# Farmers' Awareness and Adaptation Strategies in Coping Climate Change in Zamboanga Peninsula, Philippines

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***Abstract*** *- This study determined the farmers' awareness on climate change, adaptation strategies and as well as issues and problems encountered. Descriptive type of research was utilized in the study. Respondents included farmers, city agriculturist and municipal agriculturist. A total of 93 farmers were taken as respondents. The respondents were selected randomly from the list of active members of farmers association provided by the Office of the City Agriculturist of Zamboanga City and Municipal Agriculturist of Zamboanga Sibugay. A structured questionnaire and focus group discussion were carried out to answer the different objectives. Majority of the farmer respondents are aware on climate change concepts. They said that extreme weather events could affect their production and eventually their livelihood. For adaptation strategies the top 3 are: use suitable crops during extreme weather condition, adjust timing of planting activities and rainwater harvesting. For the issues and problems encountered that affect their adaptation strategies, they said; decreased yield of crops, delayed fruiting of crops and increase of pests and diseases. To be consistent with Sustainable Development Goals number 2 and 13 of the United Nations. There is a need for the local government units and national government agencies to provide the necessary information, infrastructure and other assistance to aid the farmers in dealing with the changes in the climatic conditions for them to be sustainable and resilient.*

***Keywords****: Adaptation strategies, climate change, sustainable*

## INTRODUCTION

The Philippines is vulnerable to the effects of climate change due to its geography. Being an island nation and its location, it usually experiences tropical storms or sometime extreme weather condition due to climate change [1].

The projected climate changes could affect rainfall distribution which will ultimately affect runoff to rivers and lakes in the Philippines. Hence, future problems will arise due to shortage of water supply [2].

Local farmers are always caught unaware by the changes in climate and thus early warning regarding such occurrence should be provided to the farmers to lessen the impact of climate change. [3]. Farmers considered adaptation strategies for Climate change as expensive and laborious, and sometimes too technical for them [4].

Zamboanga Peninsula Region is located in the Western part of Mindanao. It is bounded by Sulu Sea on the north; Illana Bay and Moro Gulf on the south; Misamis Occidental, Lanao del Norte and Panguil Bay on the east; and the Celebes Sea on the west. The region has a total land area of 14,138 square kilometers and has a population size of 2,831,412 in 2000 with a population growth rate of 1.97%.

In terms of economic condition, farming and fishing are the main economic activities of the region. It also has rice and corn mills, oil processing, and coffee berry processing and processing of latex from rubber. Its home industries include rattan and furniture craft, basket making, weaving and brass work.

Considering that farming is one of the main economic activities of the region, it is important to consider how farmers are coping with the changes in the climate. Adaptation measures will then help them in addressing the issue on climate change, since it will affect the food production in the region and eventually food security.

Zamboanga City is situated at 6˚53'59.99" N and 122˚03'60.00''E (City of Zamboanga, 2018); while

Zamboanga Sibugay geographically sited between 7.78˚N and 122.59˚E.

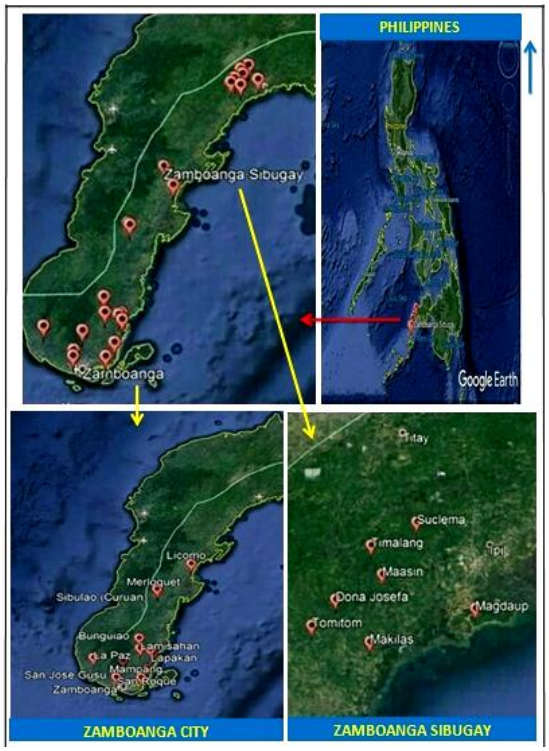


Figure 1. Study Site

The vulnerability of the Philippines to climate change is great thus this will affect the agricultural sector in terms of production. Being a tropical country, that is rain-fed, and then during drier season this would decrease production [5]. Due to climate change the future is unsure since projection due to its effect is also uncertain in terms of economic impacts like the agricultural sector [6].

Globally, climate change will have adverse effects on crop yields. The changes in the yield of crops will reduce supply and will have higher prices in the world market [7]. Accordingly, if the current levels of greenhouse gases productions will be left unattended, the average global temperature will increase by 1.4 C to 5.8 C between 1990 and 2100. Moreover, the effects of climate change have adverse impacts on developing countries like the Philippines [8].

More over there is a need to strengthen non-structural interventions such as policies. Encourage partnerships and provide necessary support to increase resiliency of the farmers and reduce the impact of climate change [9]. Due to climate change farmers reported crop failures, flooding and migration to other places. Thus, policy formulation is necessary to address such problems and plan local adaptation strategies for the farmers [10]. Furthermore, farmers in the different parts of the country have already been experiencing climate change due to changes in rainfall and temperature pattern [11].

The United Nations Environmental Programme UNEP report found that global warming, a result of climate change will add to worsening food security. The report added that reduced water availability will create one of the greatest problems to agriculture, especially in developing countries. Manifestations of the changing climates have been observed in the trend of increasing temperatures, precipitation, sea level and extreme weather events [12].

Farmers are affected due to extreme weather conditions to include their production and livelihood. The City of Zamboanga which is situated at the southern tip of Zamboanga Peninsula is exposed to coastal storm surges and flooding during heavy rainfall. Furthermore, due to extreme weather condition like long period of drought.

Few studies have been conducted related to the impact of climate change to the farmers in Zamboanga City and Zamboanga Sibugay. Hence, findings of this study will help in understanding the problem confronted by the farmers due to climate change. Results of the study can be used as basis for the enactment of policies that would alleviate the conditions of the farmers and be more resilient.

## OBJECTIVES OF THE STUDY

The study aimed to determine the level of awareness and adaptation strategies of farmers in coping climate change. Specifically, this research was conducted to determine the level of awareness of the farmers; identify farming problems encountered by farmers during climate change; determine farming strategies of farmers in coping climate change; and document best adaptation mechanism being used by the farmers in coping climate change.

## MATERIALS AND METHODS

### Research Design

The study employed the descriptive survey research design.

### Respondents

The respondents of the study were farmers who are members of associations registered with the City

Agriculturist and Municipal Agriculturist. And have been into farming activities for more than 10 years.

A total of 93 residents were randomly chosen as respondents for the study. Majority of the respondents or 65% were male, while only 35% were female. While for the age bracket of the respondents, most of them are with more than 45 years old, elementary school graduates with monthly income between Php 1,000.00 –Php 5,000.00.

The majority of the respondents are Roman Catholic (90%) others are Protestant, Islam and from other religion.

**Research Instruments**

The study used three (3) major instruments: survey, focus group discussion (FGDs) and direct observation. The research instrument has two parts: Part I, Level of awareness of the respondents regarding Climate Change; and Part II, the adaptation strategies of the respondents. The said questionnaire has been adopted with revisions from the study of Ngilangil et al. [4].

The first part was composed of 15 items or statements while the second part was composed of 10 items for the adaptation practices. For the level of awareness, 5-point Likert scale was used for Climate Change Awareness and Adaptation Strategies. Numerical value and descriptive equivalent were considered: 4.20-5.00: Very Highly Aware (VHA)/ Always Adopted (AA); 3.40-4.19: Highly Aware (HA)/ Often Adopted (OA); 2.60-3.39: Aware (A)/ Sometimes Adopted (SA); 1.80-2.59: Slightly Aware (SA)/ Seldom Adopted (SA); 1.00-1.79: Not Aware (NA)/Never Adopted (NA).

The instrument was validated by experts and pilot tested to farmers with similar conditions to determine the clarity and understanding of the questionnaire and to find out if there are items that needs to be modified. A reliability test was then conducted on the data gathered.

Afterwards, the questionnaire was reproduced and ready for the gathering of data. For FGD sessions, guide questions were prepared for this purpose and likewise issues, challenges were also taken during the session.

**Data Collection Procedure**

Prior to the distribution the questionnaire to the respondents; a letter of request was forwarded to the City Agriculturist and Municipal Agriculturist seeking permission for the conduct of the research study. Afterwards, another letter requesting the list of farmers who are registered as members of farmers associations in their locality and have been engaged in farming for a minimum of 10 years was also forwarded. When the entire request was approved, Key Informant Interview was conducted to the representative of the City Agriculturist and Municipal Agriculturist to gather information related to the study.

Subsequently, survey interview was conducted randomly to the selected farmers using the prepared questionnaire. The field enumerators personally distributed the questionnaires to the respondents with assistance from the representative of the City Agriculturist and Municipal Agriculturist.

For the Focus Group Discussion (FGD), purposive sampling was used. The schedule was arranged in coordination with the Office of the City and Municipal Agriculturist. It was conducted with the Presidents of the different farmer association. They were purposively selected due to their knowledge and awareness of the study.

There were two (2) FGD sessions conducted, one (1) in Zamboanga City and the other in Zamboanga Sibugay. In each of the FGD session there were eight (8) participants.

**Ethical Considerations**

The respondents were informed on the purpose of the research and their participation in the survey will be purely voluntary and their responses will be treated with utmost confidentiality. Informed consent was provided in the questionnaire.

**Data Analysis**

Frequency count, mean are the statistical tools used to analyze the result of the data gathered.

**RESULTS AND DISCUSSION**

As shown in Table 1, the farmers are highly aware about climate change. However, for items on shifting cultivation that can create gullies and human activities can increase green house gas emission rated the least with a score of 3.56. Comparing the study sites (Zamboanga City and Zamboanga Sibugay) both sites the respondents are highly aware in terms of climate change. The data shows that farmers have already information on climate change. During the interview they mentioned that the experienced they had with the changes in the climate made them aware of the condition their locality.

Table 1. Level of Awareness on Climate Change

| Climate Change Indicators | Zamboanga City | Zamboanga Sibugay | Mean |
|---|---|---|---|
| 1. Landslides and flashfloods not only destroy the lands but also destroy the irrigation canals, foot trails, and houses. | 3.65 | 4.50 | 4.08 |
| 2. Climate change increase weed and pest population. | 3.91 | 4.15 | 4.03 |
| 3. Climate change leads to changes in irrigation water. | 3.84 | 4.20 | 4.02 |
| 4. Vector-borne diseases are not only affecting the lowlands but also the uplands. | 3.91 | 4.05 | 3.98 |
| 5. Expansion of the range of pests could increase vulnerability and result in greater use of pesticides. | 3.95 | 3.95 | 3.95 |
| 6. A warmer climate would reduce flexibility in crop distribution and increase irrigation demands. | 3.77 | 4.10 | 3.94 |
| 7. Crop production is at great risk during extreme weather events. | 3.88 | 3.95 | 3.92 |
| 8. Seasonal changes in rainfall, temperature could alter growing seasons. | 3.84 | 3.95 | 3.90 |
| 9. Climate change intensifies and disrupts water cycle. | 3.63 | 4.05 | 3.84 |
| 10. Climate change alters land suitability. | 3.63 | 3.95 | 3.79 |
| 11. Climate change can have impact on the forest ecosystem. | 3.60 | 3.95 | 3.78 |
| 12. Forest degradation affects the local climate. | 3.56 | 3.95 | 3.76 |
| 13. Climate change is a global issue/problem. | 3.51 | 3.95 | 3.73 |
| 14. Shifting cultivation/slash and burn cultivation fields can create gullies in the valley bottom. | 3.77 | 3.40 | 3.56 |
| 15. Human activities could increase greenhouse emission. | 3.12 | 4.00 | 3.56 |
| **Grand Mean** | **3.70** | **3.61** | **3.86** |

Table 2. Adaptation Strategies

| Indicators | Zamboanga City | Zamboanga Sibugay | Mean |
|---|---|---|---|
| Rainwater harvesting. | **3.93** | **4.30** | **4.12** |
| Use suitable crops during extreme weather condition. | **3.58** | **4.15** | **3.87** |
| Apply crop rotation. | 3.42 | 4.10 | **3.76** |
| Adjust timing of planting activities. | 3.49 | 3.65 | 3.57 |
| Attend training for alternative livelihood. | 2.98 | 3.90 | 3.44 |
| Use soil conservation measures such as mulching. | 2.86 | 2.75 | 2.81 |
| Use or apply intercropping methods. | 3.05 | 2.40 | 2.73 |
| Adopt other means of livelihood. | 2.19 | 2.70 | 2.44 |
| Apply diversified farming methods. | 2.16 | 2.05 | 2.10 |
| Transfer to other location. | 1.67 | 2.90 | 2.29 |
| **Grand Mean** | **2.93** | **3.29** | **3.11** |

Table 2 shows the both study site the respondents had an average rate of sometimes adopted and with a grand mean of 3.11. However, rainwater harvesting, use of suitable crops and apply crop rotation are the top 3 adaptation strategies. Further, adjustment to planting activities, training for alternative livelihood and soil conservation measures also follows as adaptation strategies. During the interview, farmers made mentioned that adaptation strategies for climate change are expensive since such strategies will involve technologies and or additional training for them. It is noted that some of the farmers will even transfer to other location for them to have livelihood to support their families. They will return to the place, once the condition is already alright for them to plant their crops.

Thus, access to information is very essential for an institutional influence in adopting new technologies and measures [13]. Further, learning and capacitating the farmers are crucial for them to have access to resources and thus increasing adaptive capacity of the farmers [14]. Several factors affects with the choice of the farmers adaptation strategy: i.e. the farming experience, farm size, educational attainment and gender [15].

As shown in Table 3, the top 3 problems encountered by the farmer respondents are increased of pest and diseases, decreased yield of crops, and delayed fruiting of crops. However, comparing the two sites for Zamboanga City, increase of pests and diseases, decreased yield of crops and delayed fruiting of crops. However, for the Zamboanga Sibugay, almost all the indicators are considered high in terms of issues and problems encountered by the farmers. The data shows that the issues and problems encountered by the farmers are almost the same in scope.

The data of the study shows that the respondents have a good perception towards the impacts and effect of the climate change on their agricultural production.

Thus, they have adopted different strategies to cope up with the effects of climate change and learning to adapt these changes in their own initiatives.

Equally, farming experience helps with the implementation and identification of any of the existing adaptation strategy. And all the adaptation strategies have been significantly influenced by the level of education [16]

Table 3. Issues and Problems Encountered by the farmers

| Indicators | Zamboanga City | Zamboanga Sibugay | Mean |
|---|---|---|---|
| Increase of pests and diseases. | 4.33 | 5.00 | 4.67 |
| Decreased yield of crops. | 4.30 | 5.00 | 4.65 |
| Delayed fruiting of crops. | 4.23 | 5.00 | 4.62 |
| Low crop productivity. | 4.19 | 5.00 | 4.60 |
| Increase cost in farm operations. | 4.12 | 5.00 | 4.56 |
| Lack of crop/varieties suited for extreme weather conditions. | 3.95 | 5.00 | 4.48 |
| Adaptation measures are laborious | 3.95 | 5.00 | 4.48 |
| Adaptation measures are expensive. | 3.91 | 5.00 | 4.46 |
| Lack of information regarding climate change coping strategies. | 3.86 | 5.00 | 4.43 |
| Lack of technical assistance provided to the farmers. | 3.81 | 3.95 | 3.88 |
| **Grand Mean** | **4.07** | **4.90** | **4.49** |

The climatic conditions result to different adaptation strategies of farmers for them to have to good harvest., However, given the wide range of agricultural diseases and pests due to changes in the climate it encouraged the farmers to utilize the improved variety of pesticides and fertilizers, which will result to the loss of biodiversity; the contamination of the soil and water in long-term effects, and they all have the direct impacts on animal and human health [17].

The best adaptation practices in agricultural is to go back to organic farming which will reduce the impact on the use chemicals to eliminate pest and diseases and even the application of inorganic fertilizer. Since the use the chemicals in the environment causes global warming and eventually climate change. [18]

## CONCLUSION AND RECOMMENDATION

Climate change is a serious issue that threatens not only the environment but also the livelihood, food security and health of the large proportion of the country's population.

The study revealed that farmers both in Zamboanga City and Zamboanga Sibugay are highly aware about the climate change The main adaptation strategies of the farmers were: the rainwater harvesting (that supports their production during dry spell season), the usage of suitable crops during extreme weather condition (avoiding the risk among the production), and the application of crop rotation.

Due to the existing climate change, farmers likewise perceived the different modification: the changes in irrigation water, the massive growth of the weeds, the vector-borne diseases (affecting the low and uplands), and the expansion of the variety pests which increases the vulnerability among the production, and which led to a greater use of pesticides.

Nevertheless, this paper showed the main problems encountered by the farmers: the increased of pests and diseases among the production, resulting in the decreased yield of crops with low crop productivity, and the delayed fruiting of crops and the lack of crop varieties suited for the extreme weather condition. Moreover, there are some barriers that impede farmers from adopting the strategies (assistance, availability of resources), and the lack of information have also tested their ability to cope up with the effect of climate change.

Farmers with access to information and technologies and who are more educated and experienced will have better adaptation strategies; although support from the government, non government organizations and even academe should be in place since to cope up with climate change scenario by the farmers would need everybody's support.

As far as best practices of the farmers, while it is mentioned that by practicing organic agriculture will reduce the impact on global warming and climate change; there is no single best practice/s that can be adopted by the farmers since it will all depend on the location, which will include rain fall pattern, farm inputs and technology available to the farmers.

Education, experience of farmers is also to be considered.

Hence, among the 17 Sustainable Development Goals (SDG); Sustainable Development Goals, goal number 2, to end hunger, achieved food security and improved nutrition and promote sustainable agriculture and goal number 13 to take urgent action to combat climate change and its impact should be given importance by the policy of the government in order to help the farmers.

According to Pope Francis, the problem of climate change is a social justice issue that needs to be addressed not just by the world governments but by civil society as well [19]. Moreover, the findings of this study have actions to address and public policy implications. Adaptation policies regarding the climate change should be given a priority on the government development agenda. Policy makers should improve the plan of action for climate change adaptation through agricultural policies.

In this way farmers will be more resilient and will be able to cope up with the different challenges that they will encounter in the future. Future studies can also be conducted to include farmers who are engaged in the planting of other crops. Since, this study was limited to farmers who are planting only vegetables.

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