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Adaptation and Coping Strategies to Extreme Climate Conditions: Impact of Typhoon Frank in Selected Sites in Iloilo, Philippines

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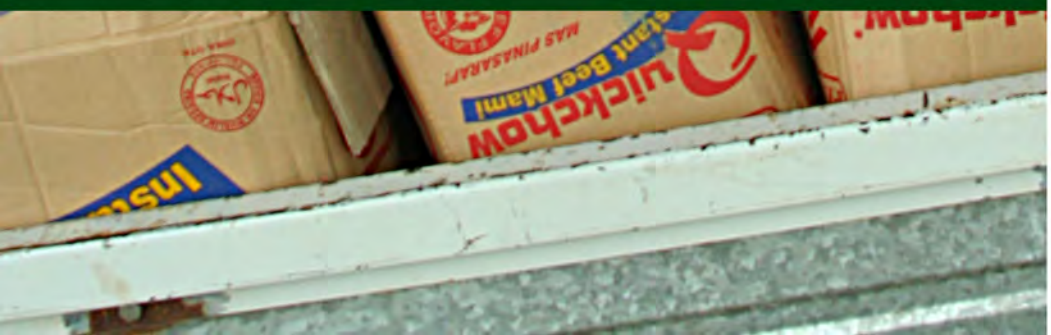

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Farisal U. Bagsit
Josefa T. Basco

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Comments should be sent to:

Rodelio F. Subade, Division of Social Sciences (DSS), College of Arts and Sciences (CAS), University of the Philippines Visayas (UPV), Miagao, Iloilo, Philippines. Email: redabus@yahoo.com, rodanasu@gmail.com

Jee Grace B. Suyo, DSS, CAS, UPV, Miagao, Iloilo, Philippines. Email: jeegsuyo@gmail.com

Jorge S. Ebay, DSS, CAS, UPV, Miagao, Iloilo, Philippines. Email: jorgesebay@gmail.com

Emeliza C. Lozada, School of Technology, UPV, Miagao, Iloilo, Philippines. Email: lizaclozada@gmail.com

Jessica A. Dator-Bercilla, Christian Aid Philippine Field Office, Quezon City, Philippines. Email: jbercilla@gmail.com

Andres C. Tionko, Panay Rural Development Center Incorporated (PRDCI), Iloilo City, Philippines. Email: chito.tionko@gmail.com

Farisal U. Bagsit, Institute of Fisheries Policy and Development Studies, College of Fisheries & Ocean Sciences, UPV, Miagao, Iloilo, Philippines. Email: fubagsit@upv.edu.ph

Josefa T. Basco, DSS, CAS, UPV, Miagao, Iloilo, Philippines. Email: upvbidani@yahoo.com

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The Authors

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EXECUTIVE SUMMARY

The province of Iloilo, along with Capiz, Aklan, and Antique was one of the areas most heavily affected by Typhoon Frank in June 2008. The damage that the typhoon wrought – amounting to more than PhP 13.5 billion – is among the biggest for the past two decades. More than 500,000 houses were partly damaged while about 131,700 houses were totally destroyed. The total cost of assistance provided to the victims from the government, non-government organizations, and other institutions amounted to more than PhP 300 million.

This study aimed to understand the immediate and long-term measures adopted by the households and the community to adapt to and cope with the impacts of extreme climate-induced events, particularly typhoon and flooding. The perception, level of awareness, level of vulnerability to the risks and threats posed by natural hazards, and preparedness of households, the community, and local government units (LGUs) for climate-related hazards were also assessed to come up with policy insights and recommendations for improving the adaptive management responses of households and LGUs to such hazards.

Data from a survey of 360 households were used for the analysis. The research areas include six *barangays* along the Magapa-Suage River and Jalaur River systems that were heavily affected by Typhoon Frank. The sites were clustered into three groups: the upper Suage communities in Janiuay and Badiangan, the mid-Suage communities in Pototan, and the lower Suage communities in Dumangas.

The respondents identified adverse impacts of Typhoon Frank to the economic condition of households and communities. The average losses amounted close to PhP 13,500 per household, roughly 17% of household annual income.

A paired comparison t-test was used to determine any difference in the respondents' perception of their situation before and immediately after the flood. The same test was likewise conducted to compare their perceived condition immediately after the flood and at the time of the survey. Results showed a negative change across all indicators immediately after the flood – meaning that the respondents perceived that their situation became worse. On the other hand, the second test revealed significantly positive changes across all indicators, suggesting that the respondents' condition has improved and that they have somehow recovered from the flood more than a year afterwards.

More than two-thirds of the respondents reported of being aware of climate change. The implementation of community awareness programs on climate change, as in the case of Badiangan, have helped increased people's understanding of the phenomenon. Because of the frequent occurrence of flooding in areas along or near the river systems, the respondents' mean level of awareness of flooding was above average. However, average level of awareness of other climate-induced hazards like landslides, storm surge/sea level rise, and coastal erosion are below average. There are two possible reasons for this: a) these hazards have not yet occurred in the area, or b) these are of low intensity, hence, they do not pose much threat to the community.

Because of their experience with flooding from Typhoon Frank along with similar ones in the past, 90% of the households reported that they are prepared for possible threats from climate-related hazards. The most cited strategies were "being always alert", "securing important things", and "modification of house structure". Evacuation to safer areas was the most cited coping mechanism of the respondents, followed by "restructuring/strengthening of dwelling units", and "tree planting".

The experience with Typhoon Frank showed that a combination of infrastructural, economic, and social strategies are needed for communities to better adapt to and cope with potential impacts of extreme weather events. The provision of affordable credit lines and the development of linkages with various institutions that can provide trainings on climate change adaptation will help enhance the communities' adaptive capacities.

1.0 INTRODUCTION

1.1 Background of the Study

That the global climate is changing is undisputed. A global average temperature increase of nearly 1°C over the past century has occurred concurrently with extreme weather changes such as more intense precipitation, heightened tropical cyclone peak wind intensities, and increased annual tropical cyclone means, as indicated in the report of the Intergovernmental Panel for Climate Change (IPCC as cited by Adger 2010). Moreover, the risks associated with these changes are real but highly uncertain.

Vulnerability to these risks exacerbates social and economic difficulties, especially for sectors dependent on resources that are sensitive to changes in climate. For instance, risks are apparent in agriculture, fisheries and associated sectors that constitute the livelihood of rural populations in developing countries (Adger 2010).

In the Philippines, it has been observed that warming is experienced most in the northern and southern regions of the country (northern Luzon and Mindanao), while Metro Manila has warmed less than in most parts. Extreme weather conditions have also occurred more frequently since 1980. These include deadly and damaging typhoons, floods, landslides, severe El Niño and La Niña phenomena, drought, and forest fires. Adversely affected sectors include agriculture and marine resources (Garcia 2013)

From 2004 to 2008, the Philippines saw an assortment of abnormal weather patterns. In 2004, four successive typhoons hit the municipalities of Real, Infanta, and General Nakar (REINA) along the Pacific Coast in Quezon Province and brought so much destruction to life and property. While 2005 was a relatively quiet year, the country again experienced four super typhoons (with wind velocities of more than 200 kph) in 2006, the late start of a La Niña event, an enhanced Southwest Monsoon (SWM) due to the presence of two tropical cyclones east of the country within the Philippine Area of Responsibility (PAR), and a relatively wet summer. Although 2007 was again relatively calm, the middle of the year saw the onset of a dry spell that wreaked havoc on agriculture, power and water supply, and health (Yumul *et al.* 2010).

In 2008, eight tropical cyclones affected approximately 1,414,130 families or more than 5 million people in 98 provinces. More than 650 people died[1] due to the passage of seven tropical cyclones, while the total damage caused to agriculture and infrastructure amounted to almost PhP 20 billion.

In early June 2008, the Philippine Atmospheric Geophysical Astronomical Service Administration (PAGASA) monitored a low pressure area (LPA) which was upgraded to Tropical Depression Fengshen (locally known as Typhoon Frank) by June 18. Both the Joint Typhoon Warning Center (JTWC) and the Japan Meteorological Agency (JMA) started issuing full advisories on Fengshen, designating it as Tropical Depression 07W. Early the next day the JMA upgraded it to a tropical storm, which rapidly became a severe tropical storm and then further intensifying into a typhoon later that day. The next day, Typhoon Frank made landfall in eastern Samar, Central Philippines and travelled northwest over the islands of Panay, Romblon, Marinduque, Quezon, Batangas, Zambales and Pangasinan (ESCAP/WMO Typhoon Committee 2009).

The Category 3[2] Typhoon Frank registered the biggest damage for that year, amounting to more than PhP 13.5 billion, which is equal to about two-thirds of the total yearly damage. The typhoon totally destroyed about 131,700 houses and partly damaged more than 500,000. The total cost of assistance provided to the victims by the government as well as non-government and private institutions was over PhP

[1] This figure does not include those who perished with the sinking of a passenger ship during Typhoon Frank.
[2] A Category 3 is a severe tropical cyclone according to the Tropical Cyclone Category System.

300 million. Most of the casualties were due to floods/flashfloods and drowning (ESCAP/WMO Typhoon Committee 2009). The Philippines was the most heavily affected country in the wake of Typhoon Frank, which was one of the deadliest typhoons to hit the country killing over 1,300 people, mostly from the sinking of the passenger vessel *Princess of the Stars,* the flag carrier of *Sulpicio Lines* during the storm (GMA News 2009).

1.2 Research Problem

Typhoon Frank remains to have caused the biggest damage to Western Visayas economy, affecting the gross regional domestic product (GRDP) in its three major sectors namely agriculture, fishery and forestry, and industry and services (RDC VI and NEDA VI 2011). Damage to infrastructure was close to PhP 6.4 billion; damage to environment, including DENR projects, over PhP 132.3 million; and damage to agriculture, which include agricultural infrastructure and facilities, around PhP 3.1 billion (Griño-Caoyonan 2010). The National Disaster Coordinating Committee (NDCC) estimated the total damage to have reached PhP 13.5 billion across the affected provinces of Leyte, Eastern Samar, Sultan Kudarat, Cebu, Aklan, Iloilo, and Capiz, with the latter three provinces (of Panay) as the hardest-hit (IFRCRCS 2008).

In Iloilo, Frank brought with it heavy rains, causing devastating floods and killing many people and destroying crops and properties worth billions of pesos. This rare occurrence flooded more than 60% of Iloilo City and riverside *barangays*[3] in the various towns of Iloilo. In the province of Iloilo alone, 135 people were reported dead, 1,011 injured, and 69 missing (Catalan 2008).

Hence, it is worth understanding how people affected by such an extreme weather event responded to the disaster. It is also relevant to determine whether those affected, their communities, and their local government units (LGUs) had opportunities or occasions to prepare themselves in adapting to such extreme conditions.

1.3 Research Objectives

1. Determine the socio-economic characteristics of communities in general and households in particular in areas vulnerable to typhoon-induced hazards in Iloilo;
2. Assess the nature and extent of vulnerability of these households and communities to typhoon-induced hazards like floods and landslides;
3. Identify and analyze the adaptation measures/strategies and coping mechanisms being formulated and implemented by the households, communities and LGUs to mitigate the impacts of natural disasters;
4. Determine the perception, level of awareness, and preparedness of households, communities, and LGUs with regard to typhoon-induced hazards such as floods and landslides; and
5. Draw policy insights and recommendations for improving adaptive management responses of households, communities, and LGUs to natural hazards, particularly those that are typhoon-related.

2.0 METHODOLOGY

2.1 Study Areas

The research team conducted a pre-proposal consultation and pre-field discussion/ workshop to identify study sites which were affected by Typhoon Frank along the Magapa-Suage River and Jalaur River systems, from the uplands towards the coast. Six *barangays* were selected and clustered into three groups:

a) the upper Suage communities (Brgy. Sianon in Badiangan and Brgy. Danao in Janiuay);
b) the mid-Suage communities (Brgys. Tuburan and Gibuangan in Pototan); and
c) the lower Suage communities (Brgys. Cayos and Bantud Fabrica in Dumangas).

[3] A barangay or village is the smallest (basic) administrative political unit in the Philippines.

The lower Suage communities lie toward the tail end of the same river that passes through the mid-Suage communities and is largely coastal and estuarine, heavily dependent on fishing and aquaculture (Figure 1).

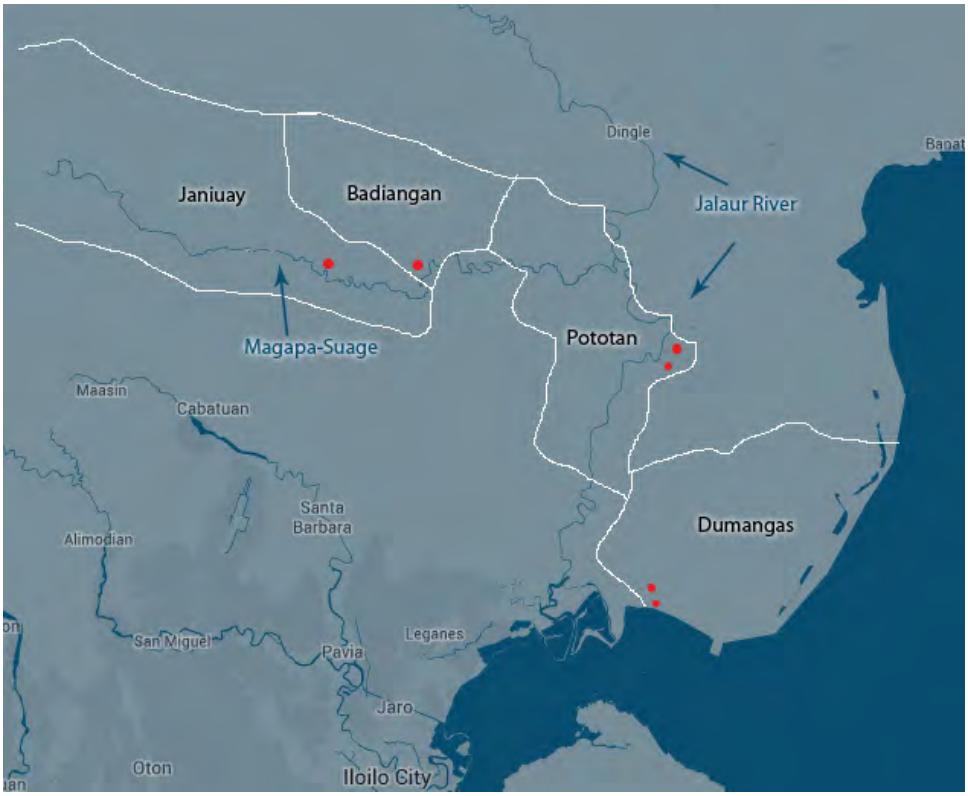

Figure 1. River systems in Iloilo and the approximate location of study sites

2.1.1 Dumangas

Dumangas is a coastal town located at the southeastern part of Panay Island. It is basically a farming and fishing municipality. Large scale fishpond operations can be found especially in coastal *barangays*.

Dumangas has always been affected by typhoons and floods since it serves as the catch basin of Jalaur River, one of the biggest rivers in the island. Because of the severe impacts of disasters to the municipality, it was chosen as the pilot area for the Agro-meteorological project of PAGASA, which is further discussed in section 3.6.1 (MPDO-Dumangas 2010).

Bantud Fabrica. Brgy. Bantud Fabrica is one of the 45 *barangays* of Dumangas and is located 8.5 km from Dumangas proper[4]. The *barangay* relies mainly on agriculture and fishing. The village is flooded twice a year on the average due to its location along the Jalaur River. Continuous heavy rains in the uplands, impending storms, and the darkening (coffee-colored) and rapid rise of river water serve as warning signals of imminent flooding. The absence of a flood control system, illegal logging, and a damaged dike exacerbate the situation (MPDO-Dumangas 2010).

Cayos. Brgy. Cayos is adjacent to Bantud Fabrica. It is 7 km away from Dumangas proper and can be reached by motorcycle or public transport such as tricycle, jeepney, or van. It is also a farming community. There are fishponds in the area, although their owners are not village residents.

[4] Alternatively called a *poblacion or centro,* which indicates the center or administrative seat of a town or municipal government.

Only a few houses were damaged by Frank here since the village is on higher elevation compared to Bantud Fabrica. For instance in 42 households were affected in Sitio[5] Tubigan and 15 households in Sitio Gines were advised to evacuate.

Similar to Bantud Fabrica, one of the causes of flooding is the immediate release of water from the Moroboro Irrigation Dam which is less than a hundred kilometers away and is located in Brgy. Moroboro, Dingle. The *barangay* officials rely on information (e.g., schedule of water release from the dam) from the municipal government. In turn, the *barangay* officials advise the local residents about forthcoming hazards using a mobile van with a loudspeaker so the community can prepare accordingly (MPDO-Dumangas 2010).

2.1.2 Pototan

Pototan is situated at the central part of Iloilo province. It is composed of 50 *barangays* and around 85% of its land area is dedicated to agriculture. It is now considered as one of the top rice-producing municipalities in Iloilo.

The municipality is generally flat and is traversed by Jalaur River from Calinog and Suage River from Janiuay. Although it is not frequented by typhoons, *barangays* located along or near the two river systems are affected by flooding, especially during heavy rains (MPDO-Pototan 2010).

Guibuangan. Brgy. Guibuangan is 3.5 km away from Poblacion, Pototan. Main sources of income are rice and tobacco farming. Other crops planted include mungbean, corn, and vegetables.

Major natural hazards that strike the *barangay* are typhoons and floods. When rains pour continuously for 4-5 days, residents usually expect flooding to occur. The most vulnerable areas identified are those located along the riverbanks (Zones 2 and 3). Affected residents are usually evacuated to the *barangay* hall and school (MPDO-Pototan 2010).

Tobacco crops planted along the riverbanks usually sustain a lot of damage, along with farms and farm animals reached by the overflow. Since most of the residents rely on farming, their income is consequently affected. However, most of the farm lands eventually recover through subsequent cultivation. Water provision (using motor pumps) is not affected thereby minimizing the impact of the disaster.

Tuburan. Brgy. Tuburan is 36 km away from the city of Iloilo and is situated 6 km from Poblacion, Pototan. Agriculture is the main source of income of most residents. The Jalaur River separates Brgy. Tuburan from the municipality of Barotac Nuevo, with the Jalaur Bridge connecting them. The *barangay* is divided into six zones (north and south) and has a total number of 443 households.

Brgy. Tuburan is one of the most frequently flooded areas in Pototan and, as such, the residents have already learned some adaptation strategies to flooding. Majority of the houses have second floors while others are built on stilts. To prevent further erosion, the *barangay* road in Zone 1, which is located near Jalaur River, was also cemented (MPDO-Pototan 2010).

2.1.3 Badiangan

The town of Badiangan is located in the western-central part of the province and is 40 km away from Iloilo City. It has 31 *barangays* that are mostly agricultural where rice and sugar cane are the primary crops grown.

Badiangan has not yet experienced flooding (except for areas located near creeks), even during Typhoon Frank, since most of the town is hilly. However, the residents are still not totally safe, especially from landslides (MPDO-Badiangan 2010).

[5] A *sitio* is a hamlet; large *barangays* are often subdivided into *sitios.*

Sianon. Brgy. Sianon has a total of 164 mostly poor households. It was selected by the Panay Rural Development Center, Inc. (PRDCI) along with Christian Aid as recipient of their community resiliency project. Because of its topography (from gently sloping to upland), the village is prone to several natural hazards like soil erosion and landslides.

One major climate adaptation scheme adopted by the community is the planting of introduced crops that can withstand new weather patterns. New agricultural practices were also explored and farmers were encouraged to make their own organic fertilizer. Alternative crops and agricultural methods were introduced like backyard vegetable farming instead of planting rice and sugar only. The farmers have devised methods to protect vegetables against pests (e.g., using mosquito net). The *barangay* also has a seed storage system that uses bamboo, lemongrass, and *agahaw* leaves as pest repellants. The farmers have also made their seed bank sturdy enough to withstand strong winds (MPDO-Badiangan 2010).

2.1.4 Janiuay

The Janiuay municipality is located at the central part of the province. Approximately 55% of the total land area of its eastern part is flat while its western part is mostly hilly and mountainous. Janiuay is composed of 60 *barangays*, 44 of which are classified as rural and 16 are urban. Farming is the major source of income of most households while a number of the residents are employed in government or private firms. Several *barangays* are frequently flooded during typhoons and heavy rains since the Suage River traverses the town (MPDO-Janiuay 2010).

Danao. Brgy. Danao, situated 7 km away from the *poblacion,* is divided into three zones: Danao Center, Gantong, and Buga. Danao is an agricultural community with 70% of its population relying mostly on farming. Its main products are rice and taro.

The area is considered at risk to flashfloods since it is located along the Suage River. Flooding occurs at an average of two times a year, usually caused by heavy rains, illegal logging, and quarrying. The latter two reasons are believed to have reduced forest cover, thereby exposing the community to more risk (MPDO-Janiuay 2010).

After Typhoon Frank, PRDCI provided disaster preparedness training to community officials covering the following topics so that they may better deal with flashfloods in the future (MPDO-Janiuay 2010):

a) identification of hazard/risk prone areas through hazard and risk mapping;
b) development of disaster preparedness skills;
c) identification of evacuation areas for affected families;
d) monitoring of water level in the river so residents will know when to prepare and evacuate; and
e) devising an early warning system to notify residents of forthcoming hazards like flooding, e.g., striking a bamboo pole *("ginatultog ang kawayan")*

2.2 Sources of Data

Both primary and secondary sources of data were utilized for the study. Secondary sources were reports, publications and documents from the municipalities and *barangays,* including articles sourced from the Internet. Primary data were gathered through a household survey, focus group discussions (FGD), and key informant interviews (KII).

2.3 Sampling and Household Survey Instrument

Fixed proportion systematic sampling with a random start was used to select 60 respondents (who were affected by Typhoon Frank in 2008) per site. These respondents were household heads and were personally interviewed using a pre-tested questionnaire, adapted from the work by Predo *et al.* (2009) in Leyte, Philippines.

The questionnaire collected the following information: background information on experience with natural disasters or climate-related hazards; household demographic and socioeconomic characteristics; income profile (for the previous year); information on the household's farming, fishing, and aquaculture activities; ownership of assets and indices of living; social affiliation; access to credit; and financial grants and assistance. Other information gathered pertained to awareness, perceptions, and preparedness of households to deal with climate change-induced sea level rise (SLR) and other natural hazards; nature and extent of the impacts of natural disasters (flooding, landslide, and coastal erosion due to storm surge/SLR) on households; and adaptation measures/strategies and coping mechanisms of household to mitigate the impacts of climate change-induced hazards.

FGDs with at least two groups per study site and KIIs were conducted to corroborate the data collected through the household survey.

2.4 Data Analysis

Descriptive statistics was employed such as means, standard deviation, and frequency distribution to summarize survey results. Regression using ordinary least squares was done to come up with some predictive analysis of data (e.g., factors/drivers affecting vulnerability of households). Adaptation strategies and coping mechanisms undertaken or being adopted by the households were documented to provide additional inputs to analysis.

3.0 RESULTS AND DISCUSSION

3.1 Nature and Extent of the Impacts

In comparison with other typhoons which struck Panay Island, Typhoon Frank is considered one of the strongest and among the most destructive. The Iloilo Provincial Disaster Coordinating Council (PDCC) estimated a total of more than PhP 1 billion worth of damage to agriculture for Iloilo province alone (PhP 800 million to farmland/farms and PhP 230 million to fisheries). At least 135 people died, 69 persons were reported missing, and 1,011 persons were injured. Around 17,035 houses were totally destroyed, while 50,261 were partially damaged.

Typhoon Frank's most cited impact was on people's economic conditions, as shown in Table 1. Almost a fourth (23%) of all the respondents felt the typhoon to be a cause of their poverty; 22% cited damage to property; 19% indicated damage to farms; and 14% reported damage to houses. Another 12% cited the typhoon as a cause of "family inconvenience".

On a per site basis, more respondents from Dumangas reported damage to their farms (including death of their animals), houses, and property. However, a larger percentage of the respondents from Pototan claimed the typhoon to be the cause of their poverty, which may also be attributed to their loss of property and agricultural lands.

The respondents provided estimates of their losses as shown in Table 2. However, these are limited to those which they could give numerical estimates, and were classified as damage to household property and appliances, agricultural lands and animals, and loss of livelihood.[6] Across all sites, average total damage amounted to almost PhP 13,500 per household, which is more than 17% of estimated annual household income. The estimated value of livelihood losses per household amounted to about PhP 1,000; damage to household property and appliances was worth over PhP 5,000; while cost of damage to agricultural lands and animals was close to PhP 6,000.

[6] From the respondents' perspective, loss of livelihood pertains to the amount they could have earned if they did not (have to) stop working. Damage to farms and death of animals refer to the perceived market price of the farm or animal that was damaged or lost because of the disaster.

Table 1. Impacts of Typhoon Frank on the respondents' household and community

Impact	Dumangas n=120	Pototan n=120	Janiuay/Badiangan n=120	All N=360
Cause of poverty	16 (13)	40 (33)	27 (23)	83 (23)
Damage to property	37 (31)	29 (24)	13 (11)	79 (22)
Damage to agricultural lands or farms (decreased harvest)	31 (26)	29 (24)	8 (7)	68 (19)
Damage to house	42 (35)	9 (8)	1 (1)	52 (14)
Cause of family inconvenience	11 (9)	15 (13)	17 (14)	43 (12)
Loss of livelihood	11 (9)	17 (14)	7 (6)	35 (10)
Death of farm animals	18 (15)	9 (8)	1 (1)	28 (8)
Cause of illness	3 (3)	8 (7)	0 (0)	11 (3)
Mud got into the house	6 (5)	1 (1)	0 (0)	7 (2)
Loss of life	1 (1)	1 (1)	2 (3)	4 (1)
Hunger	3 (3)	0 (0)	0 (0)	3 (1)
Children temporarily stopped schooling	1 (1)	0 (0)	0 (0)	1 (0.28)
Damage to fishing gear	1 (1)	0 (0)	0 (0)	1 (0.28)
None (or did not indicate)	3 (3)	24 (20)	73 (61)	100 (28)

Note: Multiple response table. Percentages, in parentheses, are based on n=120 and N=360.

Table 2. Type and cost of damage due to Typhoon Frank, 2009-2010

Type of damage	Dumangas	Pototan	Janiuay/ Badiangan	All
Household property and appliances	70* PhP 3,335.83 (5,738.11) 400,300**	73* PhP 7,962.93 (19,495.55) 955,550**	47* PhP 4,096.58 (10,280.01) 491,590**	190 PhP 5,131.78 (13,268.23) 1,847,440**
Agricultural lands and animals	47* PhP 4,564.4 (16,583.17) 547,755**	62* PhP 9,406.08 (30,135.07) 1,128,730**	25* PhP 3,662.03 (11,123.71) 439,444**	134 PhP 5,877.58 (20,965.98) 2,115,929**
Loss of livelihood	22* PhP 3,283.33 (9,604.08) 394,000**	2* PhP 5.00 (46.47) 600**	0.00	24 PhP 1,096.11 (5,742.32) 394,600**
Average cost[7]	n=120 PhP 11,188.79 (18,860.37) 1,342,655**	n=120 PhP 21,496.53 (36,122.68) 2,574,831**	n=120 PhP 7,758.62 (15,535.75) 931,034**	N=360 PhP 13,468.11 (25,776.11) 4,848,520**
Loss as % of house-hold annual income	89,211.29 12.54%	87,047.61 24.70%	56,764.25 13.67%	77,674.38 17.34%

Notes: * number of households reporting; PhP figures refer to average value of damage; figures in parentheses are standard deviations; ** sum across reporting cases.

Across the three *barangay* clusters, the Pototan respondents suffered the highest cost of damage due to Typhoon Frank, amounting to almost PhP 21,500/household or about 25% of their annual income. The respondents from Janiuay/Badiangan reported the lowest damage cost at less than PhP 8,000/household. It should be noted that the low average costs of damages or losses for the Janiuay/Badiangan respondents are due to the fewer households who reported on the impact of Typhoon Frank to their household as presented in Tables 1 and 2. The lower number of respondents who reported Frank's impact may be further attributed to Badiangan being hilly or mountainous – thus, not prone to flooding and therefore, sustaining less damage. Across sites, Janiuay/Badiangan respondents suffered the

[7] Although the number of households reporting varied by type of damage and by site, n=120 was used to compute for the average cost to give a comparison of losses for the three *barangay* clusters.

least in terms of cost of damage (PhP 7,759/household) but not in terms of magnitude of loss (13.7% of households' average annual income).

Although Dumangas respondents' average loss was quite higher (PhP 11,189), they experienced the lowest loss relative to household annual income (12.5%). Perhaps the longer experience of Dumangas in coping with floods and typhoons, plus the earlier introduction of risk reduction strategies in the said municipality, enabled the residents to mitigate their losses. Another reason is that Dumangas had the least percentage of households with concrete houses and galvanized iron (GI) roofing (Table 3). And since there are more houses made of light materials, the corresponding monetary loss is relatively less compared to Pototan and Janiuay/Badiangan.

Table 3. Percentage of households with concrete houses and galvanized iron sheet roofing

Variable	Dumangas	Pototan	Janiuay/ Badiangan	All
Concrete house	31 (25.8%)	44 (36.7%)	36 (30.0%)	111 (30.8%)
With GI sheet roofing	69 (57.5%)	90 (75.0%)	91 (75.8%)	250 (69.4%)

To get some indication of resiliency, or the ability/capability to recover from typhoon, respondents were asked, *"Based on your own estimates, how many days were you and your household able to recover from the effects of Typhoon Frank?"* The average for all sites was 53 days. On a per cluster basis, the Pototan *barangays*, which had autonomous and some LGU initiatives on disaster risk reduction, had the longest recovery period of 60 days or two months (Table 4).

Table 4. Average number of days to recover from Typhoon Frank

Site	Mean	N	Std. Deviation
Dumangas	41.22	120	79.681
Bantud Fabrica	*62.08*	*60*	*105.563*
Cayos	*20.35*	*60*	*27.870*
Pototan	60.20	120	105.130
Guibuangan	*65.75*	*60*	*117.625*
Tuburan	*54.65*	*60*	*91.617*
Janiuay/Badiangan	58.45	120	132.825
Sianon	*13.52*	*60*	*25.968*
Danao	*103.38*	*60*	*175.508*
Total	53.29	360	108.119

The average of 58 days for Janiuay/Badiangan is pulled up by the severe damage on some 100 ha of rice lands in Brgy. Danao; many respondents claim that they either have not recovered yet or that recovery took them longer (i.e., 100 days).

Dumangas *barangays* had the shortest recovery period of 41 days, somehow indicating their capability to cope with typhoons as honed by past experiences and earlier capability building on disaster risk management.

3.2 Perceived Impacts of Climate-related Disaster

To assess perceived impacts of climate-related disasters on households, the respondents were asked to evaluate their conditions on certain indicators using a 10-point ladder. The indicators were as follows: a) overall wellbeing of households; b) access to land for cultivation; c) access to water resources; d) access to coastal fishery resources; e) access to credit and financial grants; f) household income; g) employment opportunity; h) household risk and vulnerability; and i) overall state of natural resources.

Using a 10-point ladder diagram drawn on a card as a visual guide, respondents were asked to make an ordinal judgment of their situation/condition at three different periods: a) before Typhoon Frank; b) immediately after; and c) at the time of the interview, which was a little over a year afterward the typhoon. The highest step in the ladder (10), represents the best possible situation while the lowest step (1) is the worst possible situation in terms of the aforementioned indicators.

A paired comparison t-test was used to determine if there was a statistically significant difference in the perceived situation of respondents before the typhoon (or flood) and immediately afterwards. The same test was done to determine any perceived difference between after the flooding and at the time of the survey.

3.2.1 Perceived difference in situation before and after the typhoon

Across sites or *barangay* clusters, the decreasing trend in the indicator scores before and immediately after the typhoon/flood (implying lower or worsened conditions) were significant only for the first four indicators (i.e., household wellbeing, access to land for cultivation, access to water resources, and access to fishery resources) (Table 5). For all these variables, Pototan respondents reported the highest perceived reduction in their conditions.

On the other hand, the improvement in the respondents' conditions (immediately after the typhoon/flood and at the time of the survey) was significant again for the same first four indicators. In addition, the positive change was also true for household income and overall state of natural resources and the environment (Table 5). For all these variables, Pototan again had the highest improvement in conditions.

Table 5. Test of difference across sites on the perceived impacts of climate-related disasters

Indicator	Dumangas		Pototan		Janiuay/ Badiangan		All sites			
	Mean		Mean		Mean		A		B	
	A	B	A	B	A	B	Mean	Sig.	Mean	Sig.
HH wellbeing	-1.5167	1.5167	-1.6917	1.5667	-1.0750	.8917	-1.4278	.093	1.3250	.027
Access to land for cultivation	-0.8667	1.2167	-2.7083	2.6000	-1.6583	.7250	-1.7444	.000	1.5139	.000
Access to water resources	-1.3667	1.4583	-2.0667	2.1667	-1.3667	.7667	-1.6000	.079	1.4639	.000
Access to coastal and fishery resources	-.6833	.5083	-.1000	.0083	.0000	.0083	-.2611	.000	.1750	.003
Access to credit and financial grants	-.8000	.8417	-.7000	.9083	-.4833	.4583	-.6611	.429	.7361	.151
Household income	-1.2250	1.3667	-1.5833	1.6917	-1.4500	.7167	-1.4194	.526	1.2583	.002
Employment opportunity	-1.4250	1.1333	-1.2833	1.1917	-1.2750	.7333	-1.3278	.855	1.0194	.219
Household risk and vulnerability	-1.0250	.9167	-1.1333	1.4500	-1.0583	.9750	-1.0722	.937	1.1139	.188
Overall state of natural resources and the environment	-1.9833	1.5667	-2.6667	2.0500	-2.3833	1.2083	-2.3444	.182	1.6083	.011

Notes: A = before and immediately after the typhoon/flood. B = immediately after the typhoon/flood and at the time of survey

Table 6 shows that respondents perceived a negative change in their household wellbeing due to the flood and its after effects, which confirms their reports on damage costs in the previous section. In the case of Brgy. Danao in Janiuay, 100 ha of rice land were covered with sand and gravel from the river that overflowed. Roads and bridges became impassable, making transport very difficult. Others reported that potable water supply became a problem since most of the water sources were contaminated by the flood.

Table 6. Comparison of impact indicators before and immediately after Typhoon Frank

Indicator	Dumangas		Pototan		Janiuay/ Badiangan		All	
	t	Sig.+	t	Sig.+	t	Sig.+	t	Sig.+
HH wellbeing	7.25/ 5.73 6.802	0.000	7.23/ 5.53 8.397	0.000	7.07/ 5.99 5.653	0.000	7.18/ 5.75 11.998	0.000
Access to land for cultivation	5.03/ 3.88 4.209	0.000	5.96/ 3.20 9.198	0.000	6.19/ 4.53 6.617	0.000	5.77/ 3.86 11.674	0.000
Access to water resources	8.13/ 6.76 5.635	0.000	7.84/ 5.78 7.843	0.000	8.15/ 6.78 5.444	0.000	8.04/ 6.44 10.928	0.000
Access to coastal and fishery resources**	2.68/ 1.87 3.390	0.001	0.32/ 0.17 1.983	0.051	*	*	1.75/ 1.23 3.719	0.000
Access to credit and financial grants	5.00/ 4.08 3.976	0.000	4.38/ 3.60 3.657	0.000	*	*	4.32/ 3.61 6.552	0.000
Household income	5.86/ 4.61 5.557	0.000	5.93/ 4.34 6.813	0.000	6.18/ 4.72 6.477	0.000	5.99/ 4.56 10.910	0.000
Employment opportunity	5.70/ 4.22 6.289	0.000	5.80/ 4.52 6.238	0.000	5.62/ 4.34 6.241	0.000	5.71/ 4.36 10.848	0.000
Household risk and vulnerability	5.68/ 4.65 4.226	0.000	5.34/ 4.21 5.396	0.000	6.38/ 5.32 5.390	0.000	5.80/ 4.72 8.574	0.000
Overall state of natural resources and the environment	6.07/ 4.07 7.013	0.000	6.54/ 3.88 10.560	0.000	6.59/ 4.21 9.513	0.000	6.40/ 4.05 15.450	0.000

Notes:
1. * Paired t-test could not be processed because standard error is 0.
2. In the t-columns, first figure = self-rating on the particular indicator prior to the typhoon; second figure = self-rating immediately after the typhoon; last figure = t-value.
3. ** For the Pototan and Janiuay/Badiangan *barangays,* access to coastal and fishery resources were rated very low since they are far inland and hence access to such resources are limited.

Overall, respondents' self-rating on all indicators decreased between the two periods (before and immediately after the typhoon/flood) across all sites, indicating the difficulties the households had to cope with immediately after the typhoon. It is also worth noting that the typhoon increased the respondents' perception of their vulnerability and exposure to risk.

3.2.2 Perceived difference in situation after the typhoon and during the survey

Comparison of scores immediately after the flood and at the time of the survey revealed significantly positive changes across all indicators in all the study sites (Table 7). This implies that largely, the affected households have somehow recovered from the effects or impact of Typhoon Frank about a year-and-a-half later.

Table 7. Comparison of impact indicators after Typhoon Frank and at the time of survey

Indicators	Dumangas		Pototan		Janiuay/ Badiangan		All	
	t	Sig.+	t	Sig.+	T	Sig.+	t	Sig.+
HH wellbeing	5.73/ 7.25 -7.412	0.000	5.53/ 7.10 -7.438	0.000	5.99/ 6.88 -5.141	0.000	5.75/ 7.08 -11.570	0.000
Access to land for cultivation	3.88/ 5.50 -6.033	0.000	3.20/ 5.85 -9.839	0.000	4.53/ 5.26 -3.694	0.000	3.86/ 5.52 -11.230	0.000
Access to water resources	6.76/ 8.22 -6.460	0.000	5.78/ 7.4 -7.928	0.000	6.78/ 7.55 -3.236	0.000	6.44/ 7.90 -10.103	0.000
Access to coastal and fishery resources	1.87/ 2.48 -2.58	0.011	.17/ .18 -.155	0.877	*	*	1.23/ 1.58 -2.55	0.012
Access to credit and financial grants	4.08/ 5.05 -4.53	0.000	3.60/ 4.61 -4.31	0.000	*	*	3.61/ 4.40 -7.27	0.000
Household income	4.61/ 6.00 -6.32	0.000	4.34/ 6.03 -8.19	0.000	4.72/ 5.44 -4.39	0.000	4.56/ 5.82 -10.92	0.000
Employment opportunity	4.22/ 5.40 -5.066	0.000	4.52/ 5.71 -5.98	0.000	4.34/ 5.08 -4.07	0.000	4.36/ 5.39 -8.73	0.000
Household risk and vulnerability	4.65/ 5.57 -3.87	0.000	4.21/ 5.66 -5.97	0.000	5.32/ 6.60 -3.39	0.001	4.72/ 5.94 8.57	0.000
Overall state of natural resources and the environment	4.07/ 5.65 -7.27	0.000	3.88/ 5.93 -9.54	0.000	4.21/ 5.42 -7.57	.000	4.05/ 5.66 -13.90	0.000

Notes:
1. * Paired t-test could not be processed because standard error is 0.
2. In the t-columns, first figure = self-rating on the particular indicator after the typhoon; second figure = self-rating at the time of the survey; last figure = t-value.

Those whose livelihoods were affected may have already recovered or may have opted to shift to other income sources. Although perceived access to fishery and coastal resources has increased, the difference is not as significant as in the other indicators. All in all, it can be concluded that respondents believe that their overall situation more than a year after the typhoon has already improved.

3.3 Awareness of Households on Climate Change and Climate-induced Hazards

More than two-thirds of the respondents across sites (69%) reported being aware of climate change (Table 8). Among the *barangay* clusters, Pototan had the highest percentage (76%) while a relatively lower number from Dumangas (61%) were aware of this phenomenon. Janiuay and Badiangan have implemented community awareness programs on climate change, which might have played a vital role in increasing people's understanding of this phenomenon.

The respondents were further asked to rate their awareness level (of climate change) using a 10-point scale where 1 corresponds to the lowest level of awareness and 10, the highest. The overall average mean level of awareness was above average (more than 5.0) as shown in Table 8. Although fewer respondents in Dumangas reported being aware of climate change, their mean level of awareness based on self-rating is the highest across three areas. This may simply indicate that those who are aware of climate change (in Dumangas) rated their level of awareness higher than those from the other two municipalities.

Table 8. Awareness of climate change, sea level rise, and risks and threats from natural hazards

	Dumangas n=120	Pototan n=120	Janiuay/Badiangan n=120	All N=360
Climate Change phenomenon				
Aware	73 (60.8)	91 (75.8)	83 (69.2)	247 (68.6)
Not aware	47 (39.2)	29 (24.2)	37 (30.8)	113 (31.4)
Mean level of awareness (Std. Deviation)	6.12 1.76*	5.31 1.97*	5.83 2.08*	5.72 1.97*
Sea level rise				
Aware	79 (65.8)	79 (65.8)	70 (58.3)	228 (63.33)
Not aware	41 (34.2)	41 (34.2)	50 (41.7)	132 (36.67)
Mean level of awareness (Std. Deviation)	5.84 2.20*	5.34 2.08*	5.80 2.02*	5.65 2.11*
Risk and threats from natural hazards				
Aware	108 (90.0)	117 (97.5)	108 (90.0)	333 (92.5)
Not aware	12 (10.0)	3 (1.7)	12 (10.0)	27 (7.50)

Note: Figures in parenthesis are percentages of column total (n or N); figures with asterisk (*) are standard deviations

Nearly two thirds (63%) of all respondents were aware of SLR while almost all (92.5%) were aware of the risks and threats that result from natural hazards in general. SLR awareness across the three sites was above average, with respondents from Dumangas (being a coastal community) and Pototan (which experienced severe flooding) scoring higher than those from Janiuay/Badiangan *barangays*. Their responses are also indicative that they are aware of the possibility of SLR if the world's temperature continues to rise.

As to levels of awareness of the risks and threats associated with flooding, landslide, storm surge/SLR, and coastal erosion, Table 9 shows that only flooding was rated above average (i.e., score of more than 5 points) across the three sites. As previously mentioned, prior experiences of households in coastal and low-lying areas have increased their awareness of the effects of flooding. Landslide received the second highest mean awareness with the highest score from Janiuay/Badiangan, it being the only high terrain site among the three clusters. In general, storm surge/SLR and coastal erosion registered below-average awareness levels. Possible reasons for this are: a) these hazards have not yet occurred in the area or b) the intensity of occurrence is low, hence, they do not pose much threat to the communities.

Table 9. Average level of awareness of the risks and threats from natural hazards

Natural Hazard	Dumangas	Pototan	Janiuay/Badiangan	All
Flooding	6.14 (2.742)	5.96 (2.687)	5.38 (3.160)	5.79 (2.91)
Landslide	2.83 (3.391)	3.41 (3.305)	4.73 (2.878)	3.65 (3.28)
Storm surge/SLR	3.40 (3.234)	2.69 (3.178)	2.39 (3.304)	2.81 (3.16)
Coastal erosion	2.32 (3.046)	2.38 (3.048)	2.38 (3.010)	2.35 (3.02)

Note: Figures inside parentheses are standard deviations.

A test of difference across sites was undertaken and showed that results on average level of awareness were indeed significantly different across sites. Please refer to Appendix 1 for details.

3.4 Perceived Vulnerability of Households and the Community to Climate-Related Hazards

3.4.1 Level of vulnerability

The respondents were asked to evaluate their level of vulnerability to risks from climate-induced hazards (i.e., flooding, landslide, storm surge/SLR, and coastal erosion) using a 10-point scale, where 1 is least vulnerable and 10 is most vulnerable. Again, vulnerability to flooding was rated above average (5.81), with low-lying areas like Dumangas and Pototan having relatively higher ratings (Table 10). These two communities are frequently flooded, being located along the Jalaur and Suage river systems. Hence, it was logical for the residents to have rated their vulnerability to flooding higher than vulnerability to the other natural hazards.

Table 10. Average perceived level of vulnerability to risks and threats from natural hazards

Natural hazards	Dumangas	Pototan	Janiuay/Badiangan	All
Flooding	6.44 (3.018)	6.93 (2.776)	4.12 (3.510)	5.8167 (3.35)
Landslide	0.96 (1.976)	1.61 (2.665)	3.70 (3.294)	2.0861 (2.93)
Storm surge/SLR	2.18 (2.973)	1.04 (2.023)	0.92 (2.027)	1.3778 (2.44)
Coastal erosion	1.52 (2.560)	1.55 (2.403)	0.94 (1.984)	1.3306 (2.33)

Note: Figures in parentheses are standard deviations.

Conversely, in areas that were not usually flooded like Janiuay and Badiangan, respondents perceived themselves to be less vulnerable to this hazard. However, because of the observed increase in the flood level in 2008 as brought about by Typhoon Frank and which also affected Danao in Janiuay, the respondents fear that such an extreme event might occur again in the future. Moreover, although Janiuay/Badiangan *barangays* are relatively safer from flooding, they are more vulnerable to landslide due to their topography. Storm surge/SLR and coastal erosion are still generally rated low in terms of their threat to these communities.

3.4.2 Factors influencing perceived vulnerability of households and community to climate-related hazards

This study adopted the vulnerability model used by Predo *et al.* (2009), which explored what factors may affect the household's perceived vulnerability to risks and threats from extreme climate conditions like Typhoon Frank. The model specified *perceived vulnerability level* (Vk), which was a self-rating by the respondents, as a function of *socio-economic characteristics* (Sj), *wealth or asset ownership* (Wk), *access to credit* (A) and a random term:

$$Vk = f\ (Sji,\ Wki,\ \ Ai) \qquad \text{(Equation 1)}$$

The socio-economic characteristics included in the model for this study are education, age, household size, household annual income, residential land holdings, house size, access to grant and credit, and awareness levels on natural hazards (i.e., floods, landslides, storm surge, and coastal erosion). Descriptive statistics on these variables were derived prior to regression analysis, and are shown in Table 11 below; awareness levels on natural hazards were previously presented in Table 9.

Table 11. Respondents' socio-economic characteristics

Variables	Dumangas	Pototan	Janiuay/Badiangan	All
Education level (years)	8.15 (3.47)	8.91 (3.24)	9.01 (3.03)	8.71 (3.27)
Age (years)	47.98 (14.27)	49.45 (16.56)	46.91 (16.78)	48.12 (15.91)
Household size	4.96 (2.23)	4.86 (2.40)	4.63 (2.11)	4.81 (2.25)
Household annual income (PhP)	89,211 (179420.8)	87,048 (146870.88)	56,764 (67183.25)	77,674 (139775.82)
Residential landholdings (m^2)	251 (1843.58)	843 (2439.71)	832 (3561.54)	642 (2716.77)
House size (m^2)	58 (87.77)	56 (91.90)	57 (140.50)	57 (106.72)
Access to grant and credit	3.16 (1.37)	3.5 (1.39)	3.40 (1.51)	3.30 (1.41)

Note: Figures in parenthesis are standard deviations.

Educational attainment averaged 8.7 years across all respondents, with the Janiuay/Badiangan group having the highest at 9 years. Average age of all respondents was 48.12 years, with Pototan respondents being the oldest cluster at 49.45 years. Household size was the same across the three clusters at five members per household. Household annual income stood at PhP 77,674/household across all sites, with Dumangas respondents having the highest among the three groups at PhP 89,211.

House size averaged 57 m^2, with Dumangas respondents having the highest average (at 58 m^2), while Pototan had the smallest at 56 m^2. Ease of access to credit, which ranged from 1 (very difficult) to 5 (very easy), averaged at 3.30 with Dumangas having the lowest access at 3.16.

Considering the low R-square value of the various regression models, the results in Table 12 below can be taken as indicative, but not specifically definitive, of the variables' relationships.

Table 12. Factors influencing perceived vulnerability to climate-related hazards

Factors	Flooding		Landslide		Storm surge/SLR		Coastal erosion	
	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
Constant	1.99**	2.40	1.28*	1.94	-0.36	-0.64	-0.14	-0.29
DumD	1.82***	4.14	-1.88***	-5.18	0.78**	2.52	0.71***	2.70
PotD	2.56***	5.98	-1.27***	-3.63	0.70	0.23	0.83***	3.23
Age	-0.0017	-0.85	-0.0029*	-1.85	0.00009	0.07	0.0038***	-3.17
Household size	0.025	0.33	-0.036	-0.58	0.027	0.50	0.023	-0.51
Sex	0.087	.262	0.34	1.26	-0.010	-0.05	0.15	0.74
Access to credit	-0.0030	-0.80	-0.0035	-1.14	0.0016	0.60	0.0011	0.48
Floor area	-0.00099*	-1.75	-0.00039	-0.851	-0.00041	-1.04	-0.00049	-1.45
HH annual income	-0.0000003	-0.17	0.0000013	1.13	0.0000013	1.28	0.00000087	0.98
Landholding	-0.000096	-1.18	0.000024	0.36	0.89	1.57	0.000069	1.42
Education	-0.0057	-0.11	0.032	0.78	0.010	0.28	-0.027	-0.86
Awareness: Flood	0.42***	7.04	NA	NA	NA	NA	NA	NA
Awareness: Landslide	NA	NA	0.35***	8.36	NA	NA	NA	NA
Awareness: Storm surge/SLR	NA	NA	NA	NA	0.42***	11.44	NA	NA

Table 12 continued

Factors	Flooding		Landslide		Storm surge/SLR		Coastal erosion	
	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
Awareness: Coastal erosion	NA	NA	NA	NA	NA	NA	0.49***	14.86
R-square	0.24		0.35		0.36		0.47	
F-value	8.53		14.78		15.73		24.38	
N	360		360		360		360	

Note: *** Significant at 1%. ** Significant at 5%. * Significant at 10%

In all the regression models, site dummy for Dumangas was found as significantly affecting the dependent variable, implying that the (Dumangas) respondents' perceived vulnerability to climate-related hazards are significantly higher compared to the respondents from the other towns (which are non-coastal). It is obvious that as a coastal site, Dumangas is more vulnerable to storm surge, coastal erosion and flooding.

Perceived vulnerability to flooding was significantly affected by respondent's awareness about floods (+), house size (floor area) (-), and site dummy variables for Dumangas (+) and for Janiuay/Badiangan (+). These results imply that respondents with higher awareness of flooding feel more vulnerable to this hazard, while respondents with bigger houses feel less so. It is interesting to note that as previously presented in Table 10, respondents from Dumangas and Pototan had higher perception of vulnerability to flood since they have experienced flooding many times before.

The regression model results for vulnerability to landslides show that the site dummy for Dumangas was significant at 1% and negatively-signed, i.e., respondents from these *barangays* had lower perceived vulnerability to landslides. This is expected since these areas do not have upland or hilly portions where landslides may occur thereby lowering the likelihood of this hazard. The age variable was also significant (at 10%) and negatively-signed, indicating that older people feel less vulnerable to landslides thereby implying that they had rare or no experience with landslides.

The regression results on storm surge shows that vulnerability to this hazard was significantly affected by the Dumangas site dummy, just like the two other previous regressions. The positive coefficient sign means that Dumangas respondents tend to feel more vulnerable to storm surge than respondents from the other sites. This is quite logical since most Dumangas respondents live near the coast and have experienced storm surges.

Both site dummy variables for Dumangas and Pototan were found significant and positively signed for vulnerability to coastal erosion. Again this can be expected since respondents from the *barangays* of both towns are nearer the coast compared to those from Janiuay/Badiangan, which are hilly and mountainous. These results also support the figures shown in Table 10 that the respondents from Janiuay/Badiangan were found to have the lowest average level of perceived vulnerability to the risk and threats from coastal erosion. The age variable was also significant (at 10%) but negatively-signed, indicating that older people feel less vulnerable to coastal erosion and implying they had rare (or no) experience with coastal erosion in the past.

3.4.3 Preparedness and plans considered by households

Respondents were also asked about their preparedness against possible threats from natural hazards. While such preparedness does not specifically pertain to flooding alone, the strategies they mentioned most often referred to this hazard, considering that it poses immediate threat to all the communities with the exception of Brgy. Sianon, Badiangan (where only a few residents experienced flooding from a nearby creek).

Across sites, 93% replied that their households were prepared, with Dumangas registering the highest percentage of respondents who believed so (94%). As to their level of preparedness, about 67%

from Dumangas and 68% from Pototan mentioned being either "prepared" or "highly prepared". Overall, very few (0.8%) admitted that they are unprepared (Table 13).

Table 13. Perceived preparedness for possible threats from natural hazards

Item	Dumangas n=120		Pototan n=120		Janiuay/Badiangan n=120		All N=360	
	Freq	%	Freq	%	Freq	%	Freq	%
Are households prepared?								
Yes	113	94	109	91	111	93	333	93
No	7	6	10	8	9	8	26	7
No answer	0	0	1	1	0	0	1	0.3
Status of preparedness								
Not prepared at all	0	0	2	2	1	0.9	3	0.8
Less prepared	38	34	26	24	35	32	108	30
Prepared	39	35	40	37	61	55	140	39
Highly prepared	36	32	34	31	9	8	79	22
Not applicable	7	6	10	8	0	0	17	5
No answer	0	0	7	6	5	5	12	3

Respondents were also asked what preparation strategies they considered to prevent or minimize the potential impacts of natural hazards. "Always being alert" was cited by a majority of the respondents across all sites, with the highest portion of respondents indicating so (61%) coming from the Janiuay/ Badiangan *barangays* (Table 14). While such a strategy sounds too general, the respondents thought that if people were indeed always alert, especially when a typhoon is coming, they would be more attentive to information and warnings, and better able to prepare their households and coordinate accordingly with leaders and other people in the community. Only 11 out of the 360 respondents indicated that they have no preparation plans yet.

Table 14. Preparations considered in preventing or minimizing potential damage from natural hazards

Plans/ Preparations	Dumangas n=120		Pototan n=120		Janiuay/ Badiangan n=120		All N=360	
	Freq	%	Freq	%	Freq	%	Freq	%
Always being alert	53	44	68	57	73	61	194	54
Secure important things	24	20	32	27	12	10	68	19
Modify house structure	14	12	16	13	25	21	55	15
Plan to relocate residence	23	19	18	15	11	9	52	14
Construct protective structure	23	19	5	4	11	9	39	11
Follow early warning system	13	11	6	5	11	9	30	8
Plant trees	5	4	12	10	10	8	27	8
Pray	7	6	0	0	6	5	13	4
Stock up on food	10	8	0	0	4	3	14	4
No plans yet	7	6	3	2	1	0.8	11	3
Prepare *banca* or floating device	8	7	1	1	0	0	9	3
Relocate animals to safer place	1	1	4	3	0	0	5	1
Proper garbage disposal	1	1	0	0	2	2	3	1
Stock up on drinking water	2	2	0	0	0	0	2	1
Follow traditional beliefs	1	1	0	0	0	0	1	0.3
Monitor water level	1	1	0	0	0	0	1	0.3
Coordinate with officials	1	1	0	0	0	0	1	0.3
Help those affected	0	0	1	1	0	0	1	0.3
No answer	0	0	0	0	0	0	167	46

Note: Multiple response table. Percentages are based on n=120 and N=360.

The second most cited preparation strategy was "securing important things" like important documents and personal belongings, cited by nearly a fifth (19%) of all the respondents, and 27% from the Pototan *barangays* (Table 14).

The third most cited preparation strategy considered was "modification of house structure", mentioned by 15% of respondents across sites. One-fifth of the Janiuay/Badiangan respondents cited this preparation strategy (Table 14).

The fourth, cited by 14% of all the respondents, was the plan to relocate residence – with a fifth of the Dumangas respondents citing this preparation strategy (Table 14). For those who have experienced the brunt of and losses from several typhoons and floods, and particularly the recent Typhoon Frank, this plan is clearly meant to prevent similar damage/losses. However, relocation will entail costs.

3.5 Household and Community Adaptation Strategies and Coping Mechanisms

3.5.1 Adaptation strategies

Adaptation to climate change is the adjustment of a system to moderate the impacts of the said phenomenon, to take advantage of new opportunities, or to cope with the consequences (Adger 2010). In the context of this study, adaptation measures are geared towards securing livelihood or minimizing losses from climate-induced disasters. When respondents were asked if their households have any adaptation measures, 71% said yes, with Dumangas having the biggest percentage of respondents (78%) saying so (Table 15).

Table 15. Adaptation strategies to minimize impacts of climate-related hazards

Item	Dumangas (n=120)	Pototan (n=120)	Janiuay/ Badiangan (n=120)	All (N=360)
Do households have any adaptation measures?				
Yes	94 (78)	87 (73)	75 (63)	256 (71)
No	26 (21)	33 (28)	45 (38)	104 (29)
			Adaptation measures/strategies*	
transfer household members to evacuation area	27 (23)	35 (29)	10 (8)	72 (20)
restructure/strengthen dwelling unit	29 (24)	17 (14)	24 (20)	70 (19)
plant more trees	19 (16)	16 (13)	23 (19)	58 (16)
relocate residence to safe place permanently	11 (9)	1 (1)	10 (8)	22 (6)
change livelihood/source(s) of income	10 (8)	5 (4)	6 (5)	21 (6)
pray/trust in God	5 (4)	9 (8)	3 (3)	17 (5)
prepare important things	4 (3)	9 (8)	2 (2)	15 (4)
improve dike/canal system near residence	3 (3)	6 (5)	4 (3)	13 (4)
be alert always	3 (3)	4 (3)	5 (4)	12 (3)
build stone breakwaters	2 (2)	1 (1)	2 (2)	5 (1)
change land use to fit new condition	2 (2)	0 (0)	3 (3)	5 (2)
segregate garbage	2 (2)	2 (2)	0 (0)	4 (1)
working hard	1 (1)	2 (2)	1 (1)	4 (1)

Note: * Multiple response section. Percentages, in parenthesis, are based on n=120 and N=360. Excluded from this table are answers with overall frequency of 3 or less.

The most popular adaptation strategy, cited by a fifth of all respondents, is moving household members to evacuation areas. Pototan had the biggest percentage of respondents – nearly a third (29%) – who implemented this strategy. Indeed those people, particularly from Brgy. Tuburan, have experienced flooding many times in the past, and are therefore used to evacuation.

The next most popular adaptation strategy, undertaken by 19% of all respondents, is the restructuring or strengthening of houses. This is followed by "planting more trees", as cited by 16%, the biggest percentage (19%) of which came from Janiuay/Badiangan *barangays* (Table 15). Planting trees is a common measure to prevent soil erosion. As previously mentioned, these two municipalities are in hilly or upland areas where landslides often occur.

It is interesting to note that 22 respondents (6%) – half of them from Dumangas – consider relocating residence to a safe place permanently as their adaptation strategy, while another 6% cited "change of livelihood" as their adaptation strategy (Table 15).

3.5.2 Self-rating of the effectiveness of adaptation strategies

On a 10-point scale where 10 is the most effective and 1 is the least effective, the respondents gave their adaptation strategies an overall rating of 6 with regard to preventing or minimizing the negative impacts of climate-related hazards (Table 16). Among the three *barangay* clusters, Dumangas respondents had the highest self rating of almost 9.0, indicative of their long and repeated experience of dealing with climate related hazards.

Table 16. Perceived effectiveness of adaptation strategies being used by households

	Dumangas	Pototan	Janiuay/Badiangan	All
Mean rating	8.91	5.68	3.66	6.09
Std deviation	6.60	6.52	5.27	6.51

3.5.3 Sources of adaptation strategies

Table 17 shows the sources of adaptation strategies being implemented by the households. The most cited source was indigenous knowledge, which was indicated by 45% across the three sites, and more than half (55%) of the respondents from Dumangas.

Table 17. Sources of adaptation strategies implemented by households

Sources of adaptation strategies	Dumangas	Pototan	Janiuay/Badiangan	All
Indigenous knowledge	66 (55)	52 (43)	44 (37)	162 (45)
Mass media	24 (20)	19 (16)	29 (24)	72 (20)
Community	17 (14)	21 (18)	6 (5)	44 (12)
Experience	3 (3)	2 (2)	0 (0)	5 (1)
School	2 (2)	0 (0)	0 (0)	2 (1)
Elders	1 (1)	0 (0)	0 (0)	1 (0.3)

Note: Multiple response table. Percentages, in parentheses, are based on n=120 and N=360.

The second most common source of adaptation strategy across sites was mass media, cited by 20% of total respondents. On a per cluster basis, more respondents from Janiuay/Badiangan (24%) cited this particular source. Even though these barangays are dominantly rural, cable TV, radio and mobile phones are accessible in these communities.

Community was the third most cited source of adaptation strategy across sites, mentioned by 12% of the total respondents. This may imply openness and teachability/trainability among community stakeholders in developing adaptive capacity. On a per cluster basis, Pototan respondents had the highest percentage of respondents (18%) that cited it, followed by Dumangas (14%), then Janiuay/ Badiangan (5%).

3.5.4 Coping mechanisms

Coping mechanisms or strategies are the bundle of short-term responses to situations that threaten

livelihood systems, and they often take the form of emergency responses in abnormal seasons or years (Berkes and Jolly 2001). Table 18 shows the various coping mechanisms employed by the respondents who experienced losses from Typhoon Frank. Getting a loan was the leading strategy, with a fourth of the respondents mentioning getting loans from friends and relatives and 12% from money lenders. Taking out a loan seems to be a common response for many with no savings or disposable income who are faced with unexpected expenses as a result of the damages incurred (e.g., house repairs, hospitalization/medical bills, burial expenses, and purchase of seedlings for those whose crops were damaged).

Table 18. Household strategies to cope with the impacts of climate-related hazards

Strategies	Dumangas	Pototan	Janiuay/ Badiangan	All
Got loan from friends, relatives	25 (21)	43 (36)	21 (18)	89 (25)
Got loan from money lender	21 (18)	15 (13)	7 (6)	43 (12)
Through hard work	22 (11)	12 (10)	9 (8)	43 (12)
Resorted to other income sources	13 (9)	13 (11)	14 (12)	40 (11)
Used family savings	3 (3)	18 (15)	8 (9)	29 (8)
Asked assistance from parents/relatives	7 (5)	8 (7)	6 (5)	21 (6)
Not affected	4 (3)	4 (3)	7 (9)	15 (4)
Asked assistance from children	6 (5)	5 (4)	4 (3)	15 (4)
Sold livestock	9 (8)	3 (3)	1 (0.8)	13 (4)
Prayed	1 (0.8)	7 (9)	3 (3)	11 (3)
Asked assistance from *barangay*	3 (3)	5 (4)	2 (2)	10 (3)
Pawned land and/or jewelry	3 (3)	4 (3)	0 (0)	7 (2)
Relied on salary of spouse	4 (3)	0 (0)	2 (2)	6 (2)
Sold jewelry	1 (1)	1 (1)	3 (3)	5 (1)
Used other alternative food sources	4 (3)	0 (0)	1 (1)	5 (1)
Cooperation among families	1 (1)	3 (3)	1 (1)	5 (1)
Has already prepared things prior to flood	0 (0)	5 (3)	0 (0)	5 (1)
Did nothing/*bahala na* attitude	2 (2)	0 (0)	3 (3)	5 (1)

Notes: Multiple response table. Percentages, in parentheses, are based on n=120 and N=360. Responses with overall frequency of 3 or less are excluded from the table.

About 12% of the total respondents believed that through hard work, they would be able to cope with the impact or effects of climate-induced disasters. Almost the same number cited resorting to other income sources as their coping strategy.

It is interesting to note that, overall, only five or a very low 1% cited "cooperation among families". With only a few people citing this as a strategy, one may wonder whether the Filipino virtue of *bayanihan* (community cooperation or joint community effort) is still alive.

3.6 Adaptation Strategies and Plans Undertaken by the Government

Even prior to Typhoon Frank, various typhoons should have directed the LGUs concerned to come up with their own adaptation and coping strategies. The discussion below includes activities and measures that have been implemented by the LGUs in collaboration with other agencies and institutions.

3.6.1 Municipal adaptation strategies/activities in Dumangas

The various storms or typhoons that led to damage and losses in Dumangas have seasoned the town on how to adapt to and reduce the impacts of such climate-induced hazards. In July 1999, the municipal government established the Dumangas Rescue and Emergency Assistance Movement (DREAM). Its functions include: a) quick response in times of disasters; b) monitoring and reporting of the disaster situation and recommending appropriate measures to the Municipal Disaster Coordinating Council (MDCC);

and c) participation in programs, projects and activities of the municipal government on disaster risk reduction (DRR).

Due to the severe impacts of previous disasters on the municipality, Dumangas was chosen as the pilot area for the Agro-meteorological (Agro-met) project of PAGASA. In the project, designated municipal employees perform daily weather observation using weather gauge instruments. The gathered data are sent to PAGASA for processing; PAGASA in turn transmits the information (data interpretation) back to the Agro-met in Dumangas for timely dissemination. In the event of an expected extreme weather event, the LGU/community can then make preparations to mitigate the impacts of the impending hazards.

Moreover, a community-based disaster mitigation and early warning system was established with participation of the municipal and *barangay* LGUs and community residents. Key informants revealed that the Bangkok-based Asian Disaster Preparedness Center (ADPC) assisted Dumangas by providing training to LGU personnel.

Dumangas also participates in the Climate Change Field School program being coordinated by the ADPC through the Iloilo Provincial Agriculturist's Office. The field school provides on-site training on proper farming techniques and appropriate technologies to mitigate the adverse effects of climate change on agriculture.

3.6.2 Municipal adaptation strategies/activities in Pototan

In the case of Pototan, the municipal LGU prepared a hazard map with the assistance of the Mines and Geosciences Bureau of the Department of Environment and Natural Resources (MGB- DENR). They also undertook an awareness program on earthquakes, fires, and other natural or man-made calamities. A training-seminar on the subject was also conducted for the *Barangay* Disaster Coordinating Councils (BDCC). Both activities will be a continuous undertaking of the LGU.

Also, the LGU created early warning systems (EWS) like ringing of the church bell, fire truck sirens, and "2x bamboo claps" for areas along the rivers. These EWS are vital to timely evacuation and rescue operations once a typhoon or any disaster strikes.

Other adaptation measures adopted by the Pototan LGU include:

1. river bank stabilization through tree planting;
2. construction and rehabilitation of river dikes and water breaks;
3. dredging of the Suage River and re-establishment of riverbanks with the dredged soil;
4. rehabilitation of river controls;
5. establishment of community tree park;
6. designation of school buildings and gymnasium as evacuation sites; and
7. training course on search and rescue operations for the Pototan Mountain Tigers Rescue Volunteer group.

3.6.3 Municipal adaptation strategies/activities in Badiangan

Based on the interviews and secondary sources, Badiangan has not undertaken much adaptation activities. Most of the LGU's efforts are concerned with agriculture and sustainable agriculture, e.g., organizing the Badiangan Organic Farmer's Association. Activities related to climate-related concerns are limited to repair of dikes/bridge and disaster risk reduction training in schools.

3.6.4 Municipal adaptation strategies/activities in Janiuay

In Janiuay, the LGU has embarked on the comprehensive rechanneling of the Suage River from Brgy. Calmay to Brgy. Tolarucan. This undertaking aims to reduce the risk and potential damage to populated areas in case another extreme weather event similar to Typhoon Frank strikes the town. Moreover, the municipal council has been working on the enactment of an ordinance for the resettlement of informal settlers, especially those along the riverbanks.

Other adaptation-related programs and activities include the: a) organization of a disaster brigade; b) organization of a rescue team; c) conduct of a seminar-workshop on disaster and climate change for the BDCC; and d) first responders training for the community youth.

Among the *barangays* covered in this study, Brgy. Sianon in Badiangan and Brgy. Danao in Janiuay have received assistance and DRR training from PRDCI and Christian Aid. Moreover, Oxfam conducted a training-workshop in Brgy. Bantud Fabrica in Dumangas and Brgy. Danao in Janiuay for the drafting of their *barangay* disaster plans, which outline some adaptation measures to undertake in case of a calamity.

In contrast, the Pototan *barangays* did not receive any DRR or climate-related projects or grants. In Brgy. Gibuangan, residents are expected to be responsible for themselves during calamities. However, people are engaged in tree planting activities, while the women participate in giving medical assistance (especially the *barangay* health workers). One local resident mentioned that "people are used to flooding" and hence, they supposedly already know what to do. In fact, several people from the *barangay* are members of the Pototan Mountain Tiger Rescue Volunteer Group, which is usually activated during typhoons. Table 19 summarizes the main climate change adaptation (CCA) measures of each study site.

Table 19. Study sites and main CCA- related activities

Study sites	Main CCA- related activities
Upper Suage River communities a) Brgy. Sianon, Badiangan b) Brgy. Danao, Janiuay	1. Introduced adaptation strategies (Christian Aid site): with CCA & DRR assistance
Mid-Suage River communities a) Brgy. Gibuangan, Pototan b) Brgy. Tuburan, Pototan	2. Autonomous or none, with LGU-initiated CCA/DRR programs
Lower Suage River communities a) Brgy. Bantud Fabrica, Dumangas (with fishing & aquaculture) b) Brgy. Cayos, Dumangas	3. Introduced adaptation strategies (non-Christian Aid site): with CCA & DRR assistance

4.0 SIGNIFICANT LEARNINGS

There is increasing awareness of global warming and climate change issues worldwide. Extreme weather events like Typhoon Frank in the Philippines prove that no country is exempt from the impacts of climate change.

Findings from this study in selected sites of Iloilo echo reports of substantial loss to property, livelihoods, and lives experienced elsewhere in Western Visayas. Cost of damage was even as much as one-fourth of average household annual income in one *barangay cluster*, a stern reminder that preparations for similar events in the future are necessary to minimize similar losses. The study also found that people are resilient and eventually recover, although the extent and speed of recovery will depend on their experience, preparedness, capabilities, and the enabling environment.

People's high level of awareness about climate-related risks and threats seem to indicate their long experience of coping and adapting to climate-related hazards, particularly flooding. This is true for both the Dumangas and Pototan respondents.

The difference between the two study sites, however, is that Dumangas has received various assistance programs on DRR and CCA, introduced by external agencies (e.g., ADPC, Oxfam, and PAGASA). This underscores the importance of outside intervention in helping communities better prepare for and deal with the impacts of extreme weather events. The LGU has also organized a team principally responsible for quick response in times of emergencies and as its partner in DRR programs and activities. The Dumangas

example illustrates that experience and higher awareness can lead to better preparedness and consequently, the ability to more quickly recover from the impacts of a disaster.

On the other hand, the experience of Pototan showed that the residents' home-grown initiatives (e.g., higher elevation of houses) may not always be enough to adequately cope with hazards such as flooding. It was found that by cluster, they suffered the biggest losses in terms of costs and percentage of annual income. Moreover, it took them the longest time to recover from the effects of typhoon Frank.

5.0 CONCLUSIONS AND POLICY IMPLICATIONS

Typhoon Frank has wrought havoc and destruction on Western Visayas, especially to the province of Iloilo. In its aftermath, communities received external assistance, which in some cases included capability training in DRR and CCA.

Respondents showed a high level of awareness of the risk and threats from flooding, compared to those for sea level rise, land slide and coastal erosion, which could be due to their experiences with flooding in the past.

Of the 90% who claimed that their households would be prepared for similar extreme weather events, only 70% indicated that they are either "prepared" or "highly prepared". The range of preparations and adaptation strategies they mentioned include a combination of infrastructural (e.g., strengthening of house, relocation, dike construction, etc.) and behavior-related strategies (e.g., being always alert, change livelihood and source of income). Moreover, respondents from the upland study sites of Janiuay/Badiangan have been practicing some "soft engineering" approaches such as tree planting to minimize landslides and flooding.

Losses from extreme weather events often translate to unexpected expenses, which the study found to be as much as one-fourth of household annual income in one *barangay* cluster. This indicates the need for affordable credit lines that can be supplied by both the private and government sectors.

Survey results also point to the need to introduce more CCA capability building programs that can be offered to LGUs by national government agencies (NGA) like the National Disaster Risk Reduction and Management Council (NDRRMC). The academe can partner with the NDRRMC and other agencies in this regard. The University of the Philippines System can do this, thereby creating a niche for being a national academe/training center for CCA and DRR. This can complement the lack in NGA resources.

Since experience is a good teacher, LGUs can learn from each other's strategies for preparedness, adaptation, and coping with climate change and its attendant hazards. A network of LGUs, which can be web-based and which regularly meet through workshops for cross-learning, can serve as additional capability building strategy. This can be based either in NDRRMC or UP.

The passage into law of the Disaster Risk Reduction and Management Act (Republic Act 10121) is a good start, but actualizing its implementation is necessary so as to contribute to enabling LGUs and households to prepare for, adapt to, and cope with the impacts of extreme climate-related events.

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Appendix 1. ANOVA results for Table 9 (Average level of awareness of the risks and threats from natural hazards)

						95% Confidence Interval for Mean			
		N	Mean	SD	Std. Error	Lower Bound	Upper Bound	Min	Max
Flooding	Dumangas	120	6.44	3.018	.275	5.90	6.99	0	10
	Pototan	120	6.89	2.831	.258	6.38	7.40	0	10
	Badiangan_Janiuay	120	4.12	3.510	.320	3.48	4.75	0	10
	Total	**360**	**5.82**	**3.353**	**.177**	**5.47**	**6.16**	**0**	**10**
Landslide	Dumangas	120	.96	1.976	.180	.60	1.32	0	10
	Pototan	120	1.60	2.658	.243	1.12	2.08	0	10
	Badiangan_Janiuay	120	3.70	3.294	.301	3.10	4.30	0	10
	Total	**360**	**2.09**	**2.934**	**.155**	**1.78**	**2.39**	**0**	**10**
Storm surge	Dumangas	120	2.18	2.973	.271	1.65	2.72	0	10
	Pototan	120	1.03	2.016	.184	.67	1.40	0	8
	Badiangan_Janiuay	120	.92	2.027	.185	.55	1.28	0	10
	Total	**360**	**1.38**	**2.443**	**.129**	**1.12**	**1.63**	**0**	**10**

ANOVA results

		Sum of Squares	df	Mean Square	F	Sig.
Flooding	Between Groups	532.350	2	266.175	27.122	.000
	Within Groups	3503.550	357	9.814		
	Total	**4035.900**	**359**			
Landslide	Between Groups	493.539	2	246.769	33.925	.000
	Within Groups	2596.792	357	7.274		
	Total	**3090.331**	**359**			
Storm surge	Between Groups	117.622	2	58.811	10.368	.000
	Within Groups	2025.000	357	5.672		
	Total	**2142.622**	**359**			

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