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DAVAO – BUKIDNON HIGHWAY, CALINAN POBLACION, DAVAO CITY

**ASSESSING FLOOD VULNERABILITY IN
BARANGAY RIVERSIDE, CALINAN, DAVAO CITY**

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August, 2023

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APPROVAL SHEET

In partial fulfillment of the requirements in Practical Research 1 and 2, this study entitled, **ASSESSING FLOOD VULNERABILITY IN BARANGAY RIVERSIDE, CALINAN, DAVAO CITY** prepared and submitted by **Ella Kristina Jeanne Albarracin, Kristine Grace Sacamos, Althea Bea Omo, Nyehlla Sophia Dagondon, Albert Alexius Benedict Soliven**, is hereby recommended for oral examination, approval and acceptance.

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ABSTRACT

Floods are natural phenomenon caused by extreme heavy rain and has affected many people. As a result, this research aimed to assess the level of flood vulnerability in Barangay Riverside, Calinan, Davao City. The study followed a quantitative descriptive-comparative design using a simple random sampling method. There were 60 randomly selected residents as the respondents who experienced flood and lived in the area for at least three years. The statistical tools used to analyze the socio-economic status and number of members in the family was frequency and percentage. While mean was used to know the level of flood vulnerability of the residents. Additionally, One way ANOVA is the statistical tool used to know the significant difference of their flood vulnerability in terms of socio-economic and number of members in the family. Consequently, it was found that most respondents have a monthly income of less than 10, 957 pesos (80.49%) and have less than 5 or 5 family members (61.66%). The result of the level of flood vulnerability in Barangay Riverside have obtained a total mean of 3.71 in their exposure which is described as High Vulnerable to flood. Susceptibility has a total Mean of 3.49. Lack of resilience has a total Mean of 3.83 which is described as Very High Vulnerable to Flood. And the total mean of the indicators obtained is 3.68 and is described as High Vulnerable to Flood. There is also no significant difference in the level of flood vulnerability of the respondents when compared according to their socio-economic status and number of members in the family because the P value is greater than 0.05.

Keywords: Barangay Riverside, Floods, Risks and Vulnerability, Socio-economic status, Number of members in the family

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Chapter 1

INTRODUCTION

Background of the Study

Floods affect billions of people worldwide (Zarekarizi, Srikrishan & Keller, 2020). Indeed, according to the Emergency Events Database (Centre for Research on the Epidemiology of Disasters [CRED], 2019), around 50,000 people died, and approximately 10% of the world population was affected by floods between 2009 and 2019. Due to population growth and climate change, more frequent and widespread floods are anticipated (Hirsch & Archfield, 2015; Leung, Russell & Connell, 2019).

It is estimated that the reported number of annual weather-related disasters were 335 between 2005 and 2014, an increase of 14 percent compared to the period 1995-2004, and almost twice the level recorded during 1985-1995 (CRED and United Nations International Office for Disaster Risk Reduction [UNISDR], 2015). Climate-related disasters accounted for about 90 percent of the 7255 major disasters between 1998 and 2017, most of which were floods and storms (United Nations Office for Disaster Risk Reduction[UNDRR], 2019). The devastating impact of these disasters underscore the importance to reduce the loss of life, the numbers of people affected, the damage to critical infrastructure and the economic losses (Gu, 2019).

Several countries stand out with particularly large populations directly exposed to high flood risk. In particular, the two most populous countries, China and India, also have the highest absolute population exposure to flood risk. Approximately one-third of all people exposed to flood risk globally reside in India or China. These two countries are

home to approximately as many flood exposed people as in the next 18 highest exposure countries combined. Additionally, according to Husin, Kaman and Samsuddin (2021), it is expected that any socio-economic assessment should consider the difference in topography, weather, and seasons which can be the significant variables in determining the risk.

In November 2020, Super Typhoon Goni (Rolly), the world's most powerful tropical cyclone during that year brought torrential rains, violent winds, storm surges, and massive flooding all over Luzon (World Risk Index [WRI], 2020). Meanwhile, in Davao City according to the report of Alma (2019), several areas in Davao City were hit by flashfloods brought about by heavy rains, about 545 families were evacuated due to rising floodwaters. The hardest hit barangays were Bangkal, Ulas, Matina Pangil, Tugbok, and Los Amigos. A localized thunderstorm brought forth heavy rains on Wednesday (August 28) evening which overflowed the Talomo River. With the latest report coming from Colina (2022), that flash floods are among the major problems in the city, particularly in the first district which has 54 of the city's 182 barangays. The district, which hosts the largest voting population at 355,052 out of the city's 992,538, includes the downtown area.

Even though flooding is a severe hazard in Davao Oriental due to the typhoons, heavy rainfalls and storms, insufficient attention has been paid to flood hazard assessment (Cayamanda, Paunlagui, Bacongus, & Quimbo, 2021). According to Ross, Santiago and Lagmay (2015), it is determined that 12%–28% of each of the eight municipalities is susceptible to flooding: mostly residential, business and community

centres. It was also revealed that a storm surge with a height of approximately 1 m reached 500 m inland from the coastline during Typhoon Pablo. Unfortunately, this study focused only on the east coast municipalities, and Typhoon Pablo affected the entire province. Overtime, effects of disasters can seriously degrade a country's long-term potential for sustained development. Vulnerable communities of Davao City have experienced flooding that leads to catastrophic effects costing damage to properties and loss of lives (Cabrera & Lee, 2019).

The researchers came up with this problem because of the noticeable vulnerability of the people during a flood in their area and no study has assessed the vulnerability of the people in the area. Thus, this study focused on assessing flood vulnerability and the significant difference in their level of flood vulnerability when compared according to socioeconomic status and number of members of a family.

Statement of the Problem

The aim of the study was to assess the flood vulnerabilities in Barangay Riverside, Calinan, Davao City. Specifically, this sought the following question:

1. What is the profile of respondents in terms of:

1.1 Socio-economic status; and

1.2 Number of members in the family?

2. What is the level of flood vulnerability of the residents in terms of :

2.1 Exposure;

2.2 Susceptibility; and

2.3 Lack of resilience?

3. Is there a significant difference on the level of flood vulnerability of the respondents when compared according to:

3.1 socio-economic status; and

3.2 number of members in the family?

Ho: There is no significant difference on the level of flood vulnerability of the respondents when compared according to socio-economic status and number of members in the family.

Ha: There is a significant difference on the level of flood vulnerability of the respondents when compared according to socio-economic status and number of members in the family.

Review of Related Literature

This section focuses on various literary works and studies concerning flood vulnerability. The topics are thematically arranged to be more understandable. This includes Brief History of Flood vulnerability, Disaster Vulnerability Index, Socio Economic Status and Number of Members in the family, Factors that Affect Flood Vulnerability, Effects of Flood to Human Health and Agriculture, and Government Initiative for Flood.

Exposure, Susceptibility, and Resilience

According to Veenstra (2013), exposure refers to a hazard or flood, as well as a system or its physical elements that are at risk in the same area as the hazard and affection, or disturbance caused by the hazard. As a result, the working definition of exposure within that study is "the susceptibility of a system or its constituents to be influenced by a flood as a result of their proximity". Munyai, Musyoki, and Nethengwe, (2019), also stated that vulnerability is defined by three important factors: exposure, sensitivity, and resilience. Vulnerability refers to a person's tendency to be damaged, in this case by a hazard, and to be unable to cope with that injury, as well as the social processes that create and maintain such tendency. Human decisions, values, governance, attitudes, and behavior all contribute to the formation of situations in which dangers may cause harm (Kelman, Gaillard, Lewis, & Mercer, 2016). Intergovernmental Panel on Climate Change [IPCC] (2014) defines vulnerability to be 'The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts including sensitivity or susceptibility to harm and lack of capacity to cope and adapt'.

Flood exposure is higher for socially vulnerable populations (Lee & Jung 2014; Rolfe et al. 2020), especially for inland floods (Qiang 2019). Flood exposure to social factors specific to individuals, populations, and communities, precisely the vulnerability of people, socio demographic and socioeconomic profiles, employment, education, household composition, demographic structure, the capacity of society to cope with hazards and their effects. Analyses of social vulnerability to floods are justified by the intrinsic characteristic of these natural phenomena: the likelihood of occurrence, the

speed of onset, the potential damage, and the society's capacity to be prepared for and to cope with these events (Rufat, Tate, Burton, & Maroof, 2015).

On the other side, flood susceptibility is defined as a region's predispositions to flooding, which are determined by the physical configuration of the area excluding rainfall (Vojtek & Vojteková, 2019). Ahmadlou et al., (2019) and Bui et al., (2019), also defines flood susceptibility as the likelihood of flooding in a given location as a result of a set of geo-environmental factors.

Vulnerability and resilience are defined differently, but in general, vulnerability relates to possible disruptions, whereas resilience relies on resources that safeguard system operations (Frommer, 2013). Flood risk management is effective in reducing the danger of some flooding risks, preventing loss of life and relieving the economic load on communities after floods. Recently, academic literature has considered flood resilience as a novel technique in addition to flood risk management (Disse, Johnson, Leandro, & Hartmann, 2020).

Flood vulnerability is quite diversified in character, complex, and a critical concern (Rehman, Sahana, Hong, Sajjad, & Ahmed, 2019). Simultaneously, community resilience planning has become a national and global need in recent years. Improving community resilience necessitates extensive long-term public and private investments. (Hemmati, Ellingwood, & Mahmoud, 2020).

According to Béné, Wood, Newsham and Davies (2012), in development and vulnerability reduction sectors such as social protection, disaster risk reduction, and climate change adaptation, resilience is becoming crucially influential. The greater the

resilience, the lower the vulnerability. Resilience has become a tempting concept in disaster management due to its ability to elicit systemic adaptation before and after disasters. Various urban planners, government agencies, and other institutions have worked to develop community-based disaster management and resilience systems (Oh, Okada & Comfort, 2014; Carrasco, Ochiai & Okazaki, 2016; Tselios & Tompkins, 2017).

Various urban planners, government agencies, and other institutions have worked to develop community-based disaster management and resilience systems (Oh, Okada & Comfort, 2014; Carrasco, Ochiai & Okazaki, 2016; Tselios & Tompkins, 2017). Developed countries have also been affected by flooding: the Danube flooded in Europe in 2013, while the Kinu River in Japan flooded in 2015. However, due to historical efforts to mitigate flood impacts, flood losses and damage in wealthy countries are often less severe than in underdeveloped ones, especially in terms of fatalities (Doocy, Daniels, Murray & Kirsch, 2013).

Socio-economic status and Number of members in the family

Socio-economic status refers to a household's financial and social situation in relation to income, profession, and learning. The livelihood for disadvantaged households is often affected by the occurrence and intensity from flood damage (De Silva & Kawasaki, 2018). Numerous researchers have discovered substantial correlations among vulnerability and various socio-economic groups' susceptibility to natural disasters (Tahira & Kawasaki, 2017). The researchers found that one factor that greatly affects the

people from the flood is their socio-economic status (Alnusairat, Elnaklah, Abd Hamid, Ariffin, & Tham, 2021).

The socioeconomic level of an individual can affect their vulnerability to disasters, as well as their ability to prepare for and recover from them. People from low socioeconomic (LSE) origins are more vulnerable to disasters, but they are also the least prepared for them due to a variety of variables such as lack of housing affordability, low income, and low literacy levels (Teo, Goonetilleke, Ahankoob, Deilami, & Lawie, 2018). Demographic and socioeconomic characteristics determine how people prepare for and are affected by natural hazards, according to previous research on natural hazards and climate change adaptation (Nikkanen, Räsänen, & Juhola, 2021).

Individuals and families are vulnerable to varying degrees depending on the number of household members (Han, Huang, Kang, Wang, & Wang, 2018). On the other hand, small households often have potentially limited resources to prepare (Działek, Biernacki, Fiedeń, Listwan-Franczak, & Franczak, 2016). In the study of Alnusairat, Elnaklah, Abd Hamid, Ariffin, and Tham (2021), more prominent families are more likely to be poorer socio-economically as they need bigger money to recover from the disaster. Families with babies and younger children, particularly non-adult children, are easier targets in the disaster as they rely on adults for safety and assistance. Members of the family with a bigger number generally find it challenging to recover from a flood. Moreover, typhoons and associated epiphenomena (flooding, storm surges, and landslides) cause more deaths and damage in the Philippines than any other natural disaster. Every year, about 20 typhoons make landfall in the Philippines Area of Responsibility (PAR),

yet the role of vulnerability in typhoon-related disaster risk is little recognized, particularly at lower administrative levels (Healey, Lloyd, Gray, & Opdyke, 2022).

Socioeconomic status of the individual, such as income level, education, social capital, and family size, are considered important when there is a disaster (Nikkanen, Räsänen, & Juhola, 2021). Research shows that women are more vulnerable due to limited access and economic positions, especially when it is combined with other dependents; on the contrary, females are also known to be in charge of taking care of their families and having a more excellent coping capability. Those factors have a direct impact upon socioeconomic position & flood susceptibility, as well as resilience (Rabiu, Willie, & Parumasur, 2020).

According to a recent study, socially vulnerable populations are more at risk of flooding due to systemic disadvantages. Neighborhood-level socioeconomic deprivation, including measures of economic instability and insecurity, indicated a societal vulnerability (Chakraborty et al., 2022). Flooding risk is greater for households with lower incomes and limited access to productive natural resources. Also, at higher risk exposure levels, the disparity in income and asset distribution at the community level tends to be bigger, suggesting that vulnerable households individually are also collectively more vulnerable (Brouwer, Akter, Brander, & Haque, 2007).

Factors that affect flood vulnerability

The elements at risk are defined as the level of exposure with reference to agricultural fields, buildings/infrastructure, population, economic activities, public services, utilities, etc., which can be impacted by the flood hazard (Dewan, 2013). The

physical effect of flood vulnerability can cause physical damage to buildings, crops, and infrastructure, social disruptions in vulnerable groups, livelihoods, and local institutions that can cause direct and indirect economic losses. The weaknesses that appear during flooding indicators should cover physical, social, and psychological aspects, including structural damage to buildings as well as non-physical effects like anxiety. In contrast to physical outcomes, non-physical outcomes have largely been neglected in vulnerability assessments and deserve considerably more attention (Brouwer & Schaafsma, 2013).

Different impacts of flood vulnerability that causes hazard to individuals, households, and communities, especially those with a high potential to get harmed, are incapable of keeping themselves safe when heavy rain falls. Empirical evidence from historical flood analysis has indeed shown that particular social groups tend to carry a higher burden of death, injury, and economic impact from floods (Solangaarachchi, Griffin & Doherty, 2012). Previous studies show socially and economically disadvantaged groups tend to be particularly exposed to flood hazards in urban areas (Collins, Grineski, Chakraborty, & Flores, 2019).

Economic vulnerability actively interferes with the well-being of livelihoods and the poverty of multiple social community groups (Ortiz, Ortiz, Martín, Vázquez, 2016; Shivaparasad Sharma, Roy, Chakravarthi & Srinivasa Rao, 2018). Vulnerable populations may be defined as wage scarcity, resource inaccessibility, and social and economic crises (Balica, Popescu, Beevers, & Wright, 2013). The level of flood vulnerability depends on the economic status of an individual. Usually the poor are more vulnerable to disasters because they lack the resources to build sturdy structures and other

measurements that can protect themselves from being negatively impacted by the flood. Highly populated cities are more likely to suffer from flooding, and the impact differs from the asset (Bajracharya et al., 2021).

People in the communities that are prone and have a higher chance of getting harmed when there's a flood are the poor people, as they lack resources to use that can protect them. Factors include poor housing conditions in different regions exposed to the same hazard level. Although the vulnerability of a community has social, economic, physical, environmental, institutional, and cultural dimensions (Birkmann et al., 2013), these dimensions are all interconnected (Mazzorana et al., 2014). The strong connection between the different vulnerabilities will significantly affect society's social and economic activities.

Natural catastrophes are one of the dangers that come as a result of environmental changes. Floods have a significant impact on the quality of raw water in the flooded area. Polluted water will most likely have a harmful influence on human health (Sholihah, Kuncoro, Wahyuni, Suwandi, & Feditasari, 2020). Water management has shifted in recent decades toward natural-based alternatives. These are thought to be far more multi-purpose than typical "grey infrastructures," and they appear to be seen as a panacea for a variety of environmental problems. At the same time, compared to traditional (grey) engineering procedures, such measures necessitate more – and primarily privately owned – property and a broader range of stakeholder participation (Hartmann, Slavíková & McCarthy, 2019).

In a study in China, external factors are mainly due to heavy rainfall as a result of extreme climate change. Internal factors mainly include wetland depletion, topographical changes, and deterioration of urban drainage systems (Wu, Cheng, Shen, Lin, & Arulrajah, 2020). To address the obstacles to implementing nature-based solutions for flood risk management, multidisciplinary insights from land-use planning, economics, property rights, sociology, landscape planning, ecology, hydrology, agriculture, and other disciplines are required. Nature-based flood risk management is, in the end, a multi-disciplinary enterprise. This presents brief academic reflections from two different disciplinary perspectives that critically highlight which specific aspects are of significance, and as such, underscore the multi-disciplinary nature of the challenges faced (Hartmann, Slavíková, & McCarthy, 2019).

There are 1.81 billion people worldwide—or 23% of the world's population—live in areas that are significantly at risk of flooding, with inundation depths of more than 0.15 meters in the case of a flood that occurs once every 100 years or with at least medium risk. In other words, with a population of 7.9 billion people worldwide²⁹, over one in four people live in areas with a high risk of flooding (Rentschler, Salhab, & Jafino, 2022; WorldPop, 2021)

Monitoring and assessment of water quality is a crucial sustainability issue for surface water, especially rivers as they are of vital importance for humans (Boyd, 2019; Wu et al., 2018). The common way of the water quality evaluation is the assessment of analyzed physicochemical parameters with onset national or international limit values, which does not give a hint about the contamination sources (Ustaoğlu &

Tepe, 2019). Compared to the water column, contaminants fixed to the sediment matrix typically create a prolonged hazard for the ecosystem (Kara, Kara, Bayram, & Gündüz, 2017).

Efficient flood mitigation techniques supported by adequate flood hazard assessment, monitoring, and early warning can lessen the negative impacts on livelihoods. However, the spatial targeting of efficient mitigation techniques is restricted by a lack of monitoring and information on flood extent and flood exposure. However, up until now, there hasn't been much attention paid to flood exposure, which is defined as the people and assets located in flood-prone areas. The few flood exposure assessment studies either mainly assess broad land cover classes (Li et al., 2022). Flood Risk Mapping (FRM) is one of the most significant challenges in the assessment of the potential risks of floods and consequently lessens their destructive effects in flood-prone areas. Over the past few decades, the occurrence of numerous floods has had irreversible effects on the economy, vital resources, and benefits of people around the world. Flood risk mapping is used to precisely manage floods brought on by rain and dam overflows, minimizing harm to people and property (Farhadi & Najafzadeh, 2021).

A poor health-related quality of life is more likely to affect vulnerable populations in low- and middle-income nations due to climate change's increased stressors linked with aging (HRQOL). In nations like the Philippines, where natural calamities especially floods, occur more frequently. In the context of disaster preparedness, enhancing quality of life for both individuals and communities while also building resilience is crucial. There is currently a paucity of information on the factors influencing disaster response

and HRQOL among older Filipinos (Leyva, 2021). People who live in informal settlements, are widely acknowledged to be more vulnerable to the effects of climate change, and will more likely be disproportionately affected by the implications of climate change on cities, including those on health. Inequalities in health status between informal settlement residents and other urban dwellers already exist, and climate change will exacerbate these differences. Many people agree that informal settlements are susceptible to these health effects, including the Intergovernmental Panel on Climate Change (IPCC). (Hambrecht, Tolhurst, & Whittaker, 2022).

UNDRR (2017) defines early warning system as “an integrated system of hazard monitoring, forecasting and prediction, disaster risk assessment, communication and preparedness activities systems and processes that enable individuals, communities, governments, businesses and others to take timely actions to reduce disaster risks in advance of hazardous events. Semarang city in Indonesia’s Central Java province suffered floods in 2012 due to the Bringin river overflow. The local government joined with international agencies and local stakeholders to develop a FEWS primarily to deal with flash floods. With advanced instruments and modeling, Semarang city now operates an advanced FEWS in collaboration with local communities to minimize flood impacts (Iglesias, 2015)

Awareness consists of the actual awareness of the people in the commune and of a training they did or things like manuals or instructions which causes the people to know what to do when the area floods (Veenstra, 2013). Also informing our conceptualization of the awareness component of self-connection is the construct of mindfulness (Klussman

et al., 2022). Similarly, the awareness component of self-connection notices self-relevant aspects of experiences, potentially providing more attention to, and clarity on, those that pertain to oneself (Klussman et al., 2022).

Given the increased flood risk of cities due to climate change, spatial planning systems are increasingly expected to contribute to flood resilience (Meng, Dąbrowski, Xiong, & Stead, 2022). A common concern in managing flood risk is the potential reduction of flood damage, increased community resilience, and community prosperity. Spatial planning regulation commonly expressed in spatial plans and followed by construction regulations instructs people what alterations they can (or cannot) adopt on their properties — it has the form of direct regulation without (financially) motivating people (Hudson & Slavíková, 2022). Spatial planning is the use of available space, or more precisely, safe or non-hazardous space to create infrastructure developments in urban areas. Spatial planning includes density management, land use management, locations for future residential and industrial uses, areas for various functions, locations and types of significant investment projects, and a framework for the protection and enhancement of nature and the environment (Kodag, Mani, Balamurugan, & Bera, 2022).

In developing countries, the shift to these new approaches of flood risk management has been slower, constrained by more limited funding, resources, and technical skills; weak governance; and other factors like limited access to hydrological data and forecasting (Osti, 2019). Sustained functioning of these systems depends on their self-regulating processes for minimizing the error value between a set point and an actual value in some critical performance level (Jeong et al., 2018).

Every year, the Philippines is subjected to a number of typhoons, each of which has the potential to endanger lives, homes, and livelihoods. Such flooding results in significant property and structural damage, and it can have a detrimental effect on rural communities. For towns and individuals vulnerable to such disasters, the global community is urging action to address and reduce disaster risk (Stephenson & Miranda Morel, 2018). Emergency reports demonstrate how disaster management systems in susceptible cities are being overwhelmed by major weather events. Only a small amount of research has addressed the issue of temporary shelter in acute crisis intervention, while many studies concentrate on comprehensive and long-term coping strategies to deal with disasters. Experiences in developing nations have demonstrated that local governments have devised emergency housing in athletic facilities, educational facilities, and other structures dubbed Collective Centers. This paper's goal is to create and implement a comprehensive assessment of public infrastructure that can provide temporary shelter in the event of extreme weather (Melgarejo & Lakes, 2014).

Recurrent natural disasters have driven the Philippine government to create disaster risk reduction and management (DRRM) policies in order to better plan, respond, and recover from natural disasters, as well as to become more resilient (Iuchi, Jibiki, Solidum, & Santiago, 2022). Disaster recovery is defined as the long process of making economic reconstruction and redevelopment sustainable and resilient (Pathak, & Ahmad, 2016). When communities are affected by disasters, emergency response and recovery are done in-house based on local policy decisions and priorities. The local government makes the decision on how or whether to rebuild. Higher government agencies, such as

states and localities, may implement their own disaster recovery processes and policies in addition to or competing with local governments (Crow & Albright, 2019).

The right to social security has a strong anchor in international human rights law, most notably the Universal Declaration of Human Rights (UDHR) and the International Covenant on Economic, Social and Cultural Rights (ICESCR) (Razavi, 2022). The promulgation of the right to social security implies that States assume obligations under international law to respect, protect and fulfil those rights and that they are accountable for their realization (Razavi, 2022).

Effects of flood on human health and agriculture

According to National Health Portal [NHP] (2018), the immediate health impacts of floods include drowning, injuries, hypothermia, and animal bites. Health risks are also associated with the evacuation of patients, loss of health workers, and loss of health infrastructure including essential drugs and supplies. These impact of huge debris can cause trauma and weaken the strength of fatalities, promoting drownings (Špitalar, Brilly, Kos, & Žiberna, 2019).

Moreover, weather-related infectious disease outbreaks are most commonly caused by flooding. Flooding increases the risk of diseases like hepatitis A and cholera spreading through the groundwater (National Geographic, 2021). According to Alderman, Turner, and Tong (2012), in the first year after a flood, mortality rates rose by up to 50%. Following the floods, it was discovered that disease epidemics such as hepatitis E, gastrointestinal sickness, and leptospirosis are more likely, especially in places with

inadequate hygiene and displaced populations. Psychological anxiety in flood survivors (prevalence 8.6% to 53%) can exacerbate their physical disease.

Government Initiatives for floods

While striving to slow the spread of COVID19, the world is facing difficulties in managing disasters. Regional organizations and communities play an important role in disaster management, and scientifically-backed risk information is essential (Ishiwatari, Koike, Hiroki, Toda, & Katsume, 2020). According to a study in Davao Oriental, flooding is one of the most catastrophic disasters. The goal was to map flood-prone risk zones using a combination of variables such as rainfall, slope, elevation, drainage density, soil type, distance to the main channel, and population density (Cabrera & Lee, 2019).

Countries along the Belt and Road are still severely affected, vulnerable to extreme climates, and Southeast Asia, an important part of the Belt and Road, has been severely damaged by flood disasters (An, Tan, Gu, & Zhu, 2020). In a study about the Southeast Asian countries' solutions to flooding disasters, many megacities in Southeast Asia and beyond are still looking for acceptable adaptation paths to accommodate increasing sea levels as a result of global climate change. Adaptation can take many forms and include a wide range of concerns, locations, and time spans in order to address previously existing challenges caused by land subsidence and the increased occurrence of inland floods (Herbeck & Flitner, 2019).

This led people to embrace some technical measures, such as forcible evacuation, but others have continued customary practices, such as seeking refuge on rooftops where they could get trapped during floods (Seng, 2014). The politics of managing global

catastrophic risks are examined in this study in a stereotypically "vulnerable" megacity in the global South. It examines the disproportionate impact of the 2009 Ondoy floods on Manila's poor as a result of twentieth-century developmentalism's failures and partial accomplishments, during which the Philippine state fostered a highly unequal allocation of catastrophe risk. It claims that a disaster risk management (DRM) plan based on the removal of slum inhabitants was based on selective interpretation and suppression of data (Alvarez & Cardenas, 2019).

Hazard mapping is an important part of flood risk management, as systematic approaches need to be developed and implemented to define areas where catastrophic flood events can occur. Flood hazard maps show the range of water levels in flood areas (Cabrera & Lee, 2020). Residents' and officials' reports demonstrate a number of recurring patterns in both locations and over time, with some notable exceptions. Flooding incidents, according to respondents, pose major economic, health, and safety risks. Though some property has indeed been abandoned due to flood damage, and some better-off inhabitants have relocated, most locals do not see retreat as a viable option in the foreseeable future. Instead, the majority of people are adapting *in situ* and attempting to design flood-prevention techniques in their towns (Williams, Arguillas, & Arguillas, 2020).

The recent findings on risk reduction strategies have emphasized the significant role of communities in building its resilience toward disasters, including flooding. However, a big part of these strategies is affected greatly by the existing policies and governance. Policy leaders and lawmakers should regularly review and update existing

policies to address gaps and promote effective community engagement (Cayamanda & Lopez, 2018). Furthermore, local communities can establish plans for immediate and long-term risk reduction by assessing their vulnerabilities and capacities, as well as what they can do to decrease risk on their own and where they need additional resources as well as outside help (United Nations Office for Disaster Risk Reduction[UNDRR], 2017).

Based on the literature review of this study, the socioeconomic status of those affected by the flood is one element that the researchers discovered that has a significant impact on them. People's ability to withstand floods is significantly influenced by their socioeconomic status. Smaller households may have potentially scarce preparation resources. The concepts and investigations that make up the literature for this study have greatly aided the researcher in establishing and situating the study's context. Factors in different categories are provided on how flood give a big impact on the mentioned categories.

Theoretical Framework

This study was anchored in the study Pressure and Release(PAR) Model Theory by Wisner, Blaikie, Cannon and Davis (2004). PAR is one of the two disaster models advanced by the proponents which aimed at showing how vulnerable people are affected by natural hazards. The model consists of two main components. One is “vulnerability” on human or social side and the other is a natural event which is termed as “hazard”. The basis for the PAR idea is that a disaster is the intersection of two opposing forces: those processes generating vulnerability on one side, and physical exposure to a hazard on the other.

The theory of Wisner, Blaikie, Cannon and Davis supported the conduct of this study because this showed the vulnerability of the affected people. This study particularly analyzed the level of their vulnerability.

Conceptual Framework

The independent and dependent variables of the study are represented in Figure 1 below.

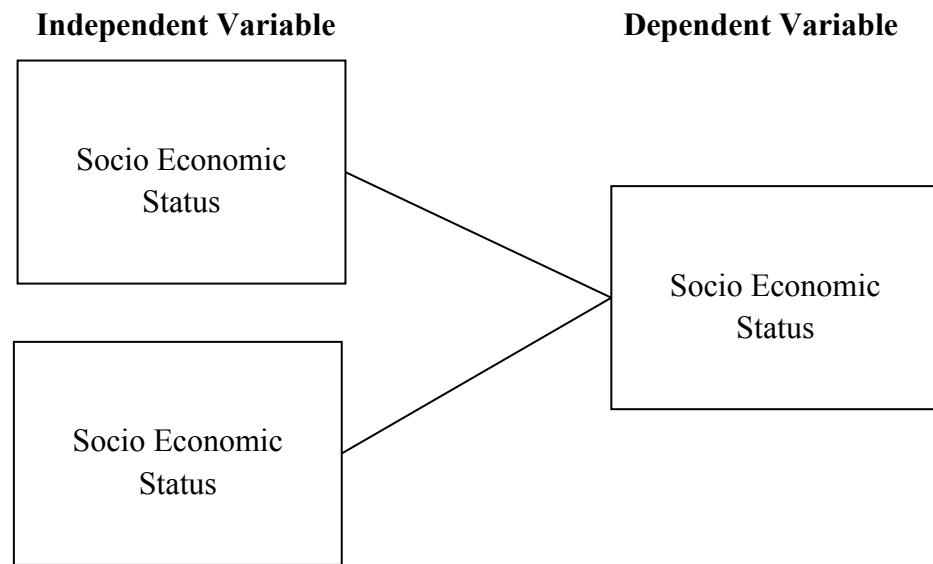


Figure 1. Conceptual Framework

Figure 1 signifies the conceptual framework of the study, which incorporates the significant difference in socioeconomic status and number of members in the family to their level of disaster vulnerability. The researchers sought to determine the level of flood vulnerability and their significant difference in terms in terms of socio economic status and number of members in the family.

Significance of the Study

The study will contribute research-based data and knowledge about disaster vulnerabilities to the residents and barangay officials of Barangay Riverside. Furthermore, society, in general, can make informed decisions that are relevant to this area. More specifically, this study shall be beneficial to the barangay officials, residents of Barangay Riverside, and future researchers.

This study will be beneficial to the barangay officials as it will show the status of their barangay when there is a flood. It can also guide them to take measurable actions to prevent disastrous events when there is flood. They can also use the research-based data gathered to start the planning and implement rules for the safety of the residents of the barangay and for the residents to enlighten them on what status their place is when there is a flood. It will also be their guide to start planning and locating the higher areas that can be used as their evacuation area; they can be guided on what to do and what to bring when they evacuate to higher areas.

In the same way, this study will be beneficial to future researchers and can be used as a guide for studying the flood vulnerability of a specific place or barangay. The researchers can get data-based information about the barangay Riverside using this study. They can also determine if the location is at high risk or low risk when there is a flood.

Scope and Limitation

In order to conduct the research, a survey was used to determine the profiles of respondents according to their socioeconomic status. Residents of Barangay Riverside

were given a survey questionnaire specifically to the head of family or any adult per household, focusing on the high-risk areas. This study did include how changes in hydrological regimes affect water resources management.

Definition of Terms

Flood Vulnerability refers to the inability to resist a hazard or to respond when a disaster has occurred

Socio-economic status refers to the categorizes of people based on their educational attainment, income, and occupation

Exposure to Flood refers to a contact with something. example: exposure to flood.

Susceptibility to Flood is a state of being exposed to or sensitive to something alarming.

Lack of resilience refers to the lack of strength to fight against the impact of floods.

Chapter 2

METHODS

In this chapter, the design, research locale, research respondents, data gathering procedures, research instrument and the analysis of the data gathered are presented.

Research Design

This study used a quantitative descriptive-comparative design wherein the researchers assessed if the residents of Barangay Riverside are ready in case of impending flooding; this also examined the significant difference in the level of flood vulnerability of the respondents in terms of socioeconomic status and the number of members in the family. According to Leedy and Ormrod (2015), descriptive quantitative research design involves either identifying the characteristics of an observed phenomenon or exploring possible associations among two or more phenomena. The descriptive design gives detailed information regarding the disaster vulnerability of the residents. According to Koh and Owen (2018), this form of research is used to characterize the fundamental characteristics of a study's data.

As a result, a comparative study was used to check the precise information on people's disaster vulnerability. The researchers used this form of analysis to characterize the data's important characteristics by assessing the respondent's circumstances and how they respond to vulnerability. The researchers' purpose was to establish the level of disaster vulnerability among residents of Barangay Riverside in the event of a flood as

well as to compare people's disaster vulnerability and flood defense vulnerability when dealing with floods.

Research Locale

This research was conducted specifically in Barangay Riverside, Calinan, Davao City, Region XI. This barangay include Purok 1-A, Purok 3, Purok 4, Purok 4A, Purok 5, and Purok 5A (Davao Region). This place belongs to the island of Mindanao, at a coordinate of approximately 7.1655, 125.4735. It is estimated that the elevation at these coordinates is 179.7 meters, or 589.6 feet, above mean sea level. Riverside's borders include: Subasta, Wangan, Biao Joquin, Calinan (Poblacion), Balengaeng, Los Amigos, and Callawa in Davao City.

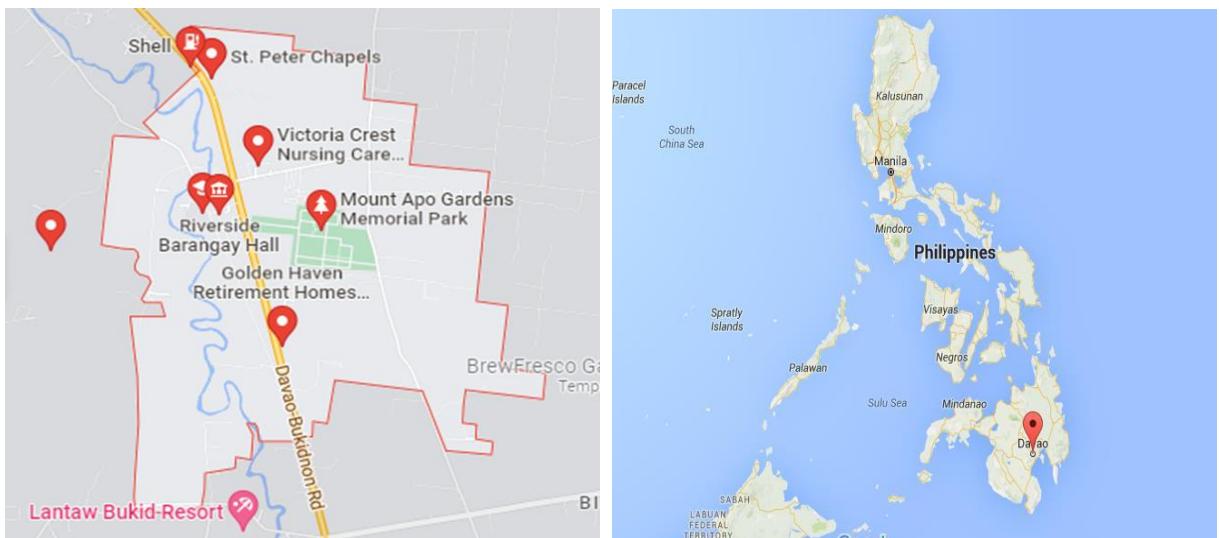


Figure 2. Research Locale

Research Respondents

There were 60 participants who participated in the study. The participants are head of the family and in the absence of the head, an adult member in the family was asked to be the respondent. Residents only from Barangay Riverside who is at the high risk areas and lived there for at least 3 years were allowed to engage with the researchers just to be sure that they met with the criteria as respondents. Only one respondent was allowed to answer the survey questionnaire per household.

The researchers used the simple random sampling to get the study's number of respondents. Simple random sampling, is a method in which, every individual from the population has an equal chance of being selected as a respondent. The data was generated using random number table or computer generated list of random numbers. It can also be done by lottery method, using currency notes, etc (Acharya, Prakash, Saxena, & Nigam, 2013).

Research Instrument

The researchers prepared a structured questionnaire to gather data. The questionnaires came from previous studies and tailored to the respondents' context. The instrument was divided into three sections. The first section asked about the disaster vulnerability index, the second section asked about socioeconomic status, and the third section asked about the number of family members.

The first part of the instrument is concerned about the disaster vulnerability index, adapted from Veenstra's (2013) study, which indicated exposure, susceptibility and lack

of resilience. The said questionnaire used a 5-point Likert scale type in which the respondents chose only one option out of the five options described as Always, Very Often, Sometimes, Rarely, Never. The scaling was done using one-half of the value of 5 as an average cut-off point or the appropriate level, with a uniform interval of 0.80.

Data Gathering Procedure

During the study's implementation, protocols and procedures were observed. The researchers requested permission to conduct the survey outside the school campus by sending a letter to the school administration. The Barangay Captain of the participating residents was sent another permission letter to conduct the survey within their barangay.

In order to maintain respondents' freedom of choice, the researchers also requested the barangay official's assistance in distributing the questionnaires, informing participants about the study's goals, and obtaining their consent to participate. Participants were informed of their right to decline participation in the study and given assurances that their names and privacy would be protected. The validation process also enabled the identification of those hazard and vulnerability features that need to be recorded and updated.

Before answering the questionnaire, the respondents were given an overview of the questionnaire and how to answer it. They were then given sufficient time to complete the questionnaire. The responses were immediately gathered when they had completed the questionnaire. A google form was also sent to individuals who have access to the internet.

Data Analysis

The researchers used frequency and percentage in analyzing the Socio-economic status and Number of members in the family. Frequency and percentage display more clear representation of data and deal with the number of occurrences (Mishra et al,2019). Since the questionnaire required the respondents to check the socio-economic status and the number of members in the family only, the researchers used frequency and percentage.

To address Research Questions 2, the mean was utilized in analyzing the level of exposure, susceptibility and lack of resilience. The most frequent measure of central tendency is the mean (average), which refers to the average value of a series of data. The average or mean is calculated by adding all the data together and dividing by the number of values (Sykes, Gani, & Vally, 2016). The data gathered were run through Excel in order to get the mean. Excel is a commonly used Microsoft program because it is incredibly convenient for performing complicated and huge calculations, as well as for gathering data for quantitative studies. Excel is used by the researchers because it is simple to use for data entry and basic data analysis (Goldwater, 2007).

To answer Research Question 3, the One Way Anova was utilized in getting the significant difference on the level of flood vulnerability of the respondents when compared according to socio-economic status and number of members in the family. A one-way ANOVA compares the means of two or more groups for a single dependent variable. When there are more than two groups in the study, a one-way ANOVA is performed. ANOVA compares variation within a group (on average) to variance depending on group means' variation (Ross & Willson, 2017).

After analyzing and interpreting the data gathered from the level of flood vulnerability index, the following gradation and interpretation were used.

Table 1. Table Interpretation on Flood Vulnerable Index

Mean	Description	Interpretation
4.80 - 5.00	Very high vulnerability to flood	This means that the residents are not always prepared and have not recovered from floods.
3.40 - 4.79	High vulnerability to flood	This means that the residents are rarely prepared and recovered from the flood.
2.60 - 3.39	Vulnerability to flood	This means that the residents are sometimes prepared and recover from floods.
1.80 - 2.59	Low vulnerability to flood	This means that the residents are often prepared and recover from floods.
1.00 - 1.79	Very low vulnerability to flood	This means that the residents are always prepared and recovered from floods.

Table 2. Table Interpretation on Level of Flood Vulnerability Index

Income Cluster	Monthly Income for a Family of 5
Poor	Less than PHP 10,957
Low income (but not poor)	Between PHP 10,957 to PHP 21,914
Lower middle income	Between PHP 21,914 to PHP 43,828
Middle middle income class	Between PHP 43,828 to PHP 76,669
Upper middle income	Between PHP 76,669 to PHP 131,484
Upper income (but not rich)	Between PHP 131,483 to PHP 219,140
Rich	At least 219,140

Source: Albert,Santos, and Vizmanos (2018), calculations based on 2015 and 2017

Family Income and Expenditure Surveys (FIES) (PSA 2015a, 2017)

Ethical Consideration

The protection and privacy of our respondents and the data gathered were our top priority, ensuring that the results were all honest and transparent without manipulating the data collected. The researchers, respected the anonymity of our respondents and their answers to get a reliable and credible piece of information that show the current status of the barangay when there is a flood.

Non-maleficence principle is controversial, despite its attraction. First, it is unclear how one should apply the principle in cases where there are risks rather than certainties of harm: clearly, if "Do No Harm" (DNH) meant that every medical

intervention that ever posed even the tiniest risk of harm would be ethically questionable, nearly every medical intervention would be (John, 2022). The researchers did not harm the respondents by not forcing them in not participating.

Respect for person involved among the values that were identified, dignity is special in that while it is sometimes used to designate a certain status or rank (Waldron Dimock, Herzog, and Rosen, 2012), one of having a worth beyond price and of being protected from degradation and instrumentalization, it is sometimes also used to designate a property by all human beings and which justifies why a principle like Respect for Persons applies to human beings. The researchers sent a letter of consent to offices informing them that the researchers are conducting a study in their barangay; the researchers protected the data collected and the personal information of the researcher respondents.

Justice according to Manda-Taylor, Mndolo, and Baker (2017), is synonymous with "fairness," and it indicates that everyone should be treated equally, similarly, fairly, and impartially. The researchers aimed to get reliable information from our respondents, making sure that the data gathered will not be manipulated or fabricated by the researchers. The researchers made sure to value impartiality and applied the Adherence to Data Protection Act. The researchers did not conclude based on the data collected from the respondents. The collected data guided the researchers as they continue with their study, ensuring that they will give accurate information to the people.

Chapter 3

RESULT AND DISCUSSIONS

This chapter contains the results of the difference in flood vulnerabilities in terms of socio-economic status and the number of members in the family. Moreover, each research question's results are also presented with their interpretation and supporting references.

Research question #1.1: What is the profile of respondents in terms of socio-economic status?

Table 3. Demographic Profile base on socio-economic status

Monthly Income	Frequency	Percentage
Poor (less than PHP 10,957)	66	80.49%
Low Income (between PHP 10,957 to 21,914)	9	10.98%
Lower Middle Income (between 21,914 to 43,828)	6	7.32%
Middle income (between 43,828 to 76,669)	0	0%
Upper middle Income (between 76,669 to 131, 484)	0	0%
Upper Income (between 131,483 to 219,140)	0	0%
Rich (at least 219,140)	1	1.22%

The table shows the profile of respondents in terms of socio-economic status. Most of the respondents (80.40%) has a monthly income of less than PHP 10,957 which implies that they are poor. Moreover, 10.98% of the respondents has a monthly income

between 10,957 to 21,914 which implies that they have low income. 7.32% of the respondents has a monthly income between 21,914 to 43,828 which implies that they have Lower Middle Income. 1.22% of the respondents has an income of at least 219,140 which implies that they are Rich. On the other hand, there were no respondents who have a monthly income between 43,828 to 76,669; 76,669 to 131,484, and between 76,669 to 131,484.

According to the results of Tasri, Karimi, and Muslim (2021), the severity of the disaster will differ based on the socio-economic conditions of the affected household. The poor will experience higher income losses. Poor households have low disaster preparedness. The poor who live in disaster-prone areas with income derived from the traditional agricultural sector which depends on the weather result in the poor people experiencing higher income losses. The level of disaster losses that occurred was related to the social and economic conditions of the community, the better the socio-economic conditions of the household, the lower the level of economic losses that occurred.

Research Question #1.2: What is the profile of respondents in terms of the number of members in the family?

Table 4. Demographic Profile based on number of members in the family

Number of members in the family	Frequency	Percentage
1 (5 or less than 5)	62	75.61%
2 (More than 5)	20	24.39%

Table 4 shows the frequency and percentage according to the profile of respondents in terms of the number of members in the family. Based on the presented data, respondents who selected option 1 have family members of 5 or less than 5 (75.61%). Respondents who chose option 2 have a family member of more than 5 (24.39%). The majority of respondents selected 1, which shows that there are five or less family members in a household.

Result from a study conducted by Qasim, Khan, Shrestha, and Qasim (2015), the average number of family members per household was almost 9. This demonstrates that a home's vulnerability to flooding increases with the number of occupants. A multi-scale map showing the Philippines' typical household size in 2022 (country, region, province, and municipality). The average household size in the country is 4 people. It is computed by dividing the number of households by the number of households overall (Bauer, 2022).

Research Question #2: What is the level of flood vulnerability of the residents in terms of: Exposure, Susceptibility; and Lack of resilience?

Table 5. Level of Flood Vulnerability

Indicators	Mean	Description
Exposure	3.71	High Vulnerability to flood
Susceptibility	3.49	High Vulnerability to flood
Lack of Resilience	3.83	Very High Vulnerability to flood
Total	3.68	High Vulnerability to Flood

Table 5 presents the final result of the level of flood vulnerability in Barangay Riverside. Lack of resilience has a higher mean than the two and had obtained a total mean of 3.83 which is described as very high vulnerability to flood which means that the residents are not always prepared and have not recovered from floods. Moreover, exposure and susceptibility obtained a total mean of 3.71 and 3.49, respectively. The result signifies that the two indicators are described to have high vulnerability to flood which means that the residents rarely prepared and recovered from the flood. As a result, the total mean of the indicators had obtained 3.68 and described as high vulnerable to flood which means that the residents are rarely prepared and recovered from the flood.

The study of Munyai, Nethengwe, and Musyoki (2019) has a similar result in this study. The community where the study was conducted has a very high vulnerability to floods socially. This is because of the high population density, lack of early warning systems for flood and poor or slow emergency services. Moreover, the data gathered in Barangay Riverside show that the flood warning/forecast has the least mean among the indicators which affect the susceptibility of the residents. On the other hand, the result of the study has a contradicting result from a study conducted by Patricia et. al (2022), which revealed that Makurdi has a relatively higher resilience index of 6.230 than exposure and susceptibility. Adaptive capacity has an inverse relationship with vulnerability, which means that the higher the adaptive capacity, the lower the vulnerability. In the context of this study, lack of resilience has the highest mean than exposure and susceptibility and has an interpretation of high vulnerability.

Research Question#3: Is there a significant difference in the level of flood vulnerability of the respondents when compared according to socio-economic status?

Table 6. ANOVA result in terms of socio-economic status

ANOVA						
<i>Source of Variation</i>	SS	df	MS	F	P-value	F crit
Between Groups	242.4412195	1	242.4412195	974.0981139	2.05E-70	899502
Within Groups	40.3198374	162	0.248887885			
Total	282.71059	13				

As illustrated in the table above, there is no significant difference because the P value of the result is greater than 0.05. Results in the Table show that the computed F-value is 974.098113861926 and has a corresponding P-value of 2.05E-70 which is greater than 0.05, indicating that the flood vulnerability has no significant difference in terms of socio-economic status.

According to a study conducted by Balica, Popescu, Beevers, and Wright (2013), stronger socio-economic characteristics of a specific area influence better resilience to floods. On the other hand, the study of De Silva and Kawasaki (2018), shows that higher percent of poor households suffer greater loses due to floods than non-poor households. Therefore, the study of De Silva and Kawasaki contradicts this study because the result of the study shows no significant difference of the level of flood vulnerability in terms of socio economic status. Moreover, the study of Zhang, Zao and Pedersen (2019), Households' vulnerability to a calamity brought on by a natural hazard may differ

significantly from their level of poverty. While non-poor households can also be exposed to a disaster, households with a relatively low income may not always be at risk.

Research Question#3: Is there a significant difference in the level of flood vulnerability of the respondents when compared according to number of members in the family?

As illustrated in table 6, the results show that the computed data has a corresponding p-value of 2.05E-70 which is greater than 0.05. Thus, the null hypothesis is accepted indicating that the level of flood vulnerability has no significant difference in the number of members in the family.

According to the study of Ali, Shah, Shaw, Ullah, and Ye (2020), families with many individuals are more vulnerable to disaster risks due to their weak financial condition as a consequence of their lower spending power and reduced ability to purchase the basics such as education, food, and health care. Their study concludes that having more family members in a household increases their risk of being vulnerable to disasters like floods.

The result of this study has contradicts a study conducted by Shah, Ye, Abid, Khan, and Amir, (2018), the survey results show that both study areas are extremely vulnerable to flood disasters and has low resilience on them. According to the study's findings, community households where the study was conducted, flood-prone areas are more vulnerable and less robust than the other community, scoring higher on the composite vulnerability index and lower on the composite resilience index.

Chapter 4

CONCLUSIONS AND RECOMMENDATIONS

This chapter contains the conclusion of the study based on the findings and generated recommendations of this section.

Conclusion

Based on the findings on the demographic profile of the respondents, 80.49% or the majority of the respondents had 10, 957 pesos or less than 10, 957 pesos monthly income which implies that they are poor. Meanwhile, most of the respondents have 5 or less than 5 members in the family as compared to 6 or more members in the family. Additionally, the result of the level of flood vulnerability shows that lack of resilience has higher mean and described as very high vulnerability in flood compared to exposure and susceptibility. The overall total of the result of the three indicators was described as high vulnerability to flood. On the other hand, the level of flood vulnerability of the respondents has no significant difference in terms of socio-economic status and number of members in the family.

Recommendations

Based on the findings of this study, the following recommendations are suggested: The researchers recommend to the barangay officials of Barangay Riverside to heighten their disaster risk reduction program for the residents and consider preventive activities and programs such as symposia, programs, and seminars about flood vulnerability in

areas that are prone to flooding to make people aware and educate them about the risks and hazards caused by floods. The researchers suggest the installation of a flood alarm and forecast which will serve as an early warning for the residents for them to be aware and ready for an impending flood. Moreover, the study only focus on the level of flood vulnerability and the significant difference in the level of flood vulnerability in terms of socio-economic status and number of members in the family, the researchers recommend to the future researcher to consider other factors or variables in measuring the level of flood vulnerability of the residents.

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HOLY CROSS COLLEGE OF CALINAN, INC

Davao- Bukidnon Highway, Calinan Poblacion, Davao City

October 25, 2022

SR. CHERIE ELOISA GARROTE, PM

School President
This Institution

Dear Sr. Garrote,

Greetings of peace and solidarity!

We are writing this letter to inform you that we will be conducting a research study entitled: **Assessing Flood Vulnerability in Barangay Riverside, Calinan, Davao City** as a major requirement in our Practical Research 1 and 2. The objective of our study is to find out the level of flood vulnerabilities of the residents in Barangay Riverside.

In line with this, we would like to ask permission to conduct the study outside the school premises since we will be gathering data from the residence of Brgy. Riverside.

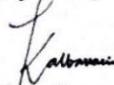
We will also inform the respondents that their participation in this study is completely voluntary, therefore, participants are free to withdraw from the study at any time without moral obligation to the researcher and to the school. Further the participants have the right to verify the data to be included in the final manuscript. Also, confidentiality of the information obtained is assured as there will be no other individuals who have access on them except the researchers and their research adviser.

Should you wish to know more about the study, please feel free to contact:

Kristine Grace Sacamos
Cellular number: 09205394656

Thank you very much.

Very truly yours,


Ella Kristina Jeanne Albarracin
Researcher


Kristine Grace Sacamos
Researcher


Althea Bea Omo
Researcher

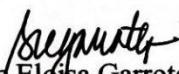

Nyehllia Sophia Dagondon
Researcher


Albert Alexius Benedict Soliven
Researcher

Noted by:


Mrs. Jessica Rabang
Research Adviser

Approved by:


Sr. Cherie Eloisa Garrote, PM
School President

Complaints about this research:

The Holy Cross College of Calinan requires that all the participants are informed and if they have complaints regarding the manner in which the research is conducted, it may be given to the researcher, or if an independent person is preferred, to the Research and Publication Head, Research Office, Holy Cross College of Calinan with the following numbers: 295-0797 or 09491985644.



HOLY CROSS COLLEGE OF CALINAN, INC

Davao- Bukidnon Highway, Calinan Poblacion, Davao City

October 24, 2022

MA. CORAZON SUÑGA, PHD

Ed. Principal
This Institution

Dear Dr. Suñga,

Greetings of peace and solidarity!

We are writing this letter to inform you that we will be conducting a research study entitled: **Assessing Flood Vulnerability in Barangay Riverside, Calinan, Davao City** as a major requirement in our Practical Research 1 and 2. The objective of our study is to find out the level of flood vulnerabilities of the residents in Barangay Riverside.

In line with this, we would like to ask permission to conduct the study outside the school premises since we will be gathering data from the residence of Brgy. Riverside.

We will also inform the respondents that their participation in this study is completely voluntary, therefore, participants are free to withdraw from the study at any time without moral obligation to the researcher and to the school. Further the participants have the right to verify the data to be included in the final manuscript. Also, confidentiality of the information obtained is assured as there will be no other individuals who have access on them except the researchers and their research adviser.

Should you wish to know more about the study, please feel free to contact:

Kristine Grace Sacamos

Cellular number: 09205394656

Thank you very much.

Very truly yours,


Ella Kristina Jeanne Albarracin
Researcher


Kristine Grace Sacamos
Researcher


Althea Bea Omo
Researcher


Nyehlla Sophia Dagondon
Researcher


Albert Alexis Benedict Soliven
Researcher

Noted by:


Mrs. Jessica Rabang
Research Adviser

Approved by:


Ma. Corazon C. Sunga, PhD
B.Ed. Principal

Complaints about this research:

The Holy Cross College of Calinan requires that all the participants are informed and if they have complaints regarding the manner in which the research is conducted, it may be given to the researcher, or if an independent person is preferred, to the Research and Publication Head, Research Office, Holy Cross College of Calinan with the following numbers: 295-0797 or 09491985644.



HOLY CROSS COLLEGE OF CALINAN, INC

Davao- Bukidnon Highway, Calinan Poblacion, Davao City

December 9, 2022

HON. JOCELYN ALCARIA

Barangay Captain
Barangay Riverside

Dear Ma'am,

Greetings of peace and solidarity!

We are writing this letter to inform you that we will be conducting a research study entitled: **Assessing Flood Vulnerability in Barangay Riverside, Calinan, Davao City** as the major requirement in our Practical Research 2. The objective of our study is to find out the level of flood vulnerabilities in Barangay Riverside and if there is a significant difference on the level of flood vulnerability of the respondents when compared according to their socio-economic status and number of members in the family.

In line with this, we would like to ask permission to conduct the study in your barangay. Questionnaires will be used to gather data from the residents therefore, we also asking for the assistance of your barangay officials or tanod during our data gathering.

We would like to assure you that participation in this study is completely voluntary, therefore, participants are free to withdraw from the study at any time without moral obligation to the researcher and to the school. Further the participants have the right to verify the data to be included in the final manuscript. Also, confidentiality of the information obtained is assured as there will be no other individuals who have access on them except the researchers and their research adviser.

Should you wish to know more about the study, please feel free to contact:

Kristine Grace Sacamos
Cellular number: 09205394656

Jocelyn E. Alcaria

12-13-22

Thank you very much.

Very truly yours,

Ella Kristina Jeanne Albarracin
Researcher

Kristine Grace Sacamos
Researcher

Althea Bea Omo
Researcher

Nyehlla Sophia Dagondon
Researcher

Albert Alexius Benedict Soliven
Researcher

Noted by:

Mrs. Jessica Rabang
Research Adviser

Approved by:

Hon. Jocelyn Alcaria
Barangay Captain

Complaints about this research:

The Holy Cross College of Calinan requires that all the participants are informed and if they have complaints regarding the manner in which the research is conducted, it may be given to the researcher, or if an independent person is preferred, to the Research and Publication Head, Research Office, Holy Cross College of Calinan with the following numbers: 295-0797 or 09491985644.



HOLY CROSS COLLEGE OF CALINAN, INC

Davao- Bukidnon Highway, Calinan Poblacion, Davao City

October 25, 2022

MISS CHERRY ROSE TACAY

Teacher
This Institution

Dear Ms. Tacay,

Greetings of peace and solidarity!

We, Ella Kristina Jeanne Albarracin, Kristine Grace Sacamos, Althea Bea Omo, Nyehlla Sophia Dagondon, and Albert Alexius Benedict Soliven enrolled in the class of Practical Research 2 are conducting a research entitled: "**Assessing Flood Vulnerability in Barangay Riverside, Calinan, Davao City**". This study aims to find out the level of flood vulnerabilities in Barangay Riverside and if there is a significant difference on the level of flood vulnerability of the respondent when compared according to their socio-economic status and number of members in the family. The following are the research questions to be addressed in this study.

1. What is the profile of respondents in terms of:
 - 1.1 Socio-economic status; and
 - 1.2 Number of members in the family?
2. What is the level of flood vulnerability of the residents in terms of:
 - 2.1 Exposure;
 - 2.2 Susceptibility; and
 - 2.3 Lack of resilience?
3. Is there a significant difference on the level of flood vulnerability of the respondents when compared according to:
 - 3.1 socio-economic status; and
 - 3.2 Number of members in the family?

May we request your kind assistance in validating the questionnaire of the research study. Would you please fill up the attached validation sheet and give suggestions/comments for the improvement of our questionnaire.

Should you wish to know more about the study, please feel free to contact:

Kristine Grace Sacamos
Cellular number: 09205394656

Thank you very much for your help.

Very truly yours,

Ella Kristina Jeanne Albarracin
Researcher

Nyehlla Sophia Dagondon
Researcher

Kristine Grace Sacamos
Researcher

Albert Alexius Benedict Soliven
Researcher

Althea Bea Omo
Researcher

Noted by:

Mrs. Jessica Rabang
Research Adviser

Approved By:

Ms. Cherry Rose Tacay
Validator



HOLY CROSS COLLEGE OF CALINAN, INC

Davao- Bukidnon Highway, Calinan Poblacion, Davao City

November 21, 2022

MISS RIALYN BAGUIO

Teacher

This Institution

Dear Ms. Baguio,

Greetings of peace and solidarity!

We, Ella Kristina Jeanne Albarracin, Kristine Grace Sacamos, Althea Bea Omo, Nyehlla Sophia Dagondon, and Albert Alexius Benedict Soliven enrolled in the class of Practical Research 2 are conducting a research entitled: "**Assessing Flood Vulnerability in Barangay Riverside, Calinan, Davao City**". This study aims to find out the level of flood vulnerabilities in Barangay Riverside and if there is a significant difference on the level of flood vulnerability of the respondent when compared according to their socio-economic status and number of members in the family. The following are the research questions to be addressed in this study.

1. What is the profile of respondents in terms of:
 - 1.1 Socio-economic status; and
 - 1.2 Number of members in the family?
2. What is the level of flood vulnerability of the residents in terms of:
 - 2.1 Exposure;
 - 2.2 Susceptibility; and
 - 2.3 Lack of resilience?
3. Is there a significant difference on the level of flood vulnerability of the respondents when compared according to:
 - 3.1 socio-economic status; and
 - 3.2 Number of members in the family?

May we request your kind assistance in validating the questionnaire of the research study. Would you please fill up the attached validation sheet and give suggestions/comments for the improvement of our questionnaire.

Should you wish to know more about the study, please feel free to contact:

Kristine Grace Sacamos
Cellular number: 09205394656

Thank you very much for your help.

Very truly yours,

Ella Kristina Jeanne Albarracin
Researcher

Kristine Grace Sacamos
Researcher

Althea Bea Omo
Researcher

Nyehlla Sophia Dagondon
Researcher

Albert Alexius Benedict Soliven
Researcher

Noted by:

Mrs. Jessiva Rabang
Research Adviser

Approved By:

Ms. Rialyn Baguio
Validator



Holy Cross College of Calinan, Inc.
Davao-Bukidnon Highway, Calinan, Davao City

Research Assessment Tool and Validation Sheet

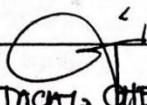
Name of Evaluator : Ms. Cherry Rose S. Tacay
Degree : BSED-Social Studies
Position : Social Studies Teacher
Institution : HCCC-BEd

To the Evaluator: Please check the appropriate box for your ratings.

POINT EQUIVALENT: 1 – Poor 3 – Good 5 - Excellent
2 - Fair 4 – Very Good

Criteria/ Indicators		1	2	3	4	5
1	CLARITY OF DIRECTIONS AND ITEMS The vocabulary level, language structure and conceptual level of questions suit to level of respondents. The test directions and items are written in clear and understandable manner.				✓	
2	PRESENTATION/ ORGANIZATION OF ITEMS The items are presented and organized in logical manner.				✓	
3	SUITABILITY OF ITEMS The items appropriately represent the substance of the research. The questions are designed to determine the condition, knowledge, perception and attitudes that are supposed to be measured.				✓	
4	ADEQUATENESS OF ITEMS PER CATEGORY The items represent the coverage of the research adequately. The number of questions per area category is representative enough of all the question needed for the research.				✓	
5	ATTAINMENT OF PURPOSE The instrument as a whole fulfills the objectives for which it was constructed.				✓	
6	OBJECTIVE Each item question requires only one specific answer or measure only one behavior and no aspect of questionnaire suggest bias on the part of the researcher.				✓	
7	SCALE AND EVALUATION RATING SYSTEM The scale adapted is appropriate for the items.				✓	

Comments and Suggestions: _____


TACAY, CHERRY ROSE

Signature Evaluator



Holy Cross College of Calinan, Inc.
Davao-Bukidnon Highway, Calinan, Davao City

Research Assessment Tool and Validation Sheet

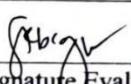
Name of Evaluator : Ms. Rialyn V. Baguio
Degree : BSED- Major in Mathematics
Position : Math Teacher
Institution : HCCC-BEd

To the Evaluator: Please check the appropriate box for your ratings.

POINT EQUIVALENT: 1 – Poor 3 – Good 5 - Excellent
 2 - Fair 4 – Very Good

	Criteria/ Indicators	1	2	3	4	5
1	CLARITY OF DIRECTIONS AND ITEMS The vocabulary level, language structure and conceptual level of questions suit to level of respondents. The test directions and items are written in clear and understandable manner.				/	
2	PRESENTATION/ ORGANIZATION OF ITEMS The items are presented and organized in logical manner.				/	
3	SUITABILITY OF ITEMS The items appropriately represent the substance of the research. The questions are designed to determine the condition, knowledge, perception and attitudes that are supposed to be measured.			/		
4	ADEQUATENESS OF ITEMS PER CATEGORY The items represent the coverage of the research adequately. The number of questions per area category is representative enough of all the question needed for the research.			/		
5	ATTAINMENT OF PURPOSE The instrument as a whole fulfills the objectives for which it was constructed.			/		
6	OBJECTIVE Each item question requires only one specific answer or measure only one behavior and no aspect of questionnaire suggest bias on the part of the researcher.			/		
7	SCALE AND EVALUATION RATING SYSTEM The scale adapted is appropriate for the items.				/	

Comments and Suggestions: _____


Signature Evaluator



HOLY CROSS COLLEGE OF CALINAN, INC.
Davao-Bukidnon Highway, Calinan Poblacion, Davao City

Subject:

I, _____, agree to participate in the study in which purpose is to help residents know the level of flood vulnerability in the area and if there is a significant difference on the level of flood vulnerability of the respondents when compared according to socio-economic status and number of members in the family. I am fully aware that the study will be conducted by Ella Kristina Jeanne Albarracin, Kristine Grace Sacamos, Althea Bea Omo, Nyehlla Sophia Dagondon, and Albert Alexius Benedict Soliven and will be supervised by Mrs. Jessica Rabang, their research adviser.

Before the onset of the study, the researchers explained to me the nature and extent of my involvement in this project. Also, during the orientation, participants were informed of the following:

- a. that there are no known risks in our participation;
- b. that my participation will involve the study's purpose is to help residents know the level of flood vulnerability in the area and if there is a significant difference on the level of flood vulnerability of the respondents when compared according to socio-economic status and number of members in the family;
- c. that the information they obtained from me will be kept confidential and that only them and their research adviser will have access on it; and
- d. that my name and the organization where I am connected will never be mentioned in the final report.

In this study, my participation is entirely voluntary and I am free to withdraw at any time without affecting my relationship with the researchers and Holy Cross College of Calinan.

For possible queries and complaints regarding the conduct of the study, contact details of the researchers and their adviser are provided.

Participant's signature

Date

12-23-22

Researcher's signature

Date

Complaints about this research:

This project has been approved by his/their research adviser. Should you have concerns about your rights as a participant in this research, or should you have a complaint about the manner in which the research is conducted, please feel free to contact Mrs. Jessica Rabang through her number 09304649677 or email her at jessrabang75@gmail.com. Alternatively, you can direct your queries to the school's Research and Publication Officer through number: 2950797.



HOLY CROSS COLLEGE OF CALINAN, INC

Davao- Bukidnon Highway, Calinan Poblacion, Davao City

SURVEY QUESTIONNAIRE

Assessing Flood Vulnerability in Barangay Riverside, Calinan, Davao City

We are carrying out an evaluation on the level of flood vulnerability and if there is a significant difference on the level of flood vulnerability of the respondents when compared according to socio-economic status and number of members in the family. Your response to this survey is crucial in providing the necessary information.

If you have any query about the questionnaire, please do not hesitate to approach any of the researchers. Your honest and sincere response and time given to answer the evaluation is greatly appreciated.

Thank you very much for your cooperation.

Instruction: Please check or supply the information needed in the space provided.

Name (Optional) _____

Instruction: Please check according to Monthly Income

Less than PhP 10,957 Between PhP 10,957 to PhP 21,914

Between PhP 21,914 to PhP 43,828 Between PhP 43,828 to PhP 76,699

Between PhP 76,699 to PhP 131,484 Between PhP 131,483 to PhP 219,140

At least PhP 219,140

Number of family members

5 or less than 5

More than 5

Instruction: Please check the box according to the following scale:

1 = Never 2 = Rarely 3 = Sometimes 4 = Often 5 = Always

		1	2	3	4	5
Exposure						
1	Do you typically suffer flooding in your community whenever there is heavy rain?					
2	How often is your area exposed to flood?					
3	Does the things inside your house get damaged by the flood?					
4	Do floods affect water quality and sediment quantity in your area?					
5	Do people still want to live in your flood prone area?					
Susceptibility						
1	Do the people with disabilities or sickness in the area get affected by any recent flooding?					
2	Do you get a flood warning/forecast?					
3	Are you aware of the risk of flood?					
4	Would you consider using flood maps for spatial planning in buying or using a new land?					
5	Does the local government provide protection measures?					
Lack of Resilience						
1	Were you able to recover from the previous flood?					
2	Are you always prepared for a flood?					
3	Are you prepared for the risk that a flood would cause you to lose your income, career, or business?					
4	Do you seek shelter during and after the flood?					
5	Do you still use or stay at your house after the flood?					

1 Number of Respondent	Socio- economic	Number of Family	Exposure					Susceptibility					Lack of Resilience					
			E1	E2	E3	E4	E5	S1	S2	S3	S4	S5	L1	L2	L3	L4	L5	
3	1	1	2	5	5	5	5	3	1	3	5	3	1	5	5	5	4.066667	
4	2	1	2	5	5	4	5	5	5	5	3	1	3	5	5	5	4.133333	
5	3	1	1	3	2	5	5	5	3	5	4	1	5	3	5	5	3.933333	
6	4	1	1	2	2	2	3	5	3	5	1	1	5	3	5	1	5	3.066667
7	5	1	1	4	3	2	2	3	2	3	5	4	4	5	5	1	5	3.533333
8	6	3	2	2	3	3	3	4	3	3	4	5	1	5	4	1	4	5
9	7	1	1	3	2	4	1	5	5	1	5	3	1	5	5	1	5	3.4
10	8	1	1	3	3	5	5	5	4	4	5	5	5	5	5	1	5	4.466667
11	9	1	1	4	3	4	5	1	5	5	5	5	5	5	4	5	5	4.4
12	10	1	1	3	3	4	5	2	5	1	5	4	5	5	5	5	5	4.133333
13	11	1	1	5	5	4	5	5	5	5	5	5	5	5	1	5	5	4.666667
14	12	1	1	5	4	2	2	3	4	5	3	3	4	3	2	2	2	3.266667
15	13	1	1	5	4	2	4	3	4	5	3	4	2	2	2	3	3	3.533333
16	14	1	1	2	5	5	5	5	3	5	5	4	1	5	3	5	5	4.2
17	15	1	1	5	4	1	1	1	1	1	1	1	5	1	5	1	5	2.266667
18	16	1	1	3	2	5	5	5	3	4	5	1	5	3	3	5	5	3.933333
19	17	1	1	3	4	1	4	5	1	5	5	4	2	5	5	5	5	3.933333
20	18	1	1	2	2	3	3	5	3	2	5	3	3	5	1	2	5	3.133333
21	19	2	1	3	3	1	5	3	5	5	5	1	3	4	5	5	5	3.866667
22	20	1	1	5	5	5	5	5	5	5	3	4	4	5	5	5	5	4.733333
23	21	1	2	2	3	3	2	5	1	5	5	1	2	1	1	3	5	2.933333
24	22	1	1	2	5	5	1	2	5	5	1	5	2	1	1	1	5	3.133333
25	23	2	1	5	1	5	4	4	5	5	5	1	5	5	5	5	5	4.066667
26	24	7	1	5	4	5	5	5	5	4	1	5	5	5	5	5	5	4.6
27	25	1	1	5	4	5	3	1	5	5	4	5	5	2	2	5	5	4.266667
28	26	1	1	5	5	3	5	1	5	5	2	5	3	5	2	5	5	4.066667
29	27	1	1	2	3	2	5	1	5	5	1	3	5	1	1	5	5	3.533333

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
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54	52	2	1	3	4	2	3	3	4	3	4	5	4	3	1	1	5	3,2666667	
55	53	3	1	4	4	3	4	5	1	5	5	1	5	3	4	5	5	3,8666667	
56	54	1	1	3	3	2	3	3	5	5	3	2	5	5	2	5	5	3,6	
57	55	1	1	2	2	1	3	3	1	2	5	3	5	1	1	1	5	2,9333333	
58	56	2	1	3	2	1	1	5	1	5	5	3	2	5	3	3	5	3,2666667	
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A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
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62	60	2	1	4	2	1	4	5	2	5	5	4	5	4	1	2	5	3.4666667
63	61	1	1	5	5	5	5	5	5	5	5	5	1	5	5	5	5	4.7333333
64	62	1	1	3	4	3	5	5	5	1	5	3	5	5	5	5	5	4.2666667
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70	68	1	1	3	3	3	3	5	1	2	5	5	5	5	5	1	5	3.7333333
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72	70	1	1	4	5	2	1	5	4	1	3	5	4	4	4	1	5	3.4666667
73	71	1	1	4	4	1	3	5	5	4	4	5	4	3	3	5	4	5.9333333
74	72	1	2	5	5	3	1	5	1	5	5	1	5	5	5	5	5	4.0666667
75	73	1	1	5	5	5	5	5	1	5	5	3	4	5	5	2	5	4.3333333
76	74	1	2	3	3	2	3	5	5	5	5	2	5	5	3	1	5	3.8
77	75	1	1	3	3	2	4	1	1	1	5	2	4	5	5	1	5	2.8666667
78	76	1	1	3	4	1	2	4	3	3	5	1	3	5	5	1	5	3.3333333
79	77	1	1	4	5	5	5	5	1	5	5	3	5	5	1	1	5	4.2666667
80	78	1	1	3	2	3	1	2	3	1	2	3	2	5	3	2	2	2.4666667
81	79	2	1	4	5	3	3	4	4	3	3	2	4	3	3	2	5	3.4
82	80	3	1	4	3	3	2	3	2	3	5	4	4	5	5	4	4	4
83	81	1	2	3	2	2	3	4	3	2	4	2	3	3	4	4	3	3
84	82	3	1	4	4	5	4	5	5	3	5	3	5	5	4	1	5	4.2
85																		
86																		3.892272.926834.81707

Appendix 7: Editor's Certificate

**HOLY CROSS COLLEGE OF CALINAN, INC.**

Davao- Bukidnon Highway, Calinan Poblacion, Davao City

RESEARCH AND PUBLICATION OFFICE**CERTIFICATION**

This is to certify that the research paper of Albarracin, Ella Kristina Jeanne, Sacamos, Kristine Grace, Omo, Althea Bea, Dagondon, Nyehlla Sophia, and Soliven, Albert Alexius Benedict entitled **ASSESSING FLOOD VULNERABILITY IN BARANGAY RIVERSIDE, CALINAN, DAVAO CITY** has undergone the editing process and been approved by the undersigned.

This certification is issued upon the request by the researcher on August 2, 2023

RIZALITO H. PAGA, PhD

Editor

CURRICULUM VITAE

PERSONAL DATA

Name:	Ella Kristina Jeanne A. Albarracin	
Age:	18	
Date of Birth:	December 18, 2004	
Place of Birth:	Davao City	
Phone Number:	09928696062	
Address:	Biao Escuela, Tugbok District, Davao City	
Email:	ekjalbarracin@gmail.com	
Civil Status:	Single	
Citizenship:	Filipino	
Religion:	Roman Catholic	
Sex:	Female	
Father's Name:	Elmer G. Albarracin	Occupation: Radio Operator
Mother's Name:	Jennifer A. Albarracin	Occupation: Housewife



EDUCATIONAL BACKGROUND

	School	Year Graduated
Elementary:	Biao Elementary School	2017
High School:	Holy Cross College of Calinan	2021
Senior High School:	Holy Cross College of Calinan	2023
Strand:	Science, Technology, Engineering, Mathematics (STEM)	

CURRICULUM VITAE

PERSONAL DATA

Name: Krisine Grace F. Sacamos
Age: 18
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Place of Birth: Davao City
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Email: sacamoskritine.grace@gmail.com
Civil Status: Single
Citizenship: Filipino
Religion: Roman Catholic
Sex: Female
Father's Name: Jose Albert C. Sacamos **Occupation:** Teacher
Mother's Name: Rodora F. Sacamos **Occupation:** Housewife



EDUCATIONAL BACKGROUND

	School	Year Graduated
Elementary:	Holy Cross College of Calinan	2017
High School:	Holy Cross College of Calinan	2021
Senior High School:	Holy Cross College of Calinan	2023
Strand:	Science, Technology, Engineering, Mathematics (STEM)	

CURRICULUM VITAE

PERSONAL DATA

Name:	Althea Bea O. Omo	
Age:	18	
Date of Birth:	June 20, 2005	
Place of Birth:	Davao City	
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Email:	altheabeaomo20@gmail.com	
Civil Status:	Single	
Citizenship:	Filipino	
Religion:	Roman Catholic	
Sex:	Female	
Father's Name:	Stanley V. Omo	Occupation: Barangay official/Farm owner
Mother's Name:	Elvira O. Omo	Occupation: Stesso Apparel Owner / business marketer

EDUCATIONAL BACKGROUND

	School	Year Graduated
Elementary:	Philippine Nikkie Jin Kai Calinan Campus	2017
High School:	Sirib National Highschool	2021
Senior High School:	Holy Cross College of Calinan	2023
Strand:	Science, Technology, Engineering, Mathematics (STEM)	

CURRICULUM VITAE

PERSONAL DATA

Name: Nyehlla Sophia T. Dagondon
Age: 18
Date of Birth: June 17,2005
Place of Birth: Davao City
Phone Number: 09995886369
Address: Prk. 2, Riverside, Calinan, Davao City
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Civil Status: Single
Citizenship: Filipino
Religion: Roman Catholic
Sex: Female
Father's Name: N/A **Occupation:** N/A
Mother's Name: Maria Rhea B. Taguibao **Occupation:** Home Base



EDUCATIONAL BACKGROUND

	School	Year Graduated
Elementary:	Calinan Lam Adventist Academy	2017
High School:	Holy Cross College of Calinan	2021
Senior High School:	Holy Cross College of Calinan	2023
Strand:	Science, Technology, Engineering, Mathematics (STEM)	

CURRICULUM VITAE

PERSONAL DATA

Name: Albert Alexius Benedict U. Soliven
Age: 17
Date of Birth: November 21,2005
Place of Birth: Matiao, Mati City
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Address: Purok 10, Wangan, Calinan, Davao City
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Civil Status: Single
Citizenship: Filipino
Religion: Roman Catholic
Sex: Female
Father's Name: Jose AlfredoD. Soliven **Occupation:** Businessman
Mother's Name: Dione U. Soliven **Occupation:** Businesswoman



EDUCATIONAL BACKGROUND

	School	Year Graduated
Elementary:	Holy Cross College of Calinan	2017
High School:	Holy Cross College of Calinan	2021
Senior High School:	Holy Cross College of Calinan	2023
Strand:	Science, Technology, Engineering, Mathematics (STEM)	