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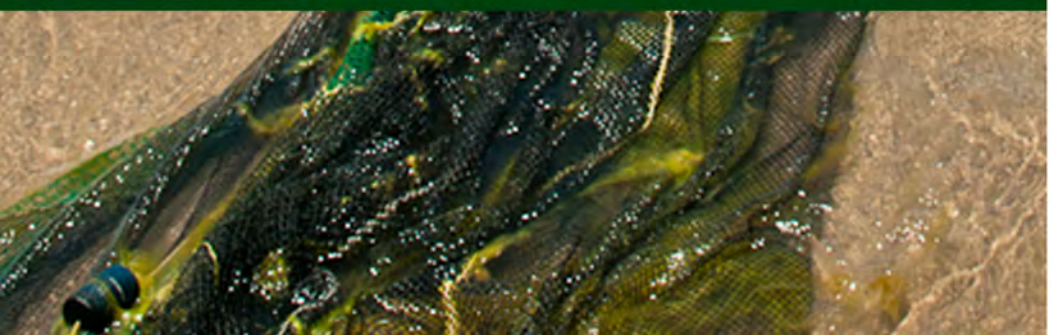
Old Livelihoods under New Climate: Assessing Potential Adaptation Strategies in Gubat, Sorsogon and Labo, Camarines Norte, Philippines

Maria Victoria O. Espaldon, Zenaida M. Sumalde, Lynie B. Dimasuay, Jaimie Kim Bayani Arias, André E. Quiray, and Jesamine F. Rebugio



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

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OLD LIVELIHOODS UNDER NEW CLIMATE: ASSESSING POTENTIAL ADAPTATION STRATEGIES IN GUBAT, SORSOGON AND LABO, CAMARINES NORTE, PHILIPPINES[1]

Maria Victoria O. Espaldon, Zenaida M. Sumalde, Lynie B. Dimasuay,
Jaimie Kim Bayani Arias, André E. Quiray, and Jesamine F. Rebugio

EXECUTIVE SUMMARY

In adapting to changing climate, Philippine rural households, particularly fishing and farming types, have been reported to address changing weather patterns in their own creative ways, usually with assistance from external institutions. This study assessed the local climate change adaptation (CCA) strategies used in two Philippine municipalities: Labo, Camarines Sur and Gubat, Sorsogon. In particular, two barangays (villages) were selected from Labo and Gubat because of their high vulnerability to flooding, as well as storm surges and sea level rise, respectively.

Data were gathered from household surveys and key informant interviews to measure the cost of damage and adaptation using the replacement cost method. It includes estimating the actual value of damage, value of time in repairing the damage, and the actual cost of replacement materials. Focus group discussions with LGU officials and communities were also done to describe the scenario at the local level. In addition, for Gubat, a household Social Vulnerability Index (SVI) was constructed.

In Labo, a total of 210 respondents were surveyed. Farming and raising livestock comprise 32% of the primary occupation while 37% derive income from off-farm activities. The combined value of the annual income of all Labo respondents amounted to PhP 10.55 million. Of this, PhP 2.26 million came from farming and PhP 500,000 from raising livestock, with the rest from off-farm activities. The total value of crops produced per year amounted to PhP 2.27 million, with rice as the most valued crop, followed by vegetables, and root crops and tubers.

In nominal terms, the total value of damage due to the recent disaster experienced by the Labo households amounted to PhP 2.38 million, more than half of which is due to damage to productivity (mainly crop production and raising livestock and poultry). In general, the high total value of damage for Labo barangays reflects their high vulnerability to typhoons, heavy rains, and flooding.

In Gubat, the 120 respondents were categorized as either receiving or not receiving assistance from a non-government organization (i.e., Coastal Core, Inc.). Sixty-five percent (65%) of assisted as well as non-assisted respondents are engaged primarily in fishing and shell gleaning. An average household size of five earns PhP 77,765 a year for those with assistance compared with those without assistance who earn PhP 64,250 annually. Estimates showed that household respondents have moderate social vulnerability from typhoons and flooding. The Coastal Core, Inc. beneficiaries have slightly lower overall SVI (0.39) than the non-beneficiaries (0.42), which can be explained by the higher resilience and ability to recover of the former.

In nominal terms, the total value of damage due to the recent disaster experienced by the Gubat respondents amounted to PhP 1.16 million, 56% of which came from non-assisted households. More than half of the value was due to damage to properties, particularly houses and household appliances. This was followed by the value of foregone income (PhP 188,090) representing the opportunity cost of missing work, with PhP 80,750 from assisted households and PhP 107,340 from non-assisted ones. The difference of the damage between assisted and non-assisted households had a small margin, probably because the period of engagement has not yet been that long to make significant impacts. However, in terms of recovery ability, Coastal Core assistance seemed to have a significant impact. Analysis showed the recovery period of assisted households was quicker by about 3 to 11 days than those not assisted. This is equivalent to a monetary benefit of about PhP 436 to PhP 2,139/household per typhoon event.

[1] This is a monograph based on two separate research reports for Labo and Gubat, respectively. Authors may be contacted for a copy of the full reports.

For both Gubat and Labo, respondents' level of awareness and perception of climate change-induced disasters were high. In Labo, 73% of those who are aware said that the climate is indeed changing and that the weather is becoming unpredictable. Those who were not aware of climate change per se noticed that typhoons are occurring more frequently and more intensely. In Gubat, more than three-fourths of both assisted and non-assisted respondents observed extreme heat in the present climate conditions. About two-thirds were also aware that stronger winds and heavier rains can induce natural disasters. Common sources of climate change knowledge in Labo and Gubat come from the media (radio and television) and personal experiences and observations.

Upon receiving the typhoon advisory, the most common anticipatory measure done by the Labo and Gubat households was to reinforce and repair their houses. Other anticipatory measures included evacuation of family members, moving appliances to safer places, and seeking updated information about the typhoon. Compared with households without assistance, assisted respondents in Gubat were more responsive to the effects of the calamity, as reflected by higher percentages of households who performed various adaptation strategies. In Labo, few farmers harvested their crops beforehand to salvage a small portion of their yield in case extreme flooding occurs. Reactive measures conducted after the typhoon in Labo and Gubat include reinforcement and repair of house damage.

The adaptation cost to natural calamities like typhoons reached PhP 1.6 million in Labo, 91% of which was incurred after the typhoon. In Gubat, the adaptation cost to recent typhoons reached up to PhP 1.18 million, 57% of which was incurred by the affected non-assisted households; average adaptation cost of non-assisted households was 80% higher compared with assisted households.

Gubat and Labo respondents suggested the following measures to strengthen their LGU's capacity to adapt to the adverse impacts of climate change: a) strengthen policies on proper waste disposal, waste segregation, reforestation (particularly mangrove rehabilitation), and the prohibition of illegal logging; b) conduct information dissemination programs to educate the citizens on climate change and introduce climate change programs; c) provide alternative livelihood or inputs for agriculture-related activities; and d) continue support to early warning system in Gubat and establish one in Labo.

1.0 INTRODUCTION

1.1 Background

The need to deal with climate change is now a top priority of many governments, including the Philippines. Evidences of climate change include warming of the Earth by seven-tenths of a degree Celsius and, in the Philippines, the very apparent increasing trends in temperature from 1951 to 2006. Rainfall has also been reducing in Northern Luzon, particularly during El Niño, but increasing over Western Visayas, Mindanao and Bicol region (except Daet) from 1951 to 2003. These changes, however, are not yet statistically significant and could be attributed to seasonal variations or climate variability (Hilario 2010).

The projected climate changes, such as rise in temperature, rainfall changes, sea level rise, and frequent occurrence of extreme events, are expected to affect different sectors of human society. Sea level rise is a threat to coastal communities and island ecosystems. Weather changes and climate variability could severely affect coastal fisheries because of coral bleaching, while fisher folks and coastal cities could be severely affected by floods. The limited rainfall available during the growing season and excessive rain during wet months will affect agricultural productivity. The country's two most important crops—rice and corn—will be at risk; hence, coupled with increasing population, more people are at risk of hunger.

The Intergovernmental Panel on Climate Change (IPCC 2007) reports other adverse impacts of climate change: increased occurrence of pests and diseases; severe soil erosion and, hence, more application of fertilizers to restore fertility; declining milk production because of limited water intake; shortage of water supply and consequently water crisis for growing population; increased risk of flooding; reduced stream flow; and increased frequency of grassland fire. Climate change also poses threats to human health through the possibility of heat stress, increased cases of malaria and dengue, and increased risk of food and water shortage and floods.

While many agencies and academic institutions, including the IPCC, have set recommendations to adapt to the changing climate, Philippine rural households, especially fishing and farming types, have been reported to address climate change or to survive changing weather patterns in their own creative ways. Other households, however, have been assisted by humanitarian organizations and institutions to adapt to climatic changes and reduce their vulnerability to increasing climate stresses.

At the household level, climate change has affected both the tangible and intangible household assets (de la Fuente 2008). Tangible assets include natural, human, physical and financial capital. Human capital is driven by education and health while physical capital includes land, tools, equipment, work animals, housing, and household services. Meanwhile, financial capital refers to cash savings and access to credit. On the other hand, an essential part of intangible household assets is member and household interaction that involves gender relations, social networks, participation in associations and organizations, and intra-household relations. At the community level, physical, environmental and social infrastructures improve the tangible assets.

Indeed, climate change is a development issue that poses a new challenge to human survival. Others push the issue further by saying that there will be losers and winners if and when climate change occurs. Tompkins and Adger (2003) emphasized, however, that what is important is to minimize the short- and long-term costs of damage due to climate changes. It is imperative that local communities are able to respond to climate change hazards and pursue a holistic response to enhance their adaptive capacity and build resilience; these involve, but are not limited to, adaptation and mitigation.

Adaptation is the act of responding to experienced or expected impacts or taking advantage of new conditions. It can be a response to an actual or projected climate change. Responses can be anticipatory, planned or spontaneous, or short-term or long-term and strategic (Tompkins and Adger 2003). Mitigation, on the other hand, refers to actions taken to prevent, reduce or slow climate change by slowing or stopping greenhouse gas (GHG) emissions (Hulme and Sheard 1999).

It is in this context that we conducted this study that explored the different adaptation strategies that various vulnerable groups perform to survive the challenges of climate change. It addressed the following questions:

1. What are the climate change-related events observed in the area and how are local communities and households affected by these events? What is the communities' level of awareness on climate change?
2. What practices/technologies are local communities undertaking to adapt to climate change and how effective are these practices?
3. What support (e.g., technology, information, etc.) do communities need to enhance their adaptive capacity?
4. What are the estimated costs of adaptation actions that communities have undertaken?
5. How were communities mobilized to deal with disasters?
6. What is the communities' level of capacity/capability and how can this be mobilized to deal with disasters, particularly those related to climate change?
7. What do communities need and how much will these cost to improve their capability to respond to climate change?
8. What existing community policies support CCA and, if none, what should these policies be?
9. How can the LGU be strengthened to respond/adapt to the challenges posed by climate change?

1.2 Objectives of the Study

The main objective of the study was to assess potential adaptation strategies in vulnerable areas in the Philippines. It was also intended to document sites that have spontaneously adapted to observed climatic changes and assisted adaptation strategies to rural households. Assessments were made at the household and community levels.

1.2.1 Household level

1. To document how households perceived they have been or are being affected by climate change and what actions they have taken to mitigate/adapt to its impacts; and
2. To estimate the cost of adaptation strategies.

1.2.2 Community level

1. To assess how communities have been mobilized to deal with disasters, using anecdotal accounts;
2. To evaluate the capacity/capability of communities to deal with climate change impacts and how this can be mobilized; and
3. To evaluate the needs of communities and estimate how much it will cost to increase their capabilities to respond to climate change impacts.

2.0 CONCEPTUAL FRAMEWORK

This study was anchored on the concept of vulnerability being a function of the presence of hazard, exposure to risk, and adaptive capacity (Espaldon *et al.* 2010; Smit and Pilisofa 2003). As shown in Figure 1, the biophysical characteristics of a community define its level of vulnerability to specified climate change hazards (i.e., sea level rises, rainfall change, rise in temperature, and frequency of occurrence of extreme climate events). For instance, low-lying areas facing the Pacific Ocean are often considered vulnerable to storm surges and sea level rise. In the same way, demographic and socioeconomic characteristics, such as livelihood, income, property, and landholding, are determinants of the adaptive capacity to climate change hazards.

The presence of hazards in a location, combined with the level of exposure in terms of demographic and socioeconomic profiles, determines the level of risks—potential and real (David 2009). Both risks can be significantly different from each other depending on community and household adaptation actions. Different actions may be taken as a response to climate risks, with some better than others. The efficiency and effectiveness of adaptation strategies can be made more effective with institutional and policy support and if the community has a strong adaptive capacity (Smit and Pilisofa 2003). This study thought of adaptation cost as a major determinant of households' and communities' willingness to contribute towards capacitating themselves to manage climate change in the future.

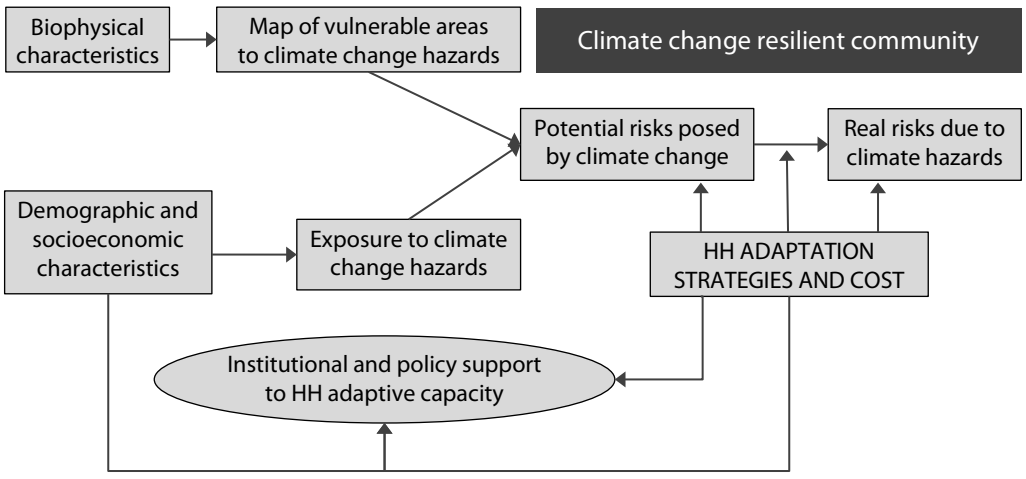

Figure 1. Climate change adaptation framework
Source: modified from David (2009)

3.0 METHODOLOGY

The study selected two municipalities in the Bicol region as cases: Gubat in Sorsogon and Labo in Camarines Norte. It used a combination of various research methods for data collection, such as:

1. Secondary data analysis;
2. Rapid appraisal of the study areas;
3. Household survey;
4. Focus group discussion;
5. Key informant interviews; and
6. Validation workshop.

To measure the cost of damage and adaptation, the study used the replacement cost method. It includes estimating the actual value of damage, value of time in repairing the damage, actual cost of replacement materials, and foregone income/opportunity cost. This study also extensively used descriptive statistics to describe the communities' level of awareness and preparedness in dealing with climate change hazards, specifically sea level rise and storm surges in Gubat and flooding in Labo.

3.1 Social Vulnerability Index and Propensity Scoring

For Gubat, we constructed a Social Vulnerability Index (SVI) to provide information about households' susceptibility of incurring damage from typhoon and flooding. The SVI has three components: a) maximum potential losses (exposure of households); b) household resilience (sensitivity); and c) household self-recovery (Chen *et al.* 2009). Table 1 shows the indicators used for, as well as impact to, each SVI component.

Table 1. Indicators and impacts to Social Vulnerability Index components

SVI components	Indicator	Impact to SVI
Maximum potential losses (exposure of households)	Economic vulnerability = Value of annual agriculture, fishery and forestry production	+
	Value of house	+
Household resilience (sensitivity)	Dependency ratio = Number of dependents/household size	+
	Incidence of flooding over the past year	+
	Perception about preparedness	-
	Access to information (early warning)	-
	Investment in adaptation measures before the event	-
Self-recovery process	Access to credit	-
	Access to other types of assistance after typhoon/flooding event	-
	Income of household	-
	Investment in adaptation measures during the typhoon/flooding event	-
	Investment in adaptation measures after the typhoon/flooding event	-

The component on maximum potential losses reflects the households' exposure to typhoon and flooding impacts. The values of production and properties indicate the potential losses that can be incurred by households. Hence, the higher the values of these variables, the higher the computed SVI will be.

Household resilience (sensitivity), on the other hand, reflects the extent by which a household can be affected by typhoon and flooding. The variables assumed to influence resilience or sensitivity include the dependency ratio of households, incidence of flooding over the past year, preparedness of households, access to information, and adoption of measures that can minimize impacts of the weather disturbance. The first two indicators positively contribute to vulnerability, while the last three indicators reduce vulnerability.

The last component, self-recovery process, reflects the capacity of households to respond to damage and impacts from typhoon and flooding. Hence, its indicators—access to credit and other types of assistance, household income, and investment in adaptation/mitigation measures during and after the typhoon and flooding—are negatively related to vulnerability. Note that the indicators used in this component are process-based; meaning, it only focuses on inputs rather than output or outcome.

To compute the index, we undertook a normalization procedure, wherein Equation 1 was used for variables that positively contribute to vulnerability and Equation 2 for variables that negatively contribute to vulnerability:

$$V_{ij}=(X_{ij}-MinX_i)/(MaxX_i-MinX_i) \quad \text{(Equation 1)}$$

$$V_{ij}=(X_{ij}-MaxX_i)/(MinX_i-MaxX_i) \quad \text{(Equation 2)}$$

where,

V_{ij} : standardized observation associated with i^{th} component for individual j
X_{ij} : value of the i^{th} component in the vulnerability index for individual j
$MinX_i$: maximum value of the i^{th} component for all individuals
$MaxX_i$: minimum value of the i^{th} component for all individuals

For each SVI component, the corresponding indicators were first averaged to get the per-component vulnerability. Each indicator was given equal weights. To arrive at a single composite index, the per-component SVIs were then averaged. Each component was assigned an equal weight of 33%.

The value of the estimated SVI ranges from 0 to 1. The closer the SVI is to 1, the higher the vulnerability will be. To aid in the interpretation of the estimated values, we used the following categorization:

$0.0 \leq SVI \leq 0.19$: very low vulnerability
$0.2 \leq SVI \leq 0.39$: low vulnerability
$0.4 \leq SVI \leq 0.59$: moderate vulnerability
$0.6 \leq SVI \leq 0.79$: high vulnerability
$0.8 \leq SVI \leq 1.00$: very high vulnerability

Lastly, the study also assessed the impact of the intervention and assistance of a non-government organization (NGO) on the resilience of beneficiary households against typhoon and flooding. For the purpose of the study, resilience is defined as the ability of households to recover from the impacts of an extreme weather event. It is assumed that the higher the resilience, the shorter the recovery period, and vice versa.

In any impact assessment, the intention is to estimate the impact of an intervention (treatment) to a participant's outcome. If assignment of the treatment is conducted through randomized trials, it would be sufficient to simply compare the outcomes of the treatment group (with intervention) vis-à-vis the control (without intervention). However, if assignment of the treatment is not random, the simple comparison of outcomes will yield biased estimation of treatment effects. Rosenbaum and Rubin (1983) suggested propensity score matching (PSM) as a method to reduce this bias. The idea is to match a participant (treated) and a non-participant (untreated) with very similar characteristics, so both have the same likelihood or propensity of obtaining the treatment. The difference in the value of the outcome variable between these two individuals can then be attributed to the presence or absence of the treatment (Becker and Ichino 2002). However, it should be noted that the PSM method can only control for observed variables. Hence, hidden self-selectivity bias may still be present in the estimation.

This research applied the PSM procedure to estimate the effect of the intervention of Christian Aid International, through its NGO partner, Coastal Core Inc., on the recovery ability of Gubat households from the impact of typhoon and flooding. The procedure starts with estimating the propensity scores for all observations. This shows the conditional probability that a certain individual will join an intervention program given sets of attributes. The propensity score was estimated through logit regression, wherein the dependent variable is a dummy variable corresponding to the presence or absence of the treatment. The

explanatory variables used in the regression include: a) income of the household head (proxy for education); b) households' engagement in farming; c) households' engagement in fishing; d) households' engagement in animal raising; e) value of annual agriculture and fishery production (economic vulnerability); f) investments in adaptation activities before the typhoon (indicator for adaptive capacity); and g) household income. The predicted value of *y* serves as the propensity score.

After computing the propensity scores, the average treatment effect on the outcome variable was estimated using the *pscore* suite developed by Becker and Ichino (2002) in *Stata*. The outcome variable used in the study is the number of days the household head was not able to work because of the impact of typhoon *Milenyo*. Four matching procedures were used in the study: a) nearest neighbor matching; b) kernel matching; c) stratification matching; and d) radius matching. The superiority of one approach over the other cannot be determined *a priori*; hence, all matching procedures were undertaken to test the robustness of estimates (See Appendix 1 for the estimators).

In the nearest neighbor method, a participant is matched with a non-participant with the closest propensity score. However, this approach has a risk of matching two individuals who are substantially different from each other because matching is done in relative terms. This implies that even though the difference in propensity scores is very large in absolute terms, two individuals will be matched so long as the difference between their propensity scores are smallest compared with other individuals. This method was done with replacement, which allowed a control unit to be matched with more than one treated unit. The difference between the outcome of the treated unit and the control unit is then computed and averaged to obtain the average treatment effect.

Radius matching is a variant of the nearest neighbor approach. However, instead of matching a participant to a non-participant, the participant's outcome is compared with the outcome of a neighborhood of non-participants within a certain tolerance (radius).

Kernel matching, on the other hand, compares the outcome of a participant to all non-participants, the outcomes being weighted based on their proximity to the participant.

Lastly, the stratification method divides the range of variation of the propensity score by intervals. For intervals that contain participants and non-participants, the difference between their average outcomes is computed. The average treatment effect is then estimated as a weighted average of the treatment effect of each block.

3.2 Site Selection and Description of the Study Area

3.2.1 Labo, Camarines Norte

Labo is a municipality located in the Bicol Region, which is identified as one of the most vulnerable regions to climate change in the Philippines. It is geographically located between 14° 01′ 06″ and 14° 11″ latitude and 122° 21′ 00″ and 122° 52′ 20″ longitude, and is about 335 km south of Manila (Figure 2). The municipality features a generally rugged and mountainous terrain with rolling hills, plains, and estuarine areas, traversed by Labo River that drains to the Pacific Ocean. Mountains found in the municipality are Cadig (736 m above sea level or m asl), Labo (943 m asl), Bagacay (986 m asl), and Nalisbitan (265 m asl) constituting the Southern Cordillera. Except for Nalisbitan, all mountains are dormant volcanoes (Labo Municipal Government 2009).

With the enactment of Presidential Decree No. 1566, which aimed to strengthen the country's capacity to manage disasters, the province of Camarines Norte promulgated Provincial Ordinance No. 13-96, or the Disaster Management Code of Camarines Norte. This became the guide for the planning and implementation of activities of the Municipal Disaster Coordinating Council (Labo Municipal Government 2009).

Typhoon *Rosing* in 1995 became a turning point for environmental governance as this claimed major economic damage and many lives due to massive flooding, which made people more aware of the need for programs on disaster management. Since then, the municipality of Labo has been at the forefront of disaster management, undertaking activities on massive information dissemination and education, forest

management and reforestation, and improvement of solid waste management. In August of 2002, Executive Order No. 21-2002 of the Labo LGU institutionalized disaster management at the barangay level and designated the Peace and Order *kagawad* (councilor) to be the Barangay Disaster Action Officer. In 2005, Sangguniang Bayan (Municipal Council) Resolution No. 006-2005 was approved that aimed to strengthen Barangay Disaster Coordinating Councils (BDCCs).

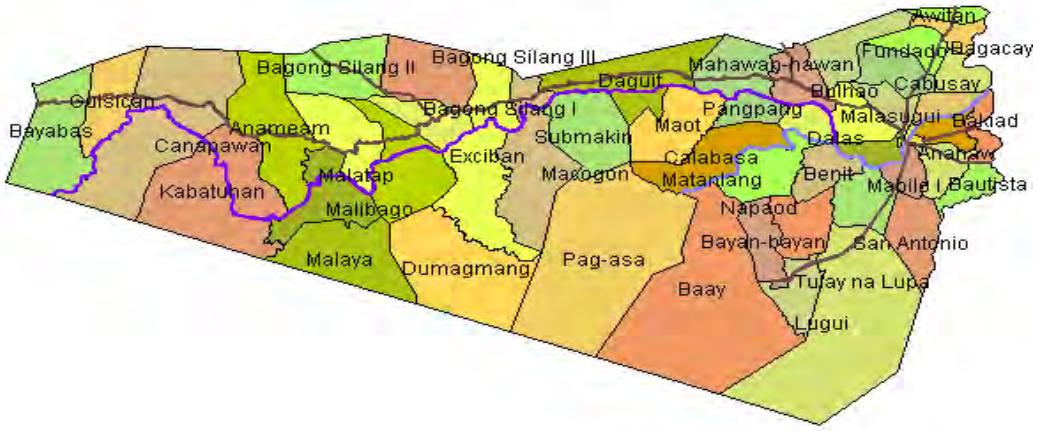

Figure 2. Municipality of Labo, Camarines Norte

Barangays Sta. Cruz and Bagacay in Labo were selected for this study because of their vulnerability to flooding hazard, as shown in Figures 3 and 4. These are considered the most flood-prone barangays of the municipality, since they are located along Labo River. The river regularly floods agricultural areas and settlements during typhoon and heavy rains. Although flooding is a usual occurrence in these areas, observations and reports in recent years (about 2005) showed intensification of flooding in terms of magnitude and duration.

Most land in the two barangays is agricultural, and during the dry season the floodplains are cultivated for rice, corn and vegetables like squash. Because their main livelihood is agriculture and its location is near the mountains and the river, the local communities are highly vulnerable to flooding. This vulnerability is further increased by the demographic characteristics of the population, as studies showed that the most vulnerable groups are those that are economically marginalized (Espaldon *et al.* 2009).

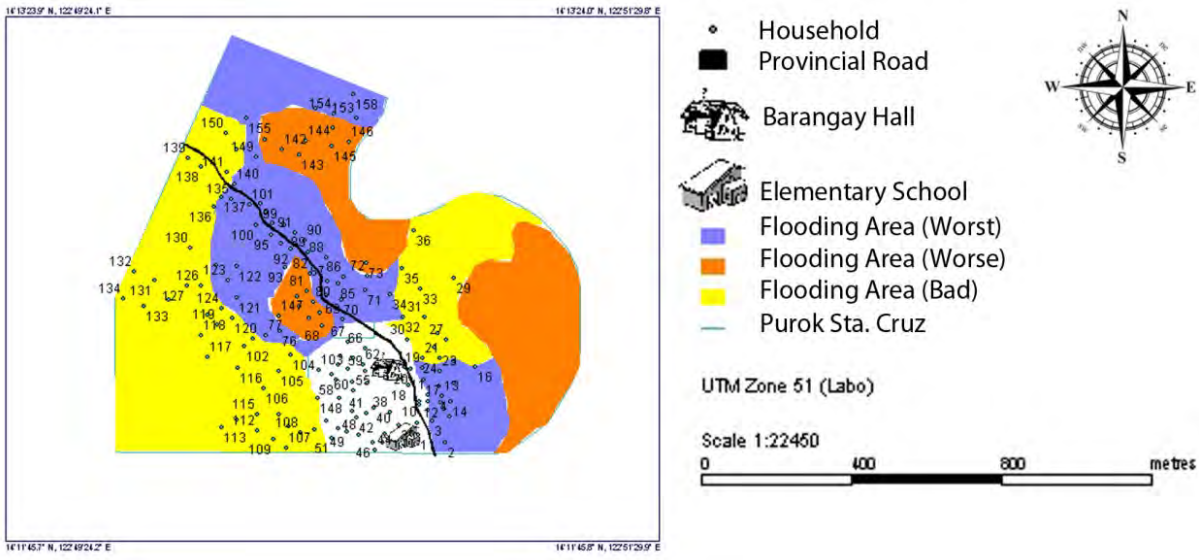

Figure 3. Flooding map of Brgy. Sta Cruz in Labo, Camarines Norte
Source: Labo Municipal Government 2009

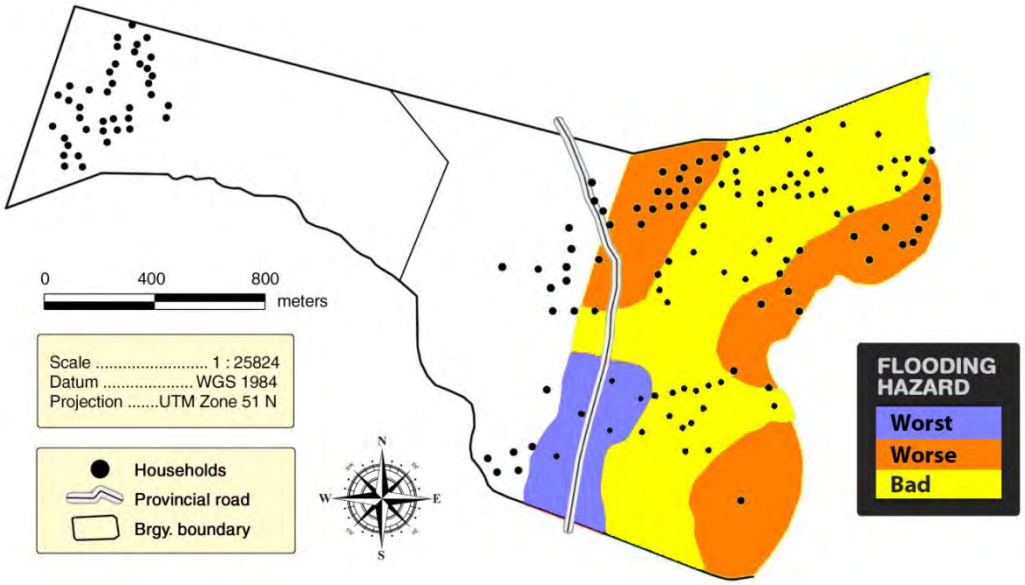

Figure 4. Flooding map of Brgy. Bagacay in Labo, Camarines Norte
Source: Labo Municipal Government 2009

Brgy. Sta. Cruz has a total population of 917 and a household population of 199, most of whom are farmers. The average household size is 4.6, with an unemployment rate of 7.62%. About 65% are below the poverty threshold, 34% are below the standards for food intake, and 8.5% experience hunger.

Brgy. Bagacay, on the other hand, has 213 households with a total population of 1,077 and an average household size of 5.1. Similarly, most of them are farmers, with an unemployment rate of 6.07% and a household poverty incidence of 54%. About 30% of households have income below the standard for food intake, while about 16% experience hunger.

3.2.2 Gubat, Sorsogon

The municipality of Gubat is a coastal town in the easternmost portion of the Sorsogon Province (Figure 5). It is located between coordinates 12° 55′ 15.63″ N latitude and 124° 07′ 28.66″ E longitude, which is 621 km south of Manila. Gubat features a mountainous and rugged terrain with coastal plains along the Pacific Ocean and crisscrossing of rivers, namely Bulacao, Basiao and Tingting (Gubat Municipal Government 2009).

Because of its location in relation to the Pacific Ocean and rivers, the municipality is potentially at risk to additional climate stresses (i.e., sea level rise, increased intensity of typhoons and storm surges), which is the primary reason for selecting the municipality as the study's second site. The area is along the path of a magnitude-III typhoon from May to December. This was also pre-selected because Coastal Core, Inc. is assisting them.

Figure 6 shows the projection of sea level rise based on different models and indicates various municipalities of Sorsogon that are prone to this hazard. Noted in this illustration from David (2009) is the prominence of Gubat-Prieto Diaz as one of the four hotspots for sea level rise. Barangays Cota na Daco (part of Poblacion) and Rizal are both located in the coast.

Rizal is a coastal barangay located in Gubat Bay, which faces the Pacific Ocean (Rizal Barangay Government 2009). It is the largest barangay of Gubat, having 623 households with a total population of 2,610 as of 2008. The residents subsist on agriculture and marine products, with coconut, vegetables, livestock (hogs, goats, carabao or water buffalo, and cow), and rice farms as common sources of income. Other non-farm sources include employment in government offices, *sari-sari* (variety) stores, cottage industries, and the transport service sector.

On the other hand, Cota na Daco is another coastal barangay with 342 households and a total population of 1,592. The residents are mainly engaged in fishing (35% of families), farming (10%), cottage

industry (15%), and employment in other sectors (15%) (Cota na Daco Barangay Government 2009). The households, which are in clusters of informal settlements and are mostly assisted by Coastal Core, Inc., are mostly engaged in different fishing activities. This barangay is directly facing the Pacific Ocean and has been observed to show evidences of the adverse impacts of increasing intensity of storm surges, such as the damaged sea wall and the subsidence of some coastal areas.

Figure 5. Municipality of Gubat, Sorsogon
Source: discovergubat.wordpress.com 2014

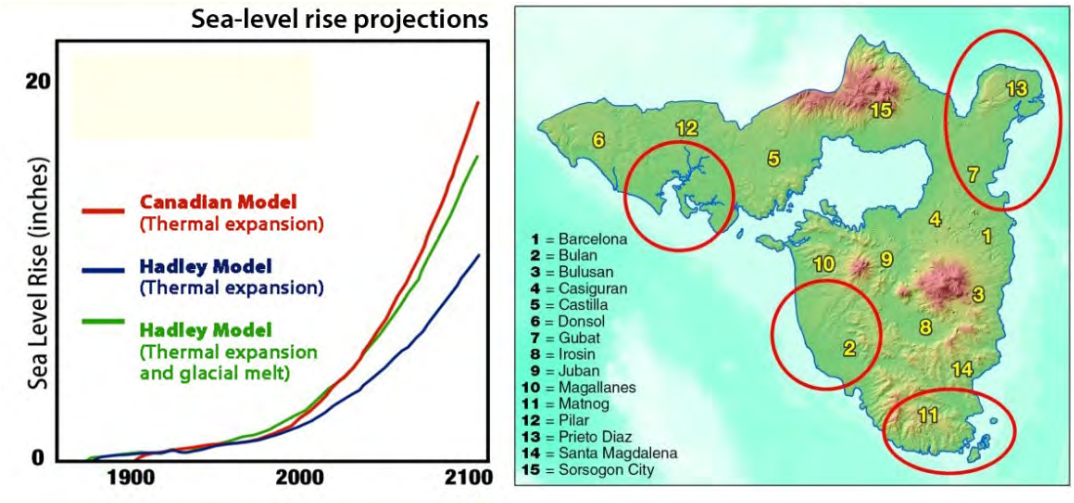

Figure 6. Sea level hotspots in Sorsogon Province
Source: David 2009

4.0 RESULTS AND DISCUSSION: LABO, CAMARINES NORTE

4.1 Socioeconomic Characteristics of Respondents

A total of 210 respondents were surveyed in Labo, with 110 from Bagacay and the remaining 100 from Sta. Cruz. In general, respondents from the two barangays have the same average age (44 years old) and are mostly female. Majority of the respondents are married (80% for both barangays). On average, each household has five members with four dependents, implying that only one member is employed.

In terms of educational attainment, 73% of the respondents from Bagacay are elementary school graduates compared to 57% from Sta. Cruz. Although Bagacay produced more elementary graduates, Sta. Cruz has more students who finished high school. However, only a few were able to attend college in both barangays.

Farming and livestock raising comprise 32% of the primary occupation of all respondents in Labo, while 37% derive their income from off-farm activities, such as operation of small variety stores, driving of public utility vehicles, and engagement in junkshops, especially in Bagacay. A few are engaged in carpentry and other blue-collar jobs, while the rest are unemployed. However, it is important to note that 64% of the respondents are female, which explains the high percentage (22%) of respondents without occupation as they are busy with household chores and taking care of their offspring.

Farming and livestock raising only contribute 21% and 5% to the total income of households, respectively, which means that a greater percentage of household income is from off-farm labor. Sta. Cruz, being the "food basket" of Labo, has a slightly higher percentage of income from farming (25%) than Bagacay (18%). However, the average total annual income of households for both barangays is relatively similar (PhP 49,184 for Sta. Cruz and PhP 51,177 for Bagacay) and is averaged at PhP 50,228/year. On a per capita basis, households from both barangays receive almost equal values of PhP 12,641/year and PhP 12,346/year for Sta. Cruz and Bagacay, respectively.

4.2 Ownership of Assets and Indices of Living

This section consists of lot, house, and other assets that the households possess. It also includes value of abode, electricity connection, and sources water.

4.2.1 Lot and house ownership

Lot and house ownership and house structure are among the indicators of the quality of living. Most respondents (63%) from Sta. Cruz are owners of residential lots while more respondents (29%) from Bagacay are part-owners.

In terms of house structure, 45% and 33% of houses in Sta. Cruz and Bagacay, respectively, are made of hard materials such as concrete. "Half-body" houses, or those constructed with semi-permanent materials, make up one-third of the total houses in Labo, but there are more houses made of light materials in Bagacay than in Sta. Cruz. This might be because there are more caretakers and fewer residential lot and house owners in Bagacay than in Sta.Cruz.

4.2.2 Value of house

In general, the house floor area and value in Sta. Cruz is higher than in Bagacay. The average house floor area of households from Sta. Cruz is 187 m^2 compared to 136 m^2 from Bagacay. The average values of houses are PhP 83,820 for Sta. Cruz and PhP 60,973 for Bagacay. However, on value per square meter basis, both are identical at PhP 448.

4.2.3 Household appliance ownership

Radio and television sets are the common sources of information and entertainment in Labo, while mobile phones are the usual means of communication. In general, more households from Sta. Cruz own household appliances compared to those in Bagacay. There is a difference in ownership of at least 10% per appliance, including mobile phones, in both barangays. Refrigerator ownership stands out the most, with 34% and 12% of households owning them in Sta. Cruz and Bagacay, respectively. Television sets and radio ownerships are 69% and 5%, respectively, for households in Sta. Cruz compared with 51% and 48% in Bagacay. Also, more households (55%) from Sta. Cruz owned mobile phones than in Bagacay (45%).

4.2.4 Electricity connection

The percentage of households that have electricity connection in both barangays is almost the same, with 79% and 78% connection in Sta. Cruz and Bagacay, respectively.

4.2.5 Sources of energy for cooking

Fuelwood and charcoal are among the common sources of energy for cooking. A higher percentage of households from Sta. Cruz (71%) use charcoal compared to those in Bagacay (53%); however, the use of fuelwood is slightly greater in Bagacay. Other sources of energy for cooking are liquefied petroleum gas (LPG) and kerosene, with Sta. Cruz utilizing them more than Bagacay.

4.2.6 Sources of water supply

The most common sources of water for domestic use are communal artesian wells and piped system. The use of communal artesian wells require households to fetch water from a strategically located deep well within the barangay that is usually provided by the local government or a donor. For the piped system, each household is connected to a main system and pays for water used based on meter reading.

For both barangays, the most common source of water is the artesian well. More than 50% of households in each barangay get their water from communal artesian wells, with 33% from Sta. Cruz and 13% from Bagacay actually owning these wells. Piped system has a utilization rate of 18% and 25% in Sta. Cruz and Bagacay, respectively. Another source of water is the river, which is used by 15% of those from Bagacay, especially in Purok (sub-village) IV, which is closest to the Labo River.

4.2.7 Type of toilet

The type of toilet used by the households is an important factor that affects the sanitation and health of the community. Majority of the surveyed households (91%) in both barangays have water-sealed toilets.

4.3 Sources of Income

The income of the respondents consists of the combined values of crop production, livestock and poultry raising, and other off-farm sources. The combined value of the annual income of all respondents amounts to PhP 10.55 million. Majority of the income comes from off-farm activities, with farming a far second and the least coming from livestock raising.

Of the PhP 10.55 million total annual income of both barangays, PhP 2.26 million comes from farming, PhP 500,000 from livestock raising, and the rest from off-farm activities. The small contribution of crop production may be due to the extreme flooding suffered by the farmers, especially during harvest seasons when crops are damaged before they can be harvested. On the other hand, income from off-farm activities is greater especially in Bagacay, where income generating opportunities are more diversified than in Sta. Cruz.

Per household, both barangays have a total average annual household income of PhP 50,228, with PhP 36,978 from off-farm sources, PhP 10,747 from crop production, and PhP 2,683 from livestock raising and poultry.

4.3.1 Land area and crops planted

Lot sizes for crop production is generally bigger in Sta. Cruz with a total of 79.95 ha compared to only 42.47 ha in Bagacay. Farm size ranges from 0.25 to 5 ha for both barangays. The average of 40,000 m^2 lot for Bagacay is double in Sta. Cruz with 80,000 m^2.

Crops planted include rice, squash, corn, root crops, tubers and vegetables. More than 50% of Sta Cruz households and around 25% of Bagacay households are engaged in farming. This may be because majority of Bagacay respondents are females, who are not engaged in farming as their primary occupation.

Most farmers practice crop rotation to diversify their produce, especially those who only have one parcel of land to cultivate. For rice, farmers could harvest up to twice a year but less than half of households attain this harvest and instead plant squash or corn for their second cropping. Another possible reason for practicing crop rotation is the absence of irrigation facilities, as farmers rely on rain for water. Thus, planting squash and corn are viable options since these crops need less water. For farmers who have more than one parcel of land or a bigger lot size, the maximum harvest of twice a year for rice and squash can be attained.

Total harvests per year are considerably small, given their big lot sizes. For rice, a maximum harvest of about 5 t/cropping can be achieved, but farmers are only able to harvest less than half of that amount. Common problems stated by farmers are that crops suffer from *rice tungro bacilliform/spherical virus* (RTB/SV) that stunts the growth of the crop during harvest seasons.

The total annual rice harvest for Sta. Cruz is 136 t, while only 86.7 t/year is harvested in Bagacay. Also, total harvests of squash (78 t) and corn (11.8 t) in Sta. Cruz are greater than in Bagacay. Aside from lot size, the lower harvest of Bagacay might be because of the more severe flooding they experience when the Labo River overflows during typhoons or heavy rains. The total annual production of root crops and tubers almost reaches 500 kg for Bagacay, which is significantly higher compared to the 153 kg/year for Sta. Cruz. Quantity of annual production of crops for both barangays is 373 t, with Sta. Cruz producing a total of 227 t/year and 146 t/year for Bagacay.

4.3.2 Value of crops produced

The figures in this section represent the gross value of all the crops produced, whether they are consumed at home or sold. The purpose of this estimation is to have an idea of the production value of households engaged in crop production.

The total values of crops produced per year amount to PhP 2.27 million, with Sta. Cruz earning PhP 1.24 million and Bagacay PhP 1.03 million. The most valued crop is rice, with PhP 1.25 million and PhP 927,830 for Sta. Cruz and Bagacay, respectively. Total value of other vegetables is second (PhP 81,290), followed by root crops and tubers (PhP 55,500) for both barangays.

Farmers from both barangays experience loss in income from planting squash and corn. Sta. Cruz suffered a loss of PhP 103,280 for squash and Bagacay lost PhP 38,660. Some farmers in Sta. Cruz failed to harvest anything due to their crops being washed out by flood during harvest season. Those who managed to harvest were able to sell the crops for only PhP 2-3/kg. Similarly, Bagacay was not able to harvest corn mainly due to flooding.

Per household, the value of crop production amounts to PhP 54,411/year for Bagacay and PhP 46,631/year for Sta. Cruz. Bagacay might appear to be more productive per household, but an estimation of the value per hectare shows that that the average value of crops per hectare in Sta. Cruz is higher (PhP 64,481) than in Bagacay (PhP 59,194). This implies that Sta. Cruz has more intensive production.

4.3.3 Value of animal production

Livestock and poultry raising is another farm activity that the households are engaged in to supplement their income from farming. There is a reasonable number of households that raise swine and chicken (38%), with a few (12%) raising other animals like goats and cows.

At least four heads of swine are raised per household in Sta. Cruz, with three per household in Bagacay. Sta. Cruz also has at least 12 heads of chicken per producing family, with nine per household in Bagacay. However, most of the other animals were raised in Bagacay.

The total value of animals raised in Sta. Cruz amounts to PhP 405,350, while those raised in Bagacay amount to PhP 329,360. However, the value of PhP 47,704/family engaged in raising livestock in Bagacay is higher than the PhP 33,845/household in Sta. Cruz. Thus, Bagacay is more productive than Sta. Cruz in terms of livestock and poultry raising.

4.4 Social Affiliation of Households

Respondents are members of a number of organizations, such as the Socio-Pastoral Action Center Foundation Incorporated (SPACFI), Lupon ng Magsasaka, and their respective purok and barangay associations. Other associations with small memberships are Tulay sa Pag-unlad, Inc. (TSPI), school organizations, and Tricycle Operators and Drivers' Associations (TODA).

Only Bagacay respondents (23%) are members of SPACFI, an association founded in Fundado, while only those from Sta. Cruz (15%) are Lupon ng Magsasaka members. On the other hand, 42% of the respondents are also members of their respective purok and barangay organizations. The benefits derived from joining SPACFI and Lupon ng Magsasaka range from obtaining free inputs for farming (e.g., seedlings, fertilizers, and animals), while other associations provide respondents some financial and medical assistance. However, 25% of members of these organizations do not derive benefits from their respective organizations.

4.5 Natural or Climate Change-induced Disaster

4.5.1 Household awareness and perceptions of climate change

The respondent's level of awareness, perception and preparedness to climate change-induced disasters was also determined. Table 2 shows that a significant number (56%) of respondents were aware of climate change, with 73% of them saying that the climate is indeed changing and that the weather is becoming unpredictable. Common sources of knowledge come from the media (radio and television) and personal experiences and observations. There was a lack of information coming from schools and various agencies that could conduct seminars on climate change.

Though a total of 44% were not aware of climate change, they noticed that the occurrence of typhoons is more frequent and more intense. They also noticed that the weather is becoming unpredictable and heat is becoming more extreme.

Table 2. Perception and awareness of climate change and climate change information sources, 2009

Item	Sta. Cruz (%, n=100)	Bagacay (%, n=110)	Total (%, n=210)
Respondents' awareness of climate change			
Yes	**55**	**57**	**56**
Unpredictable weather	75	71	73
Extreme typhoon	5	19	12
Extreme temperatures	11	5	8
Caused by pollution	11	2	6
Ozone depletion	0	2	1

Table 2 continued

Perception	Sta. Cruz (%, n=100)	Bagacay (%, n=110)	Total (%, n=210)
Information source			
Observation	27	67	48
TV/Media	64	27	45
School	2	2	2
Neighbor	4	0	2
Seminars	0	2	1
No	**45**	**43**	**44**
Observation on present climate conditions			
Unpredictable weather	69	77	73
Extreme typhoon	22	21	21
Extreme heat	9	2	5

4.5.2 Damage to property and productivity

Typhoons and heavy rains were the most damaging natural disasters that struck the survey areas in 2009. More than half (58%) of the households that experienced these disasters were unable to work for an average of 11 days, resulting in forgone income (Table 3). Household recovery period ranged from 32 to 44 days depending on the extent of damage. These included damage to property and productivity, as well as health cost. Some households needed only a few days to recover while those severely affected needed up to a year.

Table 3. Recovery period of households during the recent typhoons, 2009

Item	Sta. Cruz (n=100)	Bagacay (n=110)	Total (n=210)
Percent of households	54%	61%	58%
Total recovery period of all households (days)	2,389	2,148	4,537
Total number of days unable to work (days)	644	701	1,345
Average recovery period per household (days)	44	32	37
Average number of days unable to work per household (days)	12	10	11

4.5.3 Value of damages

The destruction left by the recent typhoon and heavy rains was seen in houses needing repair, crops being washed away, income lost due to inability to work, and people getting sick. The total value of damage due to the recent disaster experienced by the households, in nominal terms, amounted to PhP 2.38 million, with Bagacay contributing almost double the value of the damage cost of Sta. Cruz.

From Table 4, more than 50% of the total value was due to loss in productivity, mainly crop production and livestock and poultry raising, which cost PhP 500,450 and PhP 708,650 for Sta. Cruz and Bagacay, respectively. Damage in properties, particularly house and household appliances, came in second with a total value of a little over PhP 1 million, followed by health cost amounting to PhP 116,001. The value of foregone income was last with an amount of PhP 32,080 for both barangays. It can be noted that more households were damaged in Bagacay resulting to a higher total value of damage in properties, though Sta. Cruz had more households that suffered damage in productivity but with a lower value.

Damage in productivity per household showed that Bagacay had a higher average value of PhP 28,346 compared with the average value of PhP 12,832 for Sta. Cruz. This agrees with the observation that Sta. Cruz is more productive than Bagacay on a per-hectare basis. In general, the high total value of damage for Sta. Cruz and Bagacay reflects that both barangays are highly vulnerable to climate change-induced typhoons/heavy rains and flooding.

Table 4. Damages and losses per household due to recent typhoon, 2009

Type of damage	Sta. Cruz (n=100)			Bagacay (n=110)		
	Value of damage (PhP)	No. of HH affected	Damage per HH (PhP)	Value of damage (PhP)	No. of HH affected	Damage per HH (PhP)
Damage to property						
Roof	37,510.00	25	1,500.40	17,500.00	20	875.00
Whole house	269,400.00	26	10,361.54	623,990.00	52	11,999.81
Appliance	13,980.00	2	6,990.00	53,030.00	7	7,575.71
Amenities	1,580.00	1	1,580.00	3,700.00	2	1,850.00
Sub-total	**322,470.00**		**20,431.94**	**698,220.00**		**22,300.52**
Loss in productivity						
Crop/agriculture	500,450.00	39	12,832.05	708,650.00	25	28,346.00
Livestock/animal raising	0.00	0	0	0.00	0	0
Sub-total	**500,450.00**		**12,832.05**	**708,650.00**		**28,346.00**
Forgone income	**1,480.00**	**4**	**370.00**	**30,600.00**	**30**	**1,020.00**
Health cost	**42,660.00**	**9**	**4,740.00**	**73,341.00**	**11**	**6,667.36**
TOTAL	867,060.00		38,374.00	1,510,811.00		58,334.00

Households in the surveyed area also experienced power failure and water shortage in addition to damage caused by typhoon. A significant number of the total respondents suffered from power outages. Of the 69% of households in Bagacay that suffered power failure, almost 80% experienced it for more than a week compared with 47% in Sta. Cruz (Table 5). Occurrence of water supply shortage after the typhoon is minimal, with only 10% of the total respondents experiencing it (Table 5). This may be due to the fact that most households depend on artesian wells that are not easily affected by typhoons.

Table 5. Power outage and water shortage, 2009

Item		Sta. Cruz (%, n=100)	Bagacay (%, n=110)	Total (%, n=210)
Power outage and duration	Yes	64	69	67
	Less than a week	53	22	37
	More than a week	47	78	63
	No	36	31	33
Water shortage and duration	Yes	4	16	10
	Less than a week	75	50	62
	More than a week	25	50	38
	No	96	84	90

4.6 Adaptation Measures and Coping Mechanisms to Mitigate the Impacts of Climate Change-induced Natural Disasters

4.6.1 Information advisory before the typhoon

It is very important for a community to receive advisories on upcoming disasters to help them prepare. From the survey, 95% of the total respondents received advisories before the typhoon hit the community, 77% of them receiving their warnings through media (radio, television, and print materials) (Table 6). Other sources of warnings and advisories came from the respondent's relatives, neighbors and the LGU. While it is good to know that the LGU took part in disseminating information regarding disasters, only 17% of the respondents received advisory from this institution (Table 6).

The timeliness of the advisory is also important, to give households ample time to prepare. On average, information is received 26 hours before the event hit the community, with respondents taking an average of 16 hours to prepare (Table 6).

Table 6. Typhoon advisory, sources and timeliness, 2009

Item		Sta. Cruz (n=100)	Bagacay (n=110)	Total (n=210)
Received warning before the event (%)		91	98	95
Information/ warning source* (%)	Media	79	83	77
	Relative	34	34	32
	LGU	23	14	17
	Neighbor	14	14	13
Average no. of hours before the typhoon hits community when the advisory is received		24	27	26
Average no. of hours until household is prepared		16	16	16

* Multiple response.

4.6.2 Household adaptation strategies before, during and after the typhoon

The surveyed households have multiple adaptation strategies to ease and reduce the effects of typhoons. These adaptation strategies include anticipatory and reactive measures. The anticipatory measures are those done before the typhoon hits while reactive measures are those done during and after the typhoon.

Table 7 shows the anticipatory measures performed by households upon receiving advise of an upcoming typhoon. Most households from both barangays reinforced and repaired their houses before typhoon. Common reinforcement methods included placing weights, like used tires and heavy rocks, on roofs to prevent them from being blown away. Buying and storing food come in second, with families stacking up on instant goods in anticipation of a long typhoon and conditions where purchasing food outside is not possible. Third most popular anticipatory measure is the wrapping of important household items in protective materials, usually plastic bags, and moving them to safer parts of the house or to safer places in general. Other anticipatory measures included preparing evacuation means, cutting/trimming of branches, and planting trees.

Table 7. Household adaptation before the typhoon, 2009

Strategies/measures	Sta. Cruz (n=100)			Bagacay (n=110)		
	%	Ave. family labor (no. of days)	Ave. price of materials bought (PhP)	%	Ave. family labor (no. of days)	Ave. price of materials bought (PhP)
Reinforce/repair house	54	2	62	73	1	28
Buy/store foods	47	0	79	60	0	82
Move items to safer place	22	1	62	53	1	84
Prepare evacuation means	3	0	0	7	1	0
Quick harvesting	3	2	0	4	1	0
Plant trees	1	5	95	0	0	0
Cut/trim tree branches	1	1	290	5	1	64
Change cropping pattern	1	30	11,477	0	0	0

A few farmers anticipated extreme flooding and harvested their crops beforehand to salvage a small portion of their yield. An innovative farmer in Brgy. Sta. Cruz even changed his cropping calendar in an attempt to adjust to the changing weather patterns and so that harvest time does not coincide with the rainy season.

During the typhoon, majority of the respondents opted to stay inside their houses and wait for it to subside. Staying inside their houses enabled them to be with their family members to pray, keep track of typhoon information through media, monitor and reinforce some parts of their house, and rearrange and move items to safer places. Only a few evacuated to higher grounds, with those helping their neighbors even fewer in number (Table 8).

Table 8. Household adaptation during the typhoon, 2009

Strategies/measures	Sta. Cruz (n=100)			Bagacay (n=110)		
	%	Ave. family labor (no. of days)	Ave. price of materials bought (PhP)	%	Ave. family labor (no. of days)	Ave. price of materials bought (PhP)
Move items	78	0	2	4	0	50
Stay inside house and wait	62	1	0	76	1	0
Evacuate members	10	0	0	10	0	0
Keep track of disaster info and instruction prevention	9	1	30	8	1	0
Reinforce house	7	1	0	14	1	0
Pray	7	1	0	3	1	0
Help neighbors	2	1	0	3	1	0

Reactive measures performed after the typhoon included reinforcement of houses and repair of damage. Households with houses whose damage were deemed unrepairable need to have them reconstructed; this can also be considered as an adaptation strategy, in anticipation for other coming typhoons. Some households responded to the effects of the typhoon by cleaning their environment and surroundings, selling assets, helping neighbors in need, and asking aid from their relatives, friends, and the LGU. Other respondents tried to recover their agricultural production capital by repairing their fields, boats and other machineries used in farming (Table 9).

Table 9. Household adaptation after the typhoon, 2009

Strategies/measures	Sta. Cruz (n=100)			Bagacay (n=110)		
	%	Ave. family labor (no. of days)	Ave. price of materials bought (PhP)	%	Ave. family labor (no. of days)	Ave. price of materials bought (PhP)
Repair/reinforce house	55	3	6,180	76	2	3,760
Reconstruct house	10	20	49,200	11	29	8,271
Recover production capital	4	2	1,572	5	18	4,500
Sell assets	7	1	1,714	1	1	2,500
Contribute man-day and money to local funds	1	1	0	5	0	0
Cope with financial shortage	1	1	0	1	1	0
Ask aid support from govt/friends	1	1	4,000	1	3	5,600

The said strategies above are performed by households because of the following reasons: a) the actions are affordable; b) everyone is doing them; c) they are recommended by neighbors, experts and local officials; and d) they are passed on from one generation to another.

4.6.3 Costs of adaptations due to the recent typhoon

Adaptation to natural calamities like typhoons is not without costs. For affected households in the study areas, these include costs of materials and value of labor used in implementing adaptation strategies from the time of the typhoon advisory until the typhoon has passed.

Table 10 shows that the total value of adaptation costs of all affected households reached an estimated PhP 1.6 million. A big percentage of the total adaptation cost (91%) were incurred after the typhoon with an amount of PhP 915,190 and PhP 546,095 for Sta. Cruz and Bagacay, respectively. It is evident that the greater adaption costs spent by Sta. Cruz resulted in less damage values compared with the lower adaptation costs of Bagacay but higher damage values.

Table 10. Total household adaptation cost due to the recent typhoon (PhP), 2009

Strategies/measures	Sta. Cruz (n=100)	Bagacay (n=110)	Total (n=210)
Before the typhoon	**54,548**	**52,815**	**107,363**
Reinforce/repair house	24,461	22,012	46,473
Prepare evacuation means	89	1,108	1,197
Plant trees	95	0	95
Cut/trim tree branches	290	321	611
Move items to safer place	2,900	10,631	13,531
Change cropping pattern	11,477	0	11,477
Quick harvesting	353	267	620
Buy/store foods	14,883	18,476	33,359
During the typhoon	**16,437**	**21,107**	**37,544**
Reinforce house	1,704	1,724	3,428
Evacuate members	391	1,335	1,726
Move items	230	224	454
Stay inside house and wait	11,531	15,845	27,376
Keep track of disaster information and prevention instruction	1,060	1,422	2482
Help neighbors	282	390	672
Pray	1,239	167	1406
After the typhoon	**915,190**	**546,095**	**1,461,285**
Repair/reinforce house	371,871	352,413	724,284
Reconstruct house	517,851	144,429	662,280
Recover production activities	8,115	37,756	45,871
Cope with financial shortage	382	273	655
Sell assets	4,014	6,418	10,432
Ask aid support from government/friends	12,836	2,532	15,368
Contribute man-day and money to local funds	121	2,274	2,395
Total cost	**986,175**	**620,015**	**1,606,190**

Per affected household, average adaptation cost in Sta. Cruz is almost 60% higher compared with Bagacay. Table 11 shows Sta. Cruz spent PhP 12,911 in preparation for the typhoon while Bagacay spent only PhP 1,007. The difference in adaptation costs during the typhoon between the two barangays was small, and the costs during this phase is lowest compared with either before and after the typhoon since families do not spend much in terms of labor and materials at this time. It can also be seen that adaptation costs for both barangays are higher after the typhoon; a total of PhP 66,940 was spent by Sta. Cruz after the typhoon while Bagacay spent PhP 32,173. The higher adaptation cost per household before the typhoon in Sta. Cruz than in Bagacay is attributed to farmers changing their cropping calendar, while the higher adaptation cost per household after the typhoon in Sta. Cruz is because of the large amount spent in reconstructing houses.

Compared with the total value of damage due to the recent typhoon, the total cost of adaptation per household is relatively lower. This may be because the adaptation strategies reported by the households pertain only to damage to properties and other actions to minimize the effect of the typhoon. As such, it excludes the value of foregone income or the value of days when the households are not able to work due to the effect of typhoon. It also excludes adaptation activities related to coping with the effects of the typhoon on livelihood.

These costs, together with the value of property damage, crops damage, foregone income and health costs, may give an indication of the extent of adaptation strategies and the minimum resources needed by the LGU if households are to be prepared and assisted to adapt to extreme event brought about by climate change. This information would also provide useful inputs to LGUs and donor agencies (such as the NGOs) in formulating adaptation plans for these households.

Table 11. Average adaptation cost per affected household due to the recent typhoon (PhP), 2009

Strategies/measures	Sta. Cruz (n=100)	Bagacay (n=110)	Total (n=210)
Before the typhoon	**12,911**	**1,007**	**13,918**
Reinforce/repair house	453	275	34728
Prepare evacuation means	29	138	167
Plant trees	95	0	95
Cut/trim tree branches	290	64	354
Move items to safer place	132	183	315
Change cropping pattern	11,477	0	11477
Quick harvesting	118	67	185
Buy/store foods	317	280	597
During the typhoon	**907**	**824**	**1,731**
Reinforce house	243	115	358
Evacuate members	39	121	160
Move items	3	56	59
Stay inside house and wait	186	189	375
Keep track of disaster information and prevention instruction	118	158	276
Help neighbors	141	130	271
Pray	177	55	232
After the typhoon	**66,940**	**32,173**	**99,113**
Repair/reinforce house	6,775	4,242	11,017
Reconstruct house	51,785	12,036	63821
Recover production activities	2,029	6,293	8322
Cope with financial shortage	382	273	655
Sell assets	4,014	6,418	10432
Ask aid support from government/friends	1,834	2,532	4366
Total cost	**80,758**	**34,004**	**114762**

4.7 Institutional Support after Disaster/Extreme Event

Access to credit and grants is an important facility to enable households to recover after a disaster. The study shows that both barangay study sites have almost equal percentages in terms of access to credit facilities and grants (Table 12). The ease of access to these facilities varied, with 20% from those reported to have access in Bagacay saying it is hard and almost 100% in Sta. Cruz saying it is easy. The remaining respondents who were not able to get loans (48%) reasoned that there is no one to get a loan from and they really do not like to take out loans (Table 12).

After the typhoon, respondents from both barangays received assistance from the local government in terms of loans and food supplies. It is surprising, though, that Bagacay had more respondents receiving financial aid (33%) than Sta. Cruz (6%). However, only Sta. Cruz was the recipient of aid from World Vision, an international NGO that provides food supplies and other necessities (Table 12).

In terms of evacuation, only a few (45% for Sta. Cruz and 39% for Bagacay) moved to safer places. A total of 46% evacuated to a neighbors' house, 29% to a relatives' house, and only 21% moved to government buildings. Accessibility of evacuation areas was considered easy by most in Sta. Cruz (51%) and a little under half (47%) in Bagacay, with the remaining respondents stating that it was difficult. Majority of those evacuated walked towards evacuation centers. Others did not evacuate because they considered their homes safer (74%), they cannot gain access to evacuation sites (16%), or there are no safer places to go (10%) (Table 13).

Table 14 lists down the respondents' suggested actions to reduce the risks and adapt to the increasing occurrence of extreme events. About 60% from Sta. Cruz and 70% from Bagacay suggested formulating financial aid programs to cover adaptation expenses. Setting up of an insurance market for crops was also considered a very significant action by individual households (46% and 55% from Sta. Cruz and Bagacay, respectively).

Table 12. Access to grant and credit facilities and assistance received (%), 2009

Item		Sta. Cruz (n=100)	Bagacay (n=110)	Total (n=210)
Access to grant and credit facilities	**Yes**	**53**	**50**	**52**
	Hard	4	20	12
	Easy	96	76	86
	Very Easy	0	4	2
	No	**47**	**50**	**48**
	No one to get a loan from	20	60	42
	Do not want to take out loans	80	40	58
Received assistance after the typhoon	**Yes**	**79**	**65**	**72**
	Local government*	**64**	**57**	**60**
	Financial	6	33	17
	In-kind	94	67	83
	In-kind: Food supplies	100	100	100
	Provincial government*	**14**	**30**	**22**
	Financial	9	0	3
	In-kind	91	100	97
	In-kind: Food supplies	100	100	100
	National government*	**4**	**4**	**4**
	In-kind	100	100	100
	In-kind: Food supplies	100	100	100
	World Vision*	**44**	**0**	**23**
	In-kind	100		100
	In-kind: Food supplies	100		100
	Relatives/Friends/Neighbors*	**16**	**23**	**19**
	Financial	46	0	20
	In-kind	54	100	80
	No	**21**	**35**	**28**

*Multiple responses

Table 13. Household evacuation (%), 2009

Item		Sta. Cruz (n=100)	Bagacay (n=110)	Total (n=120)
Evacuated		**45**	**39**	**42**
Type of shelter	Neighbor's house	29	63	46
	Relative's house	51	5	29
	Government buildings	13	32	21
	Religious buildings	7	0	4
Accessibility	Extremely difficult	11	23	16
	Difficult	9	0	5
	Little difficult	29	30	30
	Easy	51	47	49
Means of transportation	Walk	87	91	89
	Boat	7	5	6
	Motorbike	4	2	3
	Car	2	2	2
Did not evacuate		**55**	**61**	**58**
Reason for not evacuating*	Own house is safe	95	75	74
	Cannot access	20	12	16
	No safer places to go	7	13	10

* Multiple responses

Table 14. Suggested actions to deal with climate change (%), 2009

Suggested actions*	Sta. Cruz (n=100)	Bagacay (n=110)
Financial assistance for adaptation expenses	60	70
Set-up insurance market	46	55
Construction of durable structures	45	34
Provide technology/information/knowledge	40	39

* Multiple responses

4.7.1 CCA policies and policy suggestions to LGU

Communities need support through policies to help them adapt to the adverse effects of climate change-induced disasters. The most well-known policies related to CCA, as stated by the respondents, were reforestation and the policy on illegal logging. The respondents attributed flooding caused by typhoon to the inability of their mountains to hold water runoff. Waste segregation and proper waste disposal were other policies deemed supportive of CCA by the respondents. The establishment of an early warning system was not very well-known in the area surveyed (Table 15).

Table 15. Community and LGU preparedness rating, knowledge of CCA policies, and suggestions to strengthen LGU climate risk response, 2009

Item		Sta. Cruz (n=100)	Bagacay (n=110)
Average self-rating of community preparedness to adapt*		3.5	3.5
Average rating of LGU preparedness to respond/adapt*		4.0	3.5
Known policies that support CCA** (%)	No to illegal logging	20	35
	Reforestation (including mangroves)	25	22
	Waste segregation/Proper waste disposal	20	19
	Establishment of an early warning system	10	13
	No to illegal mining	6	6
Suggested actions to strengthen LGU capacity** (%)	Introduce CC programs/ provide IECs	25	15
	Monitor illegal logging/mining more closely	24	19
	Establishment of an early warning system	23	23
	Conduct reforestation	22	18
	Provide free seeds/ agriculture-related activities	21	17
	Provide alternative livelihood	14	25
	Prepare better evacuation areas and means	13	21
	Proper waste collection and disposal	8	12

* Lowest rating = 1; highest rating = 5; ** Multiple responses

As seen from Table 15, the respondents rated the preparedness of the community and LGU as moderate. Aside from the conduct of reforestation and the monitoring of illegal logging, suggested measures to strengthen the capacity of LGUs to respond to climate risks include conduct of information, education and communication (IEC) campaigns on climate change for citizens and introduction of climate change programs; provision of alternative livelihood and resources for agricultural activities; and establishment of an early warning system.

5.0 RESULTS AND DISCUSSION: GUBAT, SORSOGON

5.1 Socioeconomic Characteristics of Respondents

A total of 120 respondents from Gubat, Sorsogon are categorized as either receiving assistance from Coastal Core, Inc. or without assistance. Each group has 60 respondents, with the former being beneficiaries of the NGO's training and livelihood assistance.

In general, respondents without assistance are younger (42 years old on average) than those with assistance (44 years old). By barangay, respondents from Cota na Daco are generally younger (41.25 years old on average) than those from Rizal (47.5 years old on average). Females comprise the dominant category of respondents by sex, with 70% from those with assistance and 63% from those without assistance. Both types of respondents have the same number (5) of household members and number (4) of dependents. This implies that on average four individuals depend on one employed household member.

Majority of the respondents are married, with 75% from those with assistance and almost 82% from those without assistance. These are followed by single respondents, with 10% and 15% from those without assistance and with assistance, respectively.

In terms of educational attainment, more than two-thirds reached elementary levels, if not elementary graduates. Less than one-third finished high school (22% and 28% from those with and without assistance, respectively) and a few have college education (3% and 8% from those with and without assistance, respectively). From this, it can be deduced that the respondents have a relatively low level of education, which may be reflected in the type of occupation they are engaged in.

Fishing and shell gleaning are the respondents' primary occupation. For those with assistance, 38% and 27% are engaged primarily in fishing and shell gleaning, respectively. On the other hand, for those without assistance, 22% are small fishers and 43% are shell gatherers. It can be noted that more respondents from Cota na Daco are engaged in these activities.

Household income comes from various sources. These include crop production, livestock raising, fishing (net of production cost), and other sources such as shell craft, shell gleaning and off-farm labor. Average total annual income of households without assistance is 21% higher than those with assistance (PhP 77,765 vs. PhP 64,250). This may appear odd, but it has to be noted that the objective of the Coastal Core, Inc. is to provide assistance to low-income households. Farming and fishing contribute 4% and 46%, respectively, to the total household income of households with assistance and only 8% each to those without assistance.

Per capita, each household member with assistance receives PhP 13,994/year, which is almost 40% lower than the per capita income of PhP 19,584 for households without assistance. However, when converted into the poverty equivalent of the United Nations' Millennium Development Goals (MDG), households without assistance live at less than a dollar (<USD1.00) per day while those with assistance live at barely a dollar (USD1.00) daily, implying that all households live below the poverty threshold.

5.2 Ownership of Assets and Indices of Living

This section discusses ownership of house and lot and other household assets, as well as value of abode, electricity connection, and sources of water.

5.2.1 Lot and house ownership

Lot and house ownership and house structure are among the indicators of quality of living. Based on lot ownership, it appears that respondents without assistance are relatively well-off compared with those with assistance. More respondents without assistance (39%) are owners and part-owners of residential lots. There are also fewer informal settlers among non-assisted households (60%) than the assisted households (70%). By barangay, those from Rizal are in a better position compared with those from Cota na Daco, the latter having more informal settlers.

The sad plight of the assisted households and those from Cota na Daco in general can also be reflected by their house structure. More than half (52%) of those with assistance and most of those from Cota na Daco have houses that are constructed using light materials, making them more vulnerable to natural calamities. On the other hand, majority of households from Rizal, 75% each from those with assistance and without assistance, have concrete and semi-concrete houses. These households may either be owners or part-owners of residential lots and houses.

5.2.2 Ownership and value of house

Respondents may be a full owner, a part owner, a renter, or staying in a house as caretaker. In general, the house floor area and value of house of those without assistance are bigger than those with assistance. On the average, households from Cota na Daco that receive assistance have a 37 m^2 house floor area valued at PhP 21,750 or PhP 595/m^2. On the other hand, those from Rizal under the same category have an average house floor area of 69 m^2 valued at PhP 97,050 or PhP 1,400/m^2.

For non-assisted households, it is apparent that those from Rizal are better off than those in Cota na Daco. The average house floor area of non-assisted households in Rizal is 92 m^2 compared with the 64m^2 floor area in Cota na Daco. The average values of the houses are PhP 116,250 (PhP 1,259/m^2) in Rizal and PhP 60,188 (PhP 947/m^2) in Cota na Daco. The higher value of houses in Rizal is another indication of the higher quality of living of households from this barangay.

5.2.3 Appliance ownership

Radio and television are the respondents' common sources of information and entertainment while the mobile phone is the usual means of communication. In general, in the survey areas, more households without assistance own these appliances compared with those with assistance. Radio and television set ownerships are 50% and 53%, respectively, among those without assistance compared with 43% and 45%, respectively, among those with assistance. However, there is a higher percentage (38%) of households with assistance that own a mobile phone than those without assistance (32%). By barangay, more households from Rizal own radio, television sets and mobile phones compared with those from Cota na Daco.

5.2.4 Electricity connection

The percentage of electricity connection is also higher among households without assistance (83%) than those with assistance (75%). For both types of respondents, more from Rizal have electricity connection compared to those from Cota na Daco.

5.2.5 Sources of energy for cooking

Electricity and fuelwood are among the common sources of energy for cooking. For households with assistance, almost three-fourths of households depend on these two sources (73% and 72%, respectively). For those without assistance, 82% and 65% use electricity and fuelwood, respectively. Charcoal is used by 52% of households with assistance and 62% of those without assistance. Other sources of energy for cooking are LPG and kerosene.

5.2.6 Sources of water supply

The most common sources of water supply for domestic uses are communal artesian wells and piped system. For those with assistance, more than half of households use both sources, while for households without assistance, 43% draw water from communal artesian wells and 55% use piped water system. Other sources of water are the river and spring, owned artesian wells, and bought bottled water, but only few households use them.

5.2.7 Type of toilet

The type of toilet used by households is an important factor that affects the community's sanitation and health. It is disheartening to note that there are households without a toilet. Toilet ownership is higher (65%) among households without assistance than those with assistance (53%). For those with a toilet, the usual types are water sealed and open pit.

5.3 Sources of Income

The respondents' income consists of the combined values of crop production, livestock and poultry raising, fishing and other off-farm sources that households are engaged in. The combined total annual income of all respondents amounts to PhP 8.52 million, 57% of which is contributed by families without assistance from Coastal Core. A greater part of the income comes from fishing and the least from livestock raising. By type of households, the income of non-assisted families exceeded those of the assisted group by 21%. It also appears that by barangay, families from Cota na Daco have higher average annual income than those from Rizal, which may be attributed to the high income from fishing of the former.

5.3.1 Land area and crops planted

As a whole, the households have very small lot sizes, with a total of only 13.3 ha and 8.76 ha for households with and without assistance, respectively. This means that on average, a household with assistance has only 2,200 m^2 for crop production while those without assistance have 1,500 m^2. By barangay, households in Rizal appear to have a larger lot area. However, looking at the range of lot area, there are households with a very small lot area of only 10 m^2.

Crops planted include coconut, rice, root crops and tubers, and vegetables. However, it can be noted that only a small percentage of households, both assisted and non-assisted, are engaged in farming. Incomes from these crops come in trickle due to small lot sizes. For coconut, farmers could harvest up to eight times a year but only 5% of households are able to do so. For rice, farmers could harvest a maximum of twice a year, but due to the absence of irrigation facilities they have to rely on rainwater; this renders them to only have one rice cropping per year. In the case of root crops and tubers, households could harvest up to six times a year depending on the type of root crop.

Because of limited lot sizes, total harvests per year are considerably small. For coconut, the total annual harvest of assisted households is only 9,560 nuts while non-assisted households, which have bigger lot areas, produce 28,900 nuts. For households with assistance, total annual rice production is only 5.33 t while non-assisted households produce up to 19.22 t. For both types of households, rice production is purely used for consumption. Meanwhile, quantities of production of root crops and tubers, which are normally sold, are 364 kg for assisted households and 67 kg for non-assisted ones. Quantities produced from other vegetables are not reflected due to varied units of measurement.

5.3.2 Value of crops produced

The figures in this section represent the gross value of all crops produced, whether consumed at home or sold. The purpose of this estimation is to have an idea of the production value of households engaged in crop production.

The total values of crops produced per year amounted to PhP 159,325 and PhP 421,850 for assisted and non-assisted households, respectively. Per household, these amount annually to PhP 22,377 for the assisted group and PhP 58,466 for non-assisted ones. Considering that households have different lot sizes, the value per 100 m^2 was estimated to have a basis for comparison between the two types of households. Based on this estimation, it appears that assisted households are more productive since the per-100-m^2 value of their crops is higher (PhP 12,133/year) than those of non-assisted households (PhP 4,340/year). This implies that households receiving assistance engage in more intensive crop production.

5.3.3 Value of animal production

Similar to typical rural households that usually raise animals in their backyards, the surveyed households also supplement their income by raising swine and poultry. It can be noted that, on average, few for both types of households raise swine and chicken (19%) and ducks (3%).

For each animal-raising family, an assisted household raises at least four heads of swine compared with seven from a non-assisted household. For poultry, both types of households raise 15 heads per

producing family, with assisted households having nine heads of ducks on average. It could also be noted that chicken and ducks are raised only by Cota na Daco households. This may be because more households from Rizal are involved in other sources of livelihood, such as shell craft, shell gleaning, and off-farm labor rather than engaged in livestock raising.

In 2009, the total values of animals raised were PhP 78,860 for Coastal Core-assisted families (PhP 7,662/household) and PhP 115,190 for non-assisted households (PhP 12,392/household). For both groups, those from Cota na Daco earn more.

5.3.4 Value of fish catch

Compared with crop production and animal raising, there are more families engaged in fishing either as a primary or secondary source of livelihood. In general, 58% of the assisted group is engaged in fishing, which is higher than the 47% from non-assisted families. By barangay, more households from Cota na Daco are involved in fishing.

It could be noted, however, that the quantity of fish caught per fishing household is higher among the non-assisted group compared with the assisted ones. These may be due to the types of gear used in fishing. The non-assisted fishers have fish cages and spears that enable them to catch more fish compared with those from the assisted group that uses only the manual hook-and-line method. For all fishers, a great portion of the catch is sold either within the barangay or to the nearby local market. It is worth mentioning that the catch of fishers in both groups is multi species; hence, values differ as well.

The combined value of fish catch by all fisher-respondents amounts to PhP 3.35 million per year, with a greater portion (52%) contributed by fishers from Cota na Daco. However, per fishing household, those from the non-assisted group have higher annual earnings (PhP 56,824) compared to the assisted households (PhP 50,324). By barangay, the fishers from Cota na Daco, who depend more on fishing, have higher earnings compared to those from Rizal.

5.4 Social Affiliation of Households

Several associations operate in the survey area, prominent of which are the Building a Disaster Resilient Community (BDRC) that is under Coastal Core, Inc., Gubat Fishing and Aquatic Resources and Cooperative (GUFARMCO), and Self-Employment Assistance para sa Kabalikat (SEA-K).

Respondents receiving assistance from Coastal Core, Inc. are all exclusive members of the BDRC; they do not belong to any other civic group. For respondents not receiving assistance, few are members of some civic groups like GUFARMCO, SEA-K, El Shaddai/Faith, St. Anthony Coop, women's group, and the barangay council. Their affiliation in community organizations gives them the privilege to avail of loan assistance, free seedlings, or medical support in case of disaster.

5.5 Natural or Climate Change-induced Disaster

5.5.1 Awareness of, perceptions on, and household preparedness for climate change

Assisted households in Cota na Daco were found to be more aware of climate change (80%) than those without assistance (63%) (Table 16). This is in contrast with respondents from Rizal, where 85% of those without assistance were aware compared with only 15% of those with assistance. Interestingly, those aware of climate change mostly attributed the phenomenon to the observed extreme temperatures (>80%) and the least to ozone depletion (<10%). Their sources of knowledge about climate change were obtained from the media, seminars attended, and observation.

Observation of extreme heat (>80%) in present climate conditions was highly visible for both assisted and non-assisted groups. Most of them were aware also that stronger winds and heavier rains can induce natural disasters (>63%), which can then pose risks and threats to the community.

Future climate change-induced disasters were perceived by majority of the respondents as more severe (>55%), with increased incidence of flooding. Thus, majority claimed they will be more prepared.

Table 16. Perception on and awareness of climate change (%), 2009

Item		Type of respondent			
		With assistance		Without assistance	
		Cota na Daco (n=40)	Rizal (n=20)	Cota na Daco (n=40)	Rizal (n=20)
Awareness on climate change	Yes	80	70	63	85
	Extreme temperatures	81	86	92	88
	Unpredictable weather	53	36	44	29
	Extreme typhoon	44	21	40	35
	Ozone depletion	6	7	4	0
	Caused by pollution	13	7	16	6
	Source of Knowledge				
	TV/Media	34	21	60	35
	Seminars	34	57	20	59
	Observation	25	21	20	6
	No	20	30	38	15
Observation on present climate conditions	Extreme heat	88	67	80	67
	Extreme typhoon	0	17	13	0
	Unpredictable weather	13	17	7	33
Awareness of climate change-induced natural disasters	Yes	73	65	63	80
	Stronger winds and heavier rain	100	100	100	100
	Rising sea level	14	15	12	0
	No	28	35	38	20
Awareness of the risks/threats from climate change-induced natural disasters	Yes	75	90	78	85
	No	25	10	23	15
Perception on frequency of major flooding incidents	Increasing	50	40	35	25
	Decreasing	18	30	33	10
	No change	33	30	33	65
Perception on future climate change-induced disasters affecting household	More severe	55	60	68	65
	Same as current	8	0	5	10
	Not sure	38	40	28	25
Preparedness for possible occurrence of climate change-induced disasters	Yes	88	90	93	85
	No	13	10	8	15

5.5.2 Damage to property and productivity

Typhoons are the most damaging natural disaster experienced in the study sites as they are felt by almost all households. The impact of typhoons was manifested by the destruction of properties and their effect on livelihood and health. Because of the damage, households became vulnerable and required time to recover. Depending on the damage, type of household, and barangay, recovery period from the impacts of the typhoon was 21 to 42 days/household (Table 17), resulting in households being unable to work for an average of four to eight days.

Table 17. Household recovery period during the recent typhoon*, 2009

Item	Type of respondent					
	With assistance			Without assistance		
	Cota na Daco (n=40)	Rizal (n=20)	Total (n=60)	Cota na Daco (n=40)	Rizal (n=20)	Total (n=60)
Percent of households	100	80	93	100	95	98
Average recovery period per household (days)	42	21	63	38	38	75
Average no. of days unable to work per household	4	7	10	8	5	13

*In Cota na Daco, the recent destructive typhoon was in 2006. In Rizal, it was in 2009.

In addition to the damage, households also experienced power failure and water shortage. More non-assisted households were affected by power failure than those assisted, but an equal percentage suffered from water shortage (Table 18).

By barangay, more families from Rizal experienced power failure (95%) compared with those from Cota na Daco (78% for assisted, 83% for non-assisted). The extent of power failure was also higher for families from Rizal, where the incidence lasted for more than a week. These may be because there are more households with electricity connection in Rizal.

The minimal effect of water shortage both in the number of households affected and the duration of effect may be due to the fact that most households depend on artesian wells, which are not easily affected by typhoon.

Table 18. Power failure and water shortage during the recent typhoon* (%), 2009

Item		Type of respondent					
		With assistance			Without assistance		
		Cota na Daco (n=40)	Rizal (n=20)	Total (n=60)	Cota na Daco (n=40)	Rizal (n=20)	Total (n=60)
Power failure and duration	Yes	78	95	83	83	95	87
	Less than a week	15	0	10	10	0	7
	More than a week	63	95	73	73	95	80
	No	22	5	17	17	5	13
Water shortage and duration	Yes	5	15	8	8	10	8
	Less than a week	5	0	3	3	5	3
	More than a week	0	15	5	5	5	5
	No	95	85	92	43	0	28

Note: *In Cota na Daco, the recent destructive typhoon was in 2006, while in Rizal, it was in 2009.

5.5.3 Value of damages

The damage caused by recent typhoons included those towards property (mostly houses) and crop and livestock production as well as loss of income due to unavailability for work and additional health cost. In nominal terms, the total value of damage due to the recent typhoon experienced by the households amounted to PhP 1.16 million, 56% of which came from non-assisted households (Tables 19a and 19b).

A greater part of the value was due to damage to properties, particularly house and appliances. This was followed by the value of foregone income (PhP 188,090) representing the value of time for not being able to work, with PhP 80,750 from assisted families and PhP 107,340 from non-assisted ones (Table 19a and 19b). It can also be noted that for non-assisted families the value of health costs (PhP 66,080) was relatively higher than those for assisted households (PhP 12,920).

Table 19a. Damage and losses per household with assistance due to recent typhoons*, 2009

Type of Damage	Cota na Daco (n=40)			Rizal (n=20)		
	Value of damage (PhP)	% HH affected	Damage per HH (PhP)	Value of damage (PhP)	% HH affected	Damage per HH (PhP)
Damage to property						
Roof	12,250	25	490	9,000	15	600
Whole house	161,000	55	2,927	97,500	60	1,625
Appliance	52,700	33	1,622	34,000	25	1,360
Vehicles/boats	13,500	10	1,350	0	0	0
Others	20,000	3	8,000	0	0	0
Sub-total	**259,450**		**5,189**	**140,500**		**7,025**
Loss in productivity						
Crop/agriculture						
Coconut	0	0	0	640	5	128
Rice (kg/cropping)	3,000	3	1,200	4,300	5	860
Root crops, tubers	150	3	60	0	0	0
Livestock/animal raising						
Pig	3,000	3	1,200	8,000	10	800
Chicken	3,000	3	1,200	0	0	0
Sub-total	**9,150**		**2,288**	**12,940**		**3,235**
Forgone income	**34,510**	55	**1,569**	**46,240**	40	**5,780**
Health cost	**720**	8	**240**	**12,200**	15	**4,067**
Total	**303,830**		**9,285**	**211,880**		**20,107**

* In Cota na Daco, the recent destructive typhoon was in 2006. In Rizal, it was in 2009.

Table 19b. Damage and losses per household without assistance due to recent typhoons*, 2009

Type of damage	Cota na Daco (n=40)			Rizal (n=20)		
	Value of damage (PhP)	% HH affected	Damage per HH (PhP)	Value of damage (PhP)	% HH affected	Damage per HH (PhP)
Damage to property						
Roof	35,010	30	1,167	40,000	25	1,600
Whole house	136,000	55	2,473	151,000	60	2,517
Appliance	36,000	8	4,800	0	0	0
Vehicles/boats	11,000	0	0	4,000	5	800
Others	10,000	0	0	0	0	0
Sub-total	**228,010**		**6,162**	**195,000**		**10,833**
Loss in productivity						
Crop/agriculture						
Coconut	1,500	3	600	0	0	0
Rice (kg/cropping)	0	0	0	50,600	35	1,446
Root crops, tubers	0	0	0	0	0	0
Livestock/animal raising						
Pig	0	0	0	0	0	0
Chicken	0	0	0	0	0	0
Sub-total	**1,500**		**1,500**	**50,600**		**7,229**
Forgone income	**98,270**	48	**5,172**	**9,070**	35	**1,296**
Health cost	**25,000**	3	**25,000**	**41,080**	15	**13,693**
Total	**352,780**		**37,835**	**295,750**		**33,051**

* In Cota na Daco, the recent destructive typhoon was in 2006. In Rizal, it was in 2009.

5.6 Adaptation Measures and Coping Mechanisms to Mitigate the Impacts of Climate Change-induced Natural Disasters

5.6.1 Information advisory before the typhoon

During natural disasters such as typhoons or floods, it is very important for the community to receive warnings. According to survey results, 92% of respondents with assistance received warnings before the typhoon hit the community, compared with only 85% from respondents without assistance (Table 20). The main source of warning for both types of household was the media. This was followed by the LGU for respondents with assistance (44%) and neighbors for respondents without assistance (31%). Both received the warning the least from their relatives.

Table 20. Typhoon advisory, sources, and timeliness, 2009

Item		Type of respondent					
		With assistance			Without assistance		
		Cota na Daco (n=40)	Rizal (n=20)	Total (n=60)	Cota na Daco (n=40)	Rizal (n=20)	Total (n=60)
Received warning before the event (%)		88	100	92	80	95	85
Information/ warning source* (%)	Media	77	95	84	81	89	84
	LGU	46	40	44	25	16	22
	Neighbors	14	10	13	38	21	31
	Relatives	6	5	5	6	11	8
Average no. of hours when advisory was received before event hits community		26	35	30	34	31	33
Average no. of hours until household is prepared		10	18	13	19	18	19

* Multiple response

Respondents with and without assistance received information about the typhoon an average of 30 and 33 hours before it hit the community, respectively (Table 20). Since respondents without assistance received the advisory earlier, they had an average preparation time of 19 hours compared with the 13 hours for those with assistance.

5.6.2 Household adaptation strategies before, during and after the typhoon

Households employ multiple strategies—anticipatory and reactive measures—to adapt to the effects of typhoon. Study results indicate that those receiving assistance from Coastal Core, Inc. were more responsive to the effects of typhoons, as reflected by the higher percentage of families performing different adaptation strategies, compared with families without assistance.

Reinforcing and repairing the house was the common adaptation strategy of households before, during, and after the typhoon. In addition, three common measures before and during typhoon included evacuation of family, moving appliances to safe places, and getting updated information about the typhoon. Other anticipatory activities included quick harvesting of crops, and buying and storing foods. However, there was a few households that said they do not prepare before the typhoon comes even if they have received the typhoon advisory (Table 21).

Table 21. Household adaptation before the typhoon, 2009

Strategies/measures		Type of respondent					
		With assistance			Without assistance		
		Cota na Daco (n=40)	Rizal (n=20)	Total (n=60)	Cota na Daco (n=40)	Rizal (n=20)	Total (n=60)
Reinforce/ repair house	Percentage of households	50	25	42	35	45	38
	Average family labor (days)	2	1	2	2	2	2
	Average price of materials	327	473	356	65	106	81
Evacuate family members	Percentage of households	25	10	20	13	15	13
	Average family labor (hours)	6	4	6	3	2	4
Move items/ appliances to safer place	Percentage of households	38	45	40	20	10	17
	Average family labor (hours)	3	2	5	5	5	9
	Average price of materials	21	24	46	18	20	33
Update information on typhoon	Percentage of households	25	5	18	20	20	20
	Average family labor (hours)	3	1	1	1	1	2
	Average price of materials	9	0	21	15	12	27
Quick harvesting	Percentage of households	3	5	3	0	0	0
	Average family labor (days)	1	1	1	0	0	0
Buy/store foods	Percentage of households	68	45	60	53	80	62
	Average family labor (hours)	1	1	3	1	4	2
	Average price of materials	110	79	183	170	100	275
Did not prepare (% of households)		18	5	13	28	10	22

During the typhoon, other adaptation measures included staying in the house and waiting for the typhoon to subside, and helping neighbors (Table 22). Those who stayed in the house said it is dangerous to go out during typhoon due to falling trees. On the other hand, those helping their neighbors volunteered to bring them to evacuation areas.

Table 22. Household adaptation during the typhoon, 2009

Strategies/measures		Type of respondent					
		With assistance			Without assistance		
		Cota na Daco (n=40)	Rizal (n=20)	Total (n=60)	Cota na Daco (n=40)	Rizal (n=20)	Total (n=60)
Reinforce/ repair house	Percentage of households	25	0	17	8	5	7
	Average family labor (days)	1	0	1	1	1	1
	Average price of materials	5	0	5	0	0	0
Evacuate family members	Percentage of households	53	65	57	50	30	43
	Average family labor (hours)	1	0	1	1	0	1
Move items/ appliances to safer place	Percentage of households	3	0	2	5	10	7
	Average family labor (hours)	3	0	3	1	2	1
	Average price of materials	0	0	0	125	10	68
Keep track of typhoon information	Percentage of households	3	35	13	23	10	18
	Average family labor (days)	1	0	1	1	1	1
	Average price of materials	50	6	31	17	0	14
Stay inside house and wait	Percentage of households	60	50	57	55	70	60
	Average family labor (days)	1	1	1	1	1	1
Help neighbors	Percentage of households	15	10	13	10	20	13
	Average family labor (days)	0	0	1	1	1	1

Households are more reactive after the typhoon, as shown by the higher percentages of households performing adaptation strategies (Table 23). This may mean that households have to do additional adaptation measures due to damage done by the typhoon. The percentage of households that reinforced and repaired houses after typhoon is higher than those before and during the event. There are also households that reconstructed their houses after the typhoon; as a result, they resorted to selling assets, mortgaging properties, and borrowing to cope with the effects of typhoon. There are also families that were forced to migrate and find jobs elsewhere, since their livelihood was destroyed by the calamity.

Table 23. Household adaptation after the typhoon, 2009

Strategies/measures		Type of respondent					
		With assistance			Without assistance		
		Cota na Daco (n=40)	Rizal (n=20)	Total (n=60)	Cota na Daco (n=40)	Rizal (n=20)	Total (n=60)
Reinforce/repair house	Percentage of households	55	60	57	60	65	62
	Average family labor (days)	3	9	5	2	1	5
	Average price of materials	3250	5875	2506	2577	6215	3855
Treat water source	Percentage of households	33	70	45	43	30	38
	Average family labor (hours)	1	1	1	1	2	1
Reconstruct house	Percentage of households	38	20	32	33	20	28
	Average family labor (hours)	17	21	38	37	56	41
	Average price of materials	9860	11000	6060	10269	22500	13147
Migrate & seek job elsewhere	Percentage of households	15	25	18	13	15	13
Mortgage/loan	Percentage of households	23	30	25	4	2	6
	Average amount generated	3856	6917	5080	7375	1250	5333

The above strategies were performed by households because of the following reasons: a) the actions are affordable; b) everyone is doing them; c) they are recommended by neighbors, experts and local officials; and d) they are passed on from one generation to another.

Among the strategies, households perceived evacuation of families as the most effective means of adaptation. Other effective strategies as perceived by the households surveyed include moving appliances to safer places, storing food, keeping track of information about the typhoon, and helping neighbors.

5.6.3 Costs of adaptation due to the recent typhoon

The total value of adaptation costs to all affected families was estimated at PhP 1.18 million, of which non-assisted families incurred 57% (Table 24). Of the total cost, a greater portion was spent on adaptation strategies after the typhoon, which was placed at 81% for the assisted families and 87% among the non-assisted group.

Per affected household, average adaptation cost for non-assisted ones was significantly higher compared with those assisted (Table 25). This may be attributed to the construction of new houses after the typhoon, where non-assisted families spent almost twice the amount as those spent by assisted households.

It can be noted that before typhoon, households with assistance had higher adaptation costs compared with non-assisted families. This is due to the higher cost incurred by the former in moving appliances to safer places and keeping track of information about the typhoon, which is negligible among the latter. For both groups, cost is lowest during typhoon, since households usually stay home and spend less in terms of labor and materials compared with activities before and after typhoon.

Compared with the total value of damage due to recent typhoon (Tables 19a and 19b), the total cost of adaptation per household is relatively lower. Again, this may be because the adaptation strategies reported by the households pertain only to damage to properties and other actions to minimize the effect of

the typhoon, and exclude the value of foregone income and adaptation activities related to coping for the effects of typhoon on livelihood.

Table 24. Total household adaptation cost due to the recent typhoon, 2009

Strategies/measures	Type of respondent					
	With assistance			Without assistance		
	Cota na Daco (n=40)	Rizal (n=20)	Total (n=60)	Cota na Daco (n=40)	Rizal (n=20)	Total (n=60)
Before the typhoon	**33,407**	**12,497**	**45,904**	**23,978**	**18,303**	**42,281**
Reinforce/repair house	17,190	7,252	24,443	10,385	7,012	17,397
Evacuate family members	788	130	917	295	631	926
Move items/appliances to safer place	1,098	377	1,475	139	-	139
Keep track of typhoon information	2,080	46	2,125	-	-	-
Stay inside house and wait	1,599	-	1,599	151	254	405
Clean house	3,208	3,367	6,576	3,224	859	4,083
Help neighbors	1,080	20	1,100	1,336	400	1,736
Buy/store foods	9,572	4,671	14,243	11,673	10,007	21,680
During the typhoon	**14,899**	**34,567**	**49,466**	**13,150**	**29,161**	**42,311**
Reinforce/repair house	4,246	8,702	12,947	1,438	2,231	3,668
Evacuate family members	1,170	2,657	3,827	1,460	1,885	3,345
Move items/appliances to safer place	67	134	201	117	269	386
Keeping track of typhoon information	115	2,097	2,212	3,103	5,345	8,448
Help neighbors	2,091	4,705	6,796	874	3,076	3,950
After the typhoon	**133,792**	**278,718**	**412,511**	**238,391**	**350,452**	**588,843**
Reinforce/repair house	12,937	38,003	50,940	32,985	63,018	96,004
Treat water source	2,275	7,228	9,503	6,293	13,391	19,684
Reconstruct house	118,083	231,079	349,163	198,474	273,025	471,498
Migrate and seek job elsewhere	6	15	21	5	9	14
Cope with financial shortage	491	2,393	2,884	635	1,008	1,643
Total cost	**182,098**	**325,782**	**507,880**	**275,519**	**397,915**	**673,435**

Table 25. Average household adaptation cost due to the recent typhoon (PhP), 2009

Strategies/measures	Type of respondent					
	With assistance			Without assistance		
	Cota na Daco (n=40)	Rizal (n=20)	Total (n=60)	Cota na Daco (n=40)	Rizal (n=20)	Total (n=60)
Before the typhoon	**4,810**	**2,178**	**6,988**	**1,643**	**1,961**	**3,604**
Reinforce/repair house	699	777	1,476	511	684	1,195
Evacuate family members	79	65	144	59	210	269
Move items/appliances to safer place	1,098	377	1,475	69	-	69
Stay inside house and wait	178	-	178	50	127	177
Clean house	214	374	588	230	215	445
Keeping track of typhoon information	2,080	46	2,125	-	-	-
Help neighbors	108	20	128	167	100	267
Buy/store foods	355	519	874	556	625	1,181
During the typhoon	**1,375**	**1,884**	**3,259**	**1,354**	**1,526**	**2,880**
Reinforce/repair house	329	427	756	369	415	784
Evacuate family members	56	63	119	73	59	132
Move items/appliances to safer place	67	134	201	59	67	126
Stay inside house and wait	300	362	662	280	334	614
Clean house	159	208	368	83	114	196
Keeping track of typhoon information	115	262	377	345	356	701
Help neighbors	349	428	776	146	181	327

Table 25 continued

Strategies/measures	Type of respondent					
	With assistance			Without assistance		
	Cota na Daco (n=40)	Rizal (n=20)	Total (n=60)	Cota na Daco (n=40)	Rizal (n=20)	Total (n=60)
After the typhoon	**8,692**	**9,810**	**18,502**	**17,319**	**16,021**	**33,341**
Reinforce/repair house	588	905	1,493	1,361	1,174	2,535
Treat water source	175	219	394	370	446	817
Reconstruct house	7,872	8,558	16,431	15,267	13,651	28,918
Migrate and seek job elsewhere	1	1	2	1	1	2
Mortgage and borrowing	55	126	181	159	144	303
Clean house and environment	1	1	2	161	604	766
Total cost	**14,877**	**13,872**	**28,749**	**20,316**	**19,508**	**39,825**

Table 26 lists the adaptation activities provided by Coastal Core, Inc. in Gubat, including assistance in building disaster resilient communities. The cost of adaptation was computed based on specific activities, like capability building, improving family nutrition and potable water sources, and providing sustainable livelihood support.

Table 26. Contribution to adaptation cost by Coastal Core, Inc. and community, May 2008 to April 2009

Activities	Cost (PhP)	Beneficiaries/Cost per HH
Coastal Core Inc. contribution		
1. Capability building	**153,000.00**	**3,825.00**
a. Gender sensitivity training	24,000.00	40 households
b. Basic health and environmental sanitation	36,000.00	
c. Disaster preparedness and management	36,000.00	
d. Community visioning and planning	45,000.00	
e. Sustainable livelihood planning	12,000.00	
2. Improving family nutrition and potable water	**241,000.00**	**2,591.40**
a. Provision of potable water	85,000.00	93 households
b. Establishment of community garden	150,000.00	
c. Family health savings	6,000.00	
3. Sustainable livelihood support	**455,000.00**	**11,375.00**
a. Livelihood support fund	200,000.00	40 households
b. Financial management training	15,000.00	
c. Livelihood skills training	40,000.00	
d. Marketing support	200,000.00	
4. Administrative cost	**107,600.00**	**896.67**
a. Personnel cost	95,000.00	120 households
b. Communication	3,600.00	
c. Transportation	9,000.00	
Community contributions	**Cost: materials (PhP)**	**Cost: labor (PhP)**
Early warning communication system	5,000.00	900.00
Composting and materials recovery facility	15,000.00	17,000.00
Establishment of community garden	6,000.00	15,000.00
Community clean-ups	5,000.00	6,000.00

5.7 Institutional Support after Disaster/Extreme Event

The establishment of an early warning system is one of the many strategies designed to reduce risks caused by disasters. Survey results show that most respondents (both assisted and non-assisted) received a typhoon advisory before the typhoon hit the community. Media was the most cited source of information,

with advance information reaching respondents within 26-35 hours. This gave enough time for the households to prepare (Table 20).

In terms of access to credit and grants, our study shows that both assisted and non-assisted respondents had access to these facilities, although those with assistance had more access (62%) compared with those without assistance (52%). The difference, however, is not significant, as both types of households reported that they found it easy to get loans. For those who were not able to get loans (38% of those with assistance and 48% of those without assistance), they reasoned that there is no one to loan from and that they really do not like to take out loans (Table 27).

Table 27. Access to grant and credit facilities, assistance received and household evacuation (%), 2009

Items			Type of respondent					
			With assistance			Without assistance		
			Cota na Daco (n=40)	Rizal (n=20)	Total (n=60)	Cota na Daco (n=40)	Rizal (n=20)	Total (n=60)
Access to grant and credit facilities	**Yes**		**63**	**60**	**62**	**53**	**50**	**52**
	Hard		8	0	5	10	0	7
	Easy		85	100	90	85	90	86
	Very easy		8	0	5	5	2	7
	No		**38**	**40**	**38**	**48**	**50**	**48**
	No one to loan from		80	75	78	80	50	68
	Do not want to loan		20	25	22	20	50	32
Received assistance	Yes		85	80	83	70	55	65
	No		15	20	17	30	45	35
Evacuated household	**Yes**		**70**	**70**	**70**	**58**	**40**	**52**
	Type of shelter	Government bldgs.	73	30	57	75	40	65
		Neighbor's house	17	30	22	23	40	25
		Others	10	35	18	5	15	7
		Religious bldgs.	0	5	2	0	15	3
	Accessibility	Extremely difficult	14	15	15	8	0	7
		Difficult	18	15	17	13	15	13
		Little difficult	28	5	22	35	40	35
		Easy	40	65	48	43	50	45
	Means of transport-tation	Walk	94	100	95	83	90	83
		Tricycle	0	0	0	13	15	14
		Motorbike	3	0	2	5	0	3
		Car	3	0	2	0	0	0
	No		**30**	**30**	**30**	**42**	**60**	**48**
	Reason for not evacuating	Own house is safe	66	100	78	88	90	90
		No safer place to go	17	0	12	5	0	3
		Cannot access	17	0	12	5	10	7

After typhoon, both types of respondents accessed/received assistance from the municipal or provincial government as well as from cooperatives (83% for assisted and 65% for non-assisted) (Table 27). Most of the said respondents accessed municipal government assistance (50% for assisted and 39% for non-assisted) predominantly for food supplies. All respondents without assistance asked for help in terms of food while only those with assistance accessed financial as well as in-kind assistance from cooperatives.

In terms of evacuation, most households (70% of those assisted and 52% of the non-assisted) moved mainly to government buildings (57% and 65%, respectively) or to their neighbor's house (22% and 25%, respectively) (Table 27). Access to evacuation areas was considered easy, as these are normally just within walking distance from their own homes. Others did not evacuate because there are no other safer places to go, and they considered their homes safer compared with other places.

Table 28 lists the respondents' suggested actions to reduce the risks and adapt to the increasing occurrence of extreme events. Sixty-seven percent (67%) of those with assistance and 80% of those without assistance suggested formulating financial aid to cover adaptation expenses. Individual households considered construction of durable structures a very significant action (70% of those assisted and 63% of the non-assisted).

Table 28. Suggested actions to deal with climate change (%), 2009

Suggested actions	Type of respondent					
	With assistance			Without assistance		
	Cota na Daco (n=40)	Rizal (n=20)	Total (n=60)	Cota na Daco (n=40)	Rizal (n=20)	Total (n=60)
Financial assistance for adaptation expenses	70	60	67	78	80	80
Construct durable structures	65	80	70	68	55	63
Provide technology/information/ knowledge	28	20	25	35	40	37
Set-up insurance market	23	20	22	15	25	18
Provide housing and livelihood materials	10	15	12	5	0	3

Results of the study indicate that the development of early warning system is not a very well-known policy support for CCA (Table 29). The most popular policy that respondents view to be related to climate change is waste segregation and proper waste disposal. Reforestation, particularly mangrove rehabilitation, and prohibition of illegal logging are also policies considered by most respondents to be supportive of CCA.

Respondents view themselves as having moderate capacity for adaptation and rate LGU's preparedness as a little less than that of their self-rating (Table 29). They suggested a number of measures to strengthen the LGU's capacity to adapt to the impacts of climate change, such as providing alternative livelihood; introducing climate change programs and providing information, education and communication campaigns on the subject; and establishing an early warning system.

Table 29. Community and LGU preparedness rating, knowledge of CCA policies, and suggestions to strengthen LGU climate risk response, 2009

Item		Type of respondent					
		With assistance			Without assistance		
		Cota na Daco (n=40)	Rizal (n=20)	Total (n=60)	Cota na Daco (n=40)	Rizal (n=20)	Total (n=60)
Ave. self-rating of community preparedness to adapt*		4	4		4	4	
Ave. rating of LGUs preparedness to adapt*		3	4		3	3	
Known policies that support CCA** (%)	Waste segregation/proper waste disposal	33	40	35	25	50	33
	Reforestation (including mangroves)	30	30	30	28	45	33
	No to illegal logging	33	10	25	23	50	32
	Establishment of early warning system	3	5	3	10	0	7
	No to illegal mining	3	0	2	0	5	2
Suggested actions to strengthen LGU capacity** (%)	Provide alternative livelihood	40	30	37	50	40	47
	Introduce CC programs/provide IECs	45	50	47	35	45	38
	Establish early warning system	5	10	7	43	30	38
	Reforest uplands and mangroves	15	25	18	15	25	18
	Better prepare evacuation means & areas	15	20	17	15	20	17
	Collect & dispose of waste properly	8	0	5	13	15	13
	More closely monitor logging/mining	8	0	5	10	10	10
	Construct seawall	10	10	10	10	5	8

* Lowest rating = 1; highest rating = 5, ** Multiple responses

The 7% response of assisted respondents on early warning system is rather interesting, compared with the 38% from those without assistance. It is possible that those with assistance were already aware of climate change hazards and with what to do to get advance information on the probable occurrence of extreme events like typhoons, earthquake, and tsunami. In fact, during one of the field visits to the site, a tsunami alert was raised in the Philippines due to the earthquake in Chile (February 28, 2010). The community organization being assisted by Coastal Core, Inc. was already advised to monitor the development through Cable News Network (CNN), an international television station that updated the whole world on the risks an earthquake of that magnitude can cause.

Proper waste management remains to be in the list of programs that need to be implemented in relation to climate change. Structural measures like sea wall construction and better evacuation areas were also suggested.

5.8 Social Vulnerability Index

Table 30 shows that household respondents in Gubat, Sorsogon have moderate social vulnerability against typhoons (0.41). The treated group, or those receiving assistance, has a slightly lower overall SVI (0.39) than the untreated group (0.42), and this difference is statistically significant based on the t-test with p-value equal to 0.01.

The lower SVI of the treated group can be attributed to their higher resilience and higher recovery process. It is important to note though that in terms of exposure the indices do not significantly differ between the two groups. To put more substance in the analysis, a detailed inspection of the SVI components is necessary.

Table 30. Summary statistics for Social Vulnerability Index

Components/Indicators		Mean			T-test
		Overall	Treated	Untreated	(p-value)
Maximum potential losses/exposure	Economic vulnerability	0.14	0.16	0.12	0.29
	House value	0.08	0.06	0.10	0.14
	Average	**0.11**	**0.11**	**0.11**	**0.98**
Household resilience/ sensitivity	Dependency ratio	0.46	0.44	0.48	0.12
	Frequency of flooding	0.41	0.39	0.43	0.29
	Preparedness	0.28	0.30	0.27	0.62
	Access to information	0.12	0.08	0.15	0.26
	Adaptation investment (before)	0.94	0.91	0.97	0.02**
	Average	**0.44**	**0.42**	**0.46**	**0.08***
Self-recovery process	Access to credit	0.45	0.38	0.52	0.14
	Access to other assistance	0.26	0.17	0.35	0.02**
	Household income	0.80	0.82	0.78	0.23
	Adaptation investment (during)	0.93	0.89	0.97	0.02**
	Adaptation investment (after)	0.88	0.88	0.87	0.76
	Average	**0.66**	**0.63**	**0.70**	**0.02****
Composite index/Overall SVI		**0.41**	**0.39**	**0.42**	**0.01****

*significant at 10%, **significant at 5%

Under exposure, households were found to have a very low vulnerability of 0.11. This can be explained by the fact that majority of these households belong to the lower income group; hence, the values of property and production activities at risk are at minimal levels. Although the SVI value for this component is higher for the treated than for the untreated, results of the statistical test show no significant differences between the two.

Under the second component of household resilience, the vulnerability index is 0.44, which falls under the moderate category. It can be noted that the estimated index for the treated group is significantly lower than that of the untreated. This can be explained by the higher adaptation investment undertaken by

the treated group. On the other hand, all respondents seem to face the same level of risk as seen in the indices, frequency of flooding, and dependency ratio. Both groups also have equally low vulnerability in terms of access to information and preparedness. Access to information means that households received early warning advisories about the occurrence of typhoons and floods. The preparedness indicator corresponds to the self-rating given by households to signify their state of being ready for the upcoming typhoon.

Finally, the SVI value under self-recovery process is the highest at 0.66 (high vulnerability). It is interesting to note that the average SVI for the treated group is lower (0.63) than that of the untreated (0.7), which is significant at 5% level. This is mainly driven by variables such as investments in adaptation measures during and after the typhoon and flooding event, and access to assistance.

Apparently, all respondents—both treated and untreated—face the same exposure and risk to the negative impacts of typhoon and flooding. However, the vulnerability of the former is lower because of their higher adaptive capacity.

5.9 Impact of Coastal Core, Inc. Assistance on Treated Households' Recovery Ability

The propensity score matching (PSM) analysis shows that Coastal Core, Inc. assistance has a significant impact on the recovery ability of treated households. It can be concluded that the quicker recovery of these households can be attributed to the intervention and not simply due to systematic differences between treatment and control. While the nearest neighbor, kernel and stratification methods show quite similar results, ranging from a difference of 3.8 to 4.4 days, the result of radius matching shows a higher treatment effect of 11.44 days, which is statistically significant at 5% level (Table 31).

Table 31. Treatment effects of Coastal Core, Inc. assistance

Matching method	Simple difference (number of days)	Average treatment effect on the treated (ATT)	S.E.	T statistic
Nearest Neighbor	-12	-3.826	6.701	-0.571
Kernel		-4.355	5.527	-0.788
Stratification		-3.839	5.393	-0.712
Radius		-11.441	5.508	-2.071**

*significant at 10%, **significant at 5%

The impact of Coastal Core, Inc.'s intervention on the household's recovery ability can be monetized by multiplying the treatment effect with the prevailing wage rate or the estimated per capita income from agriculture or fishery production per day. The resulting value yields the benefit of the intervention per household per typhoon event. Using the daily income data generated from the survey, the benefit per household is estimated to range from PhP 436 to PhP 1,304/typhoon (Table 32). Higher benefits were estimated using the minimum wage rate, with values ranging from PhP 715 to PhP 2,139/typhoon. These values, however, are considered lower bound estimates of the interventions' true impact since assisted adaptation may also increase resilience and reduce overall vulnerability of households. However, the data collected from the survey is insufficient to validate such an assertion.

Table 32. Monetization of Coastal Core, Inc. impact on households' recovery outcome

Approach	Reduction in recovery period (in days)	Value (PhP/HH per typhoon)	
		Daily income estimate	Minimum wage rate
Nearest Neighbor	3.83	436	715
Kernel	4.36	496	814
Stratification	3.84	438	718
Radius	11.44	1,304	2,139

Sources: Daily income estimate (PhP 114/day) from survey data; minimum wage rate (PhP 187/day) from the Department of Labor and Employment

6.0 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Climate change is now a widely recognized threat to the well-being of the human population, and the threat is a real one especially in the Philippines. We have no choice but to act proactively to avert its adverse impacts.

To look at the impacts of climate change on households and communities and to assess the potentials of some adaptation strategies, two study areas each in Labo, Camarines Norte and Gubat, Sorsogon were selected. The two Labo barangays (Sta. Cruz and Bagacay) were considered highly vulnerable to flooding. On the other hand, the two Gubat barangays (Cota na Daco and Rizal) were considered highly vulnerable to storm surges and sea level rise.

Different research methods were used for data collection. Primary data gathered through household surveys and key informant interviews were used. To measure damage and/or cost of adaptation of households to climate-induced disasters, replacement cost method was used. Foregone income/opportunity cost was also considered in the total calculation of damage cost. Descriptive statistics were also used extensively to describe the level of awareness and preparedness of the communities in dealing with climate change hazards. On the other hand, information from focus group discussions with local officials and community members together with secondary data analysis were used to describe the scenario at the community level.

In Labo, Camarines Sur, a total of 210 respondents were surveyed, 100 of which were from Brgy. Sta. Cruz and 110 from Brgy. Bagacay. Farming and livestock raising comprise 32% of the primary occupation engaged in by all the respondents while 37% derive their income from off-farm activities. These activities are mainly the operation of small stores, driving of public utility vehicles, and engagement in junkshops, especially in Bagacay. An average household size of five earns PhP 49,184 in Brgy. Sta. Cruz and PhP 51,177 in Brgy. Bagacay.

The study showed that household awareness of climate change is considered high. Most are aware of unpredictable weather, stronger typhoons and extreme temperatures being caused by pollution and ozone depletion. The source of information about climate change mainly comes from the media, next to personal observation. Only a small percentage of the respondents learn about climate change in school. While Memorandum Circular 71 institutionalizes disaster risk reduction in schools, there have been problems regarding its implementation.

Damage caused by typhoons based on recollection of recent typhoon occurrence was estimated based on actual damage to property, loss in productivity, foregone income, and health cost. The total value of damage due to the recent disaster experienced by the households, in nominal terms, amounted to PhP 2.38 million, with Bagacay contributing almost double the value of damage of Sta. Cruz. In general, the high total value of damage for Sta. Cruz and Bagacay reflects that both barangays are highly vulnerable to climate change-induced typhoons, heavy rains and flooding.

Among the adaptation strategies, households perceive reinforcement and repair of houses as the most effective means of adaptation. This is followed by buying and storing of food upon receiving typhoon advisory. Other strategies perceived to be effective include the moving of appliances to safer place, keeping track of the information about the typhoon, and helping neighbors.

In Gubat, Sorsogon, a total of 120 respondents were categorized as either receiving or not receiving assistance from Coastal Core, Inc. Primary occupation of the surveyed respondents are fishing and shell gleaning, as they live in coastal areas. An average household size of five earns PhP 77,765/year for those with assistance compared with PhP 64,250/year for those without assistance, implying that Coastal Core, Inc. is at point in choosing the households that need their training and livelihood assistance.

Using data gathered, this study constructed an SVI with three components, namely, maximum property loss or exposure, household resilience (or sensitivity) and household recovery ability. Estimates show that household respondents only have moderate social vulnerability from typhoons and flooding. The assisted households have slightly lower overall SVI (0.39) than the non-assisted group (0.42), which can be explained by the higher resilience and higher recovery ability of the former.

Like in Labo, Gubat household awareness of climate change is considered high. Most are aware of extreme temperatures being experienced, unpredictable weather and stronger typhoons. Ozone layer depletion knowledge is surprisingly high, while common sources of information are media, seminars, and personal observation.

Using the same method as in Labo, damage based on the recent recollection of typhoon occurrence was estimated. These total to about PhP 300,000 for Cota na Daco (based on a 2006 typhoon) and PhP 290,000 for Rizal (2009 typhoon). The difference between assisted and non-assisted households has a small margin, probably because the period of engagement has not yet been that long to make significant impacts. However, in terms of recovery ability, assistance by Coastal Core, Inc. seems to have a significant impact. Results of the PSM analysis show the recovery period of assisted households are quicker than those non-assisted by about 3 to 11 days. This is equivalent to a monetary benefit of about PhP 436 to PhP 2,139/household per typhoon event.

A look at adaptation measures implemented shows that those receiving assistance from Coastal Core, Inc. are more responsive to the effects of calamities as shown by the higher percentages of families that practice different strategies compared with families without assistance. This is probably due to the information provided by the said NGO. Three common measures done to adapt to typhoon include evacuation of families, moving appliances to a safer place, and getting updated information about the typhoon. Our estimation shows that the total adaptation costs (via replacement cost) can reach up to PhP 1.18 million, which includes cost of materials and value of labor. Per household, average adaptation cost of those not receiving Coastal Core, Inc. assistance is higher compared with those assisted.

Most respondents in both Gubat and Labo have access to disaster-related information through advisories circulated by the media. On average, information is received a day or two before the typhoon, thus providing households in both sites ample time to prepare. A large portion of the respondents in both study sites evacuate to safer grounds upon receiving the advisory. After a typhoon, households in both sites seek aid from different institutions in terms of relief goods and loans.

While the respondents in Gubat and Labo have their own ways of dealing with the effects of disasters, they suggested actions for the LGU to strengthen its capacity to respond to climate risks. Respondents view these risks as resulting from the degradation of the environment caused by irresponsible human actions. As such, their suggested actions to support CCA consist of reforestation (particularly mangrove rehabilitation) and prohibition of illegal logging. Proper waste disposal techniques, such as segregation, were also deemed to be helpful in protecting and cleaning the environment.

In Labo, Camarines Sur, a relocation site for those who are frequently flooded was built in Purok 3 of Sta. Cruz. This relocation project was sponsored by the Department of Social Welfare and Development (DSWD). Recipients of the houses come from the different puroks in Sta. Cruz. Since most of the recipients are engaged in farming, they suggested that the LGU should provide alternative livelihood. A survey of livelihood opportunities should be a priority. Since squash is one of the major crops of the municipality, food processing may be considered. In relation to farming activities, irrigation facilities should also be provided to prepare for an extreme and longer dry season.

Overflowing of the Labo River is one of the reasons why there is extreme flooding in the two barangays. It has been suggested for the LGU to provide pump boats to puroks located along the river for evacuation purposes. Construction of a riparian zone and planting of bamboo along the river banks to prevent soil erosion were also recommended.

Lastly, other recommendations include providing an early warning system to all barangays in Labo and fully institutionalizing an information office. Dissemination of information regarding disasters is very important, thus it is necessary to have a stable means of communication within the municipality and among its barangays. The most cost-effective method of communication during typhoon is the use of two-way radios. Other forms of early warning system can be considered such as the use of *batingaw*.

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Appendix 1. Propensity score estimation using Logit Regression

Dependent variable: Treatment	Coefficient	S.E.	P>|z|
Income of respondent	0.000014	0.0000106	0.326
Income of household	-0.0000128	.0000104	0.218
Dummy-household engaged in farming	0.9821391	.7029081	0.162
Dummy-household engaged in animal raising	-1.659588	.8120641	0.041**
Dummy-household engaged in fishing	2.503432	.7684149	0.001***
Economic vulnerability	6.98e-06	9.25e-06	0.451
Adaptation expenditures before the typhoon	.003824	.0019222	0.047**
Constant	-1.163144	.5491679	0.034**

Notes: Optimal number of blocks: 5
The balancing property is satisfied
Log likelihood = -42.604078
Number of obs = 88
LR chi2(7) = 36.60
Prob > chi2 = 0.0000
Pseudo R2 = 0.300

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