



Farmers' Resilience towards Climate Change Related Disasters (CCRDs): The Case of Barangay Mabalbalino, San Carlos City, Pangasinan

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ABSTRACT

The effects of climate change is imminent in the future, especially without building resilience of communities across the globe. The alteration in the climate variables often causes extreme events, which often leads to Climate Change Related Disasters (CCRD). This study explored through the resilience of farmers in Barangay Mabalbalino, San Carlos City, Pangasinan, Philippines. Specifically, it described the demographic profile of the respondents; determined the knowledge on climate change and its related disasters, readiness and initiatives towards climate change related disasters, and programs and services towards climate change related disasters. The study utilized qualitative design, specifically using phenomenological method. Farmers were interviewed using an interview schedule.

Based from the findings, it was determined that, the farmers were not familiar about the meaning and characteristics of climate change and its related disasters. With regard to farmers' readiness towards CCRD, it was found that they were not resilient towards the phenomenon, this is clearly pictured in the demographic profile of the farmers (i.e. low income and low level education). However, it was known that there were initiatives in the community to adapt to CCRD which makes the farmers resilient at certain degree. These initiatives included elevation of houses, construction of two-storey house for floods and irrigation practices for drought conditions. Without programs and services to combat the effects of CCRD, the farmers were found vulnerable and at risk. Based from the findings, it was therefore recommended to conceptualize programs and services in improving and building the resilience of farmers. In addition, reiteration and adoption of mitigation and adaptation strategies of the National Framework Strategy on Climate Change should further be stipulated to combat CCRD.

Key Words: Climate Change, Resilience, Farmers, Disasters

INTRODUCTION

Climate refers to the average weather in a place – it includes patterns of temperature, precipitation (rain or snow), humidity, wind patterns and seasons (DOE-Washington, 2016). Climate plays a vital role in different agricultural activities. Wherein, on these times, the expected alteration of climate had come into existence. Change in climatic conditions is projected to affect food security from the local to global level.

The predictability in rainy season patterns will be reduced, while the frequency and intensity of severe weather events such as floods, cyclones and hurricanes will increase; other predicted effects will include prolonged drought in some regions; and water shortages; and changes in the location and incidence of pest and disease outbreaks (Glantz, Gommers, and Rumasamy, 2009).

It can be understood that the effects of climate change are widespread, most especially affecting our natural resources, particularly the agriculture sector, which aids sustenance for the growing human population.

The first half of this decade will be ostensibly remembered for deadly climate-related disasters; among them, the great floods in Thailand in 2011, Hurricane Sandy in the United States (US) in 2012, and Typhoon Haiyan in the Philippines in 2013. The year 2014 was the Earth's warmest in 134 years of recorded history (NASA, GISS 2015). It is hydrometeorological (floods, storms, heat waves) and climatological disasters (droughts, wildfires) rather than geophysical ones (earthquakes, volcanic eruptions) that are on the rise (Thomas, 2015).

The Philippines is an agricultural country with a land area of 30 million hectares, 47 percent of which are agricultural land. In the Philippines, prime agricultural lands are located around the main urban and high population density areas (DLSU-Manila, 2016). According to the 2013 Census of National Statistics Office, the preliminary results of the 2013 Annual Survey of Philippine Business and Industry (ASPBI) showed that the country had a total of 1,147 establishments with total employment of 20 and over engaged in agriculture, forestry and fishing in the formal sector of the economy.

One of the world's greatest fears is that warming will endanger global agricultural and food production. Most economic analyses of climate change impacts on agriculture have focused on developed countries and specifically the United States (Adams et al., 1990, 1995, 1999; Easterling, et al., 1993; Kaiser et al., 1993; Mendelsohn et al., 1994, 1999; Mendelsohn and Dinar, 2003). Although these studies have contributed to our understanding of climate impacts in the United States, they serve as a poor reference for what is likely to happen in developing countries such as the Philippines.

In the past several decades, air temperatures have been warming in most of the major cereal cropping regions around the world. Average increasing trends were roughly 0.3°C per decade for maximum temperature and 0.2°C per decade for minimum temperature (Mall et al., 2016). Crop production is vulnerable to climate variability, and climate change associated with an increase in temperature, an increase in CO₂, and changing patterns of rainfall may lead to a considerable decline in crop production. Also, extreme weather events such as droughts, extreme heat waves, and heavy rainfall leading to floods have increased in past decades (Mall et al., 2016).

The rural sector's lack of resilience to climatic accidents seems to be one of the main reasons for the transformation of climatic accidents into environmental, economic and social disasters for local communities. Thus, the integration of activities geared towards the improvement of community resilience seems to be of utmost priority (Bockel et al., 2009). It was also added that this can be achieved by integrating prevention and risk-management tools into already existing social safety-nets within the framework of food security and poverty reduction strategies.

Consequently, the lack of empirical data for understanding the farmers' resilience towards CCRD, specifically here in the Philippines, had pushed the researchers to analyze the situation and learn the factors regarding this.

The purpose of this study was to identify and assess the resilience of farmers in barangay Mabalbalino, San Carlos City, Pangasinan towards climate change related disasters (heatwaves, storms, flooding, and drought). Specifically, it describes the demographic profile of the respondents; determine the knowledge on climate change and its related disasters, readiness and initiatives towards climate change related disasters, and programs and services towards climate change related disasters.

MATERIALS AND METHODS

Research design. Qualitative research specifically phenomenological method was used in this study. This was used to obtain information concerning the current status of rural farmers' resilience towards CCRD in Barangay Mabalbalino, San Carlos City, Pangasinan. This paper also employed field survey method as the research strategy. In this method, the participants answer the questions administered through interviews, after which, researchers describe the responses given (Hale, 2011).

Time and place of study. This study was conducted in November 2016. Barangay Mabalbalino of San Carlos City, Pangasinan was chosen as the locale for the study. It was determined that the major activity in this area, according to the profile of the barangay is farming (60%), thus, this represents a community where farming is their major occupation. In addition, according to the assessment made by Ortega (2016), the barangay identified Risk Reduction and Disaster Management as one of the top programs or services needed by the community.

Sampling. Purposive sampling was utilized in this study. Since the research conducted an interview type of data gathering (Creswell, 1998, as cited by Maso, 2010), 30 farmers who are head of the household served as the respondents. Barangay officials were also interviewed as key informants.

Instrumentation and data gathering procedures. This study utilized an interview schedule which included a combination of fixed and open-ended questions. The instrument included the following: (a) demographic profile of the respondents; (b) knowledge towards climate change and its related disasters; (c) readiness and initiatives towards climate change related disasters; and (d) programs and services towards climate change related disasters. A permission request from the barangay captain was stipulated to inform farmers in the community that an interview would be conducted on a specified date.

RESULTS AND DISCUSSION

Profile of the respondents

Table 1 shows that the average age of the farmer-respondents is 51.83 years, ranging from 46 to 60 years old. Most of them were within the age range of 49-51 years old. Majority of them were high school graduate, with average farm size of 2.42 hectares and engaged in farming as their occupation for 28.03 years. Their average monthly income was P 7,350.00

Table I. Profile of the respondents

Age of the respondents	Frequency n=30	Percentage (%)
64 and above	3	10.00
58-63	4	13.33
52-57	6	20.00
46-51	9	30.00
41-45	8	26.67
Total	30	100.00
Mean: 51.83		
Range: 46-60		
SD: 4.23		
Educational Attainment		
College Level	1	3.33
High School Level	8	26.67
High School Graduate	18	60.00
Elementary Graduate	3	10.00
Total	30	100.00
Farm size		
2.9-3.4	4	13.33
2.3-2.8	8	26.67
1.7-2.2	12	40.00
1.1-1.6	3	10.00
.50-1.0	3	10.00
Total	30	100.00
Mean : 2.17		
Range: 1-4		
SD: 0.69		
Years in Farming		
36 and above	2	6.67
32-35	4	13.33
28-31	10	33.33
24-27	8	26.67
20-23	6	20.00
Total	30	100.00
Mean:28.03		
Range:20-36		
SD:4.61		
Monthly Income		
10,001 and above	2	6.67
8001-10.000	10	33.33
6001-8000	12	40.00
4001-6,000	3	10.00
2000-4000	3	10.00
Total	30	100.00
Mean: 7,350		
Range: 2000-10000 and above		
SD: 2085		

Knowledge towards climate change and its related disasters

There is already a paradigm shift in the definition and concept of climate change (CC). This traverses from a naturalist perspective into a social perspective. As defined by the American Meteorological Society, climate change is “any systematic change in the long-term statistics of climate elements (such as temperature, pressure, or winds) sustained over several decades or longer.” On the other hand, Rahman (2012) described climate change as the most uttered environmental term of the present time which has been used to refer to the change in modern climate brought predominantly by human being. Thereby, climate change is now clearly attributed to human activities.

Based from the interview conducted, the farmers are not familiar towards climate change as well as its related disasters. This is due to the fact that, when all interviewees were asked if they already heard about climate change, they cannot tell anything about its description, results, and causes. Also, they are not fully aware of disasters related to it. Dressa et al. (2011) said, farmers’ knowledge and understanding of the climate are recognized as influencing factors on farmer awareness of climate change. Mertz et al. (2009) cited in their study on farmers perception on climate change showed that there is a high-level awareness amongst most of the farming population once a clear focus on climate change is placed in discussion. Heikkenin (2015) mentioned in her research article that farmers were sometimes reluctant to talk about climate change because they saw variations in weather on a regular basis and current weather patterns could be part of cycle that would eventually fix itself. Nkwusil et al. (2015), found that 53 percent of their respondents in Lagos State agreed that the climate is changing but do not understand what climate change is. They further mentioned that 64.76 percent do not really understand what climate change is, but are taking one step or the other to adjust with the observed changing climate variables.

Based from the demographic profile of the farmers, it was noted that majority farmers were high school graduates (60%) and belonged to the age range of 41-64 years old. Thus, it therefore reflected that their idea towards climate change was lacking because of their age and education. Additionally, despite their unfamiliarity about the results of climate change, their common answers were ‘flooding’. This answer was common because the barangay is located in a low lying area and near a river system. On the other hand, they were also not aware of the causes of its effects.

However, when they described climate change related disaster (CCRD), their common answer was linked to typhoon and flooding. Unconsciously, even the farmers who were not familiar with the meaning of climate change, could tell the phenomenon. Fitzgerald (2016) in her study entitled, Farmer Resiliency in a Changing Climate, cited that overall lack of specific knowledge on climate change indicates a potential scarcity of widespread information available to farmers if they want or need to find out more about climate change adaptation in agriculture. She further mentioned that additional factors that could contribute to knowledge of climate change, such as age and level of education, are important to take into consideration.

The farmers also experienced drought as well as heat waves in their area, but, they were not considering these as disasters based from the conversation made. In relation to this, the study of Tripathi and Mishra (2017) found out that farmers were aware of long-term changes in climatic factors (e.g. temperature and rainfall), however, they were not able to identify these changes as climate change.

In addition, since they were not familiar with climate change and its related disasters, the ideas elicited were based from their experiences and observations in their physical environment. As told by the farmers, they did not have accessible information from the television and other forms of media because of their tiresome from day-to-day work. They preferred to rest after working.

Readiness and initiatives towards climate change related disasters

According to International Law Commission, as cited by Sciaccaluga (2015), Climate Change Related Disasters (CCRD) is defined as a natural event or series of events in whose causation or manifestation climate change plays a role and which “result in human suffering and distress or large-scale material or environmental damage, thereby seriously disrupting the functioning of society.”

CCRD in Barangay Mabalbalino is common due to its topography and place of location. As can be observed in the spatial map of the barangay (Figure 1), this is surrounded by bodies of water, such as the Agno River (Figure 2) and water basins (Figure 3) which are utilized for irrigation, thus, the area is prone to flooding. Heatwaves, as well as drought are also common in the place due to the absence of vegetation.

The frequency of disasters in the area is associated with seasonal patterns in the country: wet and dry seasons. Heavy rain is common in the place during the wet season, however, it does not mean that flooding will always be the result of this event. According to the respondents, flooding commonly takes place in the area, most especially if the San Roque dam in the province releases water. The barangay is also near the Agno River. Furthermore, the saturation of water basins used for irrigation, especially during heavy storms worsen the effects of flooding.



Figure 1. *Spatial map of Barangay Mabalbalino*



Figure II. *Agnos River near the barangay*



Figure III. *Water basins used for irrigation*

During dry season, drought and heat waves are also common. However, these are not considered disasters by the respondents because it is being managed effectively with the use of generators for farm irrigation. Moreover, they were already used to this environmental situation during dry season. The farmers usually get water from water basins which sometimes, become dry. As remedy, the farmers utilize groundwater using water pumps to irrigate their fields. Though, the issue of this practice is related to the capability of the farmer in using water pump and to the economic status of the farmer. Based from the interview, not all farmers can afford to use water pumps for irrigation.

Furthermore, the farmers were also asked about their responses before and after disasters. The farmers' responses were shown in Table 2.

Table 2. Farmers' responses on Climate Change Related Disasters

Climate Change Related Disasters Response	Frequency* n = 30	Percentage (%)
a. Heavy Rains and Flooding		
Stayed in the house before a typhoon arrived	30	100
Stock resources in the houses and wait for the heavy rain to subside	30	100
For minor flooding, they move their things in an elevated area in their houses	30	100
For major flooding, tend to move away from their homes and move to the nearest high elevated dike together with them are their family members and cattle for a living.	26	86.67
Stayed in two story house	4	13.33
b. Heat Waves and drought		
Farmers use generators and water pumps to irrigate their rice fields	30	100
Adapt to changing temperature conditions.	30	100
For tolerable temperature , they return home and rest to prevent illness or diseases	30	100

*Multiple response



Figure IV. Dike near Barangay Mabalbalino



Figure V. Livestock of farmers in the barangay

As regards their relocation during floods, it was found that there were no evacuation areas in the dike where they moved. Moreover, they moved in the place to safeguard their cattle and live together with their relatives in the dike. However, for those community residents with no relatives, they eventually returned to their houses once the floods subsided.

It can be noted that due to variation in climatic conditions, farmers were at risk to certain illness and diseases. This was raised by the Barangay official, where he said that the top need of their community is on medical services. This was again proven true by the assessment conducted by Ortega (2016) where medical service is the top program needed by the community.

Initiatives to combat the effects of CCRD

The practices and initiatives to combat the effects of CCRD were determined based on the farmers' responses. In terms of environment, there were many ways to prevent or lessen the effects of disasters. The farmers mentioned that planting backyard plants and vegetables (100%) could increase vegetation in the area. However, based from the topography of the barangay's landscape, it can be gleaned that community members, including farmers cannot initiate programs such as tree planting activities, because majority of the barangay's vast land is dominated by agricultural landscape. Only patches of vegetation can be observed in the barangay which are usually found along residential areas (Table 3).

Tucker et al. (2010) found farmers in Guatemala are expressing greater concern about climate than those in Mexico and Honduras. In terms of responses, few farmers in Mexico and Guatemala changed their crop mix. Meanwhile in Honduras, 73 percent of farmers had expanded their holdings, using fallow or forestry land and anticipation of future price rises.

The barangay is an agricultural landscape. Therefore, to combat the effects of CCRD, 40 percent of the farmers used water pump during drought while 60 percent planted corn that did not require more water. Farmers should initiate the practice of multi-cropping or intercropping practices to at least lessen the effects of monoculture industry that often leads to high emission of greenhouse gases (GHGs). But, it was documented that the farmers were still practicing monoculture in their lands, i.e. planting rice during the wet season (June-October) and planting corn during dry season (November-March).

Uddin et. al. (2014) found that irrigation was ranked first and thus most important among farmers' adaptation strategies to climate change. Irrigation increases the yield of production, improving nutrient availability to the plants. Practicing crop diversification was identified as the second-ranked adaptation strategy. Continuous mono-cropping (for example rice cultivation) has different adverse effects which include pest resurgence and soil quality deterioration, and the issues of loss risk associated with monocultures. In response to these effects, farmers adopted diversified cropping practices, reducing overall farm risk and expanding opportunities for farm profit to boost the farmers' average incomes. Crop insurance was ranked as the least important adaptation strategy.

Most farmers have an average monthly income of Php 7,350 thus, prevents them to upgrade their houses or no changes in their housing/infrastructure (60%) to withstand flooding as well as strong typhoons. However, some farmers even the community as a whole started to absorb disasters in their place. This was due to the observed initiative of the community members to elevate their houses (26.67%) and 13.33 percent establish a 2-storey house (Figure 6). Thus, the community already accepted the fact that whenever strong typhoon comes, flooding is already anticipated.

Table 3. Initiatives to combat the effects of Climate Change Related Disaster (CCRD)

Areas and Initiatives	Frequency n = 30	Percentage (%)
a. Environment		
Planting of backyard plants and vegetables	30	100
b. Agriculture		
Using water pump for irrigation during drought	12	40
Planting corn that does not require more water	18	60
c. Housing/Infrastructure		
Establishing 2-storey house	4	13.33
Elevating their houses	8	26.67
No changes	18	60.00
d. Health*		
Preventing exposure to heat waves	30	100
Preventing exposure to floods	30	100

*Multiple response

In relation to health, it was identified that this is the number one concern that the barangay is requesting, because of common illness such as cough, headache, colds, and fever (Ortega, 2016). Since majority of the citizens in the barangay are self-employed and deal with farming, these illnesses are expected to occur. With regard to this aspect, farmers deal with adaption strategies. In a way, all farmers (100%) moved out from the farm during heat waves and stayed in their homes. The same practice is also made whenever strong typhoons are in place.



Figure VI. Elevated houses and establishment of 2 story houses

Other Adaptation strategies

As to the attitude of moving out or migrating from the place whenever affected by disasters, the farmers were still returning to their respective home regardless of the damage incurred from the disaster. Furthermore, it was revealed that there was already an observed migration pattern of residents of the barangay to the urban core. The reason associated with this was due to the distance of the

barangay. As known, once citizens moved out from the place to work, most of them started residing in cities and returned to barangay if there were only occasions or other events. In the study of Harmer and Rahman (2014) entitled Climate Change at the Farm-level Adaptation strategies in Developing Countries, they found out that one of the most prominent strategies of farmers' adaptations on climate change, was diversification of farming and migration to local or international.

With respect to insurances, not all farmers have the capacity to acquire insurances – only those members of farmers' organization, especially coming from the Department of Agriculture (DA). This reason is related to the distance of the barangay to the office of the agency. Thus, farmers are at risk for possible income loss due to disasters. Certain amounts were not elicited from the farmers for insurance, due to their low income and possible incapability to produce other capital for future protection.

Additionally, one respondent stated that to cope with this economic loss, most farmers were having chances in their second cropping. But then, not all farmers had the capacity to proceed to next cropping, unless, farmers incurred debt to start again. As specified by the barangay officials as the key informants during the interview, the chances of earning from farming practices in their community were weak. Farmers would eventually pay their debts at the end of the cropping season, thereby, less or no earnings after farming.

Farmers were also aware of risks generated by climate variability and extreme climatic events. However, farmers were not taking concrete steps in dealing with perceived climatic changes, although it was find out that farmers were changing their agricultural and farming practices. These included changing sowing and harvesting timing, cultivation of crops of short duration varieties, inter-cropping, changing cropping pattern, investment in irrigation, and agroforestry.

IFAD's (2012) study on climate change analysis and adaptation responses in Vietnam found that common climate change adaptation response by the farmers includes, shifting from annual crops to livestock production due to drought in the mountains of Northern Vietnam and the Central Highlands, and high percentages of farmers changing cropping patterns, calendars, varieties and cultural practices because of drought and reduced water availability.

Programs and services towards climate change related disasters

There were various programs to combat the effects of climate change, thus, decreasing chances of CCRD. This is actually stipulated in the National Framework Strategy on Climate Change and divided into two pillars which is Mitigation and Adaptation (Table 4).

Table 4. Programs and services towards Climate Change Related Disasters

Programs	Available in the community		Not available in the community	
	Freq.	%	Freq.	%
Mitigation				
Energy efficiency and conservation			30	100
Renewable energy			30	100
Environmentally sustainable transport			30	100
Sustainable infrastructure			30	100
National REDD+ Strategy			30	100
Waste management	30	100		
Adaptation			30	100
Enhanced vulnerability and adaptation assessments				
Integrated ecosystems-based			30	100

management			
Water governance and management		30	100
Climate-responsive agriculture			
LGU subsidized rice seeds	30	100	
LGU subsidized corn seeds	30	100	
Climate-responsive health sector		30	100
Climate-proofing infrastructure		30	100
Disaster risk reduction		30	100

Because of the unavailability of majority of the programs and services in the community, unfortunately, farmers were not familiar on the said programs and services to combat the effects of climate change and its disasters. It is very clear that despite the risks as well as the vulnerability of farmers towards CCRD, they were not experiencing the necessary services that should be provided by their government unit. Furthermore, no resources were given to farmers to become resilient towards CCRD, except for seeds and waste management provided by the Agriculture Office. Thus, farmers in Barangay Mabalbalino are endangered with the impacts of climate change related disasters.

When the barangay official was asked about the need of the farmers on their activities, he specified two concerns: irrigation and solar dryer. Because of drought, irrigation is now a major problem in their barangay. Thus, the need to provoke the government agency, particularly the National Irrigation Administration (NIA). Moreover, solar dryer was requested because accidents are common in the place when barangay public roads are used for drying grain, like corn. Follow-ups and request letters were already forwarded to government agencies and units, but yet, there was no any response. However, it was peculiar in its sense because despite of weak programs and services provided by the local government unit, farmers were eager to participate in increasing awareness of their respected farmers to combat the effects of CCRD. The only suggestion is there should be transparency in all meetings and seminars to be conducted in the barangay.

Social resilience, like other facets of human well-being, is comprised of objective and subjective elements. Objective elements relate to actual capacities and capabilities such as natural, human and financial capital. Subjective dimensions refer to how people perceive climate change risks and their own adaptive capacity (Adger et al., 2011).

Adger et al. (2013) also added that social resilience to climate change is primarily concerned with individuals and communities, and has important socio-demographic traits. Social resilience is also intricately linked to the resilience of the broader political and ecological systems in which populations, settlements and economies are embedded.

Summary, Conclusions, and Recommendations

The farmers interviewed were not familiar about climate change and its related disasters. The common answer given as the results of climate change was flooding. On the other hand, the farmers did not know about the causes of climate change. Some examples identified as CCRD were only typhoons and flood.

Farmers were not ready to CCRD. This was to less and few initiatives to combat the effects of climate change. Also, there was no management scheme being practiced and implemented in the barangay to recover and reduce the effects of disasters in the area. Migration attitude after a disaster was not common among farmers. Moreover, insurances were selective among farmers because of the accessibility or the distance of the government agency particularly, Department of Agriculture. Only members of farmers' organization in the barangay were informed about insurances and other benefits.

With regard to programs and services to combat CCRD, the farmers had no experienced on activities towards the issue. On the other hand, distribution of seeds for farming and waste management were the only resources and information obtained by farmers to become resilient. However, it was not specified if the seeds are for drought or flood resistant.

Despite the unfamiliarity of the farmers towards climate change, they are willing to participate in increasing the awareness of their co-farmers to combat the effects of CCRD. For this reason, it was stated that this would benefit all members of the community at large.

Based on the summary specified, the following conclusions were drawn:

1. The demographic profile of farmers indicates that they are vulnerable to CCRD (age, economic status, and educational attainment);
2. The knowledge of farmers towards climate change and its related disasters is lacking;
3. Farmers are not ready to CCRD because of deficient knowledge on climate change and associated demographic profile;
4. There are no aggressive practices and initiatives to combat the effects of CCRD, thus, further increases the risk towards the problem;
5. No existing programs are felt by the community at large, including the farmers to combat the effects of CCRD; and
6. Farmers are willing to participate in increasing awareness to combat the effects of CCRD.

Based on the conclusions derived, the recommendations were formulated as follows:

1. To improve the resiliency of farmers towards CCRD, there is a need to improve the quality of the farmers' economic status, such as monthly household income, by incorporating other livelihood options as back-up for monetary issues;
2. An information dissemination campaign on climate change and its related disasters should be conducted to make farmers more aware of the global phenomenon;
3. Programs and services in improving and building the resilience of farmers should be conceptualized as well as reiteration, and adoption of mitigation and adaptation strategies of the National Framework Strategy on Climate Change should further be stipulated;
4. There should be seminars and extension services on the mitigation and adaptation towards climate change, incorporated to disaster readiness and risk reduction program; and
5. Maximize the participation of farmers, even the community at large, to adopt community based adaptation (CBA) approach to combat the effects of CCRDs.

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