Intra-Household Impacts of Climate Change Hazards and Autonomous Adaptation: Evidence from Bohol, Philippines

Adrian Boyett D. Agbon, Corazon G. Anzano, Asa Jose U. Sajise, Paul Joseph R. Ramirez, and Glaiza J. Zamora

Published by WorldFish (ICLARM)– Economy and Environment Program for Southeast Asia (EEPSEA)
EEPSEA Philippines Office, SEARCA bldg., College, Los Baños, Laguna 4031 Philippines
Tel: +63 49 536 2290 loc. 4107; Fax: +63 49 501 3953; Email: admin@eepsea.net

EEPSEA Research Reports are the outputs of research projects supported by the Economy and Environment Program for Southeast Asia. All have been peer reviewed and edited. In some cases, longer versions may be obtained from the author(s). The key findings of most *EEPSEA Research Reports* are condensed into *EEPSEA Policy Briefs*, which are available for download at www.eepsea.org. EEPSEA also publishes the *EEPSEA Practitioners Series*, case books, special papers that focus on research methodology, and issue papers.

ISBN: 978-621-8041-50-9

Front cover photo: Anda beach, Bohol, Philippines. Photo by Cedric Buffler
under the creative commons license at https://www.flickr.com/photos/cedriana/8407941625/

Suggested Citation: Agbon, A.B.D.; C.G. Anzano; A.J.U. Sajise; P.J.R. Ramirez; and G.J. Zamora. 2017. Intra-household impacts of climate change hazards and autonomous adaptation: Evidence from Bohol, Philippines. EEPSEA Research Report No. 2017-RR17. Economy and Environment Program for Southeast Asia, Laguna, Philippines.

Intra-household Impacts of Climate Change Hazards and Autonomous Adaptation: Evidence from Bohol, Philippines

Adrian Boyett D. Agbon
Corazon G. Anzano
Asa Jose U. Sajise
Paul Joseph R. Ramirez
Glaiza J. Zamora

April, 2017

Comments should be sent to: Adrian Boyett D. Agbon
Faculty, Department of Economics, School of Business and Economics
University of San Carlos, Cebu City 6000, Philippines
Tel No: 62 (32) 253 1000 local 310
Fax No: 63 (32) 255 4341
Email: abagbon@usc.edu.ph; abagbon@gmail.com

The Economy and Environment Program for Southeast Asia (EEPSEA) was established in May 1993 to support training and research in environmental and resource economics. Its goal is to strengthen local capacity in the economic analysis of environmental issues so that researchers can provide sound advice to policymakers.

To do this, EEPSEA builds environmental economics (EE) research capacity, encourages regional collaboration, and promotes EE relevance in its member countries (i.e., Cambodia, China, Indonesia, Lao PDR, Malaysia, Myanmar, Papua New Guinea, the Philippines, Thailand, and Vietnam). It provides: a) research grants; b) increased access to useful knowledge and information through regionally-known resource persons and up-to-date literature; c) opportunities to attend relevant learning and knowledge events; and d) opportunities for publication.

EEPSEA was founded by the International Development Research Centre (IDRC) with co-funding from the Swedish International Development Cooperation Agency (Sida) and the Canadian International Development Agency (CIDA). In November 2012, EEPSEA moved to WorldFish, a member of the Consultative Group on International Agricultural Research (CGIAR) Consortium.

EEPSEA's structure consists of a Sponsors Group comprising its donors (now consisting of IDRC and Sida) and host organization (WorldFish), an Advisory Committee, and its secretariat.

EEPSEA publications are available online at http://www.eepsea.org.

ACKNOWLEDGMENT

We would like to thank the following individuals and organizations for their support in the completion of this project:

The WorldFish Center-Economy and Environment Program for South East Asia (EEPSEA) and the Climate Change, Agriculture and Food Security (CCAFS) for providing us the funding;

Dr. Maripaz L. Perez for giving us technical support and expertise;

Fr. Dionisio M. Miranda, SVD, SThD- President, University of San Carlos, Dr. Danilo B. Largo- Research Director, Office of Research, Dr. Challoner Matero- Dean, School of Business and Economics;

The Bohol Team namely, Carlson Saniel- Research Assistant, Bohol Island State University- Bilar Campus; field Interviewers and facilitators: Dino D. Alleluya, Stalin S. Baja, Ericson Digamon, Marisel C. Fallar, Arlene Gudmalin, Melchor M. Lapinig Jr., Joven Mansueto, Christian P. Mebrano, Rosadel Tampus and students of BISU who helped during the field work and data encoding.

The Cebu Team Lauren Ligaton- Research Assistant, Celeste Villaluz, Jay Masna, and Gigi Bejer;

LGU officials in Anda, Bien Unido, and Inabanga Bohol for providing us secondary data and documents for our document reviews. All residents, Barangay officials, health workers, and CSO representatives in Poblacion and Suba, Anda, Bohol; Nueva Estrella and Poblacion, Bien Unido, Bohol; Tungod and Cagawasan, Inabanga, Bohol.

TABLE OF CONTENTS

LIST OF TABLES AND FIGURE

INTRA-HOUSEHOLD IMPACTS OF CLIMATE CHANGE HAZARDS AND AUTONOMOUS ADAPTATION: EVIDENCE FROM BOHOL, PHILIPPINES

Adrian Boyett D. Agbon, Corazon G. Anzano, Asa Jose U. Sajise,
Paul Joseph R. Ramirez, Glaiza J. Zamora

EXECUTIVE SUMMARY

This study is an attempt to systematically study the intra-household implications and issues of climate-related shocks or hazards. We look at how the internal dynamics of decision making within the household and the joint adaptive action of household members (particularly the husband and wife) affect outcomes/risks for different groups and individuals within the household itself. The areas covered in the study are three municipalities in the province of Bohol, Philippines, namely, Anda, Bien Unido, and Inabanga, which are all coastal areas in the province. The local officials identified two *barangays* (villages) in each of the municipality as the specific study sites for the study. These identified areas have high risk of climate change impacts and a relatively high incidence of poverty.

A household survey was administered to 300 households. The respondents were identified through stratified random sampling. Through participatory community-based hazard mapping during the FGDs, these communities were delineated into hazard and non-hazard zones. Coastal erosion and sea level rise appear to be the most apparent threats in all the study sites in Bohol, Philippines, although other climate hazards such as typhoons, flooding, and saltwater intrusion are also felt. Based on the estimated values, damage to house is highest in Nueva Estrella, Tungod, and Cagawasan. The income loss of the wife is highest in Tungod and Cagawasan, both of which are in Inabanga. Looking at the time men and women devote to activities before and after a calamity provides another view of gender dynamics in the household. The average time spent fetching water and taking care of children declined across all study sites, although there was a decrease in the time women devoted to childcare.

This paper provides a relatively clear picture of the vulnerable condition of people living in selected coastal areas in Bohol, Philippines. The situation of women in the study areas provided a glimpse of how limited income opportunities are for them. Households in the coastal or fishing communities have high poverty incidence. Perhaps, social protection in the form of insurance to fisherfolk could be developed so that they can recover from shocks, as this may be better than the usual dole-out system. Building more resilient communities does not only mean capacitating the local officials but also providing more inclusive disaster and risk reduction strategies. The role of women and children must be integrated into the whole plan as their needs are different from those of men during and after calamities.

1.0 INTRODUCTION

Climate change is a global problem requiring a global solution. For the past decades, the world has increasingly been concerned with changes in our climate due to their potentially large and adverse impacts, which are seen and felt not just globally but also at the regional, national, and even local levels. Climate change is occurring and will intensify in the next few decades, threatening developing economies in particular such as the Philippines, which is one of the most vulnerable countries in the world. Addressing climate change has been high on the international policy agenda, and (in many occasions) subjected to debates among experts and the scientific community.

Moreover, coastal and marine ecosystems are vital to most Southeast Asian countries, primarily because most of them depend on fish and other marine products to fuel their economy and feed their population. Furthermore, populations living in the coastal areas that are dependent on this resource base are among the poorest in the region. Thus, it is not surprising that governments in this region have been at least concerned about the environmental problems confronting these ecosystems and the populations depend on them. Coastal ecosystems and communities are even more at risk in the face of climate change as most of its attendant effects like sea level rise, storm surges, and typhoons often emanate from the sea. Whereas environmental externalities have been traced from the ridge to the reefs in the past, with climate change, the problem is looked at from the reef to the ridge. These ecosystems and the population dependent on them are placed in a very precarious position. Furthermore, unlike terrestrial ecosystems, coastal communities face a confluence of hazards such as flooding/typhoon, storm surges, coastal erosion/sea level rise, and saltwater intrusion. At times when hazards impact these communities simultaneously, intervention and adaptive behavior tend to be more complex. Thus, increasing the resiliency of coastal communities to climate change impacts is an urgent task for countries in Southeast Asia. The only way to build such communities is to understand, and eventually increase, adaptive capacity and resiliency at both the public (local government units or LGUs) and household levels.

In June 2013, a report entitled *Turn Down the Heat; Climate Extremes, Regional Impacts, and the Case for Resilience* was prepared for the World Bank (WB) by the Potsdam Institute for Climate Impact Research and Climate Analytics. It focused on the risks of climate change to development in Sub-Saharan Africa, Southeast Asia, and South Asia, and provided a thorough analysis of the possible impacts of current 4–6°C warming on agricultural production, coastal vulnerability, and water resources.

Another report from the Asian Development Bank (2009) highlighted that climate change is likely to be one of the most significant development challenges confronting Southeast Asia in the 21st century, as the countries in the region are located along continental arcs and offshore archipelagos of Asia. Moreover, the report has noted that the region is widely considered one of the world's most vulnerable to climate change because of its long coastlines, high concentrations of population and economic activities in coastal areas, heavy reliance on agriculture for providing livelihoods (especially those at or below the poverty line), and high dependence on natural resources and forestry. Another WB report entitled *Getting a Grip on Climate Change of the Philippines* (2013a) mentioned that the Philippines suffers and will continue to experience climate-related impacts, which will have detrimental consequences on the poor and on their livelihoods in rural and urban areas. The key findings of the technical report are as follows:

1. Sixteen provinces are among the top 50 most vulnerable and four cities are among the top ten most vulnerable cities to climate-related impacts in the region.
2. Sea level rise is a larger threat to the Philippine coastline compared to other countries in the region, with 42% of the coastal population (2nd in the world) and 14% of the total population (1st in the world) at direct risk.
3. Climate-related impacts will reduce cultivatable land and nursery areas for fisheries, which will increase food insecurity and loss of livelihoods for poor communities.
4. Fast-growing environmental deterioration and unsustainable development trends combined with high levels of poverty and one of the fastest population growth rates aggravate climate-related impacts.

Agriculture is the most vulnerable sector in the Philippines, and this is also where high levels of poverty incidence can be found *(*Table 1*)*. Among those families whose household head are farmers and fisherfolk, the highest poverty incidence are among oyster and mussel gatherers (100%). Poverty incidence among inland and coastal water fisherfolk is at 40%, although this figure is lower than that for charcoal (62%) and corn farmers (57.6%). In terms of absolute numbers, there are more poor households among corn and rice farmers at 437,857 and 387,121, respectively.

Table 1. Poverty incidence among farm households in the Philippines, 2012

Farmer Occupation	Poor	Non-poor	Total	Incidence
Oysters and mussel gatherers	645	0	645	100.0
Charcoal makers	26,424	16,216	42,640	62.0
Corn farmers	437,857	322,706	760,563	57.6
Inland and coastal waters	162,224	243,074	405,298	40.0
Coconut farmers	198,507	328,129	526,636	37.7
Vegetable farmers	89,574	155,155	244,729	36.6
Sugarcane farmers	14,233	26,391	40,624	35.0
Deep-sea fishermen	34,570	70,524	105,094	32.9
Seaweeds cultivators	11,990	25,539	37,529	31.9
Rice farmers	387,121	997,866	1,384,987	28.0

Source of basic data: FIES (2012), PSA and authors 'calculations

It is against this pressing concern that the WorldFish-Philippine Country Office has spent the past two years documenting and analyzing adaptive strategies against climate hazards in coastal communities in Southeast Asia. The results of these studies have provided information critical in identifying appropriate and cost-effective public/planned strategies, as well as in understanding the determinants of autonomous or household adaptive behavior.

1.1 Objectives of the Study

This study is an attempt to systematically study the intra-household implications and issues of climate-related shocks or hazards. We look at how the internal dynamics of decision making within the household and the joint adaptive action of household members (particularly the husband and wife) affect outcomes/risks for different groups and individuals within the household itself. The specific objectives of the study include the following:

1. To describe the role of men and women in decisions related to adaptation against various climate hazards in coastal communities;
2. To describe and identify the various adaptation strategies employed by husband and/or wife for different climate-related hazards;
3. To measure the physical and monetary damages in terms of health, individual asset damage, and labor allocation (time cost) incurred by individual members of the household from climate-related hazards (i.e., intra-household impacts of climate hazards);
4. To identify cultural and social community norms that affect the degree of women participation in adaptation decision making and action;
5. To describe and measure how intra-household dynamics (i.e., women's participation in decision making both for adaptation and general decision spheres) result in intra-household impacts from different climate hazards; and
6. To explore and identify emerging issues in the intra-household study of adaptation decision making and action.

This report is organized as follows: the next section (Section 2) discusses the methodology. Section 3 explains in detail the impacts of climate hazards from the household survey. Section 4 outlines the autonomous adaptation, and Section 5 provides the conclusions and policy implications.

2.0 METHODOLOGY

2.1 Study Site Description

The areas covered in the study are three municipalities[1] in the province of Bohol, Philippines (Figure 1). The local government units are Anda, Bien Unido, and Inabanga, which are all coastal LGUs in the province. The local officials identified two *barangays* (village)[2] in each of the LGUs as specific study sites for the study. The study sites in LGU Anda are barangays Poblacion and Suba.

These identified areas have high risk of climate change impacts and a relatively high incidence of poverty according to the National Economic and Development Authority in Region 7 and based on interviews with municipal engineers and planning officers. Figure 1 provides a glimpse of the poverty incidence in the study sites.

Bien Unido had the highest poverty incidence in 2009 at 63.7%. The other study sites also exhibited higher poverty incidence. Barangay Nueva Estrella in LGU Bien Unido was also identified as highly vulnerable to climate change impacts.[3] The local government of Inabanga identified barangays Tungod and Cagawasan as study sites for this study, as it has a pending proposal to relocate residents of the former due to the risk of storm surge in the area while the latter was identified to be at-risk of storm surge and soil erosion. Table 2 provides comprehensive information about the three LGUs in this study.

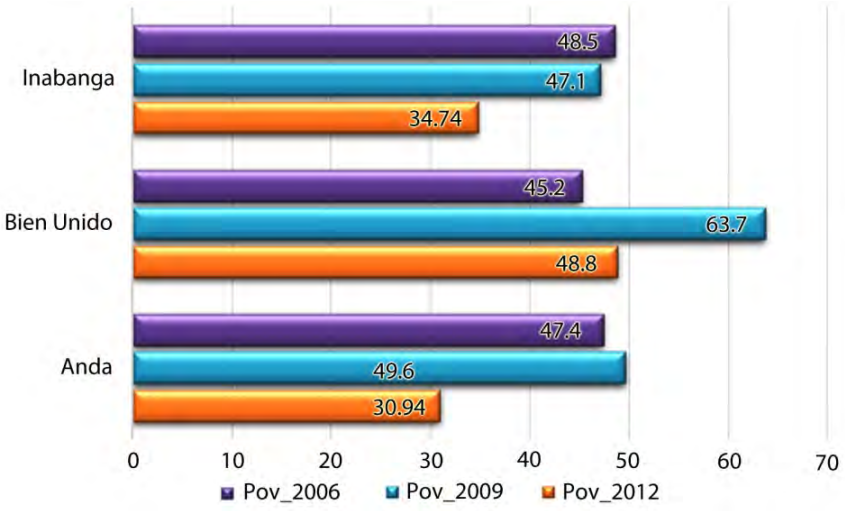

Figure 1. Poverty incidence in LGU study sites

Source: PSA, Small Area Estimates[4]

[1] Municipalities are also called local government units (LGUs) in the Philippines, a term indicating a political subdivision in the country.

[2] Political term given to the smallest unit of government in the Philippines and is further subdivided into *sitios* or *puroks*.

[3] Based on interview with the municipal planning and development officer, and given that most of the barangays in the LGU are island barangays

[4] Data for this table were obtained from https://data.hdx.rwlabs.org/dataset/philippines-small-area-poverty-estimates-2012–2009–2006.

Table 2. Profile of the LGU study sites

LGU	Inabanga	Bien Unido	Anda
Location	Northwestern coast of Bohol	Northern part of Bohol	Eastern tip of Bohol
Congressional district	2nd	2nd	3rd
Number of barangays	50	15 (6 coastal, 8 island, 1 non-coastal)	16
Income classification	3rd	4th	5th
LGU current operating income in 2014 (million PHP)	91	55	54.55
Total municipal land area	13,166 has	4,482 has	6,286.15 has
Timberland area	5,305 has (mangrove 767 has)	582 has	
Alienable and disposable	None	3,900 has	4,005 has
River Basins	Inabanga RB, Dait RB	Ipil RB, Soom RB	Lumbay RB, Cance RB
Population			
2000	40,174	23,412	
2007	43,331	23,412	16,616
2012	33,286	24,779	16,355
Average population growth rate	0.86	0.75	0.99
Total number of HH	8,755	4,454	3,286
Major industries	Farming, mat weaving, fishing, nipa thach making	Fishing, farming, mat weaving	
Climate hazards	Typhoon, storm surge/sea level rise, drought, coastal soil erosion, salt water intrusion	Typhoon, drought, earthquake, soil erosion	Typhoon, storm surge, drought, La Nina,

Source from http://www.ppdobohol.lgu.ph/ www.bglf.gov.ph

Based on 2014 information on the three LGUs, Inabanga has the highest annual income at PHP 91 million, whereas Bien Unido's and Anda's annual incomes are at PHP 55 million and PHP 54.55 million, respectively. In terms of income classification, this translates to Inabanga being a third-class municipality, Bien Unido a fourth-class municipality, and Anda a fifth-class municipality. Inabanga is also the biggest in terms of total land area at 13,166 ha, whereas Anda has 6,286 ha and is bigger than Bien Unido, which has 4,482 ha. While LGUs have river basins, only Inabanga has a 5,305-hectare timberland area, 767 ha of which are mangroves. As reported, only Bien Unido and Anda have alienable disposable lands spanning 3,900 ha and 4,005 ha, respectively. In terms of population, Inabanga's population in 2012 is highest at 33,286 individuals, although this is already significantly lower compared to the 2000 and 2007 census. Bien Unido's 2012 population (24,779) is bigger than Anda's (16,355) population in the same year (Table 3).

Table 3. Bohol study sites, population and number of households, 2012

LGUs	Barangays	Population	Number of Households
Anda	Poblacion	1,385	274
	Suba	1,126	266
Bien Unido	Nueva Estrella	1,787	342
Inabanga	Tungod		215
	Cagawasan	1,449	252

Source: data collected from each of the barangay*s* through their secretary

All three LGUs have less than 1% average population growth rate (APGR), lower than Bohol's APGR of 1.06% in 2007. Of the three LGUs, Inabanga has the largest number of households at 8,775, whereas Bien Unido has 4,454 and Anda has 3,286. The livelihoods of the residents in the three LGUs are fishing and farming. Mat weaving is also common in both Bien Unido and Inabanga, while nipa thatch making is also practiced in Inabanga.

2.1.1 Anda, Bohol

The municipality of Anda is located in a small peninsula at the eastern tip of Bohol, 100 km from Tagbilaran City. This place was once a wilderness; the shores were swampy and covered with thick mangroves and hardwood trees. The northern part of the town consists of mountain ranges, with variable valleys gradually diminishing their height until they reach the town proper. The lands along the coast are level lands, ideal for residential and commercial purposes. Elevation range is from 0–300 meters above sea level.[5] Barangay*s* Poblacion and Suba are described as land formed over time as layers of sand, gravel, and corals amassed by sea waves piled on top of one another.

Anda also has identified manganese deposits, although its quality and volume is immeasurable. Guano, an organic matter, can also be found in some caves in the municipality. Coral formations are potentially available in some coastal barangay*s*. Swamps and mangroves for fishpond development (with an approximate area of 338 ha) are also available. Fish sanctuaries are being developed and maintained along the coastal areas in the municipality. The area is endowed with potential for fish production given its coral reefs and seashells, although most of the fishermen use fishnets and hooks. The Integrated Fisheries and Aquatic Resources Management Council (IFARMC) at the barangay level has been organized and institutionalized to help conserve, manage, and protect marine resources. The major sources of income are agriculture (including fishing and farming with corn, rice, banana, coconut, and root crops as staple crops) and tourism. In the coastal barangay*s*, some are engaged in small businesses (e.g., *sari-sari* store or neighborhood variety store), and others are employed by the government or the private sector, such as in beach resorts.[6]

2.1.2 Bien Unido, Bohol

The municipality of Bien Unido is located on the northern part of the province of Bohol. This municipality has 15 barangay*s*—6 coastal, 8 island, and 1 coastal. More than half (52%) of its population are residing in island barangay*s,* while 48% are in the coastal areas. Over the years, the municipality has experienced a steady increase in its population. The LGU has a total land area 3,121 ha, which is divided into alienable and disposable lands (83.75%) and forestland/mangrove (16.25%). Areas for potential development in the area include Danajon Double Barrier Reef for

[5] Description of Anda's topography was obtained from the official website of the LGU http://www.andabohol.gov.ph/topography/

[6] Information obtained from http://www.andabohol.gov.ph/income/.

diving and other tourism activities, as well as the 20-hectare solar power plant initiated by the local chief executive.[7] As a coastal municipality, Bien Unido is highly vulnerable to natural hazards such as drought, storm surges, liquefaction, tropical cyclones, and sea level rise.[8] The principal industries in this town are fishing, farming, and mat weaving.[9]

2.1.3 Inabanga, Bohol[10]

The municipality of Inabanga is a third-class municipality located on the northwestern coast of the province of Bohol. Inabanga has 50 barangays sharing a total road length of 130.60 km. The locals are engaged in trading, fishing, farming, and nipa thatch making. This town is also popular in the production of saguran, mats, baskets, and hats.

The municipality of Inabanga is located on the northern coast of Bohol, 71 km from Tagbilaran City. Considered a third-class municipality, the town covers a total land area of 13,166 ha and is Bohol's third largest town. It has a population of 43,331 people residing in 7,867 households, according to the 2007 census.

It is further divided into 50 barangays. The area is blessed with natural attractions, rolling terrain, hills and mountains, Ilihan Falls, the Macavan Cave and Inabanga River (the largest river in Bohol). Other attractive sights are the centuries-old Inabanga Church, which is dedicated to Saint Paul, whose feast day falls on June 30. Getting its share of visitors is the Inabanga Nature Park and Fishing Village.

The people of Inabanga are industrious. Many are engaged in fishing, mat weaving, making nipa thatches, and seafood preservation such as salted *sisi, litub, tagimtim* and *kaykay*. The womenfolk are also adept at saguran weaving, the weaving of blankets and the making of hats, bags, and baskets. Others, especially those located at the town proper, are engaged in trading. Establishments available are bakeries, lending institutions, gasoline stations, stores selling construction materials, and others. Despite all these, however, Inabanga is still one of the impoverished towns of Bohol. To alleviate the economic situation of the town, various projects are being implemented by the town's local government

.

One such endeavor is the establishment of the seaweeds-farming project in Hambongan Island for marginalized fishermen, which is funded with a grant from the municipal government. The Sea *Kaunlaran* Association (SKA) was formed, and it initiated the planting of *Eucheuma* seaweeds (known locally as "*guso*") in deep seawater. Planting on a staggered basis on staked areas guarantees year-round harvest and a steady income; fishermen can harvest one area after another.

Another laudable venture is the establishment of a 20-hectare site to be used for the planting of *lakatan* bananas, a variety that is quite in demand nowadays. The inhabitants of Barangay Ilihan were the recipients of this project and were rallied to plant and nurture this banana variety for commercial purposes. The project has been launched by the local government under the leadership of the incumbent mayor.

---

[7] This is an on-going project according to the Hon. Mayor Boniel of the LGU Bien Unido.

[8] This information was from the CLUP or Comprehensive Land Use Program of the LGU 2011-2020 and the Multi-Geo-Hazard Maps of the Province of Bohol from the Municipal Planning and Development Office (MPDO)

[9] Information obtained from http://www.bohol.ph/mun49.html

[10] This information is from http://celmarne-anime.blogspot.com/.

2.2 Household-Level Data and Sampling Strategy

A household survey was administered to 300 households to answer the study's key research questions. The respondents were identified through stratified random sampling. First, coastal communities—i.e., those within 1 km from the coastline were identified. Through participatory community-based hazard mapping during the FGDs, these communities were delineated into hazard and non-hazard zones. The target number of respondents in each study site was distributed proportionally according to the fraction of the coastal population living in the identified hazard and non-hazard areas.

A multi-purpose household questionnaire was designed to gather data which, among other things, included the following:

1. Household demographic information;
2. Consumptive and non-consumptive expenditure of households;
3. Assets of husband and wife as well as their assets brought into marriage;
4. Income sources of individual household members;
5. Occurrence, damages, and impacts of flooding/ typhoon, saltwater intrusion, and coastal erosion/storm surges;
6. Adaptive strategies implemented by husband and wife;
7. Participation of husband and wife in decision-making activities, including choice of adaptive strategies;
8. Time allocation of household members before and after an extreme weather event;
9. Incidence of disease as well as sickness and treatment expenditure after an extreme weather event; and
10. Awareness of husband and wife on climate change issues and adaptation choices.

Portions of the questionnaire were administered separately to the husband and wife.

2.3 Measuring Women's Participation in Decision Making: Women Empowerment Index (WEI)

In order to measure women's level of participation in various household decision-making spheres, including the choice of adaptive strategies, we used the women empowerment index (WEI), which is computed as follows (Paris et. al. 2010):

$$WEI_i = \frac{\sum_i x_i}{d}$$

where:

WEI = women's empowerment index for identified activities of each respondent,
x = value of decision making on the i[th] activity and has the following values:

$$X_i = \begin{cases} 1 - \text{Husband decides alone} \\ 2 - \text{Husband dominates the decision} \\ 3 - \text{Husband and wife make the joint decision} \\ 4 - \text{Wife dominates the decision} \\ 5 - \text{Wife decides alone;} \end{cases}$$

d = total number of decisions given by the respondent; and
I = i[th] decision making activity

A higher index or score indicates that the woman in the household is more empowered or has a higher participation in a decision-making activity. The total number of decisions (*d*) given may vary among respondents because some questions may not be applicable to certain households. In cases where either the husband or the wife is not available (i.e., deceased, abroad, etc.), the husband was replaced by an adult male who is involved in household decision making such as the grandfather or brother. Similarly, an adult female who is involved in the household decision making replaced the wife in case of her absence.

3.0 IMPACTS OF CLIMATE HAZARDS

This section discusses the several impacts of the identified climate hazards in the study sites. The study sites are coastal barangay*s* in Bohol, Philippines. The climate hazards that were mentioned during the FGDs were typhoon, flooding, coastal erosion, and salt water intrusion. As discussed in the previous section, typhoon, flooding, and coastal erosion are observed in all study sites. Saltwater intrusion was said to have affected only Barangay*s* Cagawasan and Tungod in Inabanga, Bohol.

3.1 Household-Level Damages to Property and Livelihood[11]

Table 4 below shows the average percentage of households per study area that are affected by the identified climate hazards. Across all the study sites, Barangay Tungod is affected by all the climate hazards identified. With regard to the impact of flooding and typhoon, Barangay Tungod has the highest number of affected households at almost 99% of the households interviewed. This is followed by Barangay Suba (49%), while the percentage of affected households in Poblacion is 20%. The last two barangay*s* with lowest mean scores for typhoon and flooding are Cagawasan (12%) and Nueva Estrella (2%).

[11] No values for household-level damages from coastal erosion/sea level rise and saltwater intrusion by barangay/commune and whole sample

Table 4. Distribution of affected households

% of Households Affected by Calamities	Obs	Anda, Bohol		Bien Unido	Inabanga		Whole Sample
		Poblacion	Suba	Nueva Estrella	Cagawasan	Tungod	
		n = 44	n = 55	n = 88	n = 34	n = 79	N = 300
Flooding/Typhoon	Mean	20.5%	49.1%	2.3%	11.8%	98.7%	36.5%
Coastal Erosion/ Sea level rise	Mean	100.0%	100.0%	98.9%	97.1%	94.9%	98.2%
Saltwater intrusion	Mean					6.3%	6.3%

Note that for coastal erosion and sea level rise, all mean scores of the five study sites are very high. All households in Barangay*s* Poblacion and Suba in Anda reported being affected by coastal erosion and sea level rise, while Nueva Estrella can also be considered as very prone to sea level rise and erosion given its mean score of 99%. The percentages for Cagawasan and Tungod are also very high at 97% and 95%, respectively. These figures signify that all study sites are apparently affected by both coastal erosion and sea level rise. The overall percentage pertaining to these climate hazards is much higher (98%) than the overall percentage for typhoon and flooding (36%). Coastal erosion and sea level rise have become everyday-threats to those affected households in the mentioned barangay*s*. Barangay*s* Poblacion and Suba in Anda, Bohol are both located near a reclaimed land and river estuary. Barangay Tungod residents are to be relocated since the barangay has been submerged in seawater most of the time after the earthquake.

Although saltwater intrusion was mentioned to have affected both Barangay*s* Cagawasan and Tungod during the FGDs, survey results show that only Barangay Tungod was affected (6%).

Another point of interest is quantifying in monetary terms the damage to house and loss of income from both agriculture and fishery. As seen in Table 5, the highest mean value for damage to houses is in Barangay Nueva Estrella, averaging PHP 605.75. This is followed by Tungod at PHP 543.04, while Cagawasan in the same LGU posted a mean value of PHP 369.70. The lowest mean values for damage to house are in Suba and Poblacion at PHP 294.55 and PHP 151.14, respectively.

Table 5. Mean value of household level damages from typhoons and flooding

Damages	Obs	Anda		Bien Unido	Inabanga		Whole Sample
		Poblacion	Suba	Nueva Estrella	Cagawasan	Tungod	
		n = 44	n = 55	n = 87	n = 33	n = 79	N = 298
Damage loss to house	Mean	151.10	294.50	605.70	369.70	543.00	392.80
Loss in agricultural production	Mean	–	18.18	202.30	9.09	–	76.52
Loss in fishing income	Mean	188.64	208.55	761.49	366.67	386.33	382.33

3.2 Intra-Household and Gender-Differentiated Damages: Gender-Differentiated Asset and Income Impacts from Extreme Weather Events

Table 6 attempts to quantify the income losses of the wife and the husband in the five barangays. Across all the study sites, the estimated loss of income for the wife is highest in Tungod and has a mean value of PHP 170.89, while Barangay Cagawasan in the same LGU posted a mean value of PHP 162.12. Income loss of wives in barangay Nueva Estrella averages PHP 103.45, while wives in Barangays Poblacion and Suba in Anda lose PHP 46.36 and PHP 41.82 of potential income due to extreme weather events, respectively. The overall average income loss for wives in all study sites is PHP 104.93.

Table 6. Income losses of wife and husband due to extreme weather events

Income Losses	LGU	Anda		Bien Unido	Inabanga		Whole Sample
	Barangay	Poblacion	Suba	Nueva Estrella	Cagawasan	Tungod	
	Observation	n = 44	n = 55	n = 87	n = 33	n = 79	N = 298
Wife's Income Loss	Mean	46.36	41.82	103.45	162.12	170.89	104.93
Husband's Income Loss	Mean	294.09	70.91	198.28	896.97	475.63	1935.88

On the other hand, the estimated value of the husband's income loss due to extreme weather events is highest in Barangay Cagawasan (PHP 896.97) and followed by Barangay Tungod (PHP 475.63) in the same LGU. The lowest mean value of PHP 70.91 was posted by Suba in Anda. This is much lower compared to the estimated mean values for husbands' income loss in Poblacion (PHP 294.09) and Barangay Nueva Estrella (PHP 198.28). Overall, the mean value for the husband's loss of income due to extreme weather events is PHP 1,935.88, substantially higher compared to the mean value for wife's income loss (PHP104.93). It can be recalled that during the pre-survey activities, focus group discussions revealed that most of the wives devote their time to non-wage activities such as taking care of the children and other household chores. Delving into income disparity between husband and wife in the study sites gave us a clear picture of the limited income opportunities for women in these coastal areas in Bohol, Philippines.

Table 7 provides a more detailed valuation of the damages to the various assets owned by the husband and wife in Bien Unido and Inabanga study sites. There were only a few observations in each of the sites mentioned.

Table 7. Asset losses of wife and husband due to extreme weather events

LGU		Anda		Bien Unido	Inabanga	
Barangay		Poblacion	Suba	Nueva Estrella	Cagawasan	Tungod
Damage to husband-owned appliances	Obs	–	–	1	1	4
	Mean (PHP)	–	–	300	1,000	3,137.5
Damage to husband-owned livestock	Obs	–	–	4		
	Mean (PHP)			600		
Damage to husband-owned assets	Obs			2		1
	Mean (PHP)			1,750		2000
Damage to wife-owned appliances	Obs	0	0	1	1	4
	Mean (PHP)			300	1,000	3,137.5
Damage to wife-owned livestock	Obs			4		
	Mean (PHP)			600		
Damage to wife-owned assets	Obs			2		1
	Mean (PHP)			1,750		2,000

There was only one observation each for Nueva Estrella and Cagawasan, while Tungod had four observations as regards damage to husband-owned appliances. Barangay Tungod has the highest mean value of damage to husband-owned appliances at PHP 3,137.50. In Barangay Cagawasan, the mean value of damage to husband-owned appliances was estimated to be PHP 1,000. The lowest mean value of PHP 300 is posted by Nueva Estrella.

Only Nueva Estrella in Bien Unido had observations with regard to damage to livestock, and both husband and wife in this barangay posted the same mean value at PHP 600. For other husband- and wife-owned assets, two observations in Nueva Estrella with a mean value of PHP 1,750 and one observation in Tungod with a mean value of PHP 2,000 were recorded.

3.3 Gender Differentiated Impacts on Leisure Time

Table 8 lists the hours spent by male and female decision makers on different "unpaid" activities during normal days and after an extreme weather event. There is a clear increase in the average time spent cleaning the house during the normal days and after an extreme weather event. Specifically, the mean for men increases by 0.19 hours while the mean for women increases by 0.26 hours. For cleaning the house's surroundings, it can be observed that average time spent on this activity increased for both men and women at 0.22 hours and 0.16 hours, respectively. This is understandable, as men normally do clean-up operations after a calamity. The table also clearly shows a reduction in the average time allotted to washing clothes by 0.05 hours for men and 0.10 hours for women. Time spent on cooking increases slightly by 0.01 hours for men after an extreme weather event while for women, it slightly decreases by 0.01 hours.

Table 8. Mean hours spent on unpaid household activities and leisure time

Activities (Obs = 300)	Men		Diff	Women		Diff
	Normal Days	After Extreme Weather Event		Normal Days	After Extreme Weather Event	
	(Hours)	(Hours)		(Hours)	(Hours)	
Cleaning house	0.54	0.73	0.19	0.98	1.24	0.26
Cleaning house's surroundings	0.67	0.88	0.22	1.02	1.18	0.16
Washing clothes	0.62	0.57	–0.05	1.82	1.72	–0.10
Cooking	0.35	0.36	0.01	0.58	0.57	–0.01
Fetching water	0.36	0.35	–0.01	0.25	0.22	–0.03
Childcare	1.39	0.71	–0.68	4.77	2.87	–1.89
Feeding house animals	0.26	0.23	–0.03	0.18	0.16	–0.02
Watching TV Listening to radio	1.40	1.31	–0.09	1.47	1.31	–0.16
Personal hygiene	0.31	0.26	–0.05	0.38	0.28	–0.10
Sleeping	7.26	4.51	–2.75	7.57	4.93	–2.64

The average time for fetching water has declined for both men and women by 0.01 hours and 0.03 hours, respectively. The time devoted for childcare has also declined for both men and women across all study sites, but the average decrease for women is much higher at 1.89 hours while for men, there was only an average decrease of 0.68 hours. Average time for feeding pets and house animals has also declined for men and women at 0.03 and 0.02, respectively. The data also revealed a reduction in the average number of hours devoted to watching television and listening to the radio for both men and women; the average decline for men is 0.09 hours while the decline for women is higher at 0.16 mean hours. Time men and women devote for personal hygiene also decreased after a calamity. Among the activities listed, however, sleeping is most affected for both men and women, with men spending about 2.75 hours less and women spending 2.64 hours less on this activity. This is normally acceptable as sleeping hours are normally sacrificed during and after calamities.

3.4 Intra-household Health Impacts after Flooding/ Typhoon

This section discusses the mean health expenditure and time allocated for treating sick household members affected by diseases after a flooding event. Waterborne diseases associated with flooding are diarrhea, worms and helminths, cough, fever, and colds (Table 9). Barangay Tungod has highest mean amount spending at PHP 885 for respiratory diseases. The average expenditure for diarrhea in Nueva Estrella is PHP 500, while the figure for Barangay Tungod is PHP 175. In Barangay Suba, the expense for a reported case of worm and helminths was PHP 20 only.

Table 9. Mean health expenditure after a flooding event

Disease	Barangay	Suba	Nueva Estrella	Tungod
Diarrhea	Obs		1	2
	Mean (PHP)		500	175
Worms/Helminths	Obs	1		
	Mean(PHP)	20		
Cough, fever, colds	Obs			4
	Mean(PHP)			885

Table 10 below shows the hours spent by other members in the household to take care of their sick family members after the latest flooding/typhoon event. Wives in Tungod spent the most number of hours (10.5) taking care of other family members who were having cough, fever, and colds, while the husbands spent only 7 hours. For diarrhea, husbands and wives in Nueva Estrella spent one hour each taking care of the sick family members. In Barangay Tungod, husbands, wives, and others spent two hours taking care of sick members.

Table 10. Hours spent caring for sick members after a flooding event

Waterborne Disease	Suba			Nueva Estrella			Tungod		
	H	W	O	H	W	O	H	W	O
Diarrhea				1	1	1	2	2	2
Worms/Helminths	1	1							
Cough, fever, colds							7	10.25	

Note: H = Husband, W = Wife, O = Others

4.0 AUTONOMOUS ADAPTATION

This section explains the household's adaptation and coping mechanisms to various climate change-related hazards. The survey asked about the defensive and accommodating adaptation actions, as well as evacuation and credit as adaptive mechanisms in the different study sites. We also asked respondents as to who initiated their decision to undertake the different forms of adaptation strategies. Women participation in decision making was based on the women empowerment codes (WEI) discussed earlier.

4.1 Household Adaptation Choices

Table 11 presents information on decision making within households as regards preparations against potential damages from typhoons and flooding. Study sites that appear to have higher mean values for men are Poblacion, Anda (27.3 %) and Nueva Estrella, Bien Unido (36.4 %). In contrast, the mean values for women in the aforementioned sites are at 22.7% and 27.3%, respectively. In Cagawasan, the figure for women is higher at 41.2% compared to the 38.2% posted by their male counterparts. This is also true for barangay Tungod in Inabanga where the average value for women (77.2%) is higher than the figure for men (73.4%).

Table 11. Adaptation choices of main household decision makers and Women Empowerment Index, Typhoon

Brgy	Poblacion		Suba		Nueva Estrella		Cagawasan		Tungod		As a whole	
Typhoon	M	W	M	W	M	W	M	W	M	W	M	W
Obs	44	44	55	55	88	88	34	34	79	79	300	300
Mean, %	27.3	22.7	23.6	23.6	36.4	27.3	38.2	41.2	73.4	77.2	42.7	40.7
WEI												
Obs	9	9	12	12	22	22	10	10	53	53		
Mean	3	3	3	3	2	3	2	3	2	2		
t-value	1.00		1.00		1.95		2.11		2.51			

Note: M = Men, W = Women

Table 12, on the other hand, presents information on decision making within households as regards preparations against potential damages from coastal erosion. Each study site has the same mean value for men and women in terms of adaptation to coastal erosion, which signifies joint decision making between men and women when it comes to protecting the household against coastal erosion.

Table 12. Adaptation choices of main household decision makers and WEI, coastal erosion

Brgy	Poblacion		Suba		Nueva Estrella		Cagawasan		Tungod	
Coastal erosion	M	W	M	W	M	W	M	W	M	W
Observation	44	44	55	55	88	88	34	34	79	79
Mean, %	2.27	2.27	5.45	5.45	2.27	2.27	29.41	29.41	58.23	58.23
WEI										
Observation			3	3	2	2	10	10	46	46
Mean			3	3	1	1	3	3	3	3

Note: M = Men, W = Women

Lastly, Table 13 above shows that saltwater intrusion could be observed only in Barangay Tungod in Inabanga, where the mean value for adaptation in relation to this hazard is slightly higher for men at 5.06% compared to the 3.80% posted by their female counterparts.

Table 13. Adaptation choices of main household decision makers and WEI, saltwater intrusion

Salt Water Intrusion	Tungod	
	Men	Women
Observation	79	79
Mean	5.06%	3.80%
WEI		
Observation	3	3
Mean	2.67	3.67
t-value		1.73

4.2 Women's Participation and Decision Making in Adaptation Choices

4.2.1 WEI and autonomous adaptation

It is clear that women's participation, their decision-making capacity, control over resources, and their own welfare practices are the major factors in women empowerment, or the opportunity for and action toward their full participation in choices, decisions, and processes affecting their lives. As part of the overall development process, women empowerment entails enabling women to exercise their choices with full capability in order to contribute to social and economic growth benefiting their welfare (Paris et al. 2008). In Section 4.1 on household adaptation choices for typhoons, the WEI values (Table 11) reveal that in Poblacion and Suba in Anda, the husband and wife see decision making within the household to lessen the adverse impacts of typhoons and flooding as a joint exercise (WEI = 3). In Barangay Nueva Estrella in Bien Unido, men perceive that the husband dominates the decision (WEI = 2) while women perceive decision making related to this hazard to be a joint exercise. Lastly, results vary for the two barangay*s* in Inabanga. Men in Barangay Cagawasan (WEI = 2) perceive that they dominate decision making on adaptation choices during typhoons, while women (WEI = 3) see this as a joint activity between the husband and wife. On the other hand, men and women in Barangay Tungod are in agreement that husbands dominate decision making in relation to this hazard (WEI = 2 for both men and women).

Table 12 above also presents WEI values for adaptation choices against coastal erosion of main household decision makers in the study sites. It can be observed that in Barangay Suba, men and women posted the same mean score of 2.67, implying that decision making on adaptation choices against coastal erosion in this study site are still dominated by men. This is also true for Barangay*s* Cagawasan and Tungod whose mean scores are 2.80 and 2.82, respectively. In Barangay Nueva Estrella, the mean score for both men and women is 1.00, implying that the husband solely decides on adaptation choices against coastal erosion.

Table 13 above also reveals the WEI for adaptation choices of main household decision makers in the study sites in Barangay Tungod in Inabanga, the only study site affected by saltwater intrusion. From the men's perspective (WEI = 2.67), decision making on adaptation choices for this type of hazard is dominated by men. In contrast, women perceive decision making in relation to saltwater intrusion to be dominated by women (WEI = 3.67).

4.2.2 Participation of household members in autonomous adaptation

Table 14 shows the adaptation participation rate for typhoon, flooding, and coastal erosion in Anda, Bohol. In Barangay Poblacion, the highest adaptation participation rate for typhoon and flooding and coastal erosion was posted by male and female respondents aged 25–65 (40%). They are followed by males aged 19–24, whose participation rate was at 8%. Females above 65 years old posted a slightly higher participation rate (5%) than their male counterparts (4%) in this barangay. The same trend can be observed in Barangay Suba. Participation rates for men and women between 25–65 years old were highest at 48% for males and 51% for females. However, among those over 65 years old, the participation rate of males (11%) is higher than that of females (6%) for typhoon and flooding as well as coastal erosion hazards.

Table 15 shows the adaptation participation rates for typhoon, flooding, and coastal erosion in the Nueva Estrella, Bien Unido study site. In this study site, adaptation participation is highest for those aged 25–65 for both men (80%) and women (79%). Notably, 18% is the adaptation participation rate for younger men aged 19–24, but females in the same age bracket do not participate in adaptation activities. Surprisingly, there was also no adaptation participation for males aged 65 above in this barangay, but the rate for females in the same age bracket was at 9%.

Table 14. Adaptation participation rate within each age and gender cohort in Anda, Bohol

Gender and Age Group	Typhoon/ Flooding	Mean	Std. Dev	Coastal Erosion	Mean	Std. Dev
Poblacion						
Male						
19– 24	8	12.50	35.35	8		
25– 65	40	23.75	42.34	40	1.25	7.91
> 65	4	25.00	50.00	4		
Female						
25– 65	40	12.08	31.12	40	2.50	15.81
> 65	5			5		
Suba						
Male						
25– 65	48	22.91	41.20	48	6.25	24.46
> 65	11	9.09	30.15	11		
Female						
25– 65	51	23.86	40.72	51	5.88	23.76
> 65	6			6		

Table 15. Adaptation participation rate within each age and gender cohort in Bien Unido

Nueva Estrella, Bien Unido	Typhoon/ Flooding	Mean	Std. Dev	Coastal Erosion	Mean	Std. Dev
Gender and Age Group						
Male						
19– 24	18	5.55	23.57	18		
25– 65	80	32.50	45.54	80	2.50	17.71
Female						
25– 65	79	21.52	39.77	79	1.26	11.25
> 65	9	22.22	44.09	9		

Table 16 shows the adaptation participation rate for typhoon, flooding and coastal erosion for the Cagawasan and Tungod study sites in Inabanga, as well as adaptation participation rates for saltwater intrusion in Tungod. In Barangay Cagawasan, 31% of males aged 25–65 participated in adaptation activities for typhoon, flooding, and coastal erosion. In the same age bracket, 29% females participated in adaptation activities for the aforementioned hazards. In Barangay Tungod, adaptation participation is more prevalent in all ages of both genders. The adaptation participation rate of men aged 25–65 is considerably the highest at 70%, while the figure posted by females in the same age bracket is 71%. The adaptation participation rate of younger males aged 7–18 in this barangay is also considerable at 40% and only slightly lower for females at 34%. Interestingly, participation in adaptation activities is high at 28% among much younger female aged six and below. The adaptation participation rate of females aged 65 above (11%) is also higher than that of males in the same age group (9%).

Table 16. Adaptation participation rate within each age and gender cohort in Inabanga, Bohol

Gender & Age Group	Typhoon/ Flooding	Mean	SD	Coastal Erosion	Mean	SD	Saltwater Intrusion	Mean	SD
Cagawasan									
Male									
25– 65	31	41.9	46.7	31	25.8	40.6			
>65	6	33.3	51.6	6					
Female									
25– 65	29	43.1	49.5	29	17.2	38.4			
>65	5	40.0	54.8	5					
Tungod									
Male									
7–18	40	1.2	7.9	40			40		
19–24	21	7.1	23.9	21	7.1	23.9	21	2.38	10.91
25–65	70	69.3	42.5	70	45.2	46.5	70	4.28	20.39
>65	9	77.8	44.1	9	44.4	52.7	5		
Female									
0–6	28			28	1.8	9.4	28		
7–18	34	1.4	4.6	34	1.5	8.6	34		
19–24	18			18			18		
25–65	71	46.2	47.3	71	31.0	44.2	71	5.63	23.22
>65	11	63.6	50.4	11	36.4	50.4	11		

Table 17 shows the demographic distribution of adaptation within households in Anda, Bohol. In the case of typhoon and flooding, the mean value of males aged 25–65 (4.49) in Barangay Poblacion is higher than that of females in the same location and age group (2.75). In the case of coastal erosion, men and women in the same age bracket posted the same mean value of 0.76. In adaptation participation with regard to typhoon and flooding in Barangay Suba, the mean value of women (6.98) is higher than the corresponding figure of men (5.62) in the 25–65 age bracket. As for coastal erosion in the same barangay, males and females in the same age group posted the same value (1.82). Apparently, older males above 65 years old in both barangays still have roles to play within their respective families during typhoon and flooding.

Table 17. Demographic distribution of adaptation within the households in Poblacion and Suba, Anda, Bohol

Hazards	Typhoon/Flooding		Coastal Erosion	
Gender and Age Group	Mean	Std. Dev	Mean	Std. Dev
Poblacion, Anda				
Male				
19–24	0.45	3.01		
25–65	4.49	8.08	0.76	5.03
>65	0.32	2.10		
Female				
25–65	2.75	7.49	0.76	5.02

Table 17 continued

Hazards	Typhoon/Flooding		Coastal Erosion	
Gender and Age Group	Mean	Std. Dev	Mean	Std. Dev
Suba, Anda				
Male				
25–65	5.62	11.60	1.82	8.29
>65	0.45	3.37		
Female				
25–65	6.98	13.22	1.82	8.29

The demographic distribution of adaptation within households in Bien Unido's Nueva Estrella follows the same trend in other study sites, where adaptation participation in relation to typhoon and flooding is greatest among those between 25 and 65 years old (see Table 18). The mean value of males is 6.06, which is higher than that of the females (4.07) mean value. For coastal erosion, the mean value of males is still relatively higher (0.51) than that of females (0.28). A closer look at the table also reveals that females 65 and older (0.52) and males aged 19–24 (0.19) also play an important role in the adaptation of typhoon and flooding.

Table 18. Demographic distribution of adaptation within the households in Nueva Estrella, Bien Unido, Bohol

Hazards	Typhoon/Flooding		Coastal Erosion	
Nueva Estrella, Bien Unido (n = 88)	Mean	Std. Dev	Mean	Std. Dev
Gender and Age Group				
Male				
19–24	0.19	1.77		
25–65	6.06	9.35	0.51	3.39
>65				
Female				
25–65	4.07	8.07	0.28	2.66
>65	0.52	3.78		

Table 19 shows the demographic distribution of adaptation within households in Inabanga, which is affected by typhoon, flooding, coastal erosion, and saltwater intrusion. Figures for this barangay follow the general trend of greater participation in typhoon and flooding adaptation among males and females aged 25–65. In Barangay Cagawasan, the mean value of males in the aforementioned age bracket is 9.83, while the figure of females is 8.11. In Barangay Tungod, the mean value of males is 12.56, whereas it is 8.96 in females. Both men and women above 65 years old in Cagawasan show a degree of participation in household adaptation choices for typhoon and flooding. For coastal erosion in Barangay Cagawasan, the mean value of males aged 25–65 is 5.62, while the value of females in the same age bracket is 3.53. For the same hazard in Barangay Tungod, the mean value of males in the same age bracket (9.22) is also higher than the mean value posted by their female counterparts (6.38).

While results from the FGD mentioned saltwater intrusion in Cagawasan, survey data suggest that saltwater intrusion adaptation within households is present only in Tungod. The mean value posted by females aged 19–24 (0.94) is higher than the figure posted by males in the same age group (0.25), and there was also participation among males aged 25–65 (0.69).

Table 19. Demographic distribution of adaptation within the households in Inabanga, Bohol

Hazards	Typhoon/Flooding		Coastal Erosion		Saltwater Intrusion	
Gender and Age Group	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev
Cagawasan (n = 34)						
Male						
25–65	9.83	12.55	5.62	9.83		
>65	1.56	6.57				
Female						
25–65	8.11	11.69	3.53	9.14		
>65	1.57	6.57				
Tungod (n = 79)						
Male						
19–24			0.68	4.38	0.25	2.25
25–65	12.56	10.03	9.22	11.00	0.69	3.52
> 65	3.30	11.37	2.3	10.24		
Female						
0–6			0.06	0.96		
7–8	0.25	2.25	0.18	1.61		
19–24					0.94	4.14
25–65	8.96	11.04	6.38	10.65		
>65	2.86	10.00	2.00	9.07		

5.0 SUMMARY AND POLICY IMPLICATIONS

Coastal erosion and sea level rise appear to be the most apparent threats in all the study sites in Bohol, Philippines, although other climate hazards such as typhoons, flooding, and saltwater intrusion are also felt by the communities. Based on the estimated values, damage to house is highest in Nueva Estrella, Tungod, and Cagawasan. The income loss of the wife is highest in Tungod and Cagawasan, both of which are in Inabanga.

Looking at the time men and women devote to activities before and after a calamity provides another view of gender dynamics in the household. The average time spent fetching water and taking care of children declined across all study sites, although there was a decrease in the time women devoted to childcare. Average time for personal hygiene and for feeding pets and house animals also declined for both men and women after a calamity. The time spent sleeping was the most affected and had the biggest decline for both men and women. Waterborne diseases associated with flooding are diarrhea, worms and helminths, cough, fever, and colds.
Wives generally spent the most number of hours taking care of other family members who are sick.

In Tungod and Cagawasan, women dominate the decision making within households in relation to preparations against potential damages before the typhoon. Household participation in different types of adaptation activities are dominated by members aged 25–65 years old in both men and women, although a few over 65 years old also participate in some study sites.

The present study provides a relatively clear picture of the vulnerable condition of people living in selected coastal areas in Bohol, Philippines, where women and children are considerably the most affected during and after calamities. The situation of women in the study areas provided a glimpse of how limited income opportunities are for them. As discussed in the introductory part, households in the coastal or fishing communities have high poverty incidence. Perhaps, social protection in the form of insurance to fisher folk must be developed so that they can recover from shocks, as this may be better than the usual dole-out system. Building more resilient communities does not only mean capacitating the local officials but also providing more inclusive disaster and risk reduction strategies. The role of women and children must be integrated into the whole plan as their needs are different from those of men during and after calamities. It is necessary to continue mainstreaming the local development plan to include risk reduction management to integrate this into the school curricula.

LITERATURE CITED

ADB (Asian Development Bank). 2009. The economics of climate change in Southeast Asia: A regional review. http://www.adb.org/publications/economics-climate-change-southeast-asia-regional-review (Retrieved February 18, 2014).

Paris, T.; A. Singh; A. Cueno; and V.N. Singh. 2008. Assessing the impact of participatory research in rice breeding on women farmers: A case study in Eastern Uttar Pradesh, India. http://impact.cgiar.org/pdf/118.pdf (Retrieved June 8, 2015).

WB (World Bank). 2013a. Getting a grip on climate change in the Philippine. The World Bank, Washington, D.C., VA.

——— . 2013b. Turn down the heat: Climate extremes, regional impacts, and the case for resilience. http://www.worldbank.org/en/topic/climatechange/publication/turn-down-the-heat-climate-extremes-regional-impacts-resilience (Retrieved January 16, 2014).

Strengthening local capacity in the economic analysis of environmental issues

Recent EEPSEA Research Reports

Trade-Off Analysis between Ecosystem Services, Habitat Quality, and Development Plans: The Case of Pu Mat National Park in Vietnam
Nguyen The Chinh, Lai Van Manh, Ngo Dang Tri, Nguyen Thi Thu Ha, Phan Thi Truong Giang, and Nguyen Thi Yen
2017-RR12

To Drink or Not to Drink: Exploring The Riddle of Household Water Quality
Jamil Paolo Francisco
2017-RR13

Climate Change Impact, Vulnerability Assessment, and Economic Analysis of Adaptation Strategies in Ben Tre, Vietnam
Kim Anh T. Nguyen, Trang T.H. Le, Chuong N.P.T. Bui, Tram Anh T. Nguyen, and Curtis M. Jolly
2017-RR14

Intra-household Impacts of Climate Hazards in Coastal Communities: A Cross-Country Perspective
Asa Jose U. Sajise, Paul Joseph B. Ramirez, Glaiza J. Zamora, Jheanna Marie R. Herbosa, Nguyen Viet Dang, Adrian Boyett D. Agbon, and Jannette J. Icao
2017-RR15

Intra-household Impacts of Climate Hazards and Autonomous Adaptation in Selected Coastal Areas of Zamboanga del Norte
Jannette J. Icao, Asa Jose U. Sajise, Paul Joseph B. Ramirez, and Glaiza J. Zamora
2017-RR16

Intra-household Impacts of Climate Hazards and Autonomous Adaptation: Evidence from Bohol, Philippines
Adrian Boyett D. Agbon, Corazon G. Anzano, Asa Jose U. Sajise, Paul Joseph B. Ramirez, and Glaiza J. Zamora
2017-RR17

Intra-household Impacts of Climate Hazards and Autonomous Adaptation in Selected Coastal Areas of Vietnam
Nguyen Viet Dang, Nguyen Thi Minh Thu, Nguyen Thi Thiem, Pham Thi Thanh Thuy, Nguyen Thanh Phong, Do Thi Diep, Truong Thi Cam Anh, and Asa Jose U. Sajise
2017-RR18

Valuing the Protection Service Provided by Mangroves in Typhoon-hit Areas in the Philippines
Moises Neil Seriño, Julie Carl Ureta, Jayson Baldesco, Karl John Galvez, and Canesio Predo
2017-RR19

Is the Value of Statistical Life Sensitive to the Choice of Measure? Evidence from Transportation Accident and Cancer Risks in Vietnam
Nguyen Tuan Kiet and Jack Knetsch
2017-RR20

Mangrove and Shrimp Farming Profitability in the Mekong River Delta, Vietnam
Truong Dang Thuy and Do Huu Luat
2017-RR21

Trade-off Analysis: Tourism and Environmental Quality of Si Phan Don, Champasak Province, Lao PDR
Kaysone Chansina, Bounthom Sisoumang, Chansamone Vongphaisit, and Keuangkham Sisengnam
2017-RR22

Crop-Choice Games for Analyzing Externality Problems of Rice Field Conversion into Oil Palm Plantation in North Sumatera Province, Indonesia
Eva Anggraini
2017-RR23

Optimal Regulatory Design in the Context of Weak Enforcement: Do Regulatory Stringency and Regulatory Approach Matter in Determining Common Pool Resource Extraction Behavior?
Kanittha Tambunlertchai and Sittidaj Pongkijvorasin
2017-RR24

Valuing Health Risk in Agriculture: A Choice Experiment Approach to Pesticides in Anqiu County, China
Jin Jianjun, Wang Wenyu, and He Rui
2017-RR25

How Should the Value of Statistical Life be Measured? The Effect of the Disparity between the Measures of Willingness to Pay and Willingness to Accept
Phumsith Mahasuweerachai and Phouphet Kyophilavong
2017-RR26

EEPSEA is administered by WorldFish on behalf of its donors, Sida, and IDRC.

WorldFish Sida IDRC CRDI