



Adaptation and adaptive capacity to flooding of farming households: Insights from Mabitac, Laguna, Philippines

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Received: 02 March 2016 / Accepted: 17 July 2017 / Published online: 26 July 2017

Abstract

Vulnerability to flooding due to climate change results in limited access to resources, soil erosion and/or deposition, and reduced quality of water supply among others, affecting many farming communities. Recognizing the need to assess and better understand the adaptive capacity of farming communities, this study determined the effects of flooding and assessed the adaptive capacity levels of farming households in Mabitac, Laguna, Philippines as a case. Using analytic hierarchy process, it also explored the contribution of human, physical, and financial resources, information, and livelihood diversity in enhancing adaptive capacity. Human resource and livelihood diversity received the highest (0.3087) and lowest (0.0566) weight due to labor-intensive and mono-cropping practices, respectively. About two-thirds (69%) of the farmers have moderate level (0.36-0.50) of adaptive capacity. Their level of adaptive capacity is not associated with their adaptation practices because the decision can be attributed to other factors. Although adaptive capacity is an established factor of household vulnerability, the study showed that it is not a sole determinant of adaptation practices. To increase adaptive capacity and reduce vulnerability to flooding of farming households, the study recommends local policies and programs that are focused on improving livelihood diversity and physical resources.

Keywords: Climate change · adaptation · adaptive capacity · Mabitac · flooding

DOI: <https://doi.org/10.18783/cddj.v002.i02.a06>

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Introduction

According to a study by the United Nations University's Institute for Environment and Human Security (UNU-EHS) and the German Alliance Development Works (2011), the Philippines is the third most vulnerable country to climate change. Its geographical location and physical characteristics leave it exposed to an average of 19 tropical cyclones every year (Philippine Atmospheric Geophysical and Astronomical Services Administration [PAGASA], 2013) as well as other climate-related hazards such as flooding, rain-induced landslides, and droughts. Agriculture has been largely affected by the impacts of climate change due to the following: climate variability, seasonality, changes in mean precipitation, and water availability (Wreford, Moran, & Adger, 2010). The role of agriculture as a source of income and food security is highly affected. Climate Change Commission (CCC) (2011) reported that the annual damage to agriculture has reached 3% (PhP 12 B) of the total agricultural production. The said damages led to food insecurity and loss of livelihood especially for the small farming households.

Adaptation and Adaptive Capacity

Adaptation refers to adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts. It also refers to changes in processes, practices, and structures to moderate potential damages or to benefit from opportunities associated with climate change (United Nations Framework Convention on Climate Change [UNFCCC], 2014).

Agricultural adaptation strategies were created since farmers had to save their source of livelihood through switching crops, cultivars, and/or timing of field operations. Another adaptation strategy is to alter crop mix, favoring the relatively higher yield and profitable crop varieties. Agricultural adaptation to climate change can happen in various forms including changes in agricultural land areas, use of irrigation, and technical innovations (Kaiser & Drennen, 1993).

Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (2007) stated that adaptation practices are rooted in adaptive capacities. Adaptation strategies will not be successful unless there is willingness to adapt among those affected. In turn, adaptive capacity can be undermined by a refusal to accept the risks associated with climate change, or by a refusal of key actors to accept responsibility for adaptation (Brooks & Adger, n.d.).

IPCC (2001) defined adaptive capacity as the ability of a certain system, region, or community to adapt to the impacts of climate change. Different determinants of adaptive capacity are known to involve farming households and are used in identifying and assessing the adaptive capacity of a community (McCarthy, Canziani, Leary, Dokken, & White, 2001).

Adaptive capacity works better with the influence of some indicators: having managerial ability; access to information, financial and technical resources, and infrastructure; implementation of policies; and creation of networks. Additionally, adaptation practices are indicators of adaptive capacity in the case of integrating the

traditional practices of farming households (Bhadra, 2012). Farming household's adaptation practices usually include crop diversification, irrigation, water management, disaster risk management, and insurance (Adger, Agrawala, & Mirza, 2005).

Lasco, Habito, Delfino, Pulhin, and Concepcion (2011) reported that farmers in Southeast Asia have been exploring new farming adaptation practices to address climate change such as changing of crop calendars, water management and conservation, pest management, agroforestry, and community-based adaptation, particularly in the Philippines. Government policies and efforts include improving the agricultural extension and services through better access to information, education, and communication (IEC) programs by encouraging local government units (LGUs) to participate in farming trainings and seminars related to adaptation practices (National Economic and Development Authority [NEDA], 2011).

Flooding in Mabitac, Laguna

Mabitac is a fifth class agricultural municipality in the province of Laguna, Philippines. Its location along the coast of Laguna Lake and its topography contribute to its vulnerability to the impacts of climate change, such as flooding. Although not all barangays¹ experience the extreme effects of flooding, majority of them recognize the difficulties in recovering from such. Agriculture is the most common livelihood and source of income of the residents. Farming households are one of the major sectors affected by climate change (Department of Interior and Local Government [DILG], 2013), particularly in times of flooding. Their income, food, and other basic necessities are hinged on the crop growth. The harms of flooding can limit their capabilities to thrive and survive (Pati, Franco, Alcantara, Pacardo, & Resurreccion, 2014). Maintaining high quality and status of agriculture in Laguna is significant in addressing the food instability issue within the province. As an agricultural municipality, it is important to study the relationship of adaptive capacity and adaptation of the farming households.

This study assessed the adaptive capacity to flooding and adaptation practices of farming households in Mabitac, Laguna. Specifically, it (i) identified the effects of flooding as an impact of climate change to farming households, (ii) analyzed the levels of adaptive capacity of farming households, (iii) identified adaptation practices done by farming households, and (iv) determined the relationship between adaptive capacity and adaptation.

Methodology

Site Selection

Mabitac Municipality is vulnerable to climate-related stress such as flooding, and local communities are dependent on farming as the main source of livelihood and income (Mabitac MDRRMO, 2014).

¹ A barangay is a Filipino term referring to the smallest administrative division or a village in the Philippines.

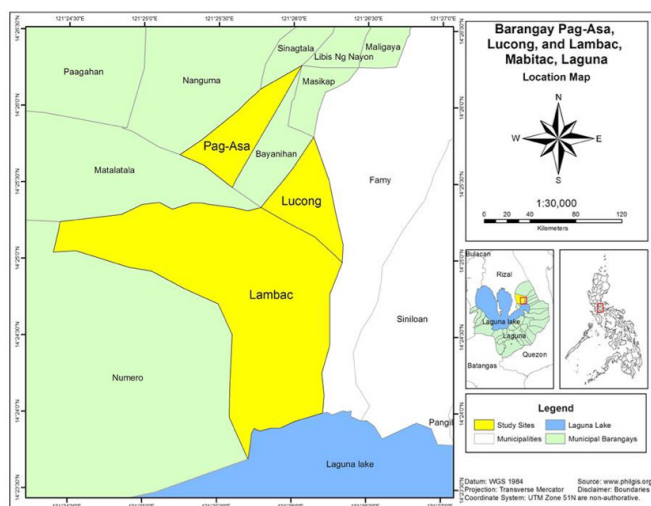


Figure 1. Location map of the three barangays (Pag-Asa, Lucong, and Lambac)

The study focused on the three barangays (Figure 1), namely, Pag-asa, Lucong, and Lambac representing the municipality based on their topography and main source of livelihood.

Data Collection and Analysis

Household surveys, key informant interviews (KIIs), and focus group discussions (FGDs) were employed to generate primary data. A total of 75 farming households in the three barangays, selected through stratified random sampling, were interviewed. Household survey was used to determine the level of adaptive capacity using Sustainable Livelihood Framework (modified and adopted from Defiesta & Rapera, 2014). The assumption is that the adaptive capacity can be measured using the indicators of adaptive capacity of farming households (Table 1). This was supplemented by KIIs with agricultural experts, municipal employees and staff, and resource persons using Analytic Hierarchy Process (AHP) to determine the relative weights of the indicators of adaptive capacity. FGDs were conducted with the leaders of farmers' organizations to elaborate adaptation practices to flooding.

Table 1. Indicators of adaptive capacity of farming households

Indicators	Sub-Indicators	Description	Assumption	Reference
Human Resources	Farming experience	↑ Number of years the respondent has been farming	↑ Adaptive Capacity	Defiesta and Rapera (2014)
	Educational attainment	↑ Number of years the respondent has been farming	↑ Adaptive Capacity	Leary, Conde, Kulkarni, Nyong, and Pulhin (2008)
	Percentage of adults in the household	↑ Number of adults in the household expressed as percentage of the total number of household members	↑ Adaptive Capacity	Defiesta and Rapera (2014)
	Percentage of adults with primary education	↑ Number of adults in the household that finished elementary education expressed as percentage of the total number of adults in the household	↑ Adaptive Capacity	Weir (1999)
	Percentage of adults who are working in the farm	↑ Number of adults in the household who are working in the farm	↑ Adaptive Capacity	Defiesta and Rapera (2014)
	Diseases present in the household	↑ Number of types and frequency of diseases in the household	↓ Adaptive Capacity	Steeg, Herrero, and Notenbaert (2013)
	Percentage of household members having a prevailing disease	↑ Number of household members expressed as percentage having a prevailing disease	↓ Adaptive Capacity	
	Type of training on farming	↑ Number of types of training that the farmers attended in the last five years (2009 to 2013)	↑ Adaptive Capacity	Mungo (2015)
Physical Resources	Farm size	↑ Farm size in hectares	↑ Adaptive Capacity	Defiesta and Rapera (2014)

Table 1 (Continued)

Indicators	Sub-Indicators	Description	Assumption	Reference
Physical Resources	Irrigation	↑ Number of Sources of irrigation	↑ Adaptive Capacity	Mondal, Jain, DeFries, Galford, and Small (2014)
	Ownership of farm implements/machine	↑ Number of useful farm machines owned by the farming household	↑ Adaptive Capacity	Ellis (2002)
	Access to vehicles	↑ Number of vehicles owned /rented by the farming household	↑ Adaptive Capacity	Arimi (2014)
	Farm ownership	Type of farm occupancy	Ownership means ↑ Adaptive Capacity	Defiesta and Rapera (2014)
	Nearness to the urban centers (i.e., market, government)	↓ Minutes of travel to the urban centers	↑ Adaptive Capacity	Yu, Zhu, Breisinger, and Hai (2013)
Financial Resources	Financial assistance from family members	↑ Amount of monetary assistance received by the household	↑ Adaptive Capacity	Defiesta and Rapera (2014)
	Sources of income from farming	↑ Amount of all sources of monthly income of the farming household from farming	↑ Adaptive Capacity	
	Sources of income from non-farming	↑ Amount of all sources of monthly income of the farming household from non-farming	↑ Adaptive Capacity	
	Monthly expenditure for farming	↑ Average monthly expenditure for farming	↑ Adaptive Capacity	
	Monthly expenditure for non-farming	↑ Average monthly expenditure	↑ Adaptive Capacity	
	Value of farm animal units	↑ Number of farm animals owned and raised by the household	↑ Adaptive Capacity	Takeshima and Salau (2011)
	Recipient of financial assistance/subsidy from the government	Whether the respondent has availed financial assistance or subsidy for farming from the government regularly or not	Higher assistance means ↑ adaptive capacity	Defiesta and Rapera (2014)
	Access to credit	Access to credit from 2009 to 2013	Formal credit means ↑ adaptive capacity	Ringler, Bryan, Hassan, Alemu, and Hillesland (2011)
	Recipient of technical assistance	If the farmer has consulted or has been regularly visited by an agricultural extension officer from 2009 to 2013	Technical assistance means ↑ adaptive capacity	Defiesta and Rapera (2014)
Information	Access to new information regarding farming	↑ Number of medium to access new information regarding farming	↑ Adaptive Capacity	
	Membership in farmers' organizations	If the respondent is a member of any farmers' organization	↑ Adaptive Capacity	Frank and Buckley (2012)
	Sources of climate information	↑ Number of sources accessed by the farmer about the climate information	↑ Adaptive Capacity	Defiesta and Rapera (2014)
	Sources of income	↑ Number of sources of income and employment of all the household members	↑ Adaptive Capacity	Umoh et al. (2013)
Livelihood diversity	Crops planted	↑ Number of crops planted	↑ Adaptive Capacity	Defiesta and Rapera (2014)
	Crops farm size	↑ Size of farm for every crop	↑ Adaptive Capacity	

Analytic Hierarchy Process (AHP)

AHP tool was used to assess how each indicator of adaptive capacity (human, physical, and financial resources, information, and livelihood diversity) contributes to the overall adaptive capacity level as perceived by the key informants. It is a multi-criteria decision-making method that models the complexity of decision problem, incorporating both quantitative and qualitative factors. It follows a process to derive the weights or priorities and synthesize the information to determine the relative ranking/scores of alternatives (Saaty, 1980). They were asked to select the most important indicator of adaptive capacity using pairwise comparison.

Normalization

To obtain consistent values and units of data, the adaptive capacity scores per indicator and sub-indicator calculated from the AHP were normalized by adjusting the values measured on various scales to a common scale. The normalization method, or the min-max approach, is as follows:

$$\text{Normalized } (e_i) = \frac{E_{\text{actual}} - E_{\text{min}}}{E_{\text{max}} - E_{\text{min}}}$$

where: E_{actual} = actual value for variable E
 E_{min} = minimum value for variable E
 E_{max} = maximum value for variable E
 thus, if $E_{\text{max}} = E_{\text{min}}$ then normalized (e_i) is set to 0.5

Chi-square was also used to determine the relationship between adaptive capacity level and adaptation practices of farming households.

Results and Discussion

Socio-Demographic Profile of Respondents

More than half (60%) of the respondents are male household heads. The average household size of families in the three barangays ranges from five to eight members (48%). About three-fourths (77%) of the household families are tenants while only 16% are owners of farmlands.

Effects of Climate Change to Farming Households

Farming households and key experts perceived flooding as the immediate effect of climate change. Flooding can cause soil erosion, especially in the upland, and depletion of resources such as soil and important organic matter. It can also cause crop damage resulting in lower farm productivity. While some materials are eventually deposited to the lowland areas providing soil nutrients, excessive deposition would cover suitable soil for rice farming as it is replaced by less suitable upland soils. Farmers also reported the changes in water quality

and quantity that affected the choice of crop to plant. Unlike in the past when they were only dependent on rice, some farmers have recently resorted to planting vegetables, such as mustard, Chinese cabbage, and string beans. Alternative crops or resources that are more resilient such as fruit trees and rattan were likewise considered.

Adaptive Capacity Indicators

The adaptive capacity indices of the farming households in Mabitac were identified as human resources, financial resources, information, physical resources, and livelihood diversity with the intervention of policies, institutions, and processes. The adaptive capacity scores were classified according to the levels of adaptive capacity (low, moderate, or high).

The adaptive capacity indicators were compared and weighted using AHP tool which showed the contribution of each of the indicator to the level of adaptive capacity. Figure 2 illustrates the different scores calculated for each adaptive capacity indicator and its sub-indicators.

Human resources obtained the highest weight (0.3087), followed by financial resources (0.2531), information (0.2202), physical resources (0.1615), and livelihood diversity (0.0566). This implies that human resources is the primary contributor to adaptive capacity of a farming household due to the importance of their farming experience and skills. According to Yang and An (2002), human resources can boost farmers' abilities both in selecting activities and performing agricultural operations. It is also significant for households in deciding how to allocate resources between agriculture and non-agriculture and it increases the technical skills and managerial ability of using input, such as high-yielding seed varieties (Huffman, 1977).

Livelihood diversity got the lowest weight (0.0566) since rice farming is mostly monoculture. According to Lyimo and Kalangawe (2010), livelihood diversity, inclusive of farming and non-farming activities, is vital in ensuring sustainability in a rural area. However, some find it hard to do due to years of traditional practices.

Sub-indicators

Human resources. The percentage of adults working in the farm got the highest weight (0.618) while diseases present in household got the lowest (0.0104) score. Thirty-two percent of the respondents have been farming for 10 to 20 years which contributes to their adaptive capacity because more experience gained and mastery of farming methods mean improved ability to respond to possible climatic changes. Twenty-four percent of the respondents were high school graduates. Ninety percent of the respondents attended farming or agricultural trainings, which also contributes to higher adaptive capacity since more exposure to farming trainings means higher adaptive capacity. Only a few number of respondents are exposed to diseases such as cough (34%) which is another contributor to adaptive capacity.

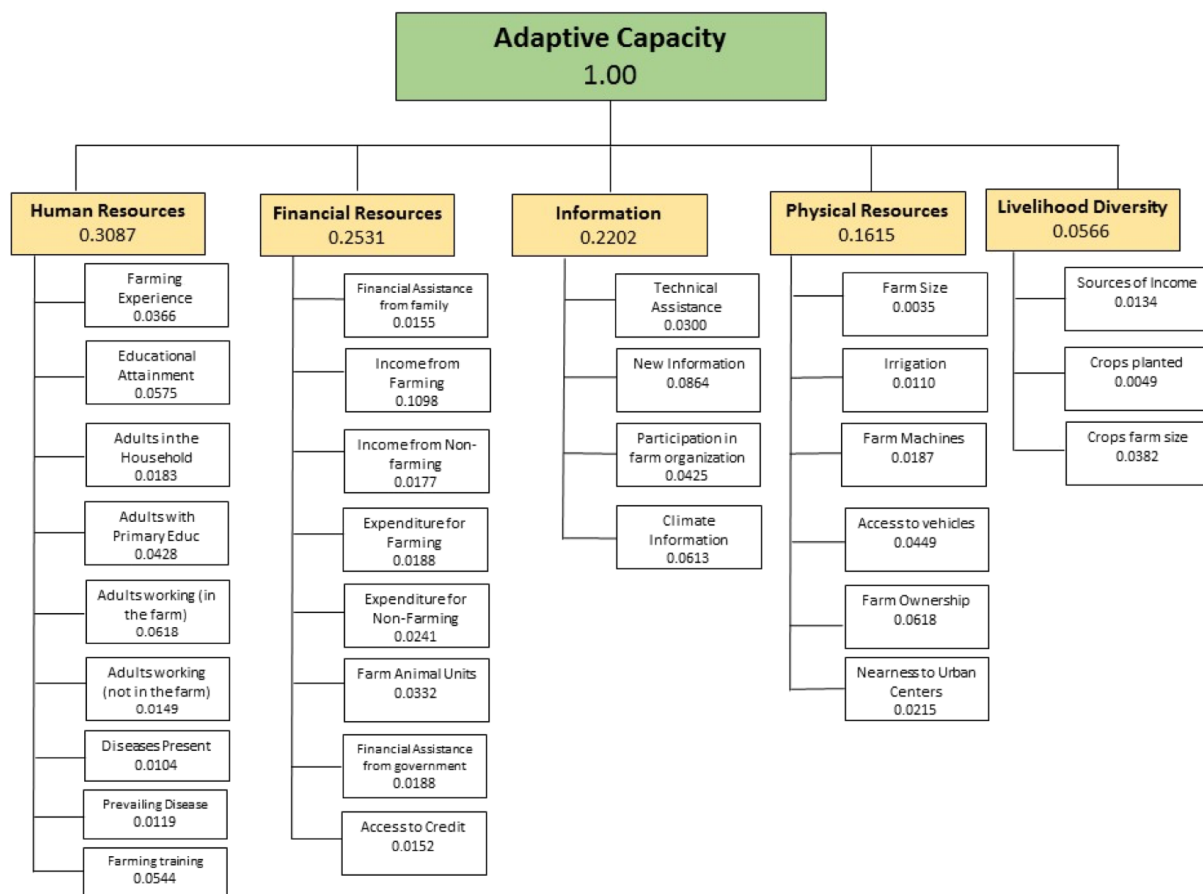


Figure 2. Analytic hierarchical tree of adaptive capacity indicators and sub-indicators

Financial resources. In the Philippines, the impacts of climate change are threats to the livelihood of the community especially in the field of agriculture (Penalba & Elazegui, 2013). Lack of financial resources limits adaptation options. Lack of money means lesser access to farming systems, technology, and opportunities like access to credit and remittances from family members.

About 41% of the farming households have a monthly income of PhP 5,001 to PhP 10,000 (USD 100 to USD 200). This means that most households have relatively high adaptive capacity. Majority (60%) indicated that they do not have income from non-farming activity such as working in offices, hence majority of the households have lower adaptive capacity. Respondents also stated minimal expenditure in farming because some resources needed by farming households were given for free by the owner as part of the tenancy agreement and/or by the LGU. Consequently, monthly expenditures for non-farming activities are high ranging from PhP 5,001 to PhP 10,000 per household, which includes food, electricity, school concerns, and others.

Although majority (69%) owned animals, most of these animals are pets (46%), while only 32% are farm animals. Due to this, most households have low adaptive capacity.

After natural calamities, farming households have no choice but to depend on the government's assistance. Among the respondents, 52% received financial assistance from the government which was mainly for the beneficiaries of 4Ps (Pantawid Pamilyang Pilipino Program), increasing the level of adaptive capacity.

Through credit sources, people are more able to afford the necessities and resources for farm inputs. Accordingly, 79% have access to credit, while the remaining 21% have chosen not to ask for credit because they thought they could not pay the loans in the long run or their money was enough. According to the experts' interview, some farming households who availed loans cannot pay on time. Thus, interests of the loaned amount are compounded, increasing the amount needed to be repaid. Since there are only a few number who do not have access to credit, there is also less number of households who have lower adaptive capacity.

Remittances and/or contribution from other family members add to one's financial resources. Only 29% of farming households had been receiving remittances ranging from PhP 500 to PhP 1,000 monthly. Majority of the households therefore have lesser assistance which means lower adaptive capacity.

Information. Access to new information received the highest weight (0.0864) among its sub-indicators. Access to information is important as it increases the probability of adaptation because farmers become aware of the steps they should and should not do. Majority (93%) have access to new and relevant information regarding farming, hence higher adaptive capacity. The most common source of new information is the Municipal Agricultural Office (MAO) and Department of Agriculture (DA) followed by television. Farmers are not accustomed to sharing what they know because they think that the other farmers already know the information. This is why farmers' organizations help the farmers in strategies and techniques in agriculture as well as in adaptation sharing.

Seventy-nine percent mentioned that they were members of organizations such as Dakila Lucong Irrigation Association (DALIA), Fisheries and Aquatic Resources Management Council (FARMC), Samahan ng mga Magsasaka ng Mabitac or Organization of Farmers in Mabitac, Pag-asa's Farming Organization, National Food Authority (NFA), National Irrigation Administration (NIA), and Agricultural Committee. The respondents who were members of farmers' organizations also gain new information from the membership such as new planting methods or strategies. Hence, majority of the households gain higher adaptive capacity in terms of information.

Technical assistance obtained the lowest weight (0.0300) because of its limited practice and accessibility. According to the Municipal Disaster Risk Reduction and Management (MDRRM) staff, technical assistance is possible but not in all areas because of the differences in context and nature of the region.

Physical resources. Farm ownership got the highest (0.618) while farm size got the lowest (0.0035) weight. Farm ownership is an important indicator as it translates to personal decision on what farming practices to implement to attain full productivity of the land. Results showed that 77% of the farming households were tenants. Most of the farmers share the resources with the owners including the risks and rewards.

Majority (82%) of the respondents have access to the irrigation system of NIA, while six percent still have rain-fed farms. In the study, 74% of farming households own farm equipment with hand tractor as the most common (22%). Most households have high adaptive capacity because of their high access and exposure to physical resources mentioned above.

Ownership of vehicles also has a significant role in farming as the distribution of harvested crops becomes easier. Accordingly, about 53% of the respondents own vehicles while 43% only rent. Owned vehicles were mostly tricycles (55%) and motorcycles (30%).

Most of the farms are near the main road. However, the travel distance from the farm to the marketplace (Siniloan Market) is 35 minutes and above. The travel time from the farm to the government and urban centers would take 11 to 15 minutes.

Due to a relatively longer distance of the farm from and to urban centers, most households have lower adaptive capacity.

Livelihood diversity. Only a few respondents have different sources of income. Most of the household income was derived from the farm (56%) while others have income from employment (20%), business (15%), or both (9%). Having diverse sources of income makes a specific household stable even when disaster and/or flooding occurs. Most of the farming household have limited livelihood diversity that contributes to their low adaptive capacity.

Levels of Adaptive Capacity

About 12%, 69%, and 19% of the respondents have low, moderate, and high adaptive capacity levels, respectively (Table 2). Majority of the farming households exhibited moderate level of adaptive capacity based on the AHP of their assets and resources.

Table 2. Adaptive capacity level of farming households in Mabitac

Levels of Adaptive Capacity	Frequency	Percentage (%)	Adaptive Capacity Scores (Range)
High	14	19	0.6490 - 0.5045
Moderate	52	69	0.5044 - 0.3600
Low	9	12	0.3599 - 0.2155
Total	75	100	

Information resources contribute the highest value for both the moderate and high adaptive capacity levels. The pentagram (Figure 3) shows that the main difference between those with low adaptive capacity level and those with moderate and high is the access to and use of new and significant information resources. The value of financial resources and livelihood diversity for households with high adaptive capacity is also significantly higher compared to those with moderate and low adaptive capacity. Those who have employment and business usually have higher adaptive capacity level. This shows that the low adaptive capacity level of farming households is mainly caused by low level of information resources, financial resources, and livelihood diversity.

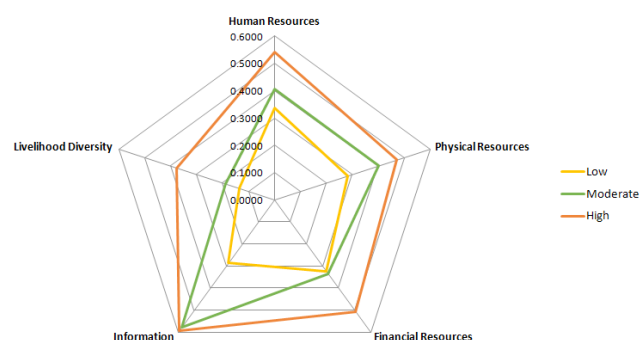


Figure 3. Pentagram of the farming households' adaptive capacity indicators' scores

The overall adaptive capacity level of farming households in Mabitac can therefore be increased by enhancing the human resources aspect through capacity building; improving the physical resources by providing necessary infrastructures such as irrigation and improved market access; and promoting livelihood diversity through diversification of crops and providing alternative sources of livelihood. Strong financial and information resources should be sustained and supported through increased access to credit and new information and technology.

Farmers' Adaptation Practices and LGU Activities

Adaptation practices of farmers in Mabitac include changing the cropping calendar (41%) particularly among those practicing rain-fed agriculture. Farm-level adaptation practices are helpful in coping with the impacts of climate change, but their effectiveness can be enhanced by institutional and policy support from the government (Asian Development Bank [ADB], 2009). Other practices such as crop rotation and additional farm inputs (fertilizer) aim at increasing productivity amidst climate change. Some farmers have already shifted from rice mono-cropping to crop diversification (e.g., mustard, Chinese cabbage, and string beans). Some are also venturing to fruit trees or tree-based production such as rattan.

The activities of the LGU regarding climate change adaptation include developing early warning systems; forming rescue teams and first responders; establishing the Local Disaster Risk Reduction and Management Council; conducting relief operations; providing trainings and seminars; distributing fertilizers and seeds after a disaster; implementing waste management; building river walls; maintaining irrigation; and distributing farming implements. These activities allow farmers to better facilitate adaptation within the household and farm levels.

Adaptive Capacity Level and Decision to Practice Adaptation

With regard to the relationship between adaptive capacity level and decision to practice adaptation, results of the study (Table 3) showed that there is no association between adaptive capacity level and decision to practice adaptation among the farming households in Mabitac. The high level of adaptive capacity does not guarantee that the farming households practice adaptation; in the same way, a low level of adaptive capacity does not necessarily imply that they do not practice adaptation. The relationship of adaptive capacity level with the number of adaptation practices/strategies employed by the different households likewise showed that there is no association between the two variables (Table 4). This agrees with the findings of Hogan, Berry, Ng, and Bode (2011) that the levels of adaptive capacity are non-determinants to adaptation practices among farming households.

Table 3. Adaptive capacity levels vs. decision to practice adaptation among farming households in Mabitac, Laguna

Decision to Practice Adaptation	Adaptive Capacity Level			Total
	Low	Moderate	High	
To practice adaptation	3	30	8	41
Business as Usual (BAU)	6	22	6	34
Column Totals	9	52	14	75

Table 4. Number of adaptation practices employed by farmers vs. their adaptive capacity level in Mabitac, Laguna

Decision to Practice Adaptation	Adaptive Capacity Level			Total
	Low	Moderate	High	
1	2	14	5	21
2	1	15	3	15
3	0	1	0	1
4	0	1	0	1
5 and above	0	3	0	3
Column Totals	3	30	8	41

Conclusions

Majority (69%) of the farming households have a moderate level of adaptive capacity resulting from better access to information, and human and financial resources. The low adaptive capacity level of farming households is mainly caused by low level of information resources, financial resources, and livelihood diversity. These can serve as guide in designing interventions that seek to increase the adaptive capacity of farming households aiming to reduce their vulnerability to increased flooding caused by climate change.

There is no association between the level of adaptive capacity and the decision to practice adaptation, including the number of adaptation practices employed by the farming households. Even households with low adaptive capacity level can practice adaptation in the same way as those households with moderate or high adaptive capacity. There are other intervening factors that affect the households' decision to either adapt or not adapt to the impacts of climate change such as the mono-cropping and other traditions of the farmers as well as some policies within the community.

Recommendations

For the Local Government Unit of Mabitac

The adaptive capacity of farming households in Mabitac can be enhanced by improving their livelihood diversity, human

capital, and physical resources. Towards this end, development interventions such as crop financing and insurance, climate-field school, and crop diversification program need to be pursued to increase the adaptive capacity level of farming households.

The adaptive capacity and adaptation insights gained from this study can be integrated into Climate and Disaster Risk Assessment (CDRA) that will form part of the different local plans such as Disaster Risk Reduction Management Plan (DRRMP), Local Climate Change Action Plan (LCCAP), and Comprehensive Land Use Plan - Comprehensive Development Plan (CLUP-CDP). Furthermore, the lessons learned can also be used in prioritizing adaptation strategies of the LGUs particularly on scaling-up existing adaptation practices and increasing adaptive capacity of households through capacity building and provision of support services for agriculture.

For Further Research

For further research, the sub-indicators of adaptive capacity used in this study can be expanded and extended to incorporate and test other factors affecting one's adaptation, such as community capacity, experience, and behavior. The complexity of adaptation practices and their effectiveness can also be further studied to understand the rationality of adoption.

Acknowledgments

The researchers would like to thank Dr. Marilyn Elauria and Ms. Maria Aurea Dancel for the assistance in statistical analysis and language editing.

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