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Extent of Typhoon Ulysses Flooding and Flood Risk Management Interventions of Heavily Affected Households in Isabela Province, Philippines

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ABSTRACT

The study assessed the extent of typhoon Ulysses flooding and the flood risk management interventions of heavily affected households in Isabela Province. A total of 3,000 respondents were selected through quota sampling technique in four municipalities, namely Cabagan, San Pablo, Sto. Tomas, and Santa Maria. Microsoft Excel and open source GIS software were used in the processing and analysis of data. Results show that in Cabagan, about 3,380 hectares of land were submerged to flood, including about 1,925.56 hectares of cornfields and 407.96 hectares of rice fields. In Santa Maria, about 16.04 percent (245.39has.) of its total land area has been flooded with the cornfields (991.10has), which contributed to the largest area flooded, followed by rice fields and grasslands with 546.76 and 193.72 hectares, respectively. In Sto. Tomas, about 2,724.7 hectares have been flooded, including 1,363.53 hectares of cornfields and 836.65 hectares of rice fields. In San Pablo, the total area flooded was 321.4 hectares. Cornfields represent the largest area flooded (244.8has.) followed by the built-up areas (33.1has.). Based on the survey respondents, the top three interventions made before the onset of widespread flooding were: stay alert on MDRRMC's notice and media news, buy emergency kits, and store food. In relation to the provision of immediate help from the government and non-government organizations, all participants received relief goods, cash aid, clothing, and beddings. In contrast, few received hygiene kits, agricultural inputs (seeds for sowing, seedlings, and fertilizers), and home reconstruction materials. However, there is a need to improve the government's response to the calamity.

INTRODUCTION

The Philippines is situated within the Pacific Ring of Fire and the Pacific Typhoon Belt. Due to its geographic location, the country is prone to natural and anthropogenic hazards such as typhoons, floods, heavy rainfall, long dry seasons, increasing temperatures, landslides, rapid sea-level rise, volcanic activities, and earthquakes. As such, the country lands as one of the top spots of global risk indexes.

From October to November 2020, the country experienced eight (8) weather disturbances: typhoons Nika, Ofel, Pepito, Quinta, Rolly, Siony, Tonyo, and Ulysses. These weather disturbances have brought tremendous impacts to the affected communities in the country, causing physical injuries, casualties, and damages to the country's physical assets. Many also suffered from psychological effects, especially those who were greatly affected. According to several reports, the calamities that caused the most damage and destruction were typhoons Rolly and Ulysses.

Typhoon Ulysses made three (3) landfalls when it traversed the country. The National Disaster Risk Reduction and Management Council (NDRRMC) reported on November 14, 2020 that typhoon Ulysses had affected a total of 285,978 families or 1,110,910 persons in 3,811 barangays across all affected regions (Malindog-Uy, 2020). In Cagayan Valley, the Regional Disaster Risk Reduction and Management Council (RDRRMC) reported on November 15, 2020 that almost 100,000 families or about 343,000 persons were affected by the typhoon. There

were 24 reported casualties in the region: 14 deaths due to landslides, seven (7) due to drowning, and three (3) due to electrocution. On November 21, 2020, the initial accounted damages to infrastructure and the agriculture sector in Cagayan Valley reached around 39.8 million and 73.7 million, respectively (PCOO-PND, 2020). In Isabela province, the extent of damage caused by flooding due to the onslaught of Typhoon Ulysses was far worse than what Metro Manila has sustained (ERIC, 2020). Isabela has been put under a state of calamity due to the disaster. The provincial government reported that about 26,000 families were affected by the flooding, with two (2) reported deaths due to drowning.

The impacts of flooding go far beyond direct damages to assets and infrastructure. Economic losses resulting from business disruption, welfare effects and supply chain shocks can often equal or exceed direct damages (Hallegatte, 2008). The destructive effect of massive flooding in the Cagayan Valley caused extensive damages to properties and infrastructures and displaced families and individuals. This flooding event was the worst in the region for the past four decades.

Objectives of the Study

Generally, this study aimed to assess the extent of typhoon Ulysses flooding and the flood risk management interventions of heavily affected households during typhoon Ulysses and the widespread flooding in Isabela Province. Specifically, the study sought to:

1) determine the socio-economic profile of the heavily affected households;

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2) assess the extent of flooding and the damage to the Agriculture, Aquatic and Natural Resources (AANR) sector through GIS-based generated maps;

3) determine the damage brought by typhoon Ulysses and the widespread flooding as perceived by the heavily affected households;

4) identify flood risk management interventions of households before, during and after the disaster; and

5) examine the perception of heavily affected households on institutional supports in response to the disaster.

LITERATURE REVIEW
Climate Change, Impacts and Vulnerabilities
Climate change is a global problem, and its potential impacts are becoming more severe, and the planet itself is becoming more vulnerable (DENR-EMB, 2010). Even if it is a global problem, its effects are felt locally, especially by the discounted and marginalized sectors. The World Risk Report 2014 ranks the Philippines as the second most at risk for disasters worldwide, with more than 50 percent of the population vulnerable to hazards. Moreover, within a span of two decades (1994-2013), the Philippines ranks as the fifth country most impacted by extreme weather events while it ranks eighth in the Climate Change Vulnerability Index of 2015 as one of the countries considered most vulnerable to climate change and disaster risks. According to UNESCAP (2015), climate change and variability continue to exert increasing pressure upon the agricultural sector of the Philippines. The three sectors that record the highest economic damage resulting from geophysical hazards in the Asia Pacific region are transport, housing, and agriculture. The agricultural sector is recognized as the most vulnerable of all sectors. A better understanding of major agricultural vulnerabilities to climate risks, thus fundamental to achieving more resilient farming systems, especially among poor rural households. Therefore, it is necessary to identify and prioritize, at a high-resolution scale, the municipalities and relevant crops that are most vulnerable to climate risks (Palao et al., 2017).

Based on the vulnerability mapping and geospatial study in the Cagayan River Basin, Floresca (2011) found that the highest concentration of high vulnerability is along the Cagayan River and its major tributaries and at the eastern part of the Cagayan Valley. This high vulnerability is attributed to the typhoon tracks, steep slopes, protected areas, and non-coverage of infrastructure (electricity, irrigation, telecoms). In terms of spatial distributions of vulnerability by province, Isabela has the highest land area with high vulnerability. In the study of socio-economic effects of typhoons, Huigen and Jens (2006) concluded that the farm households in the Municipality of San Mariano, Isabela had suffered severe financial damages due to crops loss, livestock loss, and damage of their houses.

In terms of vulnerability to climate change, the LGUs' adaptive capacity has an inverse relationship with LGUs' vulnerability. An LGU with a low adaptive capacity is highly vulnerable to changes in climatic hazards (e.g., increasing temperature, extreme rainfall and number of dry days). Peñaflor (2017) concluded that in the Province of Isabela, Ilagan City and the Municipality of San Mateo have very low vulnerability to climate change. On the other hand, Cauayan City, Santiago City, and the Municipalities of San Mariano and San Agustin have moderate vulnerability to climate change. All other LGUs in Isabela has a very high vulnerability to climate change.

Flooding Events and Coping Strategies
Rivers usually provide food and drink for business and means of transportations. It enhances the productivity of arable land through irrigation. If water flows are harnessed, it also provides power while an aesthetic environment is realized if its natural conditions are sustained. However, people living near rivers are also subjected to floods.

Cagayan Valley has a high rainfall amount (2000-3000 mm per year) and experiencing a rapid deforestation rate. Typhoons usually bring heavy rainfall, causing frequent floods that cause economic problems and damage in the flood plain areas adjacent to the river system (Oosterberg, 1997). Aside from earthquakes, floods account for about 30 percent of all disasters in the Philippines. They affect a large number of people because floods usually happen in the floodplains, which have distinct damages in terms of magnitude and quality.

The effects of floods have been rising in the last decade due to human-induced activities that make communities more vulnerable such as deforestation, overgrazing, and urbanization. According to Oosterberg (1997), flooding is largely affected by deforestation. In the Cagayan Valley, flooding is mostly induced by storm flows which increased by about 25% with complete removal of forest vegetation. In terms of sedimentation rate, the magnitude of the effect is almost three times higher after forest denudation.

Floods are one of the most frequent natural disasters in the Cagayan Valley, with destructive effects on humans, buildings, substructure systems, agriculture, and even the loss of life of the people. The Cagayan Valley is considered one of the most vulnerable areas during the rainy seasons for being flood-prone and a catch basin of water from tributaries. In November 2020, Cagayan Valley experienced its worst ever recorded flooding in four decades that claimed lives and displaced over 300,000 people in the Cagayan Valley Region (Visaya, 2020) and even resulted in economic losses and damages on areas adjacent to the river systems. Homes have floated off their foundation and traveled downstream, while over 83,000 people have been rescued and evacuated.

In other areas of the Province of Isabela, Manguilin (2009) observed that the adaptive strategies of most households in the flooded barangays are translocation of their belongings in the rooftops while others secure their livestock or animals, undertook savings, and some borrowed money. Few of the households evacuate to

other areas. After the flood event, belongings stored in a safe place were placed back. Moreover, cleaning the house and surroundings, replanting of crops destroyed, and borrowing money from relatives and neighbors were the other adaptive activities done by the study respondents. Based on the correlation analysis of her study (Manguilin, 2009), damage cost is positively correlated with income of the households, corn output, price of corn and loan money. However, there is a negative correlation of damage cost with new activities performed by the households after the flood. Area flooded is positively correlated with area planted, corn output, price of corn and amount of fertilizer. A negative correlation is also observed between current loans and income.

In the study of coping strategies by Mula (1999), households respond to the changed situation through several mechanisms honed through time, making these adaptive. Households cope by altering their production management by adjusting their cropping calendar, diversifying crops, and mobilizing available resources like the forest and other traditional forms of livelihood/food system. Household membership tends to become very loose in a situation of crisis. The manipulation of social relations and household membership has become a significant form of coping. Negotiations over work and other domestic responsibilities and migration of household members appeared to be part of the available coping strategies. These strategies to attain a secure livelihood do not always represent clear-cut, mutually exclusive alternatives. An outside intervention like government support in crisis situations should not just contend with emergency relief. Because disasters result in entitlement destruction, an intervention that allows for 'entitlement protection' is essential in the case of a continuing type of disaster.

Floods and landslides are often the side effect of tropical cyclones causing much damages and death. Annually, there are about twenty (20) typhoons that pass through the Philippine Area of Responsibility (PAR) (although many does not make landfall) and with varying frequencies per year from about 4 to 19 events annually (Mula, 1999). The trends show an increasing impact on the people, which can not only be linked to demographic trends but the growing concentration of people in marginal urban and degraded rural environments, which make them more vulnerable to natural hazards.

Palmiano-Reganit (2005) emphasized in her study about the coping strategy relative to a flood in Naga City that economic and social coping mechanisms were the most viable strategies in the community. Saving money and storage construction are the mitigating measures included in the economic coping mechanism. The author highlighted that social coping mechanisms like staying at the house of neighbors or borrowing food and money from relatives were examples of response and recovery measures that households were more focused on. At the different stages of flooding, one of her findings was that income influenced coping mechanisms. Households with less income were more vulnerable than households with higher income, where they had more access to assistance. In the Philippines, cultural concepts towards natural hazards can be driven by the belief in the power of God's wrath and religious mysticism. In her study of households in the Cagayan Province, Van der Zanden (2008) observed that the closely related cultural concepts of "being part of the group" (pakikipagkapwa), "sanction against breaking ranks with the group" (pakikisama), and "toiling on another's behalf and assuming another's burden" (bayanihan) are important elements in Filipino's coping strategies. These practices show the influence of shared community values which are important coping practices in cultures with continuing environmental uncertainty.

In the study of Van der Zanden (2008) on flooding in the Province of Cagayan, most households used important strategies, including translocation, cleaning, supplementing, borrowing, and precautionary savings as a risk reduction. These short-term strategies were dominant before, during and after the flood. The author also stressed that despite these traditional and short-term coping strategies, there is a vulnerable relationship between flood and farming because most inhabitants in the floodplains of Cagayan are associated with agricultural production and are affected when floods damage the crops.

Climate Change and Disaster Management Policies in the Philippines

After several years of surviving (or coping) with the aftermath of severe disasters, the Philippine Congress passed the Philippine Disaster Risk Reduction and Management Act of 2010 (R. A. 10121), making proactive preparedness and risk mitigation a national priority. Likewise, the Climate Change Act of 2009 (R. A. 9729) marks a significant step towards mobilizing stakeholders, including the academic sector, to take action to prevent and reduce the adverse impacts of climate change. These legislations advocate the mainstreaming or integration of disaster preparedness and recovery and climate change into the academic sector and implementing community-based preparedness projects and activities through LGUs. The Philippine Disaster Risk Reduction and Management Act of 2010 (RA 10121) prescribed that LGUs shall ensure the integration of disaster risk reduction and climate change adaptation into local development plans, programs and budgets as a strategy in sustainable development and poverty reduction. In addition, the Climate Change Act of 2009 (RA 9729) provides mandates to LGUs as frontline agencies in the formulation, planning, and implementation of climate change action plan in their respective areas, consistent with the provisions of the Local Government Code (LGC), the National Framework Strategy on Climate Change (NFSCC), and the National Climate Change Action Plan (NCCAP). Disaster risk reduction efforts and climate change adaptation measures

are closely related because disaster risk reduction is an essential part of climate change adaptation and serves as the first defense on the impacts brought about by climate change (Peñaflor, 2014).

METHODOLOGY

Time and Place of the Study

The study was conducted from January to August 2021 in the province of Isabela. Four specific municipalities were covered in this research, namely Cabagan, San Pablo, Sto. Tomas, and Santa Maria. These municipalities were selected in consultation with the Provincial Government of Isabela (PGI), being considered as part of the most devastated communities in the province during the onslaught of typhoon Ulysses and the widespread flooding in November 2020. This is primarily due to their geographic location being traversed by the mighty Cagayan River, the longest river in the Philippines. The basic information in each municipality is presented in the table below.

Isabela is the second largest Province in the Philippines. It has three (3) cities and 34 municipalities, and it has a total of 1,055 barangays. It has a land area of 1,066,456 hectares with a 1,593,566 human population as of 2015 with an Average Annual Population Growth Rate of 1.29

(2010-2015). Isabela is a first-class province with total revenue of PhP 2,490,192,785.00 (2017). It is strategically located between the Cagayan Economic Zone and the National Capital Center of the country, Metro Manila. It has productive forest land and watershed areas traversing the Sierra Madre Mountain Range. Isabela is also dubbed as the hybrid corn and rice champion of the Philippines. It is home of the Magat High Dam, a major source of power and water supply of Northern Luzon. It is also home to the biggest corn processing facility (Mindanao Grains) in Southeast Asia (PLGU Isabela, n.d.)

Respondents and Sampling Procedure

The respondents in this study are the heavily affected households during the widespread flooding in Isabela province brought about by typhoon Ulysses. The researchers employed a non-probability sampling technique, particularly quota sampling. There were 3,000 respondents (i.e., household heads) who participated in this research, 750 respondents in each municipality. The partner Local Government Units (LGUs) provided the list of heavily affected households.

Data Gathering

A structured questionnaire was established to gather primary data needed in this study. Desk review of secondary data from existing office files was done

Table 1. Basic information in each study site.

Municipality	Land Area (sq. km.)	Population (2020)	% share to Province's Population	No. of Barangays	Geographic Coordinates
Cabagan	430.40	53,897	3.18%	26	17° 26' North, 121° 46' East
San Pablo	637.90	26,320	1.55%	17	17° 27' North, 121° 48' East
Santa Maria	124.90	25,758	1.52%	20	17° 28' North, 121° 45' East
Sto. Tomas	80.58	24,528	1.45%	27	17° 24' North, 121° 46' East

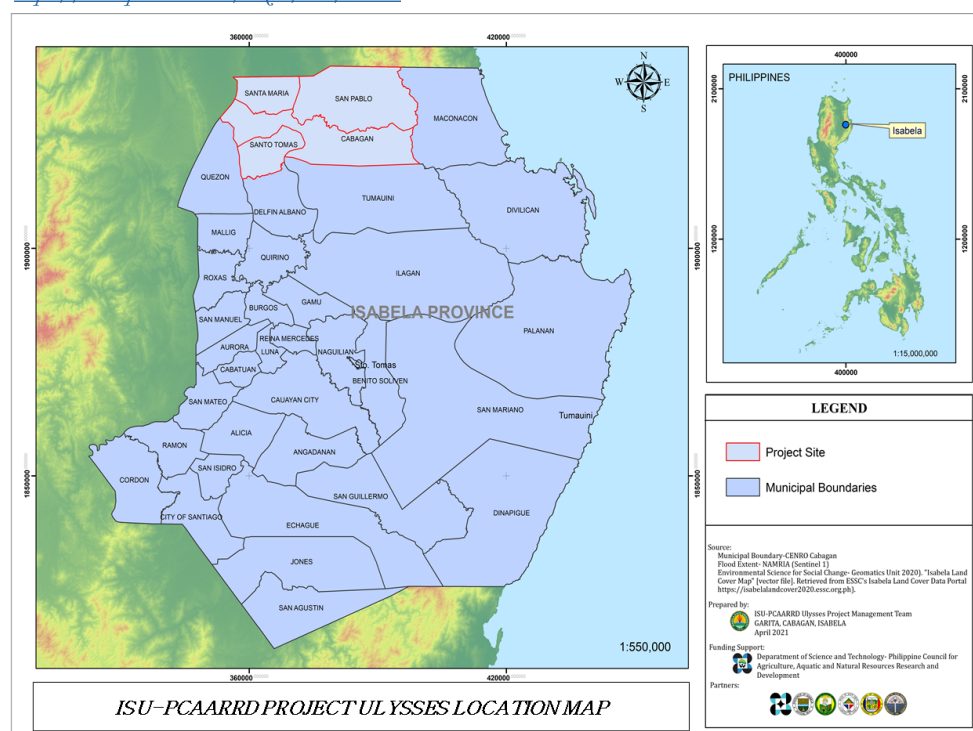*Data source: https://www.philatlas.com/luzon/r02/isabela*

Figure 1. Location map of the study sites

to gather supplementary information relative to this research. In addition, ocular observation and photo and video documentation were done. Two (2) enumerators were hired to facilitate data gathering.

In terms of the damage assessment to the AANR sector, a rapid on-site assessment was done through site documentation of the damages on crops, livestock and aquaculture of the identified areas. Desk review of existing office files, key-informant interviews, focus group discussion, and photo and video documentation was made during the assessment. Meanwhile, geo-referenced data was gathered through field visits to generate GIS-based maps highlighting the extent of flooding in each LGU. The cooperation and assistance of the Municipal Agriculture Office (MAO) and the Municipal Disaster Risk Reduction and Management Office (MDRRMO) was requested during the process. Relevant shapefiles were also requested from various offices/institutions such as the LGUs, the Environmental Science for Social Change (ESSC) and those available from the faculty in the university.

Data Analysis

The data generated from the survey were inputted in Microsoft Excel, where all statistical procedures were performed. The different sets of information were statistically analyzed using descriptive statistics. Moreover, graphical and tabular presentations were generated for easy comprehension.

RESULTS AND DISCUSSION
Socio-demographic Profile
Age Distribution

Table 2 shows the age distribution of the 3000 respondents from the four covered municipalities of the study. A total of 625 or 21% of the respondents belong to the 35-45 year old age bracket, followed by the 613 respondents or 20% with ages ranging from 45-55 years old, while 574 (19%) are under the age range of 56-65 years old. Moreover, 535 (18%) respondents are 26-35 years old, and 490 or 16% fall under 66 years old and above. Surprisingly, there are household heads that fall under 16-25 years of age, contributing 5% to the population. It can be deduced that most of the respondents belong to the middle age group, which normally is one of the characteristics of heads of households. These respondents have been staying in their households for several decades, and therefore, they have been struggling a lot in terms of the effects of typhoons and their associated hazards. Nevertheless, adaptation

and mitigation interventions have emerged from their experiences.

Sex Distribution

The figure below shows that most (62%) of the respondents are male, while females represent about 38 percent. Males usually serve as heads of households, but female members can take on the role of the head of the household in their absence. Cases like these were encountered during the survey, whereby men attend to their jobs to earn and support the needs of their families.
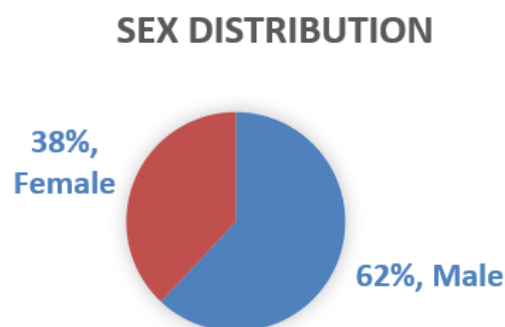

Figure 2. Sex distribution of the respondents

Educational Attainment of the Respondents

It is shown in Table 3 that most of the respondents have moderate literacy levels, whereby 28.55 percent are Elementary level, followed by 25.4 percent who are completed secondary education. Unfortunately, 31 respondents (1%) have not attended any formal education at all. According to them, poverty had pushed them to work at a very young age, putting them in several workplaces (e.g., farms, construction sites, etc.) instead of schools. Nevertheless, 5.50 percent of the total respondents have graduated from college, and six (6) respondents have attended skills development courses offered by the Technical Education and Skills Development Authority (TESDA). The literacy level of the respondents suggests that there is a need for massive information, education, and communication campaign related to disaster risk management to provide basic information that they need to prepare for and respond to disaster effects.

Table 2. Age distribution of the respondents

Age bracket	Frequency	Percentage
16 – 25	163	5
26 – 35	535	18
35 – 45	625	21
45 – 55	613	20
56 – 65	574	19
66 and above	490	16
Total	**3000**	**100**

Table 3. Educational attainment of the respondents

Level of Education	Frequency	Percentage
No education	31	1.00
Elementary level	855	28.50
Elementary graduate	653	21.80
High school level	339	11.30
High school graduate	762	25.40
College level	167	5.60
College graduate	164	5.50
Vocational graduate	23	0.80
TESDA graduate	6	0.20
Total	**3000**	**100**

Household Size of the Respondents

Table 4 presents that the majority (56.40%) of the respondents have a household size of 1-4 individuals. This figure is slightly lower compared to the average household size of 4.4 in 2015. Meanwhile, some families have 9-12 (4.9%) members in the household while the others have 13-16 (0.6%) members, and 0.1 percent with 17 and above members. Those with smaller household sizes indicate that evacuating them during calamities would be easier. In comparison, those with bigger household sizes tend to be logistically more challenging, thereby needing more effort. In addition, those with

Table 4. Household size of the respondents

Household Size	Frequency	Percentage
1 – 4	1691	56.40
5 – 8	1143	38.10
9 – 12	146	4.90
13 – 16	17	0.60
17 and above	3	0.10
Total	**3000**	**100**

bigger household sizes require a more stable source of income to sustain the needs of their growing family.

Extent of Flooding and the Damage to the Agriculture, Aquatic and Natural Resources (AANR) Sector

In the Municipality of Cabagan, about 3,380 hectares representing almost eight percent of its total land area, was submerged to flood. In terms of the municipality's agriculture, aquatic and natural resource-based sectors, most of the flooded areas were cornfields with an aggregate area of 1,925.56 hectares representing 56.97 percent of the total area flooded. Rice fields were the next most flooded with about 407.96 hectares submerged, followed by bare soil or sediments with 400.44 hectares.

In the Municipality of Santa Maria, about 2,245.39 hectares or 16.04 percent of its total land area was submerged in floodwaters. In terms of the agriculture, aquatic and natural resource-based assets, the largest area flooded were cornfields with an aggregate area of 991.10 hectares representing 44 percent of the total area flooded. The flooding also affected rice fields covering
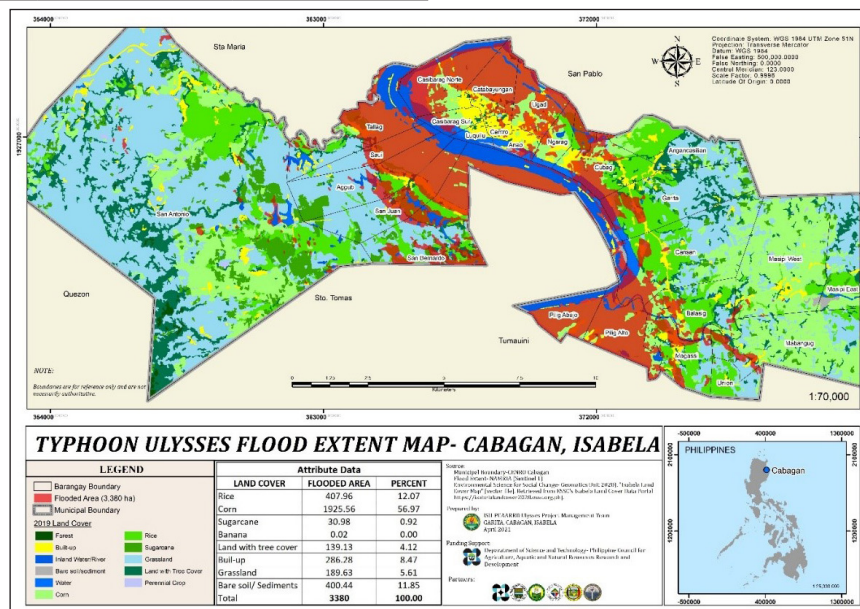

Figure 3. Typhoon Ulysses flood extent map in Cabagan, Isabela
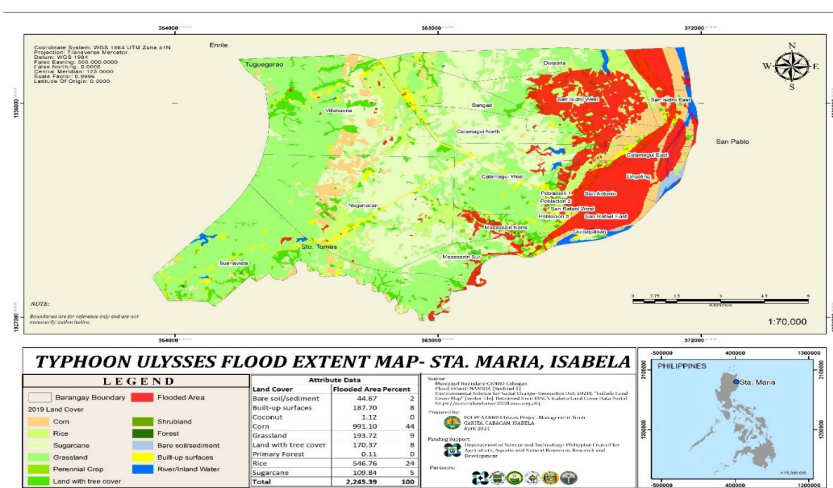

Figure 4. Typhoon Ulysses flood extent map in Santa Maria, Isabela

546.76 hectares and grasslands covering 193.72 hectares. In the Municipality of Sto. Tomas, about 2,724.7 hectares or about 32 percent of its total land area was flooded. In terms of the municipality's agriculture, aquatic and natural resource-based sectors, the largest area flooded were cornfields with an aggregate area of 1,363.53 hectares representing 50 percent of the total area flooded. 836.65

hectares of rice fields and 178.8 hectares of built-up areas were submerged during this flood event (Figure 5). In the Municipality of San Pablo, the biggest in terms of land area, the total flooded area is 321.4 hectares or 0.5% of the municipality's total land area. Cornfields with an aggregate area of 244.8 hectares represent 76 percent of the total area flooded in the municipality (Figure 6).
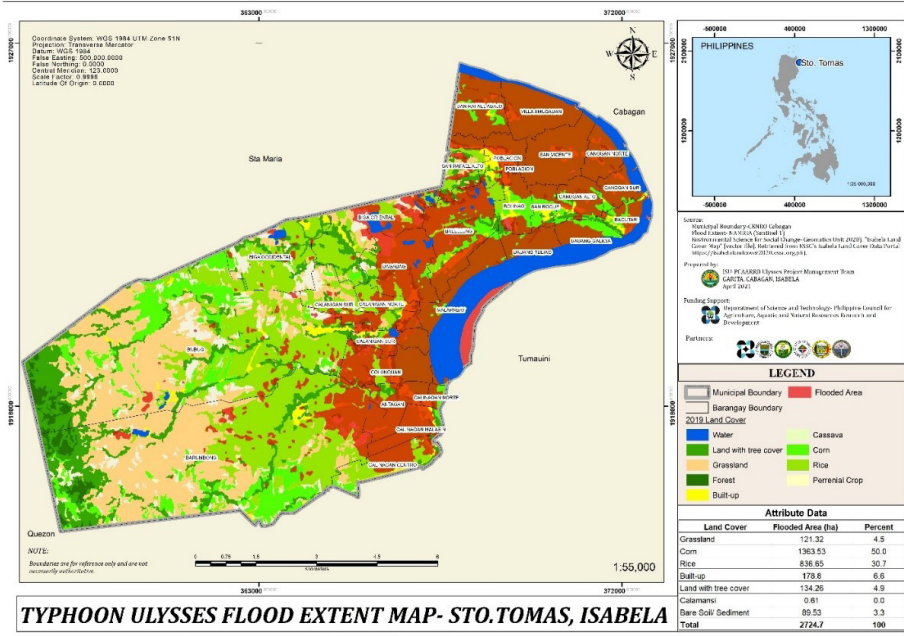

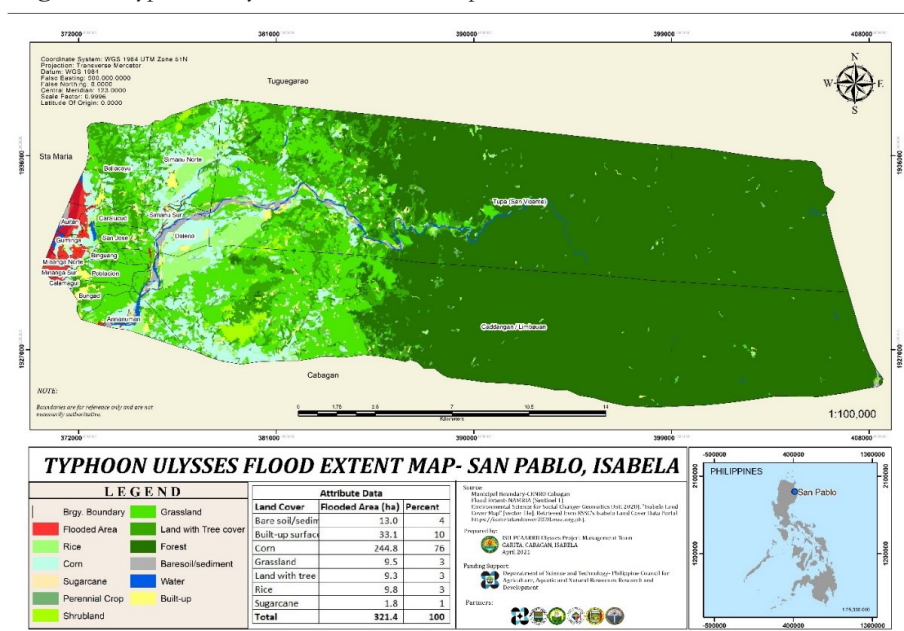**Figure 5.** Typhoon Ulysses flood extent map in Sto. Tomas, Isabela

Figure 6. Typhoon Ulysses flood extent map in San Pablo, Isabela

Flood Risk Management Interventions of Households Before the Flood
The respondents were asked about their flood risk management interventions before, during, and after the flood. Table 5 shows the multiple responses of the respondents with regard to the questions asked to them during the survey. The Top 3 flood risk management interventions of the respondents before the flood were to: stay alert on MDRRMC's notice and media news;

buy emergency kits; and store food, representing 97%, 95%, and 93%, respectively, of the 3000 respondents. According to the respondents, staying alert on various notices is of primary concern because through this activity, they could get the necessary information for them to act or respond accordingly. It is surprising that the respondents have considered buying emergency kits before the flood. They stated that having emergency kits is necessary to have something prepared to use as the need

arises. Storing food is also a common intervention of the households. In addition, 92 percent of the households identified another intervention of being selective in the kinds of equipment/things to buy. According to them, being selective is necessary because they need to prioritize the things they need to buy, given the limited financial capability of the household. Finally, few respondents (274 out of 3000) identified early harvesting of crops before the flood as an intervention. According to them, they need to immediately harvest their crops in order to save them from the impending flood.

Table 5. Flood risk management interventions of the respondents Before the flood

Interventions	Frequency	Percentage	Rank
Store food	2790	93	3
Evacuate	1886	63	5
Bring belongings to a safe area	1133	38	6
Borrow money	609	20	7
Stay alert on MDRRMC's notice and media news	2917	97	1
Buy emergency kits	2846	95	2
Being selective in the kinds of equipment/things to buy	2758	92	4
Early harvesting of crops	274	9	8

Multiple responses

During the Flood

There are 2,562 (99%) respondents who responded that they kept monitoring the water level during the flood. According to them, they needed to do this to make some adjustments in their actions and decisions while evaluating the possible risks should the flood water level continue to rise. Another intervention that respondents (91%) mentioned is putting or moving household items into a safer/higher area. Meanwhile, to be aware of several warnings or notices, 85 percent of the respondents stayed alert on MDRRMC's notice and media news. Some respondents (38 out of 3000) stayed at the roof of their houses and waited to be rescued.

Table 6. Flood risk management interventions of the respondents During the flood

Interventions	Frequency	Percentage	Rank
Stay alert on MDRRMC's notice and media news	2562	85	3
Water level monitoring	2974	99	1
Raised or moved household items	2744	91	2
Evacuated	1828	61	4
Climbed to the roof/Waited to be rescued	38	1	5

Multiple responses

After the Flood

The respondents were asked about their interventions after their experiences during the widespread flooding event. In addition, they were asked about the needed interventions to mitigate such a devastating flooding scenario. It can be seen in the table below that all respondents identified clean-up as a management intervention after the flood (Table 7). This activity was done to ease the family members back to their homes. Meanwhile, almost half (48.07%) of the respondents borrowed money since some of their belongings were damaged, and their sources of income were also affected. Some respondents (16.87%) planned to construct or renovate their existing homes to add another floor or two. According to them, they need to elevate their dwelling place in order to reduce the effects of future flooding events. Moreover, there are also respondents (16.07%) who modify their crop cycle so as to make sure that their crops will be harvested before the typhoon/flooding months. A few (3.30%) also wanted to make or buy a boat that they could use during flooding. They deemed this important for rescue operations and transporting valuable belongings into a safer place.

Table 7. Flood risk management interventions of the respondents After the flood

Interventions	Frequency	Percentage
Propose dike construction	59	1.96
Modify crop cycle	482	16.07
Make or buy a boat	100	3.30
Construction of second storey house	506	16.87
Migrate	25	0.83
Borrow money	1442	48.07
Clean up	3000	100

Multiple responses

Respondents' awareness of community-based flood risk management approaches

The respondents were asked about the existing flood risk management approaches in their community. All respondents (100%) are aware of these various community-based approaches available in their barangay. Some of the approaches that were asked of the respondents were presented in Table 8. It can be deduced that almost all (94.70%) are aware of Barangay Flood Plan. A majority (72.33%) of respondents are also aware of the Community Flood Information Board. In addition, most of them (56.07%) are also aware of Community-based Disaster Risk Reduction and Management

(DRRM) in their respective barangays. Finally, less than half (41.40%) of the respondents are aware Family Evacuation Plan. This information signifies that although all the respondents are aware of the presence of various community-based flood risk management approaches available in their barangay, there is still a need to further inform the community about these specific approaches. Meanwhile, when validated with the Barangay Officials, some barangays do not have such approaches (e.g., Family Evacuation Plan and Community-based DRRM). When asked about the need for such approaches, they affirmatively responded.

Table 8. Respondents' awareness of community-based flood risk management approaches

Community-Based Approaches*	Frequency	Percentage
Barangay Flood Plan	2841	94.70
Community Flood Information Board	2170	72.33
Family Evacuation Plan	1242	41.40
Community-based DRRM	1682	56.07

Multiple responses

Damages brought by Ulysses flooding and the households' perceived cost of damage

The table below provides the damages caused by typhoon Ulysses and the widespread flooding in November 2020. The table also shows the estimated cost of damages (in Philippine Peso, PhP) according to the affected households (Table 9). According to the respondents, the major damaged belongings were home furnishings and appliances (e.g., refrigerator, air conditioner, furniture, television, etc.) with an estimated cost of damage amounting to PhP 17,023,942.00. The estimated cost of damage for agricultural inputs and products amounted

to PhP 5,757,428.00. Moreover, damaged livestock (e.g., pigs, carabaos, cows, chickens, ducks, etc.) was estimated at PhP 2,806,100.00. There was also an estimated cost of damage on submerged motor vehicles like tricycles and cars amounting to PhP 739,700.00. In addition, livelihood structures were also damaged with an estimated cost of PhP 625,405.00. The typhoon and flooding partially and totally damaged some houses contributing to damage cost amounting to PhP 561,310.00 and PhP 254,350.00, respectively. Electronic gadgets and clothing represent the lowest estimated cost of damage, amounting to PhP 144,100.00 and PhP 42,900.00, respectively.

Table 9. Respondents' awareness of community-based flood risk management approaches

Characteristic	Est. Aggregate Cost of Damage (PhP)
Totally Damaged House	254,350.00
Partially Damaged House	561,310.00
Home Furnishings & Appliances	17,023,942.00
Electronic Gadgets	144,100.00
Clothing	42,900.00
Agricultural Inputs & Products	5,757,428.00
Animals	2,806,100.00
Motor Vehicles	739,700.00
Livelihood Structure & Products	625,405.00

Supports from government or non-government organizations to reduce flood risk

It is shown in Figure 8 the perception of the respondents in relation to the provision of support from the government and non-government organizations to reduce flood risk in their community. The majority (85.13%) of the respondents affirmatively responded, while 14.87% were not aware of any interventions to reduce the risk of flooding. When asked about the kind of assistance they received, all those who affirmatively responded mentioned tree planting activities as the only
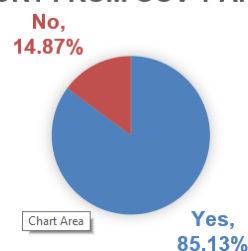

SUPPORT FROM GOV'T AND NGO

No, 14.87%

Yes, 85.13%

Chart Area

Figure 7. Supports from government or non-government organizations during or after the disaster

flood intervention mechanism to known to them.

Respondents' location during the flooding event

During the widespread flooding, about 39 percent of the respondents stayed home. Most of them have mentioned that they patiently stayed on the roof of their houses, fervently praying that the water level would no longer rise or subside. About 12 percent of the respondents were left with no choice but to proceed to designated evacuation centers of the community. These evacuation centers include schools, churches/chapels, and Barangay Hall/gymnasium. Meanwhile, almost half (49.07%) of them identified other locations/facilities they stayed in during the flooding event. These include houses of their relatives, friends, and neighbors.
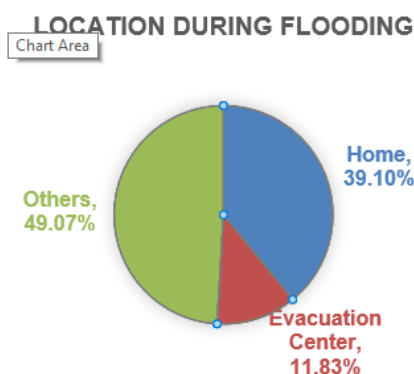

Figure 8. Location of the respondents during the flooding event

Immediate help from the government and non-government organizations

Table 10 shows the experiences of the respondents in relation to the provision of immediate help from the government and non-government organizations. All participants received relief goods immediately after the onslaught of Typhoon Ulysses. A good number of them received relief goods, cash aid, clothing, and beddings. Some received hygiene kits, agricultural inputs (seeds for sowing, seedlings, and fertilizers), and home reconstruction materials.

Table 10. Immediate help from government or non-government organizations

Characteristic	Frequency	Percentage
Relief Goods	3000	100
Cash Aid	2891	96.37
Clothing	2193	73.1
Beddings	1308	43.6
Home Reconstruction Supplies	85	2.83
Agricultural Inputs	83	2.77
Kitchen Utensils & Hygiene Kits	14	0.47

Respondents' perception on improving government initiatives

About 95 percent of the respondents believed there is a need for improvement in the government's response to the calamity (Figure 9). Some suggested improvements

include providing rescue equipment, livelihood assistance, cash aid, infrastructure development (e.g., river control, evacuation center, drainage improvement), agricultural inputs, housing and housing rehabilitation assistance, and job creation. Some of the respondents also note their difficulties in coping with the effects of natural calamities during the pandemic.
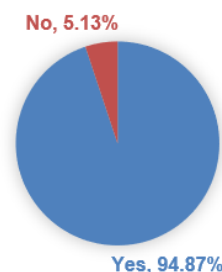

Figure 9. Respondents' perception on improving government initiatives

Table 11. Respondents' suggested improvements on government initiatives

Characteristic	Frequency	Percentage
Rescue Equipment	1221	41%
Livelihood Assistance (Capital)	776	26%
Cash Aid	460	15%
Infrastructure (e.g. River Control, Evacuation Center, Drainage & Road Improvement)	297	10%
Agricultural Inputs	244	8%
Housing & Housing Rehabilitation Assistance	94	3%
Job Creation	85	3%
Others	49	2%

CONCLUSION

Most of the respondents belong to the middle age group, wherein the majority are male with moderate literacy levels. Household size is slightly lower compared to the average household size in the Philippines in 2015. The Municipality of Cabagan represents the biggest area flooded among the four (4) municipalities covered. This is followed by the Municipality of Sto. Tomas. Among the AANR sector affected by flooding, cornfields represent the biggest area, followed by rice fields. This observation is true for all municipalities.

Before the flood, the top 3 flood risk management interventions of the respondents were to: stay alert on MDRRMC's notice and media news, buy emergency kits, and store food. During the flood, monitoring the water level, putting or moving household items into a safer/higher area, and staying alert on MDRRMC's notice and media news, are the top 3 interventions by the respondents. The respondents identified cleaning-up,

borrowing money, and construction (improvement) to a second storey house as the top 3 flood risk management interventions after a flood event.

All respondents are aware of the various community-based approaches for flood risk management. Almost all are aware of Barangay Flood Plan, while a majority are also aware of Community Flood Information Board and Community-based Disaster Risk Reduction and Management (DRRM). Less than half of the respondents are aware of Family Evacuation Plan. However, some barangays admittedly do not have such approaches (e.g., Family Evacuation Plan and Community-based DRRM), but barangay leaders also realized its importance and stated the necessity to have such plans.

As to the damages caused by typhoon Ulysses and the widespread flooding, the major damaged belongings include home furnishings and appliances (e.g., refrigerator, air conditioner, furniture, television, etc.); agricultural inputs and products; damaged livestock (e.g., pigs, carabaos, cow, chicken, ducks, etc.); damage motor vehicles like tricycle and cars; damaged livelihood structures; partially and totally damaged houses; and damage to electronic gadgets and clothing.

In relation to the provision of support from the government and non-government organizations to reduce flood risk in their community, most respondents are aware of the interventions to reduce the risk from flooding. Tree planting activities are the only intervention to reduce flood risk known to the respondents.

Most of the respondents stayed home during the flooding while others proceeded to designated evacuation centers of the community, and almost half of them stayed in other locations such as houses of their relatives, friends, and neighbors.

In relation to the provision of immediate help from the government and non-government organizations, all participants received relief goods immediately after the onslaught of typhoon Ulysses. Most of them also received cash aid, clothing, and beddings, while few received hygiene kits, agricultural inputs (seeds for sowing, seedlings, and fertilizers), and home reconstruction materials.

Respondents believed that there is a need for improvement in the government's response to the calamity. The suggested improvements include providing rescue equipment, livelihood assistance, cash aid, infrastructure development (e.g., river control, evacuation center, drainage improvement), agricultural inputs, housing and housing rehabilitation assistance, and job creation.

Recommendation

Based on the conclusions made, the researchers recommend the following:

1) Capability building activities that promote the use of flood-resistant rice and corn varieties in the flooded communities.

2) The LGUs/MDRRMCs to frequently issue notices through different communication platforms. Flood water level monitoring should be frequently done by the LGU and the most potentially affected households. The LGU to mobilize TUPAD beneficiaries to assist in clean-up operations. Also, the LGU to monitor lending/loan policies of financial institutions, including private individuals, to ensure that they will not set higher interest rates. If capable, construction of two or three-storey houses to mitigate effects of future flooding events is recommended for the affected households.

3) The Barangays with various community-based approaches should regularly conduct a public awareness forum to keep their constituents aware of their flood risk management approaches. Other barangays should benchmark best practices and appropriate approaches with the other barangays and adopt whichever method or activity is applicable and deemed appropriate within their jurisdiction.

4) The affected households should consider establishing a family flood preparedness plan and ensure that each household member is fully aware of such a plan. This is necessary in order to prepare the family well and protect their assets and other belongings.

5) The barangays should regularly inform and engage their constituents about their different programs and projects to reduce flood risk in their community. Not just on the aspect of tree planting.

6) For the affected households, when obliged by the local authorities to evacuate, strict compliance is necessary and staying home should not be an option.

7) For the local and national government authorities, including private entities, to evaluate the appropriateness and support future developmental initiatives suggested by the affected populace.

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