37.6%), improvement of the dike system or canal near residence (19.3%), building of stone breakwaters (15.6%), and relocation of household dwellings to a safe place permanently (13.8%). Other respondents prepared their household needs and safety precautions (12.8%), changed their livelihood and sources of income (4.6%), and changed their land use to fit their new conditions (2.8%) (Table 12).

It is interesting to note that the most preferred options involved individual household responses rather than community cooperation as would be needed in broader strategies or major defensive engineering works. This finding indicates that some households in the community lacked confidence to rely on cooperative solutions or to depend on local government units for defensive strategies and actions. Another interesting finding was that the households' most preferred option of temporary relocation seemed to be based on their perception that the impacts were only short-lived and that life would return to normal after such disasters. This suggests that in reality, the households did not appreciate the fact that sea level rise is a permanent or irreversible process. Hence, a more effective pro-active planning approach involving the affected households and the community is necessary to improve their understanding of the situation and to enable them to make informed decisions.

The effectiveness and usefulness of the different adaptation measures/strategies were assessed in minimizing the impacts of climate-related disasters. Majority of the respondents (41.8%) claimed that the adaptation measures or strategies they implemented were effective or very effective (20%) (Table 13). Nevertheless, a few

respondents (15.6%) mentioned that they had less effective adaptation measures/strategies.

Table 13. Effectiveness of adaptation measures/strategies being implemented by households to minimize the impacts of climate-related disasters, Leyte, Philippines, 2007.

Effectiveness	Frequency	Percent
Very effective	28	19.9
Effective	59	41.8
Less effective	22	15.6
Not applicable	32	22.7
Total	141	100.0

As to the sources of adaptation measures/strategies to mitigate or minimize the impacts of natural disasters, majority of the respondents (87.2%) said that these were indigenous knowledge. Almost half of the respondents (44%) said they learned from the media while 26% learned them from the community (Table 14). These findings showed that the indigenous knowledge of the households and the community was important to be considered always in identifying practical adaptation measures and strategies for climate-related disaster management. Likewise, the sharing or exchange of information and adaptation measures or strategies in the community need to be enhanced considering that other members of the community were also sources of these measures and strategies. Since media was also vital, they can be made accessible to more community members and households.

Table 14. Sources of adaptation measures/strategies being implemented by households to minimize the impacts of climate-related disasters, Leyte, Philippines, 2007.

Source of adaptation measures/strategies	Frequency	Percent
Indigenous knowledge	95	87.2
Learned from the media	48	44.0
Learned from the community	28	25.7

Note: Multiple responses

Apart from implementing adaptation measures, the respondents also employed coping strategies as immediate response to climate-related disaster. The top three cited coping strategies were using of family savings (41.8%), securing of loan from friends, relatives, and other persons (12.8%), and receiving of support from the government (7.1%) (Table 15). A few respondents also said that they got a loan from money lenders; they relied on their own initiative in work/business; they got support from family/relatives; they asked/received grants; they sold livestock or land or both; and they pawned land. Nevertheless, about 20.6% of the respondents did not have any coping strategy in dealing with the impacts of climate-related disaster that would affect their community (Table 15).

Table 15. Coping strategy of households from the impacts of climate-related disasters, Leyte, Philippines, 2007.

Coping Strategy	Frequency	Percent
Used family savings	59	41.8
Got a loan from friends, relatives, and other persons	18	12.8
Received support from government	10	7.1
Got a loan from money lender	9	6.4
Own initiative (work/business)	7	5.0
Support from family/relatives	5	3.5
Asked/received grants	5	3.5
Sold livestock	1	0.7
Sold land	1	0.7
Pawned land	1	0.7
None	29	20.6

Note: Multiple responses

3.6 Adaptation Strategies Implemented and Planned by the Government

Even though Ormoc City made a great effort after the flooding event to rehabilitate and reconstruct the damaged infrastructures such as roads, bridges, riparian structures as well as other drainage improvement from 1992 to1996, the works were limited to small-scale, and far from satisfying an appropriate flood control countermeasures to release Ormoc City from the menace of flood damage (DPWH, 1997). Realizing the need to improve the flood control capacity of the river systems and based on the results of the study conducted by the Japan International Cooperation Agency (JICA), the government requested for a grant aid from the government of Japan for the project, "The Flood Mitigation Project in Ormoc City."

The above approved project was implemented from 1998 to 2001 in two phases: (1) construction of three slit dams and five bridges, and (2) improvement of the river systems. The completion of the said flood control project had increased the safety and confidence of the households and the community living near the river. According to the key informants, however, there were at least two flooding events that triggered the sounding of the early warning system because the flood water exceeded the maximum level of the structure.

While some individual households employed autonomous adaptations, municipal officials have informed the community that it can use the church and gymnatorium as temporary evacuation places in case of flooding. At the community level along the coastal zones, the local government unit in the barangay revealed their planned adaptation strategies in the locality. In Ormoc, the local government unit submitted a proposal for the construction of a seawall and the permanent relocation of households located in high-risk areas to minimize the impacts of flooding resulting from sea level rise and storm surge. For Hinundayan and the coastal zones of St. Bernard, the local government at the municipal and barangay levels have installed a rain gauge, a tide level marker, and flood level measurement device to serve as early warning systems for the community. These municipalities, being beneficiaries of the national project "Hazard Mapping and Assessment for Effective Community-based Disaster Risk

Management Project" (known as READY Project), received these various equipment from the national government (UNDP, 2006).

As indicated in their development plans, the local government units of the study sites implemented or planned the implementation of the following projects as part of disaster preparedness, mitigation, relief or risk management initiatives: 1) establishment and construction of flood control structures in rivers identified to be potential sources of flood waters; 2) construction, rehabilitation, and improvement of drainage and sewerage systems especially in settlements; 3) establishment of relocation sites and housing projects for disaster victims and residents of identified high-risk areas; 4) soil and water conservation activities, and watershed and forest management projects; 5) establishment or construction of evacuation centers for displaced residents; 6) livelihood development including skills enhancement and capital assistance and financing; and, 7) community organizing and strengthening including post-trauma counselling and value formation.

3.7 Problems and Constraints to Adaptations

Adaptation strategies to natural disasters were not without problems and constraints. The common problems identified in the study sites during the focus group discussions and key informant interviews were related to relocation and protection options and strategies/measures adopted by the local government units. In an effort to minimize risks to human populations, the local government units embarked on housing projects to relocate people living in high-risk areas. Among their difficulties were the following: 1) finding an area that could be deemed safe (or at least with lower risk levels than the site to be abandoned) for human settlement; 2) mustering ample resources for the acquisition of the identified site (either through purchase or expropriation); 3) mobilizing its scarce human, physical, and financial resources for site development; 4) coordinating with donors in the construction of housing units; 5) facilitating the provision of ancillary services (e.g., electricity, water, and transportation); 6) identifying beneficiaries and awarding of housing units; and 7) community organizing and strengthening and values formation.

Finding an area suitable for relocation of affected households was difficult in the study sites (e.g., St. Bernard) because most of their lands were considered high-risk zones. In Ormoc City, some of the relocation sites were eventually established in areas deemed safe, but understandably, these were located far from the original settlements. When a relocation site deemed as near enough by the affected residents could not be identified, the local government units had to settle for evacuation centers. In such instance, the local officials provided information on where to go during emergencies (e.g., evacuation centers such as public schools and public sports centers) to households who opted to stay in their high-risk settlements.

Even if a suitable place could be found, local government units were not always assured that the property would be sold at prices prevailing prior to a disaster. According to some relief workers, land prices, especially for identified relocation sites, would usually go up as pledges for financial support to the victims would pour in. In cases where a relocation site was available, site development became another source of difficulty. Despite best intentions, local governments seemed to be deficient in one of the following: the right equipment (especially earth-moving machinery), highly-skilled equipment operators, highly-trained engineers who can supervise the work to meet

national standards, and adequate financial resources that can be mobilized to ensure adequate site development.

Disasters usually generate a lot of good will. The outpouring of relief assistance could, however, overwhelm the local managers of the humanitarian effort. As local officials come into the scene without prior experience in relief operations, they would find difficulty in coordinating donors of housing units, especially if they have their own set of criteria in determining the design of each dwelling unit and of the whole settlement itself.

Another contentious issue in the provision of housing units was the identification of beneficiaries and the mode by which each unit was to be awarded. For example, some donors required prospective beneficiaries to render counterpart labor during construction; others did not. Other donors would design the settlement to accommodate only those coming from the same community, while others were willing to accommodate victims from other communities. Some beneficiaries received a house-and-lot package; others were awarded housing units but not the lot. These variations placed local government officials in an awkward position of having to explain such donor-mandated selection and awarding criteria to the affected local people.

In some relocation sites, beneficiaries were even required to join community organizations and participate in organizational activities; otherwise they would lose their privileges. Membership in community organizations (including participation in some aspects of values formation activities) might help relocated families adjust to their new environment, but making it a condition to becoming a beneficiary seemed just too officious.

Another problem of the local government units in their relocation efforts was the returning of relocated households to their previous dwellings or nearby areas that were still considered high risk for flooding. In addition, some households sold or rented out their new houses and lots in the relocation sites because these were far from their sources of livelihood. Majority were composed of migrant workers employed in commercial and service enterprises as sales personnel and drivers in public transportation. The households also ignored the risks and returned to the affected areas because they said (1) they were not used to living in a mixed neighbourhood, and (2) they incurred higher transportation costs from relocation sites to their workplaces.

One of the common pitfalls surrounding relocation strategies for affected households was the lack of sustainable livelihood systems in the new sites. While relocation strategies were usually coupled with alternative livelihood options for the households, these were often adhoc, short-term in nature, and plagued with difficulties and limited success. An interviewee revealed that during meetings between local government officials and donor agencies, discussion on livelihood projects dwelt more on the difficulties encountered by the implementing organizations in attaining economic success. An attempt to review the data and assumptions behind the decision to undertake the projects revealed very little analysis of the proposed livelihood systems. Understandably, there was very little time and resources for a more in-depth and inclusive project study because the more urgent task of relief operations became the focus.

Over time, as activities became more settled and as additional investments poured into livelihood activities, the need for a more systematic analysis of economic options was realized. Unfortunately, because the individual beneficiaries perceived low levels of benefits, they shied away from introduced options and continued their traditional sources of livelihood in the vulnerable and high-risk areas.

Issues and constraints in the protection strategies undertaken and/or planned to be undertaken by the local government units were also surfaced during the focus group discussions and key informant interviews. First, most local government units gave low priority to addressing the threats of natural disasters in development plans, and instead, they preferred to incorporate disaster prevention, mitigation, and relief into disaster contingency plans. Second, adaptation strategies and options were identified and selected without undergoing thorough evaluation. The above issues may be related to the local government's resource allocation priorities as based on their budgeting system and on their short-term targets. Further, their lack of or inadequate capacity to undertake science-based economic assessment for the different strategies may hamper their ability to make well-informed decisions.

4.0 WHAT HAVE WE LEARNED?

Climate-related disasters such as flooding and coastal inundation due to storm surge and climate change-induced sea level rise are now receiving much attention mainly because of their significant impacts on the lives and livelihood of affected households and communities. In particular, adaptation measures of households and the community in disaster-prone areas affected by climate-induced disasters brought about by extreme climatic events are equally gaining more importance among local government units, national government agencies, and international funding agencies and donors strategies.

The flash flood in Ormoc and the flooding event in coastal areas along Cabalian Bay in Southern Leyte due to storm surge/sea level rise are examples of climate-related disasters that wrought tremendous damage and significant impacts on households and the community. Historical data revealed an estimated damage of about PhP620 million, excluding the non-quantified damages. Likewise, the survey showed that the most cited impacts were damage to property, cause of illness, loss of livelihood, and damage to agricultural lands. In addition to physical impacts, climate-induced disasters also brought significant perceived impacts on the households' welfare indicators.

Comparison of pre-disaster and post-disaster changes in impact indicators showed that climate-induced disaster affected negatively the households' socioeconomic conditions and livelihood systems, which included access to land for crop cultivation as well as coastal and fishery resources. It also significantly decreased the overall state of natural resources and environment of the households. However, climate-related disaster brought better access to credit and financial grants after the disaster, and this seemed to help the households in coping with the situation.

Results confirmed that rehabilitation and disaster relief operations were the most common activities undertaken by the local government units immediately after the disaster. However, rehabilitation works were limited only to the construction of damaged structures, while relief operations involved the provision of temporary

dwelling units to affected households; distribution of food, clothing, and medicines; and the extension of other social services.

Climate-related disaster created a high level of awareness among households. Majority of the households were aware of the global climate change phenomenon, sea level rise, and the risks and threats of climate-induced natural disaster. Their average level of awareness was high possibly because households and communities in Leyte island, especially those located in the floodplains and coastal zones, were vulnerable and continually faced threats of flooding resulting from much more frequent and severe climate-related disasters due to climate change.

Households that experienced flooding tended to perceive a high level of vulnerability to risks and threats from flooding and storm surge/sea level rise. Differences in wealth status and socioeconomics circumstances of households influenced their level of vulnerability to such risks and threats. Vulnerability regression estimates for flooding showed that vulnerability of households to flooding increased with house size and decreased with households' access to grant and credit facilities. This was probably because households with bigger houses would have greater exposure to the risks and threats from flooding that make them more vulnerable to such events.

Increasing households' access to grant and credit may reduce their vulnerability to flooding and eventually helped them to recover, adapt, and cope with the impacts of disaster. On the other hand, households' vulnerability to storm surge/sea level rise was significantly influenced by education level, household annual income, and total landholdings. Households with higher educational attainment and annual income, and bigger total landholdings tended to be less vulnerable to the risks and threats from storm surge/sea level rise. Overall, the factors that significantly and inversely affected the households' vulnerability to natural disasters were household annual income and access to grant and credit facilities after the disaster.

Despite having low socioeconomic status, most households were prepared for threats coming from natural disasters occurring in the community. Following the early warning system was the most cited form of preparation and plan to minimize the potential impacts of future climate-related disaster occurrence. Individual households can adapt to their situation based on their own calculations of their levels of risk and vulnerability. To minimize the impacts and take advantage of the opportunities from climate-related disasters, the households have implemented various adaptation measures, which could be categorized into either retreat and accommodation or protection. The three most cited adaptation strategies being implemented by most households were (i) transfer to evacuation area temporarily, (ii) restructuring of housing unit, and (iii) relocating of residence to a safe place permanently. A few households built stone breakwaters, improved the dike or canal near their residence, and changed their land use system to fit their new conditions.

The importance of indigenous knowledge of households and the community as a key source of adaptation measures/strategies to mitigate or minimize the impacts of natural disasters was highlighted. Most households used indigenous knowledge for adaptation measures or strategies individually or collectively in the community. Since households also learned their adaptation measures from the media, the role of information, education, and communication must also be enhanced.

The use of family savings, grants received/requested, and loan from friends was the most important coping strategy of households during and immediately after the occurrence of natural disaster. Hence, the provision of immediate financial assistance to households and the community in disaster-prone areas will enhance the coping capacity of households in the short term. However, long-term coping strategies need to be linked with sustainable livelihood and sources of income.

5.0 CONCLUSIONS AND POLICY IMPLICATIONS

5.1 Conclusion

Adaptation strategies and coping mechanism to climate-induced disasters vary in scope and magnitude depending on the impacts of events and on the vulnerability of the community and households to such future disasters. Vulnerability implies understanding of the characteristics of the households or community in terms of their capacity to anticipate, cope with, resist, and recover from the impacts of a natural hazard. It involves a combination of factors that determines the degree to which someone's life and livelihood are put at risk by a discrete and identifiable event in nature or society.

The adaptive strategy most preferred by households in responding to climate-related events was to move temporarily to safer locations, followed by restructuring of the housing unit to make these more flood-resistant. Building structural defenses such as stone walls or dikes were preferred less, and permanent relocation was the least liked adaptation strategy. Results indicated that the most preferred options involved individual household responses rather than community cooperation as would be needed in broader strategies or major defensive engineering works. This finding indicates that some households in the community lacked confidence to rely on cooperative solutions or to depend on local government units for defensive strategies and actions. Also, the local government units appeared to have concentrated more on disaster relief efforts rather than on long-term strategic planning and pro-active measures.

Another interesting finding was that the households' most preferred option of temporary relocation seemed to be based on their perception that the impacts were only short-lived and that life would return to normal after such disasters. This suggests that in reality, the households did not appreciate the fact that sea level rise is a permanent or irreversible process. Hence, a more effective pro-active planning approach involving the affected households and the community is necessary to improve their understanding of the situation and to enable them to make informed decisions. Overall, the findings highlight a strong need for capacity building with local government units, planning agencies, and local communities. Such capacity building would help them to: (1) identify areas at risk [e.g., using digital elevation models and Geographic Information Systems (GIS) technology, data on projected climate stressors from Global Climate Models (GCMs) or other models, and profile data on existing and projected activities at risk); (2) establish and operate effective early warning systems; (3) maintain and improve existing disaster management capabilities; (4) plan strategically for longer-term adaptive responses and outcomes; (5) design and implement engineering works or other effective adaptive measures; (6) implement community awareness and education programs on climate change and options for adaptation; and (7) establish planning

frameworks and apply techniques that prioritize the use of scarce financial and other resources for defensive and/or remedial measures.

Some of the practical approaches and tools such as benefit cost analysis (BCA), decision support systems, and risk assessment methodologies may be incorporated in a capacity-building program for local government units, other government planning agencies, research institutions, and the community. In this respect, EEPSEA and other funding institutions could contribute significantly in a capacity-building role. Such initiatives could assist in the development of plans of action and other proactive measures to avoid or ameliorate the worst impacts of climate change that might otherwise occur.

5.2 Policy Implications and Recommendations

Households and communities that have experienced climate-related disasters have implemented adaptation measures that were mostly adhoc and temporary in nature except in few cases (e.g., Ormoc flood control and housing relocation). Since climate change-induced natural disasters are inevitable, there is a need for local government units and decision makers to identify the factors/measures and policy options that could improve the adaptive capacity of vulnerable households and communities in dealing with climate change impacts.

As climate-related natural disasters are expected to intensify with climate change, the livelihoods of affected households and communities are placed at risk. Hence, there is a need for drastic changes in planning for livelihood strategies for households. Deliberate policy interventions on skills enhancement and livelihood development may be necessary, especially in communities and households relocated permanently to new sites.

Local governments have official mandates that serve as bases in helping them formulate responses to natural disasters. Very few local government units, however, consciously address the threats of natural disasters in their development plans. Rather, they prefer to incorporate disaster prevention, mitigation, and relief into their disaster contingency plans. While this may be related to their budgeting system, local government units should also exert efforts to incorporate interventions for high-risk zones into their local comprehensive land use plans, and development, operational and investment plans. To be able to do this, however, the local government units and the affected communities should have adequate information on the threats of natural hazards confronting them. Such information should include the local and indigenous ecological knowledge that that have enabled communities to cope with such threats. These information and knowledge base should then be incorporated into a participatory planning process that involves the stakeholders like land use planning, vulnerability assessment and mapping, and adaptation strategies identification and analysis.

Climate change-induced natural disasters signifcantly affected the households' welfare and the natural resources from which they depended upon for their livelihood. Hence, it is important to study the disaster's impacts on agriculture and food security, human health, ecosystem goods and services, and poverty and hunger. These issues are highly relevant for the case study areas considering the low socioeconomic status of the affected community and households.

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