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Household Vulnerability to Climate Change in Selected Municipalities in Laguna, Philippines

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Front cover photo credit: Sta. Cruz, Laguna flooding during Typhoon Ondoy (Ketsana) in 2009
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January, 2014

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HOUSEHOLD VULNERABILITY TO CLIMATE CHANGE IN SELECTED MUNICIPALITIES IN LAGUNA, PHILIPPINES[1]

Jaimie Kim Bayani Arias
Ma. Emilinda T. Mendoza
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EXECUTIVE SUMMARY

This study assessed the climate change vulnerability of households in 12 municipalities in the province of Laguna. A quantitative approach was employed using the Vulnerability Index (VI) and the Vulnerability as Expected Poverty (VEP) frameworks.

The study found that about 29% (VI) and 36% (VEP) of the households were at least moderately or highly vulnerable. The incidence of vulnerability was high for those employed in the commercial and services sector, and for those whose livelihoods are dependent on agriculture. Female-headed households were also found to have a high incidence of vulnerability. Comparing the results of the two frameworks, findings show that VEP and VI vulnerability categorization matched for only about 53 % of the observations.

The most significant natural hazards for Laguna, in terms of frequency and proportion of households affected, were typhoons and floods. The most widespread impacts were damage to houses, psychological and emotional distress, and loss of income. Majority of households implemented some forms of autonomous adaptation such as strengthening the structure of their houses, moving belongings to higher ground, and temporarily evacuating. The top five interventions preferred by the households were financial assistance, provision of relief goods, information dissemination, medical assistance, construction of flood mitigation infrastructure, and livelihood assistance.

Results of the study could serve as basis for identifying adaptation options to be subjected to economic analysis.

[1]Based on the project titled 'Developing Capacity to Adapt to Climate Change in Southeast Asia' funded by the International Development Research Centre-Climate Change and Water Program (IDRC-CCW)and the Economy and Environment Program for Southeast Asia (EEPSEA), and administered by the Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA).

1.0 INTRODUCTION

1.1. Background of the Study

Climate change, along with its impacts on natural and human systems, has received great attention from various stakeholders across the globe. Of primary concern are its potential negative impacts in developing countries as their exposure to extreme weather events is amplified by their fragile geographic characteristics and their weak socio-economic conditions.

Recognizing climate change as a real threat, the Philippines was among the first countries to take action against this natural hazard. On 8 May 1991, the Philippine government created the Inter-agency Committee on Climate Change (IACCC) by virtue of Administrative Order No. 220. Recently, the Philippine Climate Change Commission was set up by virtue of the Philippine Climate Change Act of 2009 (Republic Act No. 9729). The Commission is tasked, among other things, to formulate and implement plans to enable the country to better respond to natural disasters.

With climate change impacts being area-specific, national initiatives and programs must trickle down to the community or local level. However, both physical and financial constraints continue to hinder efforts to develop appropriate and effective location-specific adaptation strategies. Evidence-based or science-based policy support is needed to guide and pin down the most appropriate and most effective climate change adaptation (CCA) measures. As a first step, vulnerability analysis must be done as basis for policy and program identification.

1.2. Objectives

The general objective of this study was to assess the vulnerability of households in 12 selected municipalities in the province of Laguna, Philippines. Specifically, it aimed to:

1. assess the overall vulnerability of households using the Vulnerability as Expected Poverty (VEP)and Vulnerability Index (VI) frameworks;
2. describe the profile and characteristics of vulnerable households;
3. determine households' level of awareness regarding climate change impacts and adaptation;
4. assess households' exposure to various climate-related hazards as well as their impacts;
5. identify households' coping mechanisms and adaptation practices in response to climate-related hazards; and
6. identify the types of assistance most preferred by vulnerable households during typhoons and floods.

1.3. Research Questions

The study aimed to answer the following questions:

1. What is the households' level of vulnerability to climate change?
2. Do different approaches to vulnerability assessment yield different results?
3. What are the characteristics of vulnerable households?
4. How exposed are households in Laguna to climate-related hazards and what are the impacts of these hazards?
5. What are households' coping mechanisms and adaptation practices to become more resilient to typhoons and floods?
6. What types of assistance are preferred by households during typhoons and floods?

2.0 METHODOLOGY

2.1 Study Site

The study was conducted in the province of Laguna because of two key reasons. First, Laguna is in the list of top 10 provinces in the country considered most vulnerable to climate change hazards, including typhoons and floods. In the last 10 years, four typhoons brought extensive devastation to Laguna, namely, Typhoon Xangsane (*Milenyo*), Typhoon Durina (*Reming*), Typhoon Ketsana (*Ondoy*), and Typhoon Mirinae (*Santi*). Second, the provincial government of Laguna has a strong intent to develop, adopt, and implement a sound Disaster Risk Reduction Management (DRRM) program.

The province of Laguna is located 30 km from Manila. It is bounded by Laguna de Bay and the Rizal province in the north; by the Sierra Madre Mountain Range in the northeast; by Quezon province in the east; by Batangas province in the south; and by the Cavite province in the west. Laguna has a total land area of 1,759.7 km^2. It is the third largest province in the country's Region IV. The provincial capital is Santa Cruz. Eighteen of the 29 municipalities of Laguna belong to the coastal zone. It has a total coastal length of 109.2 km and a total coastal zone area of 580.2 km^2. The total population is estimated to be 1.9 million.

The study focused on municipalities covered by the three watersheds presented in Figure 1. The watershed boundary covers an area of 568 km^2, which is slightly less than a third of the province's entire area. It includes 12 municipalities, which is about half of the total number of municipalities in the province. The watershed approach was used in the selection of the study site because it captured the variety of vulnerabilities associated with the impacts of flooding and typhoon on different human ecological systems. It also enabled the analysis of the dynamic linkages of factors that contribute to vulnerability and risks across these ecosystems.

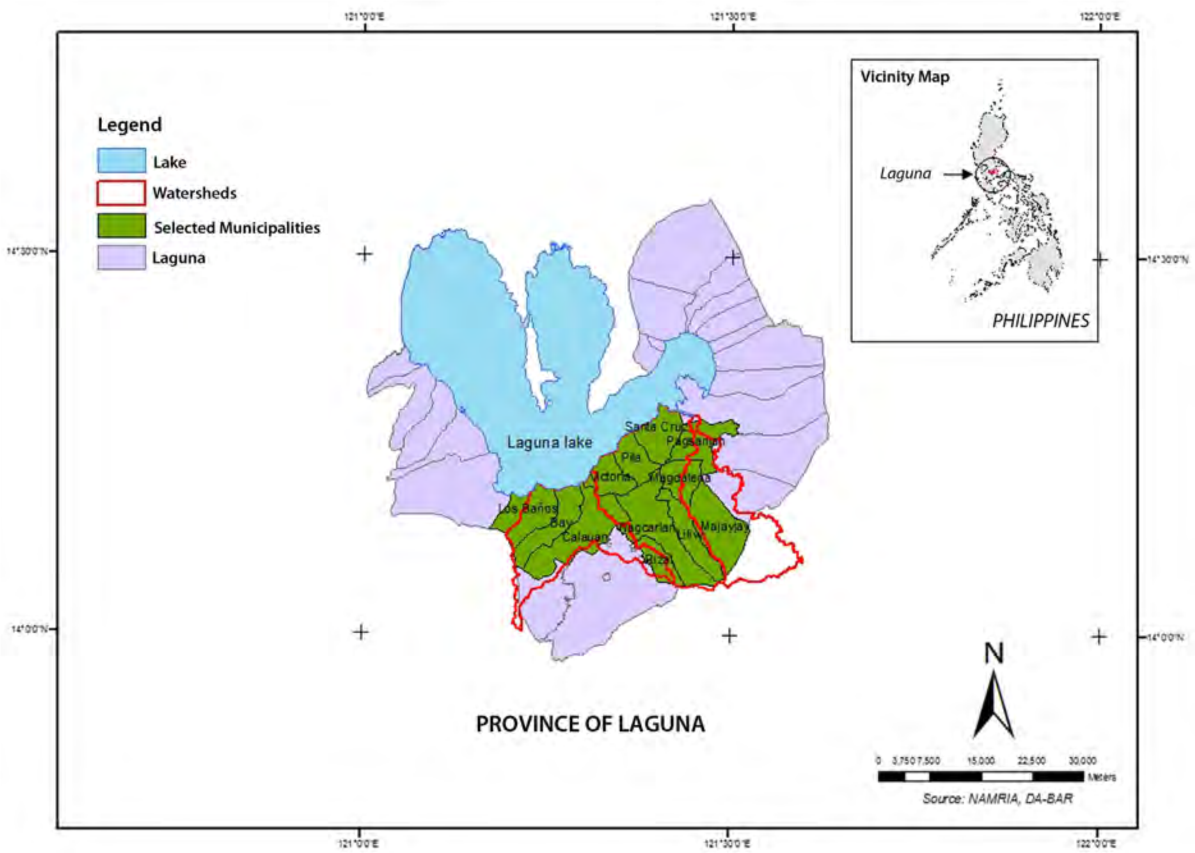


Figure 1. Map of the province of Laguna showing the study sites

2.2 Data Collection Method

A household survey was undertaken to collect data needed in the study. Face-to-face interviews were conducted using a questionnaire written in the local dialect (Filipino-Tagalog). It included questions about the respondent's characteristics, household characteristics, exposure indicators, adaptive capacity indicators, awareness and perception regarding climate change issues, coping mechanisms and adaptation practices, as well as impacts of typhoon and floods.

A two-stage stratified random sampling was applied in this study. The population of households was stratified, first by municipality, and then by type of area (i.e., whether the household was in a rural or urban barangay[2]). A stratified random sample of 600 households was then obtained using proportionate sampling. The sample of households was randomly selected from a list of households provided by local government units (LGUs) and the Barangay Integrated Development Approach for Nutrition Improvement of the University of the Philippines Los Baños (BIDANI-UPLB). When a household included in the sample could not be located or refused to participate, it was replaced by another household randomly selected from the same stratum. A total of 167 households in the original sample was replaced; 160 households could not be located while 7 refused to participate.

2.3 Data Analysis

Data were analyzed using frequency counts, means, and standard deviation. To determine if there were significant differences in various indicators, the student t-test or Analysis of Variance (ANOVA) was used, whenever applicable. A correlation analysis was used to determine the strength of relationships between variables.

In estimating vulnerability, two approaches were used: the Vulnerability Index (VI) and the Vulnerability as Expected Poverty (VEP).

2.3.1 Vulnerability Index

The Intergovernmental Panel on Climate Change (IPCC) defines vulnerability as the susceptibility of a system to sustain impacts or damages from climate change. Vulnerability is determined by three factors: hazard exposure, sensitivity, and adaptive capacity. Various indicators for these three factors were used to calculate the vulnerability index (Table 1).

Table 1. Indicators of exposure, sensitivity, and adaptive capacity and their relationship with vulnerability

Factor	Indicator	Sub-indicator	Relationship with vulnerability
Hazard Exposure*	Typhoon	Number of typhoons and tropical depressions	+
		Numbers of signal no. 3 typhoons (100 to 185 kph)	+
	Flood	Number of flood events	+
		Highest flood height (ft)	+
		Longest flood duration (days)	+
	Drought	Number of droughts	+
	Landslide	Number of landslide events	+
	Flashflood	Number of flashfloods	+
Sensitivity	Human	Dependence ratio: ratio of dependent person (below 15 years old and 65 years old and above) to family size	+
	Livelihood	Percent of annual income generated from agriculture, fishery, and forestry activities	+

*Experienced in the last 10 years

[2] The *barangay* is the smallest administrative unit in the Philippines, similar to a village or commune.

Table 1 continued

Factor	Indicator	Sub-indicator	Relationship with vulnerability
Sensitivity	Infrastructure	Ratio of family size to area of weak house	+
		Distance of dwelling unit to nearest body of water	-
	Financial	Percent of debt to total household income	+
Adaptive Capacity	Infrastructure	Average area of permanent dwelling per head	-
	Economic	Income per capita	-
		Amount of cash remittance per year	-
	Technology	Number of television sets and radios	-
		Number of phone lines and mobile phones per household	-
		Number of vehicles per household	-
	Social capital	Number of contacts the household can ask for financial help	-
	Human Capital	Number of working household members	-
		Level of education (number of years of schooling of the household head)	-

The initial step undertaken in calculating the Vulnerability Index (VI) was the normalization or standardization of values. For variables that have a positive influence or impact on vulnerability, equation 1 was used:

$$y = \frac{X_i - Min\{X_i\}}{Max\{X_i\} - Min\{X_i\}} \qquad \text{Equation 1}$$

For variables hypothesized to negatively affect vulnerability, equation 2 was used:

$$y = \frac{Max\{X_i\} - X_i}{Max\{X_i\} - Min\{X_i\}} \qquad \text{Equation 2}$$

where,

y : normalized value

Xi : value of the observation

$Min\{X_i\}$: minimum value for all observations

$Max\{X_i\}$: maximum value for all observations

After data normalization, the VI was estimated by computing the weighted average of all the variables. Specifically, a composite index was calculated. To arrive at this index, sub-indicators were assigned equal weights to compute for the indicator average. Then, indicators were also assigned equal weights to compute for the factor average. Finally, factors were assigned equal weights to compute for the composite VI. This computed composite index was again normalized to arrive at the relative vulnerability estimates for each household.

2.3.2 Vulnerability as Expected Poverty

Vulnerability as Expected Poverty (VEP) is an econometric approach in measuring household vulnerability. In the VEP framework, vulnerability is defined as the probability that households or individuals will become poor in the future or fall below a minimum consumption threshold level, given certain shocks (Chaudhuri 2003). These shocks may include the occurrence of climate extremes or climate variability.

The analytical procedure followed the work of Chaudhuri et al. (2002) and Deressa et al. (2009). First, the stochastic process that generates the consumption of a household is given by:

$$Inc_h = X_h\beta + e_h$$

The variable c_h is per capita consumption expenditure, X_h is a vector of observable household characteristics, β is a vector of parameters, and e_h is a mean-zero disturbance term which captures shocks.

As a proxy for consumption, the household monthly expenditure was used. The explanatory variables were gender, age, number of years of schooling of the household head; household size; household dependence on natural resources for livelihood (estimated as the ratio between agriculture, fishery, and forestry income to total income); a dummy variable for landownership; and a dummy variable for household with members who are chronically ill or disabled. To capture climate-related indicators, the number of typhoons categorized as signal no. 3 or stronger, and the maximum flood height over the last 10 years were included. In addition, a dummy was included for households who have experienced drought and landslides and, at the same time, whose livelihoods depend on natural resources (see Annex 1 for regression results).

The model assumes that the variance of e_h is given by:

$$\sigma^2_{e,h} = X_h\theta$$

β and θ were estimated using the three-step feasible generalized least squares (FGLS) method (Amemiya 1977). Using the estimates of β and θ, the expected log consumption for each household h was computed:

$$\hat{E}[lnc_hX_h] = X_h\hat{\beta}$$

as well as the variance of log consumption:

$$\hat{V}[lnc_hX_h] = \hat{\sigma}^2_{e,h} = X_h\hat{\theta}$$

By assuming that consumption is log-normally distributed, the above were used to estimate the probability that a household with the characteristics, X_h, will be poor (i.e., the household's vulnerability level) using:

$$\hat{v}_h = \widehat{Pr}(ln\, c_h < ln\, z\, |X_h) = \Phi\left(\frac{ln\, z - X_h\hat{\beta}}{\sqrt{X_h\hat{\theta}}}\right)$$

Where Φ(.) denotes the cumulative density of the standard normal distribution and *ln z* is the log of the minimum consumption level, below which a household would be called vulnerable.

The World Bank minimum of USD 1.25 per capita per day was used in the estimation. The analysis is based on the assumption that climate extremes or climate shocks, particularly typhoons, floods, and droughts, will have an influence on the probability that households' consumption will fall below a given minimum level (Deressa et al. 2009).

3.0 RESULTS AND DISCUSSION

3.1. Profile of Respondents

The household survey covered 12 towns and 178 villages, where 600 households were randomly selected. These towns include Bay (where 8% of the total household sample was selected), Calauan (10%), Liliw (6%), Los Baños (15%), Magdalena (4%), Majayjay (5%), Nagcarlan (10%), Pagsanjan (6%), Pila (9%), Rizal (3%), Sta. Cruz (18%), and Victoria (6%) (Figure 2).

More than half (59%) of the respondents were female whose mean age was 48; whose average number of years in school was nine; and whose livelihoods depended on agriculture, fishery, and forestry (20%). Most (83%) of the male respondents were employed while less than half (48%) of female respondents were employed (Table 2).

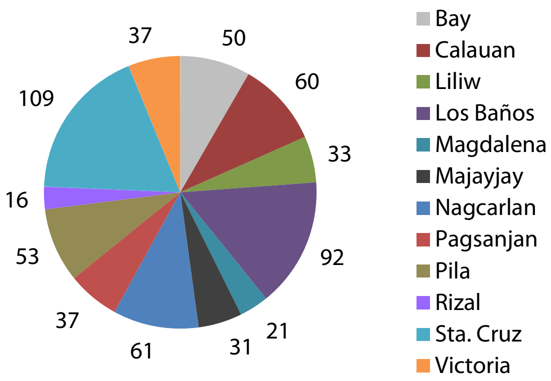


Figure 2. Distribution of households by town

Table 2. Respondents' socio-demographic characteristics by sex

Socio-demographic characteristics	Female (n=352)	Male (n=248)	All (N=600)
Percentage of married respondents (%)	72	84	77
Mean age (years)	48	48	48
Mean number of years of schooling (years)	9	9	9
Employment rate (%)	48	83	63

3.2. Overall Vulnerability of Households

Vulnerability at the household level was quantitatively assessed using an index approach (VI) and an econometric approach (VEP). These methods have their own strengths and weaknesses. With its multidimensional approach, the index approach provides a more holistic measure of vulnerability, taking into consideration biophysical, economic, and social aspects. However, estimates are highly sensitive to assumptions about the weight or relative importance of the variables, as well as the choice of indicator variables used in the computation.

On the other hand, the econometric approach is not sensitive to weighting issues, and hence not prone to subjectivity and possible manipulation. Its weakness, however, is that it measures vulnerability in terms of consumption, providing a more limited assessment of vulnerability compared to the index method. It is therefore important to explore the outcomes of the assessments and determine whether they are consistent or significantly deviate from each other.

Values estimated from both approaches fall within the range of 0.00 to 1.00, with 0.00 being the lowest and 1.00 being the highest. Table 3 shows the levels of vulnerability and their corresponding values.

Table 3. Level of vulnerability and corresponding value

Level of vulnerability	Value
Low	0.0 - 0.5
Moderate	0.5 - 0.79
High	0.8 - 1.0

3.2.1. Vulnerability Index (VI)

In estimating the VI, three factors were considered: hazard exposure, sensitivity, and adaptive capacity of households. Table 4 shows the levels of hazard exposure, sensitivity, and adaptive capacity and their corresponding values.

Table 4. Levels of hazard exposure, sensitivity, and adaptive capacity and their corresponding values

Value	Level		
	Hazard	Sensitivity	Adaptive capacity
0.0 - 0.5	Low	Low	Low
0.5 - 0.79	Moderate	Moderate	Moderate
0.8 - 1.0	High	High	High

Hazards are events or occurrences that are climate-related, such as typhoons, floods, flash floods, droughts, and landslides. The more exposed households are to these natural hazards, the more vulnerable they would be to climate change.

Sensitivity, on the other hand, refers to the inherent characteristics of households that make them more susceptible to the impacts of hazards. In this study, it was assessed based on four dimensions: human, infrastructure, livelihood, and financial. Human sensitivity was represented through a dependency ratio, such that the greater the number of dependent members in a household relative to the non-dependent members, the more susceptible the household would be to climate change impacts. Dependents included children (below 15 years old) and the elderly (65 years old and above). They are more sensitive because they are relatively frail and prone to illnesses and injuries.

Livelihood sensitivity, on the other hand, was based on the degree of dependence in agriculture, fishery, and forestry. The higher the percentage of income coming from these sectors, the more sensitive the household would be to climate change impacts. Agriculture, fishery and forestry-based livelihoods are highly dependent on natural resources which, in turn, are highly sensitive to hazards.

Meanwhile, infrastructure sensitivity was represented by two variables: a) the ratio of household size to area of weak house; and b) the distance of dwelling unit to the nearest body of water. The weaker the structure of the house, the higher the probability that it would sustain damages from a hazard. Additionally, the nearer the house to a body of water (e.g., rivers, creeks, and lake), the more sensitive the household would be to climate-related hazards.

Lastly, financial sensitivity was estimated using the percentage of debt to the total household income; the higher this value, the higher the household's sensitivity to climate change.

Adaptive capacity refers to the ability of households to reduce the impacts of climate-related hazards through adjustments and modifications in:

a. Infrastructure – measured in terms of household permanent dwelling size. The greater this is, the more resistant the household would be from climatic hazards;

b. Economic resources – measured in terms of income and cash remittances. Households with greater financial resources would be better able to invest in activities that could increase its resilience;

c. Technological resources – measured in terms of communication (i.e., television sets, radios, and phones) and transportation assets. These enable households to receive and share information when needed and to transfer to safer areas or to transport resources during calamities, respectively.

d. Social capital – was measured in terms of the number of contacts from whom the household could seek financial help. Having several contacts from whom the household could ask for financial help would increase the household's adaptive capacity; and

e. Human capital – was assessed in terms of the number of working or employed household members, and the household head's level of education. The greater the number of employed household members, the greater the access of the family to resources and assets that could increase their ability to invest in adaptation activities. Also, the higher the level of education of the household head, the greater the capacity of the household to find ways to reduce their vulnerability from climate-related hazards.

Table 5 shows that households, on the average, had low exposure to hazards and low sensitivity, with a mean hazard index of 0.08 and mean sensitivity index of 0.26. Their adaptive capacity is also low at 0.17, resulting in an overall vulnerability index of 0.43.

Table 5. Mean vulnerability indices across groups

Group	Mean vulnerability indices			
	Hazard exposure	Sensitivity	Adaptive capacity	Overall vulnerability
All households	0.08	0.26	0.17	0.43
With low vulnerability	0.07	0.23	0.19	0.36
With moderate vulnerability	0.12	0.32	0.12	0.58
With high vulnerability	0.24	0.49	0.13	0.87

Across different levels of vulnerability, highly vulnerable households had a mean VI of 0.87 while those classified as having low vulnerability had a mean VI of 0.36. Moderately vulnerable households had a mean VI of 0.58.

Mean hazard exposure and sensitivity indices were highest for the highly vulnerable group at 0.24 and 0.49, respectively, and lowest for the least vulnerable group at 0.07 and 0.23, respectively. Conversely, adaptive capacity index was highest for the least vulnerable group (0.19) and lowest for the highly vulnerable group (0.13).

3.2.2. Vulnerability as Expected Poverty (VEP)

The VEP estimate shows the probability that a household will fall below the minimum consumption level, at which they will be considered poor. In the regression analysis, the following variables were hypothesized to have an influence on consumption: household head's gender, age, and level of education; household size; household dependence on natural resources for livelihood; land ownership; presence of chronically ill or disabled household members; frequency of typhoon, drought, and landslide in the last 10 years; and maximum flood height experienced in the last 10 years.

The influence of gender on vulnerability is highly debated. Some argue that female-headed households are more vulnerable because females are more likely to be poor and highly dependent on natural resources for their livelihood. Some, on the other hand, contend that females play a crucial role in adaptation, which effectively reduces their vulnerability.

In terms of education, it was assumed that the higher the educational attainment of the household head, the lower the household's vulnerability would be. Further, household's ownership of land reduces its vulnerability. On the other hand, a household's dependence on natural resources for livelihood, particularly agriculture, fishery, and forestry, has a negative influence on its consumption level, thereby increasing its vulnerability to climate-related hazards.

The presence of chronically ill or disabled household members may increase or decrease household consumption level. On one hand, it may increase consumption because households may have higher expenditures to meet the needs of their ill or disabled members. On the other hand, it may also decrease consumption because it may mean a lower earning potential for the household since members who are well may have to spend more time in providing care for their ill or disabled members.

For the climate-related indicators, frequency of strong typhoons, drought, and landslide as well as flood height also have an impact on consumption such that the greater their frequency and the higher the flood level, the lower would be the household's expected consumption.

Table 6 shows the mean and standard deviation (S.D.) of VEP estimates across different vulnerability levels. For all households, the mean VEP was 0.37, with a S.D. of 0.37. This means that, on the average, the probability that households would become poor or have their consumption fall below USD1.25/day was 37%. The table also shows that mean VEP was 0.12 for the non-vulnerable group while it was 0.66 for the moderately vulnerable group. For the highly vulnerable households, mean VEP was 0.91.

Table 6. Mean and standard deviation of VEP estimates across groups

Group	Mean VEP	Standard deviation
All households	0.37	0.37
Low vulnerability	0.12	0.14
Moderate vulnerability	0.66	0.09
High vulnerability	0.91	0.06

Using a scatter diagram (Figure 3), VEP estimates were compared against the log of per capita consumption. The diagram is divided into six segments. Households to the left of the vertical line are poor while those on the right are not poor. Households were categorized as poor if their current (actual) consumption level was lower than the minimum consumption threshold (i.e., USD 1.25/day). On the other hand, households below the lower horizontal line have low vulnerability while those above are at least moderately vulnerable. Households above the higher horizontal line are considered to be highly vulnerable.

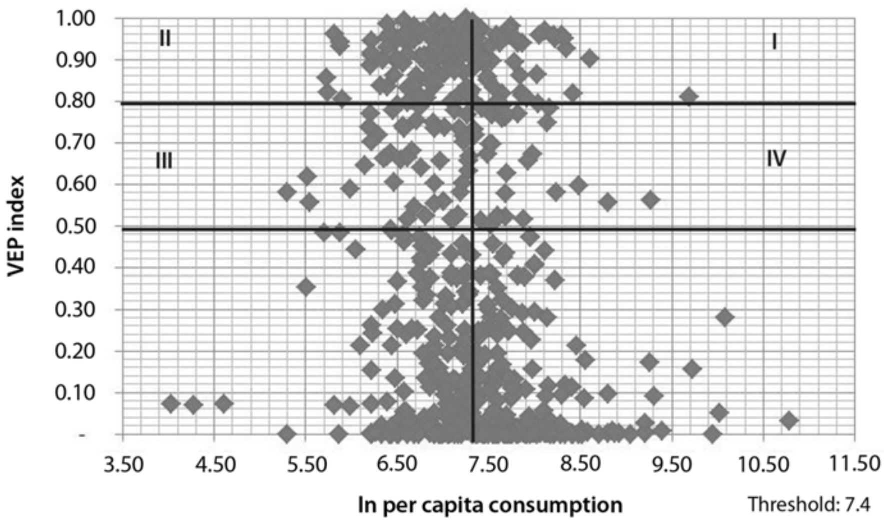


Figure 3. Vulnerability vis-à-vis per capita consumption at USD 1.25/day threshold

Table 7 shows that 32% of households were poor but not vulnerable while about 11% of households were not poor but vulnerable. This means that not all poor households are vulnerable, and similarly, even households which are not poor can be vulnerable.

Table 7. Proportion of poor and not poor households across groups

Group	Percentage	
	Poor Households	Not Poor Households
Low Vulnerability	32	32
Moderate Vulnerability	9	5
High Vulnerability	17	6

3.2.3. Comparison between VI and VEP estimates

Mean vulnerability estimate was higher for VI (0.43) than VEP (0.37). However, estimates for VEP were more variable than VI. The S.D. for VEP was 0.37, while S.D. for VI was 0.14. A higher proportion of households were found to be vulnerable using the VEP approach (36%) compared to the VI approach (29%). The incidence of high vulnerability was also higher for VEP (23%) than VI (1%) (Table 8).

A correlation analysis showed that there is a weak but positive relationship between VI and VEP estimates (p = 0.23). However, a paired t-test revealed that their means are statistically different.

Table 8. Summary of VI and VEP estimates per level of vulnerability

Indicators	Vulnerability Index (VI)				Vulnerability as Expected Poverty (VEP)			
	Low	Moderate	High	All HHs	Low	Moderate	High	All HHs
Mean	0.36	0.59	0.87	0.43	0.12	0.66	0.91	0.37
S.D.	0.09	0.08	0.06	0.14	0.14	0.09	0.06	0.37
Number	416	164	7	171	375	77	138	215
Percentage share (%)	71	28	1	100	64	13	23	100
Incidence of vulnerability (%)	-	-	-	29	-	-	-	36
p-value of t-test	0.00							
Correlation coefficient	0.23							

Furthermore, findings reveal that the categorization of vulnerability of households were the same between VI and VEP in about 53% of the observations (Figure 4). Results were more consistent in the low vulnerability category (49%) than it was for the moderate to high vulnerability categories (15%).Twenty two percent (22%) of households were classified as vulnerable under VEP but not vulnerable under VI. Likewise, 14% of households were identified as vulnerable under VI but not vulnerable under VEP (Table 9).

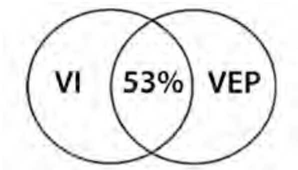


Figure 4. Venn diagram of VEP and VI estimates

Table 9. Distribution of households based on vulnerability, VI vs. VEP (%)

VI	VEP		Total
	Not Vulnerable	Vulnerable	
Not Vulnerable	49	22	71
Vulnerable	14	15	29
Total	**63**	**37**	**100**

These inconsistencies may raise questions about the reliability of the vulnerability estimation. However, as long as the conceptual and theoretical foundations are clear and strong, and the users know how to properly interpret the vulnerability estimates, the results can still provide useful insights in policy formulation. Particularly, VEP can identify households that may fall into poverty in the future due to external shocks, including those that are climate-related, while VI can identify households that are at high risk of sustaining substantial damages from future climate-related hazards.

3.3. Profile and Characteristics of Vulnerable Households

Vulnerability assessments are done to generate relevant information that can serve as a guide in formulating adaptation strategies. LGUs, NGOs, and community residents can use the results as basis in identifying interventions that are strategic and responsive to the needs of the locality. Focusing on the vulnerable groups is a rational approach as this can potentially provide the maximum benefit from investments, especially since financial resources for adaptation are usually limited. As such, it is important to describe and characterize vulnerable households.

In this study, the profile of vulnerable households was described based on the household head's gender, primary occupation, and awareness on climate change.

3.3.1. Gender and vulnerability

Most (81%) of the household heads were males with less than one-fourth (19%) being females. Both VEP and VI estimates indicate that females headed about one-fifth of the moderately vulnerable households. On the other hand, VEP estimates show that females headed almost one-fifth of the highly vulnerable households while VI estimates show that no female-headed households belonged to the highly vulnerable group (Figure 5). Nonetheless, female-headed households comprised a relatively substantial number of households in the vulnerable group. In this regard, development interventions and policies for climate change adaptation should be gender sensitive and the local government should design adaptation options that are relevant and compatible with the needs and capacities of women.

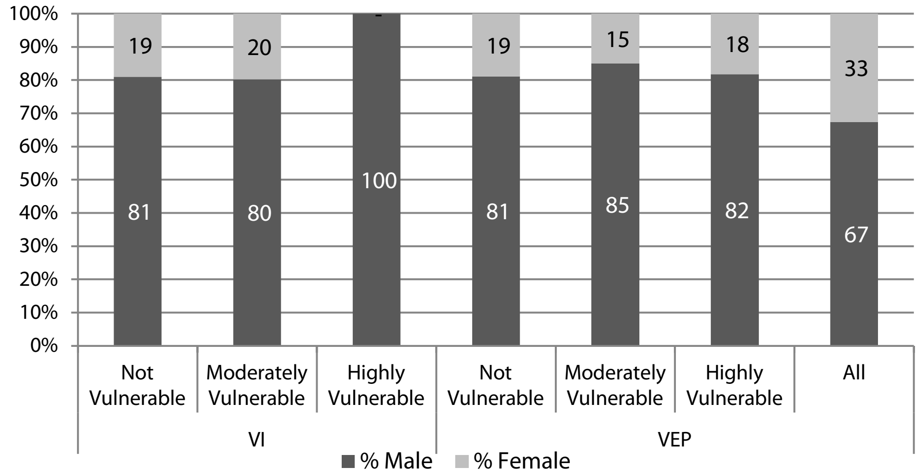


Figure 5. Household distribution based on gender of household head

Although males headed most of the vulnerable households, it does not imply that males are more vulnerable than females. Based on the VI approach, vulnerability incidence in male-headed and female-headed households were about the same at 29%. However, based on the VEP approach, vulnerability incidence was higher for female-headed households (51%) than for male-headed households (33%) (Table 10).

Table 10. Vulnerability incidence by gender of household head

Approach	Vulnerability level	Incidence of vulnerability (%)	
		Male-headed households	Female-headed households
VI	Moderately vulnerable	27	29
	Highly vulnerable	2	0
	All households	29	29
VEP	Moderately vulnerable	13	12
	Highly vulnerable	20	39
	All households	33	51

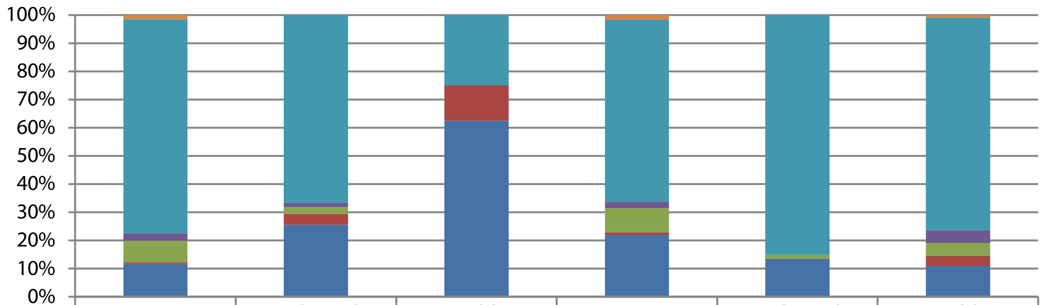
Based on the VEP approach, mean vulnerability for female-headed households was 0.52 (with S.D. of 0.39) while mean vulnerability for male-headed households was 0.34 (with S.D. of 0.35). A test of difference of means shows that VEP estimates significantly differ between male- and female-headed households. Meanwhile, based on the VI approach, mean vulnerability between male- and female-headed households was about the same at 0.42 and 0.43, respectively (Table 11). A test of difference of means shows that VI estimates between male- and female-headed households are not statistically significant.

Table 11. Mean and standard deviation of VI and VEP estimates for male- and female-headed households

Type	Mean		Standard deviation	
	VI	VEP	VI	VEP
Male-headed	0.42	0.34	0.15	0.35
Female-headed	0.43	0.52	0.13	0.39
p-value of t-test	0.73	-	-	-

3.3.2. Livelihood and vulnerability

Figure 6 shows the distribution of households based on the primary occupation of the household head. Majority (59%) of the household heads were employed in the commercial and services sector, followed by agriculture (16%), government (6%), aquaculture (2%), manufacturing (2%), and academe (1%).



	VI: Not Vulnerable	VI: Moderately Vulnerable	VI: Highly Vulnerable	VEP: Not Vulnerable	VEP: Moderately Vulnerable	VEP: Highly Vulnerable
% in Academic	1	-	-	1	-	1
% in Commercial/Services	63	53	22	54	74	60
% in Manufacturing	2	1	-	2	-	4
% in Government	6	2	-	7	1	4
% in Aquaculture	0	3	11	1	-	3
% in Agriculture	10	20	56	18	12	9

Figure 6. Household distribution based on primary occupation of household heads

Based on VI, majority (56%) of household heads in the highly vulnerable group were employed in the agriculture sector. In contrast, based on VEP, majority (60%) of household heads in the highly vulnerable group were in the commercial and services sector, followed only by agriculture (9%).

Meanwhile, in the moderately vulnerable group, majority of the household heads were in the commercial and services sector, both in the VI (53%) and VEP (74%). They were followed by those in the agriculture sector, with 20 % and 12 % of household heads in the VI and VEP, respectively. Information on the employment of heads of vulnerable households can provide guidance about the sector that needs to be prioritized when providing CCA assistance.

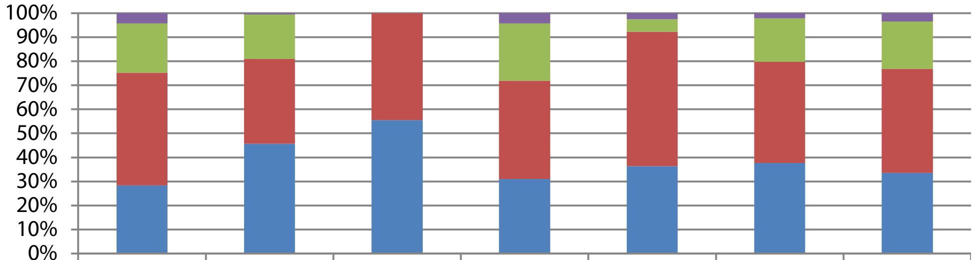
In terms of employment sector, the highest incidence of vulnerability was predicted in aquaculture, both for VI (76%) and VEP (57%). Meanwhile, incidence of vulnerability in households dependent on agriculture for their livelihood was not conclusive, with VEP predicting it at 23% and VI predicting it at 48%. Households depending on manufacturing and commercial/services sectors for their livelihood were predicted to have higher incidence of vulnerability at 42% and 41%, respectively, for VEP (Table 12). These results suggest that interventions should be targeted towards households in the agriculture and aquaculture sectors as well as in the commercial/services and manufacturing sectors.

Table 12. Vulnerability incidence across different sectors

Sector	Incidence of vulnerability (%)					
	VI			VEP		
	Moderately vulnerable	Highly vulnerable	Total	Moderately vulnerable	Highly vulnerable	Total
Aquaculture	63	13	76	-	57	57
Agriculture	42	6	48	10	13	23
Commercial/Services	25	1	26	17	24	41
Manufacturing	18	-	18	-	42	42
Government	10	-	10	3	15	18
Academic	-	-	0	-	17	17

3.3.3. Knowledge level on climate change issues

Households have low knowledge on climate change issues, with 44% having limited knowledge and 34% having no knowledge at all (Figure 7). Based on VEP, it can be seen that 38% of highly vulnerable households and 36% of moderately vulnerable households had no knowledge on climate change issues. VI estimates were higher, with 56% of highly vulnerable households and 46% of the moderately vulnerable households claiming that they had no knowledge on climate change issues. Clearly, there is a need to conduct information dissemination and education activities as these play an important role in CCA. Equipped with the right information, households will be able to make wise and timely actions that can reduce their vulnerability to climate hazards. For instance, if farmers are knowledgeable about weather patterns, they will be able to make adjustments in their farming practices or they can adopt technologies that can make their farms more resilient.



	VI: Not Vulnerable	VI: Moderately Vulnerable	VI: Highly Vulnerable	VEP: Not Vulnerable	VEP: Moderately Vulnerable	VEP: Highly Vulnerable	All Households
Fully knowledgeable	4	1	-	4	3	2	4
Adequate knowledge	20	19	-	24	5	18	20
A little bit of knowledge	47	35	44	41	56	42	44
No information/knowledge	28	46	56	31	36	38	34

Figure 7. Household distribution based on knowledge level about climate change

3.4 Exposure of Households to Climate-related Hazards

The climate-related hazards considered in the study were typhoons, floods, droughts, and landslides, which usually occur in the province of Laguna. Results show that all of the households had experienced a typhoon, with 86% having experienced strong typhoons (i.e., at least signal no. 3) (Table 13). Majority (57%) have experienced floods while almost half (49%) have experienced drought. Only 8% and 4% have experienced flash floods and landslides, respectively. Specifically, in the vulnerable group, it seems that typhoons, floods, and droughts, were the most important hazards as they affected the largest proportion of households. To aid in prioritization, it is important to identify which hazard is the most widely felt, especially by vulnerable households.

Table 13. Proportion of households with climate-related hazard experience in the last 10 years (2001-2010)

Hazard experienced	Percentage						
	All HHs	VI			VEP		
		Not vulnerable	Moderately vulnerable	Highly vulnerable	Not vulnerable	Moderately vulnerable	Highly vulnerable
Typhoons	100	99	100	100	99	97	99
Signal no. 3 typhoons*	86	83	93	100	83	88	93
Floods	57	51	72	78	41	69	93
Drought	49	45	57	67	47	52	49
Flashfloods	8	6	14	22	4	6	20
Landslides	4	3	6	22	3	8	3

* A typhoon is classified as signal no. 3 if it has a wind speed of about 100 to 185 kph. Such typhoons cause moderate to heavy damage.

Over the last 10 years, an average of 34 typhoons was experienced, which means that households experienced about 3-4 typhoons per year. Three out of the 34 typhoons had a wind speed of at least 100 kph (signal no. 3 category). Moreover, households experienced six floods on the average. The average flood height reported was 1 ft and the average flood duration was six days (Table 14). The maximum flood height reported was about 12 ft and the maximum flood duration experienced was 300 days.

Table 14. Frequency of climate-related hazards experienced by households

Hazard indicator	Mean						
	All HHs	VI			VEP		
		Not vulnerable	Moderately vulnerable	Highly vulnerable	Not vulnerable	Moderately vulnerable	Highly vulnerable
No. of typhoons	34	28	48	76	32	38	35
No. of signal no. 3 typhoons	3	3	4	4	3	3	3
No. of floods	6	3	14	36	4	8	10
Flood height (ft)	1	1	2	3	0	1	3
Flood duration (days)	6	4	8	40	3	6	12
No of droughts	2	2	3	3	2	2	2
No. of landslides	0	0	0	1	0	0	0
No. of flashfloods	0	0	0	2	0	0	1

Households categorized as vulnerable experienced climate-related hazards more frequently in the last 10 years. Highly vulnerable households experienced an average of 76 (VI) and 35 typhoons (VEP) while moderately vulnerable households experienced an average of 48 (VI) and 38 (VEP) typhoons. In terms of average frequency of floods, highly vulnerable households reported 36 (VI) and 10 (VEP) floods while moderately vulnerable households reported 14 (VI) and 8 (VEP) floods. Further, highly vulnerable households reported a mean maximum flood height of about 3 ft and longest flood duration of 40 (VI) and 12 days (VEP). For moderately vulnerable households, these mean values were lower: 1 ft (VEP) and 2 ft (VI) for maximum flood height; and 6 days (VEP) and 8 days (VI) for the flood duration.

3.5 Impacts of Climate-related Hazards on Households

Understanding how households have been affected by the hazards can also provide insights as to what particular interventions can be carried out. The study focused on typhoons and floods since these are the most common hazards experienced by the households.

Table 15 summarizes the extent of the impact of typhoons and floods. Most households (66%) incurred damages to their houses, followed by emotional distress (62%), and income loss (43%). The same pattern can be observed among vulnerable households, with damages to houses topping the list (73% for VEP and 76% for VI), followed by emotional distress and income loss. Although seldom investigated, it seems that emotional and psychological distresses are quite important impacts. Indeed, these are usually not included in the valuation of damages from climate hazards.

Table 15. Proportion of affected households per typhoon and flood impact and resulting ranking of impacts

Impact	Percentage of all affected households	Percentage of affected vulnerable households		Rank
		VI	VEP	
Damage to house	66	76	73	1
Stress/emotional impact	62	63	66	2
Loss of income	43	54	49	3
Damage to properties/appliances	26	35	43	4
Financial impact (forced to borrow money)	24	31	33	5
Illnesses in the family	12	15	17	6
Death in the family	2	2	1	7
Damage to vehicles	2	1	2	7
Injury in the family	2	2	2	7

More than one-fourth of households also incurred damages to household appliances (26%) while almost one-fourth experienced financial distress, which forced them to avail of loans (24%). In terms of health impacts, less than one-fifth reported that some family members became ill. Illnesses are rampant during typhoons and floods as water-borne diseases spread rapidly. Meanwhile, about 2% of households experienced death in the family.

During strong typhoons and floods, damages to properties and infrastructures are commonplace. When areas are inundated, households are evacuated to avoid fatalities and injuries while some are forced to permanently relocate. Supply of basic utilities is usually halted because facilities are damaged by strong winds and floods. There is also work stoppage which translates to lost wages for the employed while businesses close down resulting in income loss. Standing crops are destroyed, and livestock and fish stocks are killed. Because the hazard causes financial strain, some households are forced to borrow money. Hazards also have impacts on health, spreading illnesses and causing injury and death. Many also experience emotional distress.

In terms of the agriculture and fishery sectors, 79 farms sustained damages to their crops; 24 experienced loss of livestock; and six lost their fish stock (Table 16). The average cost incurred was about PhP 24,600 (USD 572), with a median of PhP 10,000 (USD 233) and a mode of PhP 5,000 (USD 116).

Table 16. Affected agriculture- and fishery-dependent households per type of typhoon and flood impact

Impacts	Frequency	Percentage
Damage to farm/pond equipment	13	13
Loss of standing crops	79	67
Loss of livestock	24	20
Loss of fish stock	6	5

Note: Multiple response table. Percentages computed based on sample size (n = 118).

Table 17 shows that the mean damage cost to house and properties was about PhP 11,363 or USD 264 (S.D. of PhP 35,641 or USD 829), with median of PhP 3,000 (USD 70) and mode of PhP 5,000 (USD 116). On the average, livestock losses amounted to about PhP 127,105 (USD 2,956), with median of PhP 15,513 (USD 361) and mode of PhP 1,000 (USD 23). Cost of fish stock losses from aquaculture averaged at about PhP 14,395 (USD 335), with median value of PhP 12,000 (USD 279). Business income loss averaged about PhP 5,918 (USD 138), with median and mode of PhP 1,500 (USD 35) and PhP 500 (USD 12), respectively. Medical expenses have a mean of PhP 2,561 (USD 60), while median and mode is the same at PhP 1,000 (USD 23).

Table 17. Descriptive statistics of cost of damages from typhoons and floods

Item	Number of households	Mean		S.D.		Median		Mode	
		PhP	USD*	PhP	USD*	PhP	USD*	PhP	USD*
House and properties	373	11,363	264	35,641	829	3,000	70	5,000	116
Agriculture production	87	24,559	571	58,713	1,365	10,000	233	5,000	116
Livestock production	16	127,105	2,956	253,532	5,896	15,513	361	1,000	23
Aquaculture production	7	14,395	335	17,414	405	12,000	279	-	
Business income	116	5,918	138	11,533	268	1,500	35	500	12
Medical expenses	60	2,561	60	4,357	101	1,000	23	1,000	23

*Exchange rate: USD 1 = PhP 43

Furthermore, mean and median costs of damages were higher for households in the vulnerable group than households in the non-vulnerable group. In particular, under the VI classification, the mean damage cost was about PhP 25,607 (USD 596) in the vulnerable group and PhP 12,789 (USD 297) for the non-vulnerable group. The median damage cost was about PhP 5,000 (USD 116) and PhP 2,205 (USD 52) for the vulnerable group and non-vulnerable group, respectively. Under the VEP classification, the mean damage cost was PhP 25,200 (USD 587) for the vulnerable group and PhP 11,360 (USD 264) for the non-vulnerable group. The median damage cost was PhP 5,000 (USD 116) for the vulnerable households and PhP 2,000 (USD 47) for the non-vulnerable households (Table 18).

Table 18. Descriptive statistics of cost of damages incurred by vulnerable and non-vulnerable households

Descriptive Statistics		Low Vulnerability		Moderate Vulnerability		High Vulnerability		All Vulnerable (Moderate to High)	
		PhP	USD	PhP	USD	PhP	USD	PhP	USD
VI	Mean	12,789	297	26,119	607	16,383	381	25,607	596
	Median	2,225	52	4,900	114	13,150	306	5,000	116
	S.D.	40,331	938	137,167	3,190	14,520	338	133,542	3,106
VEP	Mean	11,360	264	17,816	414	29,351	683	25,220	587
	Median	2,000	47	5,000	116	5,050	117	5,000	116
	S.D.	37,917	882	40,231	936	149,211	3,470	121,896	2,835

*Exchange rate: USD 1 = PhP 43

Climate change displaces people; some are forced to evacuate or relocate after a climate-related disaster. In the study, it was found that about 16% of the households were forced to evacuate during a typhoon while 9% were forced to permanently relocate (Table 19). The study, however, failed to examine whether the relocation was voluntary or government-mandated. Although relocation is necessary for household safety, it entails substantial costs like expenses for buying or renting a new house and transporting belongings, among others. Most importantly, people refuse to be relocated because they will be uprooted from a place where they have already established their social networks and/or where they are near their farms, workplace, schools, and the market. Nonetheless, it was found that 10% of the households had intentions to relocate in the future. Migration impacts of climate change should be further explored in future studies.

Table 19. Frequency distribution of households forced to evacuate or permanently relocate

Impact	Number of households	Percentage
Forced to evacuate	91	16
Forced to permanently relocate	51	9

3.6 Coping Mechanisms and Adaptation Practices of Households

A large number of households reported that they undertook activities to minimize the potential damages that they could incur from typhoons and floods. Since these are independently undertaken without support from the government, these were considered as autonomous adaptation. In the study, both proactive (before the typhoon) and reactive (after the typhoon) activities of the households were documented.

3.6.1. Actions before a typhoon

Twenty-one percent (21%) of the households made improvements to strengthen and protect their house structure against wind and floodwaters. About the same proportion (20%) revealed that they moved their belongings to safer ground in anticipation of inundation. A few evacuated their families to safer places (4%) while some dug canals and planted trees or vegetation to prevent floodwaters from reaching their homes and farms (Table 20).

Table 20. Proportion of households per action undertaken before a typhoon

Actions before a typhoon	Percentage
House improvement to increase resiliency against typhoons and flooding	21
Moved personal properties to a safe place	20
Evacuated to a safe place	4
Dug canals	4
Planted trees along the perimeter of property	1

Note: Multiple response table. Percentages computed based on sample size (n = 600).

For the agriculture-, fishery- or forestry-dependent households, only a limited few undertook preparations before a typhoon such as early harvesting of crops and fish stocks (3%); adoption of flood resilient farming methods (2%); procurement of crop insurance (1%); reinforcement of ponds/fish cages/animal pens (1%); and participation in savings/credit groups (1%) (Table 21).

Table 21. Proportion of agriculture-, fishery-, and forestry-dependent households per action undertaken before a typhoon

Actions before a typhoon	Percentage
Early harvesting	3
Applied flood resilient farming methods	2
Availed of crop insurance	1
Reinforced ponds/fish cages/animal pens	1
Joined savings/credit groups or coops	1

Note: Multiple response table. Percentages computed based on sample size (n = 118).

3.6.2 Actions after a typhoon

After a typhoon, more than half (58%) of the households undertook structural improvements to make their houses more resilient to typhoons and floods. About one-fifth (19%) borrowed money to cope with income loss and damages. A small percentage had to withdraw money from their savings (9%). Even fewer are those that had to evacuate during the typhoon (2%) (Table 22).

Agriculture-, forestry- and fishery-dependent households undertook the following actions after a typhoon: immediately replanted their crops (25%); availed of crop insurance (3%); replaced their livestock (3%); and reinforced their fish pens and animal cages (3%). A few replaced their fish stock (1%) and joined a savings group or a cooperative (1%) (Table 23).

Table 22. Proportion of households per action undertaken immediately after a typhoon

Actions immediately after a typhoon	Percentage
Structural improvement to house	58
Borrowed money to cope with income loss and damages	19
Withdrew from savings to undertake repairs and deal with additional expenses	9
Evacuated to a safe place	2

Note: Multiple response table. Percentages computed based on sample size (n = 600).

Table 23. Proportion of agriculture-, fishery-, and forestry-dependent households per action undertaken after a typhoon

Actions immediately after a typhoon	Percentage
Replanted farm	25
Availed of crop insurance	3
Reinforced ponds/fish cages/animal pens	3
Replaced livestock	3
Replaced fish stock	1
Joined savings/credit groups or coops	1

Note: Multiple response table. Percentages computed based on sample size (n = 118).

3.6.3 Expenditures on adaptation

Before the onset of a typhoon, the mean expenditure for adaptation activities was about PhP 1,447 (USD 34). This increased to PhP 12,539 (USD 292) after the typhoon. The median and mode expenditures before the typhoon were nil while the median expenditure after the typhoon and flood was PhP 2,000 (USD 47) (Table 24).

Table 24. Household adaptation expenditure before and after the occurrence of a typhoon

Statistics	Household adaptation expenditure			
	Before the typhoon		After the typhoon	
	PhP	USD	PhP	USD
Mean	1,447	34	12,539	292
Median	0	0	2,000	47
Mode	0	0	0	0
S.D.	20,615	479	53,715	1,249
Correlation coefficient with damage cost	0.26		0.88	

Based from a correlation analysis, a moderate positive relationship exists between damage cost and adaptation expenditures before the typhoon/flood. This suggests that those who are at risk of incurring damages may have prepared their households more against the possible impacts of the hazard. It is rational to expect that people more prone to damages are more motivated to invest in activities that can reduce their risk.

Meanwhile, a strong positive relationship exists between damage cost and expenditures on adaptation/coping activities after the hazard. This might imply that households may be more reactive rather than proactive when dealing with a hazard.

3.7 Types of Assistance Preferred by Households

The top five types of assistance that households preferred to help them cope with the impacts of disasters were financial assistance (47%); provision of relief goods (31%); information dissemination (17%); medical assistance/provision of free medicines (15%); and construction of protective infrastructure against floods (5%) (Table 25). Based on VI and VEP analysis, vulnerable households preferred the same types of assistance. The top five types of assistance preferred according to VI and VEP analysis are: financial assistance, construction of infrastructure, medical assistance, livelihood assistance, and distribution of relief goods (Table 25).

Table 25. Proportion of households per type of assistance

Needed assistance/intervention	All households		VI		VEP	
	%	Rank	%	Rank	%	Rank
Financial assistance	47	1	42	1	47	1
Relief goods	31	2	8	5	10	5
Information	17	3	5	6	6	7
Medical assistance	15	4	11	3	12	4
Infrastructure	11	5	30	2	30	2
Insurance	6	6	4	7	5	8
Shelter/Relocation	5	7	1	9	2	9
Emergency evacuation and shelter	4	8	4	7	6	7
Construction materials	4	9	-	10	-	10
Livelihood assistance	2	10	9	4	16	3
Waste management program	2	11	1	9	0	10
Inputs for production	1	12	2	8	2	9
Trainings	0	13	4	7	7	6

4.0 SUMMARY AND CONCLUSIONS

The study assessed the climate change vulnerability of households in 12 towns in the province of Laguna. Characteristics, exposure to climate-related hazards, and level of awareness about climate change of vulnerable households were determined. Further, the households' coping mechanisms and adaptation practices as well as the types of assistance they preferred were identified.

Using the Vulnerability Index (VI) and the Vulnerability as Expected Poverty (VEP) approaches, findings reveal 29% and 36% of the surveyed households were classified as vulnerable based on the VI and VEP approaches, respectively. Mean estimates for VI were significantly lower than VEP mean estimates. Findings also reveal that VI and VEP household vulnerability classification was consistent in about 53% of the observations.

The most significant natural hazards in Laguna, in terms of frequency and proportion of households affected, were typhoons and floods. Majority experienced impacts such as house damages, psychological and emotional distress, and income loss. In the agriculture/fishery sector, a significant number reported that their crops were destroyed and their livestock and fish stock were killed.

Majority of the vulnerable households were employed in the commercial and services sector as well as in the agriculture sector. A significant proportion of the vulnerable households were female-headed. Results of the VEP approach also seem to suggest that vulnerability incidence was higher in female-headed households. Findings also show that a high percentage of vulnerable households were not aware of climate change issues.

Majority conducted some form of adaptation activities to minimize the potential impacts of natural hazards. Some of the preparations they made included strengthening their houses, as well as moving personal properties to higher ground away from floodwaters. A small proportion evacuated from their homes to keep their family safe. For agriculture/fishery/forestry households, only a small percentage undertook precautionary measures such as use of flood resilient farming methods, availment of crop insurance, early harvesting, and reinforcement of fish/animal pens, to protect their livelihoods before a typhoon and flooding event.

The top five interventions preferred by households were financial assistance, provision of relief goods, information dissemination, medical assistance, construction of flood mitigation infrastructure, and livelihood assistance.

Vulnerability assessments serve as a basis in identifying strategies for adaptation interventions. Particularly, they aid in identifying vulnerable households as well as their characteristics and exposure to hazards, thereby providing guidance in policy/project formulation. Based from the results of the study, interventions focused on households dependent on agriculture for their livelihood and those that are headed by females should be prioritized because of the high incidence of vulnerability in these groups. Although households implemented some forms of adaptation, most of these were geared toward protecting their family members or their belongings. Livelihood adaptation seems to have been neglected. Hence, campaigns promoting resilience of livelihoods must also be considered by the local government. Among the different climate-related hazards in Laguna, flood and typhoons may be given priority because these are the most common hazards experienced by the households.

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ANNEX 1. Results of the three-step feasible generalized least squares regression analysis

	Variance		Expected Value of Consumption	
	Coefficient	P>|t|	Coefficient	P>|t|
Livelihood dependence on the AFF-sector (Ratio of AFF Income to Total Income)	0.179	0.656	1.933	0
Age of the household (HH) head	0.012	0.318	0.029	0
Gender of the HH head (Dummy variable takes on the value of 1 if male)	-0.127	0.227	0.891	0
Number of years of schooling of HH head	0.0124	0.53	0.147	0
HH size	-0.0228	0.627	-0.152	0
With chronically ill or disabled HH members (Dummy variable takes on the value of 1 if there is a chronically ill or disabled HH member)	-0.083	0.532	-0.137	0.432
Number of strong typhoons (at least signal no. 3 category) experienced in the last 10 years	0.037	0.313	-0.017	0.308
Highest flood height experienced by the HH in the last 10 years, in inches	0.116	0	-0.65	0
Drought (Dummy variable takes on the value of 1 for AFF HHs that have experienced drought in the last 10 years)	-0.342	0.35	0.001	0.996
Landslide (Dummy variable takes on the value of 1 if HH has experienced landslide in the last 10 years)	0.147	0.342	0.443	0
Constant	-0.685	0.62	4.97	0
Adjusted R-squared	0.27			0.76
Prob>F	0			0

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