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HAZARD AND CLIMATE RISK MANAGEMENT OF FARMING AND FISHING COMMUNITIES IN GARCHITORENA

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Abstract

The study was carried out to assess the hazard and climate risk management of farming and fishing communities in the Municipality of Garchitorena. Five (5) most vulnerable barangays were selected as study areas: Barangay 1, Ason, Canlong, Mansangat and Pambuhan. The study used descriptive and developmental research designs following a step by step assessment. Descriptive research design was used to assess the municipality's hazard and climate risk management. Developmental research design was used to formulate plans and policies apt to the local situation. The major part of the land of the municipality is agriculture with large acres of marine and aquatic resources. Farming and fishing are the major sources of food and income. Hence, the municipality is very vulnerable to climatological and hydrometeorological hazards due to its physical, environmental and socioeconomic condition. The major hazard is tropical cyclone. Climate risks include more intense and frequent rainfall, longer dry period, sea level rise and increasing ocean temperature. Major risk impacts include destruction of agriculture and coastal resources, rough seas that obstruct fishing, resulting to very low or no harvest and ultitely, scarcity in food and financial distress. The vulnerability factors, the local adaptation and coping mechanisms, the strengths and gaps were identified and discussed . On the basis of findings, socioeconomic condition and poor local governance intensify the vulnerability of the municipality. From the evaluation of the Local Government Unit's programs and initiatives, hazard and climate risk reduction and management is currently of less priority and behind in its policy and planning. Therefore, medium and long term plan of action and policies were formulated and recommended to help manage and reduce the risks posed by climatological and hydrometeorological hazards.

Keywords : Hazard, Climate Risk Management, Farming and Fishing Communties, Garchitorena.

INTRODUCTION

Today, the world is facing a great challenge, disaster events are increasing due to natural hazards and climate change, [11]. Since 1990, the Philippines has been affected by natural hazards that turned into disasters. These disaster events have caused fatalities and ecomic losses in the country. This is due to vulnerability of the

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country to natural hazards, 60% of the country's total land area is exposed to multiple natural hazards and 74 percent of the population is vulnerable to their impact, [16]. The adverse impact of climate variability and climate change is felt throughout the coastal towns of the Philippines including island provinces[5].

The Municipality of Garchitorena is one of the remote coastal towns in the Philippines where fishing and farming are the major sources of food and income. Land area is predominantly utilized for agricultural production. Aside from agriculture, its extensive fishing ground and abundant marine resources provide added source of food and income to the inhabitants and revenue to the the local treasury [8]. Hence, due to its geographical location, Garchitorena has been frequently hit by natural hazards and climate variability which is exacerbated by climate change. Such hazards and climate-related events have put fragile agricultural and fishery eco-systems at risk, which consequently result to livelihood and financial distress [5]. During these climate related events, the roads are muddy and slippery rendering them virtually impassable; at the same time the seas are rough making it dangerous for sea craft to navigate. These problems on transportation contribute to the economic woes of the municipality resulting in poverty & scarcity in food which make people starve and unfortunately lead to urban migrations[8]. The havoc that the municipality is facing needs precise attention. A science and community based hazard and climate risk information must be taken into consideration. An informed decision making is crucial in development planning and implementation of programs apt to the local situation. A situational assessment of the most vulnerable barangays must be carried out in order to collect basic information about the vulnerability of the communities to natural hazards and climate change impacts [5]. In line with this approach, an assessment has been carried out in five (5) most vulnerable barangays of the Municipality of Garchitorena. The hazards, climate risks and livelihood vulnerabilities were identified in the study along with the communities' strategies to cope and adapt with the hydrometeorological and climatological hazards. The initiative and management at the municipal level was also evaluated. The result of the study will serve as basis in drawing up policies and programs to address hazards and climate risks and help attain resilient communities abling to increase farmers' and fisher folks' income, leading to an improved human well-being. This study generally aims to assess the hazards, climate risks, vulnerabilities and coping capacities of the farming and fishing communities and determine the management and initiatives of the local government unit of Garchitorena to lessen the adverse impact of natural hazards. Specifically this study aims to: (1) describe the physical and demographical characteristics of the municipality; (2) identify the hydrometeorological hazards and climate risks of the fishing and farming communities; (3) describe livelihood profile and vulnerabilities of the fishing and farming communities; (4) determine the strategies of the farming and fishing communities to cope with the hydrometeorological hazards and climate risks; (5) identify the municipality's management and initiatives to strengthen the communities' ability to cope with the hazards, climate risks and minimize vulnerabilities; (6) recommend programs and policies to lessen the impact of the hydrometeorological hazards and climate risks on

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fishing and farming communities making them able to produce food and increase farming and fishing income.

Methodology

The study used a step by step assessment process: 1. Review of related literature about the study areas; 2. Conduct of preliminary examination of the locality; 2. Conduct actual field assessment through Participatory Rural Appraisal (PRA) sessions: Focus Group Discussions (FGD) and Key Informant Interviews (KII); and 4. Structuring and analysis of findings, [5].

The study selected three (5) most vulnerable barangays as pilot areas, these are: Barangay 1, Poblacion, Mansangat, Ason, Pambuhan and Canlong, (Figure 1). Primary Data were gathered using through Focus Group Discussions (FGD) and Key Informant Interviews using different tools such as livelihood seasonal calendar, hazard, risk and vulnerability assessment, historical timeline, institutional capacity assessment and livelihood groups profiling. Representatives from the following sectors were selected for the focused group discussion and key informant interview: Farmers, Fisher folks, Barangay Local Officials (Punong Barangay, Chairman Committee on Agriculture and Fishery), Chairman BFARMC, Oldest Fisher folk/Farmer, Women/Youth representative, Peoples Organizations (POs), Barangay Health Worker, Municipal Agriculture Office, Municipal Planning and Development Office, Municipal Assessor's Office. To carry out the livelihood groups profiling, the following methods were used in the assessment process: Classification and ranking through FGD; Characterization through small group discussion and brainstorming; Seasonal occupation assessment, CBMS data. The secondary data were generated from local government unit and other sources available in the form of reports and related studies. The study used descriptive statistical analysis, including prioritization and ranking in analyzing qualitative and quantitative information gathered during the different assessment phases of the study. Microsoft excel was used to analyze the data. Maps were generated from the comprehensive land use plan of the municipality and downloaded from official websites.

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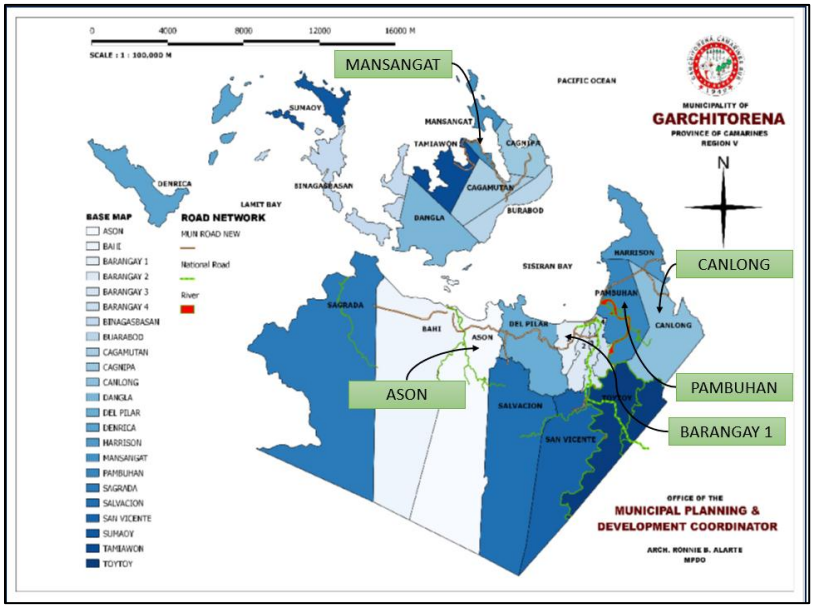

Figure 1. The Study Barangays

Results and Discussions

Municipality's Physical and Demographic Characteristics

The land area of Garchitorena is 27,392 hectares. It has a total number of household of 4,348 and a total number of population of 32,061. The municipality has 23 barangays, 20 of these are coastal barangays and 3 are upland barangays[8]. Garchitorena is a 4th class municipality from which the main sources of livelihood are fishing and farming, primarily coconut plantation and marine fishery. Population per barangay was identified using the CBMS database. Among the Barangays, Barangay 1 has the highest number of households and with the highest number of population [7].

Garchitorena is situated at 13.880 latitude and 123.697 longitude within the 4th district of the province of Camarines Sur, Philippines, [24]. Garchitorena is facing the Pacific Ocena situated on its North, on its East is Caramoan, on the West is Lagonoy, and on its south are Presentacion and Lagonoy, (Figures 2 and 3) [23].

Hydrometeorological and Climatological Hazards

There are two (2) majoy types of winds in Garchitorena: the Northeast monsoon winds and the Southwest monsoon winds. Northeast Monsoon is the most destructive wind

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in Garchitorena, [20]. It is dominant during the months of November to February. Destructive typhoons usually occur during north east monsoon. Lean months happen during northeast monsoon where fish catch is very low because of rough seas. Agriculture production is also affected because of the intense rainfall and strong winds that tend to damage the crops. The southwest monsoon is dominant from the months of July to August. This kind of wind has the potential to cause damages in rice and vegetable crops and can also hinder fishing activities. Figure 3 shows the direction of Northeast and Southwest monsoon winds.

There are also local winds that are destructive to the municipality like “hiraga” or West to East wind direction.” This type of wind is dominant from November, December and January. The residents find it difficult to sail and go for fishing during this type of winds due to strong waves. They also cannot culture seaweeds during “hiraga” wind season. Another local wind called “Dumagsa” or Northe-East wind direction. This kind of wind is experienced from the months of October to December and January to February. This is a lean season for the inhabitants as they find difficult to catch fish in the Pacific Ocean during this period due to strong waves. And then the “Salatan” means East-West, destructs the agriculture crops especially during vegetative and reproductive stage. This wind is also associated with extreme rainfall that sometimes cause landslides and floods that can damage their agricultural lands and crops.

Barangay 1, Poblacion, has very high susceptibility to flooding but with low susceptibility in landslide. Barangay Canlong has moderate and high landslide susceptibility and some portion with high susceptibility to flooding. Barangay Mansangat has high susceptibility in landslide but with one area that is very high susceptibility in flooding. Barangay Ason has a very high flood susceptibility but with low landslide susceptibility while majority of Barangay Pambuhan has low landslide susceptibility and communities living near the riverbanks are with very high flood susceptibility.

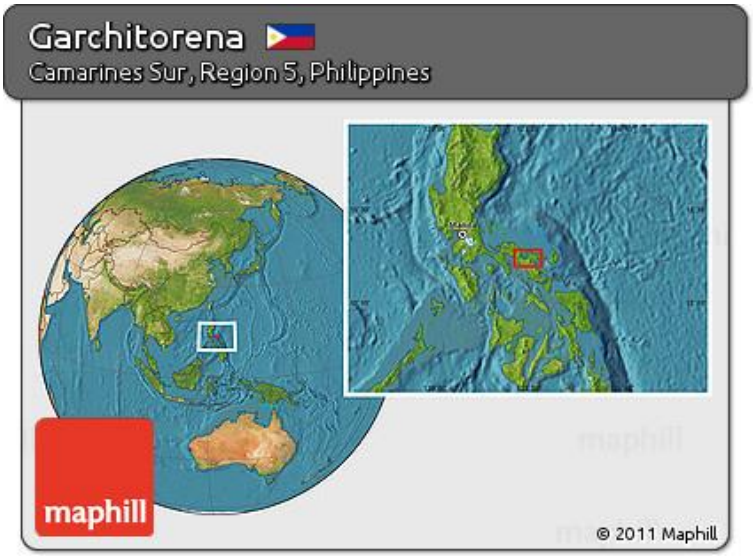

Figure 2. Location of the Municipality Garchitorena in the Philippines (Source: [23] [24])

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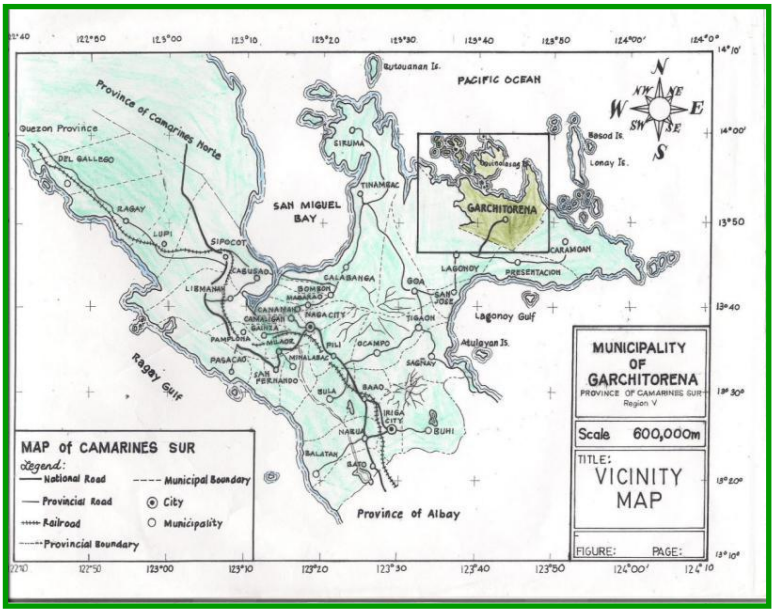

Figure 3. Vicinity Map of Garchitorena, (Source: [8])

Climate Risks

According to Mines and Geoscience Bureau, Camarines Sur has high risk in tropical cyclones as it is facing the Pacific Ocean where typhoons are originated. The provinces is often to experience more intense and frequent rainfall that may result to severe flooding. There is no volcano near the province, so the risk to volcanic eruption is low, [20]. Climate risks in the municipality were identified with the support from the information taken from the historical timeline through focused group discussion. The pattern of changes were identified, the participants were asked to recall their experiences from the year 1960 to 2017. Table 1 shows the result of the historical timeline. To identify the risk, the study used communities' perception to future and current risk risks.

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Table 1. Historical timeline. (Source: FGD, 2017)

Year	Occurrence
1960–1970	The condition of the ecosystem is very good - the participants describe it as “healthy environment” Majority of fish species and other marine products are still available in marine; Corals are healthy; Primary forests are in good condition where wild animals still can be found; Communities do not experience flooding; Climate is still predictable where farmers can still rely. Dry and wet seasons are consistent with months. Foods are abundant from forest and marines products. Farmers do not experience problems in farming, harvest are abundant with no synthetic fertilizers and pesticides.
1971-1989	Marine products are still abundant, there are normal supplies of fish and other marine products; Forest and watershed areas are still in good condition however, illegal logging and kaingin system have started. People experience the worst typhoon in history – “Bagyong Anding” Typhoon Anding which devasted the whole municipality leaving hundreds of casualties and damage to agriculture, fishery, facilities, livestock and infrastructures.
1989-1999	Illegal cutting of mangroves and conversion to fishpond are prevalent in this period; Illegal fishing are rampant like cyanide, dynamite and use small eye nets; Coral reefs are beginning to be destroyed due to rampant illegal fishing; The communities are already experiencing flooding because of decreasing tree population in the upland; Fish population and other marine resources are diminishing; Farmers started to experience a decreasing fish caught and fish catch are getting small in size; The communities experienced another strong typhoon, typhoon

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	Loleng, this brough severe damage to agriculture.
2000-2011	The impact of climate change in the community is already perceived and experienced; The communities already experienced more intense and heavy rainfall; People say the disappearance of shell in the coastlines are due to high amount of fresh water intrustion in the saline shorelines. This is the effect of heavy rains and denuded forest ecosystem; The communities are experiencing floods that they do not experience from the past; The communities already experienced strong tropical cyclones such as Reming, Milenyo and Mina. These tropical cyclones brought severe damage to agriculture and fishery; Droughts are already experienced; Droughts and extreme rainfall increase the pests and diseases infestation in agriculture specifically in rice and vegetable production. The communities are already experiencing saline water intrusion during high tides and strong winds. This affects the rice production; Communites also experienced higher temperature that reduces their seaweeds production and crop yields; Cutting of mangroves and upland trees are still rampant causing the forest and mangrove areas to be denuded; Marine products are beginning to decline; Almost 97% of corals in the whole municipality are dead.
2007-2017	The Local Government Unit of Garchitorena through the Municipal Agriculture Office in partnership with different national agencies such as Department of Agriculture and Bureau of Fishery and Aquatic Resource (BFAR) started to plan and implement programs to support farmer and fisher folks and restore mangrove areas; Capacity Building trainings are implemented such as Fishery Enforcement Trainings; Organizations are established such as Municipal Fishery and Aquatic Resources Management Council; Sisiran Task Force and Farmers Association; Ordinances are being crafted, approved and implemented such as prohibiting mangrove cutting however there are some areas that

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	cutting is still existing; Barangays are adopting ordinances for the protection of Marine and Forest Area; Marine Reserves are already established such as Municipal Fish Sanctuary - Coral Reefs and Mangrove conservation and protection; Mangrove reforestations are implemented in partnership with BFAR and the Department of Social Welfare Department;

Climate Change Impacts

The climate change and its effects were identified through focus group discussion and key informant interviews (Table 2). The participants describes how climate change affects the habitats in the coastal areas. Participants said that their barangay had experienced sea level rise which caused flooding in their locality being in the coastal area. Based from the experiences of the communities, there are shoreline and beach erosions due to frequent occurrence of storm surges in the the coastal areas. Excessive siltation due to deforestation affect the species in mangrove areas. There are instances that when heavy rainfall coincides with the denuded forests surface run-off together with silts are rushing down the coastal area causing a salinity decrease in estuaries. Some species living in the estuaries are affected by the change in the salinity. There are higher mortality in the newly natural planted mangroves causing to slow down growth production. Growth of seagrasses is also affected due to siltation. It also destroys differenct species of shells, seagrasses and corals in the area.

Seaweeds growers are also affected by some change in climate and situation. Decrease in production was noticed when heavy rainfall downpour causing siltation or when drought happens. These climate are not favorable for seaweeds production.

The communities also reveal that strong winds contributed to shoreline erosion due to frequent windsurges. There are instance when rainfall seldom occur and when it rains, the characteristics of rainfall destroys their newly planted vegetables then flooding occurs. Communities also experienced that in an hour, the weather is sunny and no sign of raining, hence, an abrupt rainfall associated with strong winds is experienced.

Communities also revealed that the sea is indeed rising because the sea is already reaching their houses. The waves nowadays are already reaching their houses they have to transfer to another place. Sea level rise felt during the months of November to February where intense rainfall and high tides happened, sometimes storm surges happen during the months of January to March.

At that time, farmers are not using pesticides and insecticides in their agricultural production. Nowadays, if they will not use pesticides and insecticides, nothing will be left in their produce because of the increasing number of pests and diseases due to climate flactuations. Pests and Diseases in crops occur during dry season from April to

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August. Diseases in livestock occur during the entire year, most extreme during the months of June to November where swine flu, hog cholera, pneumonia and new castle disease (NCD) infect the animals.

Table 2. Climate Change Impacts in the municipality. (Source: FGD)

Perceived Impacts of Climate Change	Risks
Rising Sea Level	Flooding in the coastal area;
	Storm surge occurrence that results to shoreline erosions and destruction of houses and livelihoods;
	Rising sea levels cause an increase in salinity in mangrove areas and estuaries, causing some species to migrate and slow down mangrove production and other species production;
Temperature Increase	Seaweeds and corals mortality; Decreasing seaweeds production affecting livelihood of the communities;
	Seagrasses reduced due to heat stress;
	Coral Bleaching are observed in some areas.
More frequent and Heavy Rains	Extreme rainfall in the upland, flood rushing through the lowland affects agriculture and fishery production; Siltation affects corals, seagrasses and seaweeds; Rice are flooded causing a decrease in production; Pests and diseases infestation affect agricultural production.
Strong winds	Wind surges are experienced causing a beach and shoreline erosion and coastal flooding;
Longer dry period (drought)	Longer dry period – no rains for at more than 2 weeks, lands are cracked. Damage to agriculture due to drying of crops in the absence of irrigation facilities. Pest infestations are prevalent during drought. Production decreased leading to very low or no yield and income loss.

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Risk Impact on Various Sectors

A matrix was provided to the participants to determine sectors that are vulnerable to different hazards. The participant are tasked to give statement for each hazard (Table 3). The primary and secondary hazards were presented to the participants. The physical and social impacts were identified through ranking.

The identified risks associated to agricultural production are farm destruction, crop loss, occurrence of pests and diseases which eventuall lead to very low to no yield and hunger.

Tropical cyclones that may result to secondary hazards rank first in terms of their impact to the various sectors; followed by strong and destructive wind due to different types of winds such as southwest & northeast monsoon.

On economic sector - tropical cyclones resulting to various secondary hazards severely affect peoples' livelihood leading to very low to no income. On infrastructure and service sector, people's access to roads are affected. Their houses, schools, lifeline and health facilities are affected. On the human capital sector, hazards may result to livestock mortality, destroys crops and fishery. This may result to poor nutrition due to hunger and poverty. On the social sector, all vulnerable groups including young, elderly, women and disable persons are equally affected by the hazards.

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Table 3. Natural Hazards and their impact to various sectors. (Source: FGD, 2017) [5]

Natural Hazards	Physical																			Social			Total counts	Rank
	Economic						Infrastructure and Services							Human Capital					Environmental Factor		Vulnerable Groups				
	Means of Liveli-	Productive skills	Land	Water	Livestock	Access to re-	Roads	Health	Facilities	School	Electricity	Communication	Transport	Building /housing	Mortality	Diseases	Nutritional Status	Population	Poverty Levels	Soil Quality	Water Quality	Young	Elderly	Differently Able		
1. Tropical Cyclones that may result to secondary hazards:																								125	1
a. Coastal Flooding	√		√	√		√			√	√	√								√	√	√				10	
b. Storm Surge	√		√			√	√							√						√	√	√	√	√	10	
c. River/creek flooding	√		√	√		√	√	√					√	√		√	√		√	√	√	√	√	√	16	
d. Urban Flooding	√		√	√		√	√	√	√	√	√		√	√		√	√		√	√	√	√	√	√	19	
e. Siltation	√		√	√		√		√								√	√		√	√	√				10	
f. Shoreline erosion	√		√			√							√	√					√	√					7	
g. Landslide	√		√			√	√							√						√		√	√	√	9	
h. Strong wind	√		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	23	
2. Northeast and Southwest Monsoon and other local winds	√			√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√		√	√	√	√	21	3
3.Extreme Rainfall that may result to secondary hazards like:																									77	2
a. River/creek flooding	√		√	√		√	√	√					√	√		√	√		√	√	√	√	√	√	16	
b.Urban flooding	√		√	√	√	√	√	√	√	√			√	√		√	√		√	√	√	√	√	√	19	
c. Landslide	√		√		√	√	√	√	√				√						√	√	√	√	√	√	14	

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d. Siltation	√		√	√		√		√								√		√	√	√				9	
4. Drought	√		√	√	√	√		√						√	√	√		√	√	√	√	√	√	15	5
5. Pests and diseases in Crops	√															√		√	√	√				5	6
6. Diseases in Livestock	√				√									√	√			√						5	6
7. Rising Sea Level that may result to secondary hazards:																								16	4
Coastal flooding and erosion	√		√	√									√					√	√	√	√	√	√	10	
Salt water intrusion	√		√	√														√	√	√				6	
Total Counts	17		14	11	5	13	8	9	5	4	3	1	7	9	3	8	9	1	15	15	14	7	8	8		
Rank	1		3	4		3											5		2	2	3					

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Contributing Factors to the Risk Condition due to Natural Hazards

There are identified factors that contribute to the risk condition of farmers and fisher folks due to natural hazards. One of these is the lact of irrigation facilities in the agricultural areas. The farmers find it difficult to produce rice during drought, there is no choice but to wait for the rain to come before planting begins again. Next major factor is the limited support or no support formt the local governmernt unit to capacitate the farmers and provide facilities to increase agicultural production.

For fishery, continuous illegal fishing is one of the major factors contributing to the risk condition of fisher folks. Illegal fishing dramatically decrease fish population making them difficulty in finding fish specially during strong winds. Participants observed that illegal fishing are hardly controlled by the authorities. Enforcers such as “Bantay Dagat” and member of Sisiran Task Force are not active in seaborne patrol operations because they lack equipment, insurance and incentive to perform the task.

Livelihood Profile and Vulnerabilities

One of the triggering factors that exacerbate the impact of climate change and natural hazards among farmers and fishermen is poverty. Poverty is one of the causes of vulnerability to natural hazards and climate change impacts. More than half of the total households of the barangays have income below poverty and food threshold value. Constituents have very low income and there are instances that some of the families income do not meet the amount needed to sustain their food needs. Barangay Mansangat has the highest number of households with income below poverty threshold which is 91%. These housedholds are considered with income that cannot meet and sustain their basic needs. On the other hand, 78% of the total household of Mansangat are living below food threshold value. Mansangat is considered as the most vulnerable barangay in the municipality. Nevertheless, Barangay Pambuhan has the highest number of households experienced with food shortage. Figure 2 shows magnitude of households living with income below poverty threshold value.

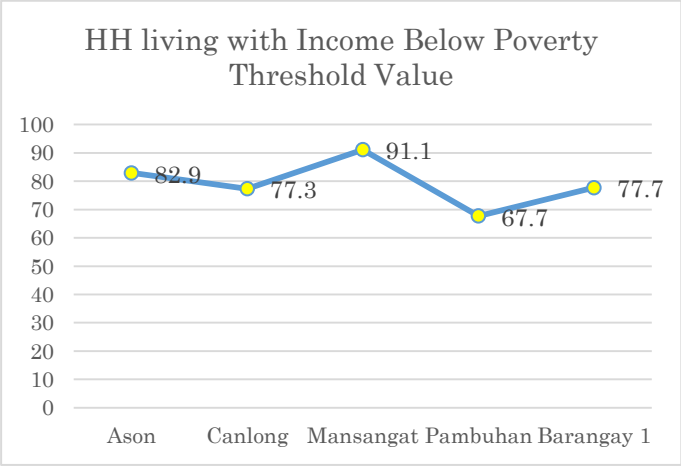

Figure 2. Proportion of household living below poverty threshold value, Source: [7]

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The Vulnerability of Different Livelihood Groups

Farming is the major source of livelihood of the communities. However one of the major lacking in farm operations is irrigation facilities. Farmers rely only on springs and wells in irrigating their farmlands. Majority of the farmers use traditional farming method which utilizes carabao and human power to cultivate land. The municipality has only two (2) service threshers which is being rented by the farmers who wish to use it. Other farmers were complaining due to unfair scheduling of utilization of the thresher.

Another major source of income of the constituents is fishing. However, when storm or strong winds hit the municipality they shift to other means of livelihood. Life is hard during storm seasons, when farmers and fisher folks cannot operate whether farming or fishing. All are affected by the climate variability and climate change. Communities in the island such as Barangay Mansangay and Canlong cannot cross the sea during storm seasons to buy foods. These affected people experienced hunger and famine during the hard season. The hardest months or they call it poverty months and food shortage start from the month of October to February. During these months, seas are rough and rainfall are intense and heavy, causing it difficult for them to plant or even do fishing activities.

Hydrometeorologial and climatological factors such as tropical cyclones and monsoon winds associated with more intense and heavy rainfall is the most prominent hazards that affect the communities. When theses events coincide with the vulnerable sectors disasters happen. Non-climatic factors that contribute to vulnerabilities are high input cost, lack of capital and support from government agencies are some of the factors that exacerbate the impact of natural hazards.

Adaptation and Coping Capacities of Farming and Fishing Communities

One of the strengths of the farmers in the municipalies is the ownership of their vast lands through Comprehensive Agrarain Reform Program awarding of land. Fishermen are also granted with free access to wide marine areas where they can harvest fish anytime. They can operate multiple cropping and fishing activities anytime within the municipal boundaries. Capacity building trainings are also conducted to capacitate farmers such as trainings on climate change proofing for vegetable production through the implementation of Comprehensive Agrarian Reform Program (CARP) of the Department of Agrarian Reform (DAR); Farmers Field School through Agricultural Traning Institute. There are also interventions coming from the Municipal Agriculture Office such as distribution of vegetable seeds, corn and certified seeds. This is to encourage them to plant and produce more.

For fishery, there are upcoming implementation of Marine Reserve and Fish Sanctuary which will help lessen illegal activities and replenish destroyed coral reefs. Fish-

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ermen also received interventions from the Bureau of Fishery and Aquatice Resources (BFAR) such as banca, fishing nets and other fishing paraphernalia. Fisher folks are willing to cooperate with the programs of the municipality in partnership with BFAR such as strengthening the capacities of the “Bantay Dagat” and Sisiran Task Force for seaborne patrol operations. Fisher folks and farmers are already registered where they can have access to any interventions given by the government.

The coping and adaptation strategies of the farming and fishing communities are shown in Table 4.

Table 4. Strategies of the communities to cope with the hazard and climate risks. (Source: FGD, 2017)

Communities' Perceive Changes	**Communities' experience impacts**	**Communities' Adaptation and Coping Strategies**	**Communities' Perceived Future Risk**
Rainfall Decrease	Decreasing agricultural productivity	Using drough resistant and early maturing varieties in rice production; Shifting from lowland to upland farming; Planting of rootcrops; Delayed planting; Manual watering;	Very low to no yield causing scarcity in food – hunger and poverty.
Drought	Crack of ricefields; Dry well and creeks; Limited to no water available for planting; Unproductive lands	Manual watering for vegetable production; Mulching using indigenous materials; No planting or delaying of planting season; Buying of foods when no produce; Livelihood switching.	Very low to no yield causing scarcity in food – hunger and poverty. Malnutrition and health problems.
Temperature In-	Decrease is sea-	Shifting to other	Loss of livelihood

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crease	weeds production; Corals and sea-weeds mortality; Decrease in fish production.	means of livelihood;	and income; Low production; Low fish catch; Scarcity in food and hunger
Extreme Rainfall Events	Impact of heavy raindrops destroy new planted crops specially vegetable; Damage to crops such as rice due to floods and flash-floods;	Temporary drainage canals are con-structed; Vegetable mulching to protect new planted; Farmers switch to other livelihood such as buying and sell-ing;	Lesser yield and income; Food insecurity
	Seaweeds, corals and seagrass mor-tality due to silta-tions associated with chemicals from farming; Pests and Diseases Infestations to rice; Decrease of marine species in man-grove areas;	Farming of sea-weeds are trans-ferred afar from the seashore areas to avoid siltations; Applying pesticides and insecticides; Fishing outside the barangay bounda-ries.	Decresing liveli-hood and income; Decreasing marine products and fish catch; More time for fish catching; Low income, hun-ger and poverty.
Rising Sea Level	Rice production is affected due to salt water intrusion; Crops decay re-sulting to death; Low Yield for the farms near the	Farms are relocated to other areas where salt water intrusion will not affect vege-table and rice pro-duction; No farming during the months where salt water intrustions	Low Yield; Low Income; Decreasing farm areas; Food shortage

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	shorelines.	are experienced;	
Pests and Diseases during drough period	More chemical to use; More investment; Declining crop production	Application of pesticides and insecticides;	Declining farm yield and income; Food shortage and hunger.

The Local Government Unit's management and initiatives for Disaster Risk Reductiona and Management and Climate Change Adaptation for Farming and Fishing Communities.

Based from the interview with the Municipal Agriculturist and the Municipal planning and development coordinator, the municipality does not have programs that is directly intended for climate change and disaster preparedness for fishing and farming. But, they have projects under the Bottom-Up Budgeting (BUB), national programs: DENR, DAR, PCA, DA, ATI and BFAR that support agriculture and fishery development. For the BUB program they have establishment of fish sanctuaries in Barangays Canlong and Mansangat, they have also livelihood program for women unde BUB; for the DENR, they have the National Greening Program; for BFAR they have mangrove plantations and distribution of fishing paraphernalia, engines and boats; for PCA and DA, they have distribution of certified seeds, fertilizers, seedlings; for ATI, they have farmers' field school and technical assistance; for DAR, they have the climate change proofing project.

The municipality already crafted the Local Climate Change Adaptation Plan (LCCAP), hence, the plan stays as plan because it is not prioritized and fund is not allocated on the stipulated plan. The Local Disaster Risk Reduction and Management Office (LDRRMO) formulated a plan for climate change adaptation and mitigation, which was implemented from 2014 to 2015 but discontinued from 2016 to 2017. There is also a problem in the governance since the Local Chief Executive does not prioritize climate change adaptation and mitigation and disaster risk reduction in agriculture and fishery sector.

Summary, Conclusion and Recommendation

Summary

Based from the result of the assessment, the municipality is frequently hit by natural hazards due to its geographic location. The major hydrometeorolical hazard in the municipality is typhoon that results to secondary hazards like storm surge, coastal, urban and river floods, shoreline erosion, landslide and strong/destructive wind. The climatological hazards experienced by the fishing and farming communities are: sea level rise, more frequent and intense rainfall, increasing ocean temperature, frequent

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occurrence of strong winds and longer dry spell. The risks due to these climate changes are: coastal flooding, storm surge, shoreline erosion, increasing salinity to rice lands due to salt water intrusion, mortality in seaweeds production and sea grass growth due to warming of ocean and exposure to heat stress, lowland flooding, siltation that affects corals and seaweeds, unavailability of water for crops which damages most specially during vegetative stage, rice lands are cracked due to longer dry months, pest and diseases infestations. These risks result to very low or no yield, scarcity in food and exacerbate poverty in the locality. Majority of the households are living with income below food and poverty threshold value, this exacerbates vulnerability of the farming and fishing communities. Due to poverty, farmers and fisher folks cannot afford to secure farming and fishing inputs suitable in their cropping needs, which perhaps, can help them produce more food and income. Farmers and fisher folks live in a very light housing materials which is very vulnerable to typhoons. Once there houses are hit by strong typhoon, it is difficult for them to recover fast and better. The climatic and non-climatic vulnerability factors were identified: the climatic vulnerabilities include typhoon damages, pest and diseases damages, strong wind and flood damages, excessive rainfall damages, drought damages. Non-climatic vulnerabilities include limited technical knowledge for farming and aquaculture production, illegal fishing and overfishing, increase in fish catch reliance, weak institutional support, continuous illegal cutting of mangroves and upland trees, high labor cost, fluctuating copra prices, lack of capital, limited technical support from the local government unit. Coping mechanism of the communities include using of drough resistant rice varieties; planting of upland rice rather than rainfed rice; shifting to rootcrops production; delayed planting; manual watering in the morning and late afternoon, planting of early maturing rice, indigenous mulching, construction of temporary drainage canal, transferring of farms to a productive site, fishing outside the municipal boundary, spraying of pesticides and insecticides, application of traditional knowledge to avoid pests attacks, switching to other means of livelihood and buying of foods.

Conclusion and Recommendations

From the basis of findings, the municipality is considered as vulnerable to both hydrometeorological and climatological hazards due to its geographic location and it is exacerbated by the socio-economic condition of the fishing and farming communities and poor governance in DRR and CCA for Agriculture and Fishery. Though, the municipality has programs on agriculture and fishery development in partnership with national agencies, it does not have specific plans, programs and activities (PPAs) addressing climate change and mitigating adverse impact of natural hazards in agriculture and fishery. The municipality has climate change action plan but it is outdated and not formulated based from climate change and disaster risk assessment (CDRA). The municipality does not have CDRA and hazard, risk, vulnerability and capacity assessment (HRVCA) which are the bases for formulating Local Climate Change Action Plan and Contingency plan (LCCAP) and Contingency plan. The LGU does not

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have programs like the Ecosystem-Based Disaster Risk Reduction and Management and Ecosystem-Based Adaptation. Therefore, it is recommended that the municipality must conduct CDRA and HRVCA to formulate an LCCAP and Contingency plan. The Results of this study must be discussed to the local chief executive together with the key officials and advocate them to adopt the policies and formulated plans, programs and activities addressing adverse impacts of climate change and natural hazards with specific focus on agriculture and fishery sector. It is also recommended that the municipality must mainstream in their existing disaster risk reduction and management system - the ecosystem based disaster risk reduction and management (Eco-DRRM) and ecosystem based adaptation (EbA) to conserve and restore the environment, making the communities and their livelihood resilient to disasters.

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