Mainstreaming Climate Change Adaptation in Watershed Management and Upland Farming in the Philippines

Draft Final Report

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I. Introduction

Being an archipelagic developing country composed of more than 7000 small islands, the Philippines is highly vulnerable to the impacts of climate related events such as tropical cyclones and ENSO. The Philippines is always battered by typhoons because it is geographically located in a typhoon belt area. Based on the 59 year period (1948-2006), annual average number of typhoons occurring within the Philippine Area of Responsibility (PAR) is around 19 to 20 (PAGASA, 2007). During the last two decades, an increasing trend on the number of strong typhoons (> 185 kph wind speed) hitting the Philippines has been observed. From 1990-1998, a total of seven strong typhoons have crossed the country (NDCC, 2000 and Typhoon 2000.com). Damages from these typhoons are staggering. They not only caused damage to properties but also claimed the lives of people. For instance, typhoon "Uring" (Thelma) which made a landfall in November 1991 caused the death of around 5101-8000 people and damaged properties amounting to PhP 1.045 billion. Typhoons 'Ruping" (Mike) and "Rosing" (Angela) caused damage to properties of almost PhP 11B each. Typhoon "Kadiang" (Flo) which entered the area of Philippine responsibility on September 30 – October 7, 1993 caused the death of 576 people and damage to properties worth PhP 8.752 billion while the most recent typhoon "Milenyo" (Xangsane) resulted to damage of PhP 6.6 B.

Aside from typhoons, the Philippines is also badly affected by ENSO events. The extreme drought that is associated with occurrence of El Nino episode puts the agricultural sector at risk. Since crop production is highly dependent on water, limited availability or unavailability of water greatly affects the yield of most crops. Evidence to this is the sharp decline in the volume of production of palay, corn, coconut and sugarcane during the two worst El Nino events in 1982-1983 and 1997-1998 (Amadore, 2005). The effect of ENSO episode on crop production does not end once the event is over rather it still linger even the following year (Canlas and Cruz, 2004).

Impacts of these climatic events are further aggravated by the deteriorating condition of the watersheds in the country. The most vulnerable sectors are the upland farmers who have very limited resources and who rely on rain as source of water for farming and domestic use. To reduce vulnerability of upland farmers to climate change and at the

same time ensure that the watersheds can continue to deliver the environmental services foremost among which is water, adaptation strategies for the watershed and upland farmers need to be developed.

Promotion of adaptation strategies to climate change by upland farmers will minimize risks among upland farmers and help attain sustainable development. There are more than 20 million people who live in the Philippine uplands who are highly vulnerable to climate related risks. Most of them cultivate marginal hilly areas and rely heavily on rain as source of water for farming and domestic use. As such, they have inherently limited resources to adapt to climate change. The AIACCC study (Lasco *et al*., 2005a; Pulhin et al., 2005) showed that some upland farmers have developed adaptation strategies to cope with the impacts of climate variability. These adaptation strategies to current climate could form a strong foundation for exploring viable options for adaptation to climate change.

In the same manner, adaptation to climate change in watersheds is also important to be achieved because watersheds are critical to the economic development and environmental protection in the Philippines. More than 70% of the total land area of the country lies within watersheds. It is estimated that no less than 1.5 million hectares of agricultural lands presently derive irrigation water from watersheds. Despite the tremendous value of the watersheds to Philippine economy and its environment, many watersheds are now in varying stages of deterioration (Cruz *et al*., 2000).

II. Objectives

The overall goal of the project is to promote climate change adaptation by upland farmers and watershed managers at the national and local levels in the Philippines. Specifically it intends to:

1. Assess the impacts of climate variability and extremes and climate change to crop yield of farmers in Lantapan, Bukidnon and water yield of Manupali watershed, Bukidnon;

2. Develop adaptation strategies for Landcare farmers and concerned Manupali watershed managers/concerned institutions to minimize risks and maximize opportunities associated with climate change;

3. Promote a multi-stakeholder approach in the formulation of climate risk adaptation through participatory approaches and capacity building of Landcare farmers and watershed managers;

4. Develop risk communication products targeted for the watershed planners and Landcare farmers; and

5. Contribute to the preparation of the Philippines' Second National Communication by providing case materials.

III. Methodology

To achieve the objectives, the project utilized a combination of methods to ensure proper delivery of outputs. Emphasis was placed on active participation of stakeholders.

1. Assessment of the impacts, vulnerability and adaptation policies/strategies to current climate risks of upland farming systems and watershed management. Impacts, vulnerability and adaptation policies/strategies to current climate risks were assessed through a combination of one-on-one interview with farmers and stakeholders, conduct of focus group discussions, workshops and review of literature. Results of the assessment were presented and validated during workshops.

2. Formulation of climate change adaptation strategies, policies, and measures for watersheds and upland farming systems. Based on adaptation to current climate risks, adaptation options to climate change were identified through a participatory process and guided by the approach recommended by Jones and Mearns (2004) and Niang-diop and Bosch (2004) and as applied in our AIACC study (Pulhin et al., 2006; Lasco et al., 2006).

3. Development and dissemination of risk communication materials. Climate risk adaptation communication materials in the forms of magazine and video were developed. The climate change magazine was popularized for easy understanding of the non-technical people. Prior to their reproduction, the communication materials were pre-tested to ensure that language used is understandable. Based on the comments gathered during the pre-testing, the communication materials were revised accordingly. Both the climate change magazine and the video were produced in English and local dialect to ensure that the target people will understand the messages conveyed in the communication materials.

Climate change magazines were given out to the constituents of Lantapan, Bukidnon. There are already a total of 1500 magazines that were distributed in the project site. For the video, only members of the local community who have CD and DVD players were able to use such communication materials. However, the video was used during series of trainings, workshops, and consultation meetings conducted by the project team.

4. Capacity building of partners. Since climate risk assessment is new to stakeholder partners especially at the local level, the project included a strong capacity building component. This took the form of formal and informal training sessions for climate change 'champions', farmers groups, stakeholders and policy makers at the local level. The capacity building activities were conducted by the science organization partners (University of the Philippines Los Baños and World Agroforestry Center) in cooperation with the Farmers' Information and Technology Services (FITS) under the municipality of Lantapan, Bukidnon, who ensures that every training/ meeting conducted is covered by the local media.

In the barangays, capacity building activities were held during their general assembly meetings. This provided an opportunity for the project team to capture as many people as possible because barangay assembly meetings are mandatory for every member of the barangay.

Series of trainings, workshops and consultation meetings were also undertaken with around 20 stakeholders which include the Bukidnon Environment and Natural Resource Office (BENRO), private companies engaged in large scale banana and pineapple plantations , academe, local DENR, local DA, NGOs, LGUs, water district, planning

offices, PAG-ASA, NPC, NIA, NDCC. Separate trainings were conducted with the farmers.

At the policy makers' level, the project team was also able to conduct trainings engaging the Sangguniang Bayan (policy makers at the municipal level) and Association of Barangay Captains (policy makers at the barangay level).

In each of these groups, presentations were made following the sequence below:

- Video presentation – Heeding the Cries of the Skies (video produced by the ACCCA project)
- Paper presentation on Climate Trends in Bukidnon, Philippines
- Paper presentation on Forests and Climate Change
- Paper presentation on Agriculture and Climate Change
- Discussion on what can be done

5. Assessment of the Impact of Capacity Building Activities. To determine the impact of capacity building activities and the communication materials developed through the ACCCA project on the level of awareness of the farmers and stakeholders on the climate change and other related concepts, surveys were conducted at the beginning and towards the end of the project. To eliminate bias of the result, a new Research Assistant who has no prior contact with the respondents was hired to conduct the post project assessment.

IV. Results and Discussion

Description of the Study Site

Lantapan is one of the 21 municipalities of the province of Bukidnon in Northern Mindanao, Philippines. It is located between the two mountain ranges of Kalantungan and Kitanglad. It is bounded on the north by the municipalities of Sumilao and Impasugong, on the east by Malaybalay City, on the south by Valencia City and on the west by Talakag (Figure 1). Lantapan lies between parallel $8^0$2'00' and $8^0$5'0' north latitude and meridians $124^0$51'00" and $125^0$11'00" (MPDO, 2000).

Lantapan has a total area of 34465 ha covering 14 barangays and 68 sitios. Four of these barangays namely Poblacion, Balila, Alanib and Bantuanon are considered urban or urbanizing barangays. These barangays cover a total of 9676 ha representing around 27% of the total land area. The rest of the barangays or 73% of the total area are rural.

The climate in Lantapan is Type IV under the Corona Classification. Lantapan has relatively cool climate with an average annual temperature of 19^oC and monthly average temperature not exceeding 21^oC. It is relatively dry from November to April and wet from May to October. Average monthly rainfall is 224.54 mm.

Topography of Lantapan is generally rugged and steep particularly in the upper portion but gently sloping in the lower section. Elevation ranges from 500 – 2150 masl with an average elevation of 600 masl. Maximum elevation is found in Kitanglad ranges at 2938 masl.

In terms of land use, only agriculture, forests and built up/industrial comprise Lantapan. Agriculture covers the largest area while built up/industrial occupies the least. Almost 50% of the total area is covered by agriculture while 40% is covered by forests. The remaining 10% is occupied by the industries and settlement.

Soil of Lantapan is of two major types: Adtuyon Clay and Kidapawan Clay. These types of soil are considered best for agricultural crops. For this reason, big companies such as Dole Philippines, Mt. Kitanglad Agriventure, Inc (MKAVI), Celebrate Life and Mt. Kitanglad Agriventure Development Corporation (MKADC) opted to invest in growing banana and/or pineapple in Lantapan. Thus, large tract of land in the area has been devoted to these crops.

Lantapan has an agricultural-based economy. Farming remains to be the dominant economic activity among the people of Lantapan. The major crops grown are corn, coffee, cabbage, potatoes and sugarcane.

Based on the 2000 census, Lantapan has a total population of 42,383 people or household population of 7,880. Barangay Kibangay has the highest population of 6006 persons while Barangay Victory has the lowest population (1367 persons). Average household size is 5.56 while population density is 120 persons per km^2.

The original inhabitants of Lantapan are the Talaandigs. During the Spanish colonial period and World War II, many people from the Visayas and Northern Luzon migrated in the Lantapan. Thus, currently the population comprising Lantapan are of different ethnic groups.

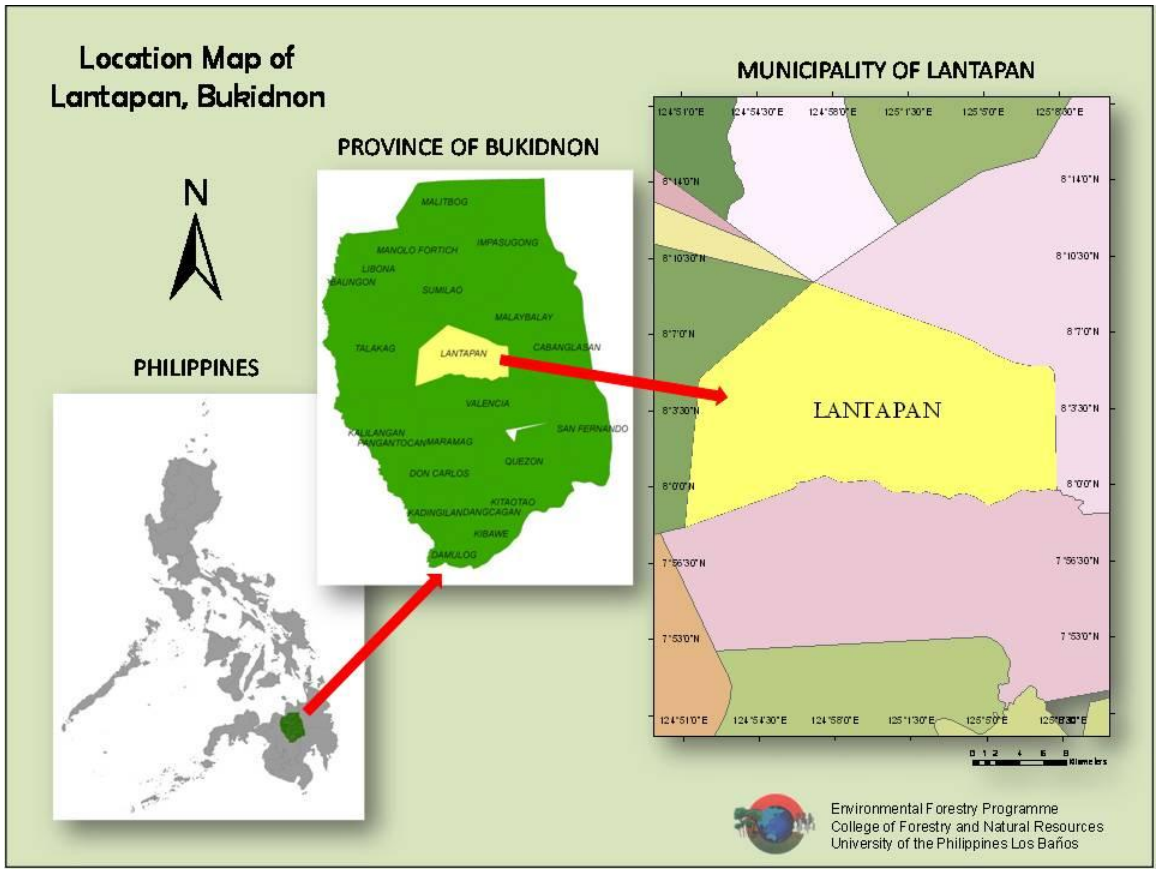

Figure 1. Location map of Lantapan, Bukidnon, Philippines.

Table 1. Landuse pattern, Lantapan, Bukidnon, 2002.

Classification	Area (ha)	Percentage
Agricultural	17,804.3	54
Forestal (Pasture, grasslands and forest lands)	12,199.2	37
Built-up areas (commercial, residential and agro-industrial)	1978.254	6
Others	989.127	3
Total (ha).	**32,970.90**	**100**

Source: MOL, 1994 and 2002 as cited by Rola et. al. (2004)

Socio-Demographic and Economic Context

Farming is the predominant livelihood of the communities in Lantapan for many decades (Coxhead and Shively, 2005). In 1988, 71% of provincial employment was in agriculture, 5% in industry, and 23% in services; agriculture provides the primary income source for 68% of Bukidnon households. As is typical of a recently settled area, most Lantapan farms (about 70%, covering 80% of total farm area) were owned or in 'owner-like possession' in 1980. Farm sizes are small by upland standards: in Lantapan in 1980, the modal farm size class (1–2.99 ha) contained 46% of farms and 75% of all farms were smaller than 5 ha. Many households live close to the poverty line. In 1988, food accounted for 59% of household expenditures in Lantapan.

In 1973, approximately 28% of total land area in Lantapan was considered agricultural land. By 1994 this share had increased to nearly half of the watershed area. This expansion in land devoted to agriculture has largely involved the replacement of forest and permanent crops by annual crops which still taking pace up to present, but in a slower and minimal means.

Lantapan has an agriculturally based economy. Until recently, 90% of the households have been dependent on smallholder farming. However, this has changed since Mt. Kitanglad agriventures Inc. (MKAVI) and Dole Skyland Philippines, two large corporations for highland banana production, started to operate in th elate 1990s (Catacutan, 2007) . the LGU estimated that about 60% of the total labour force of Lantapan was now employed in these companies, and in commercial swine and poultry farms, while others had seasonal employment in large corn farms, sugarcane plantations, and in vegetable farms.

Corn is the predominant crop. At the middle altitudes, coffee is also prevalent, while at higher elevations corn is planted alongside coffee and other vegetables. Other crops and trees distributed in the watershed include sugarcane, cassava, beans, cabbages, and tree-plantations for firewood and non-timber forest products. Table 5 shows the most recent distribution of different crops per area.

Table 2. Crops and area planted in Lantapan.

Crops Planted	Area (ha)
Corn (HYV, OPV white and traditional variety)	4,081
Irrigated rice	698
Vegetables	
Tomato	58
Brocolli	27
Ampalaya (*Momordica charantia*)	1
Cabbage	104
Carrots	13

Cauliflower	22
Sweet pepper	21
Sweet peas	16
Squash	27
Beans	17
Chayote (*Sechium edule*)	19
White beans	6
White potato	51
String beans	1
Chinese cabbage	73
Singkamas (*Pachyhizus erosus*)	3
Subtotal	459
Coffee	396
Fruit trees (lanzones and mango)	45
Rubber	42
Banana	2,000
Sugarcane	3,046
Cassava	2
Abaca	27
Total	**10,796**

Source: Municipal Agriculture Office (MAO), 2003

Earlier, corn and cassava were grown primarily for subsistence, and sold locally to Bukidnon's cattle ranching industry. But because of the improved integration of the Bukidnon's economy in the national agricultural market, and due to road improvements, corn production has flourished and became the primary commercial crop.

Description of the Farmer Respondents

Distribution

A total of 157 farmers served as respondents for the study. Most of the respondents are from Barangay Capitan Juan which comprise of 25 individuals, followed by Barangay Cawayan with 19 individuals. Number of respondents from other barangays are in the following order: Songco > Kibangay, Victory > Baclayon > Alanib, Kakatuan > Balila, Basac, Kulasihan > Bantuanon, Poblacion (Table 3).

Table 3. Number of respondents per barangay.

Barangay	Frequency	Percent
Alanib	10	6.37
Baclayon	15	9.55
Balila	6	3.82
Bantuanon	5	3.18
Basac	6	3.82
Capitan Juan	25	15.92
Cawayan	19	12.10
Kaatuan	10	6.37
Kibangay	16	10.19
Kulasihan	6	3.82
Poblacion	5	3.18
Songco	18	11.46
Victory	16	10.19
TOTAL	**157**	**100.00**

Age

The ages of the respondents range from 20 to 75 years old with an average of 44 years old. A little over 50% of the respondents fall in the age bracket of 30 - 49 while about 30% have ages of 50 and above. Fifteen respondents representing 9% of the total are 20 - 29 years old. Only one or 0.64% does not know his exact age which indicates that such respondent is still of primitive nature.

Table 4. Ages of respondents

Age Bracket	Frequency	Percent
20-29	15	9.55
30-39	43	27.39
40-49	50	31.85
50-59	28	17.83
60-70	18	11.46
>70	2	1.27
Don’t know	1	0.64
TOTAL	**157**	**100.00**

Sex and Civil Status

The total respondents are almost equally divided between males and females. Results indicate that farming is not only done by the head of the family or the husband but it is a family activity where everyone in the family gets involved. Most often, the wives help their husbands in farm activities to reduce costs of hiring laborers and hence increase their net income. In some instances, children even at their young age are also trained to engage in activities related to faming.

Majority of the respondents (92%) are married. The remaining 7% are either single (3.82%) or widow(er) (3.82%). Result obtained is expected because in rural areas in the Philippines, most men and women get married while they are still in their teens.

Table 5. Respondents according to sex and civil status

ITEM	FREQUENCY	PERCENT
Sex		
Male	91	57.60
Female	66	42.04
Total	**157**	**100.00**
Civil Status		
Single	6	3.82
Married	145	92.36
Widow(er)	6	3.82
Total	**157**	**100.00**

Educational Attainment

Educational attainment of the respondents ranges from those who had elementary education and those who finished college. A little over 50% of the total respondents have elementary education. Of these, 22% did not obtain their elementary diplomas while 29% were able to graduate from elementary. About 20% reached some high school while 15% finished their high school education. A mere 1% completed two year vocational course while 11% were able to graduate from college. Around 6% of the total respondents reached some college while less than 1% had no formal education at all. One respondent did not give any answer as regards his educational attainment. Results indicate that in general, most respondents have relatively low level of education. This result is typical to most rural areas in the Philippines where only elementary or primary

schools are built. When a person wants to continue in pursuing higher education, he/she needs to migrate in areas offering high school. These areas are often located within or in barangays near the town center. Thus, only parents who have the financial capacity can send their children to other areas offering high school and higher education.

Table 6. Educational attainment of the respondents

Educational Attainment	Frequency	Percent
Elementary	79	50.32
High School	54	34.39
College	20	12.74
Vocational	2	1.27
None	1	0.64
No answer	1	0.64
Total	**157**	**100.00**

Religion

Almost all of the respondents have religious affiliations. Bulk of those who have religious affiliations were Roman Catholics (78%) while 21% of the total respondents are either Baptist, Iglesia ni Cristo, Seventh Day Adventist, Pentecostal, Adamic, Universal Faith, and IFI. Only two respondents mentioned that they do not have any religion at all. Results show that the Filipinos in general recognize that there is a supreme being whom they can call upon during times of trouble.

Table 7. Religion of the respondents

Religion	Frequency	Percent
Catholic	122	77.71
Baptist	12	7.64
Iglesia ni Cristo	10	6.37
Seventh day adventist	3	1.91
No answer	2	1.27
Others	8	5.10
Total	**157**	**100.00**

Others include: Pentecostal, Adamic, IFI, Universal Faith, No Religion

Occupation

Major occupation of most respondents (85%) is farming. The remaining 15% of the total respondents are engaged in any of the following livelihood activities: employee (4%), housekeeping (4%), storekeeping (3%), buy and sell (1%), labourer (1%), Barangay Health Worker (0.64%), Day Care Worker (0.64%) and driving (0.64%). Result is in agreement with the description of Lantapan that it is an agriculture-based municipality.

More than half of the total respondents who regarded farming as their primary occupation said that they are engaged in the occupation for more than 15 years already. Only 11% are relatively new in growing agricultural crops since they are doing farming for 1-5 years only. Some 16% are engaged in farming for 6-10 years while another 15% are into the same occupation for 11-15 years.

Secondary occupation of the respondents include: farming, laborer, Barangay Council, storekeeping, housekeeping, business, livestock, hilot, Barangay Health Worker, carpentry and driving. Around 3% of the total respondents mentioned that they are engaged in agriculture-based activities.

Table 8. Occupation of the respondents

Occupation Type	Main Occupation		Other Occupation	
	Frequency	Percent	Frequency	Percent
Faming	133	84.71	22	14.01
Employee	6	3.82		
Store owner	5	3.18	7	4.46
Buy and Sell	2	1.27		
Laborer	2	1.27	24	15.29
Barangay Health Worker	1	0.64	1	0.64
Day care worker	1	0.64		
Driver	1	0.64	1	0.64
Housekeeping	6	3.82	78	75.82
Barangay Council			12	7. 64
Small Business			5	3.18
Livestock			4	2.55
Hilot			2	1.27
Carpentry			1	0.64

Annual income

Total annual income from farming ranges from PhP 1350 to PhP 1.5 M. It should be noted however, that there are only a handful of respondents who reported that they have relatively large earnings from farming. For instance, only one respondent said that he is earning more than a million. Thirty - eight or 24% of the total respondents have annual farm income > PhP50000. More than half (64%) mentioned that the income they derive from their farms is ≤ PhP 30000 per year. About 12% of the total respondents said that they have annual income from farming that is between PhP 30000 to PhP 50000. Results show that there are "big" farmers in Lantapan as manifested by the farm income reported amounting to over a million pesos. This group of farmers have the capital to diversify their crops and practice sustainable farming

Table 9. Annual income from farming of the respondents

Income	Frequency	Percent
1000-10000	49	31.21
10001-20000	25	15.92
20001-30000	26	16.56
30001-40000	11	7.01
40001-50000	8	5.10
>50000	38	24.20

Climate Variability and Extremes Experienced by Farmer Respondents

A number of climate variability and extremes were enumerated by the respondents. These include: 'prolonged rains', 'El Nino', 'delay onset of the rainy season', 'early onset of the rainy season' and 'La Nina'. Among the climate variability and extremes, occurrence of prolonged rain and El Nino were the most mentioned. These two climatic events received 235 responses representing 56% of the total. Anomaly on the rainy season (delay or late onset) was also a relatively common climatic event since they were mentioned by almost all of the respondents (151 or 36%). 'La Nina' however, seemed not a very common climatic event as it received 7% only of the total responses (Table 1).

Table 10. Climate variability and extremes experienced by upland farmers in Lantapan, Bukidnon

CLIMATIC EVENT	FREQUENCY	PERCENT
Prolonged rains	120	28.92
El Nino	115	27.71
Delay onset of rainy season	91	21.93
Early onset of rainy season	60	14.46
La Nina	29	6.99

Impacts of and Adaptation to Climate Variability and Extremes of Farmer Respondents

Impacts of climate variability and extremes on crops, farm income, domestic and farm water, soil and health as well as adaptation strategies undertaken to minimize the such impacts are shown in Table 2.

Crop yield

'Early onset of rainy season' has both positive and negative effects on crops. On the positive side, this climatic event resulted to increased yield of some crops like abaca and banana, savings on labor cost since they do not need to water their crops and opportunity to plant early. On the negative note, however, this climatic event increased the occurrence of pests and diseases such as blight and fungi, rotting of crops which results to decreased yield for some farmers. To avoid severe damage caused by pests and diseases, the farmers increase their use of chemicals/pesticides. For farmers who do not have enough resources to buy pesticides, they borrow money from lending institutions or individuals. Some farmers build temporary canals/drainage to drain excess water from their farms. By doing such, their crops are protected from being flooded which can cause rotting. Others diversify their crops to ensure that their families will have something to eat once their original crop fails to survive. For some farmers, however, 'early onset of rain' provides them an opportunity to plant earlier than the regular planting season. Thus, whenever there is 'early onset of rain', they immediately do land preparation. According to this group of farmers, 'early onset of rainy season' provided them an opportunity to have more number of cropping. Some farmers however do not practice any adaptation strategy to minimize the impacts of 'early onset of rainy season'. There are possible reasons why they opt not to do anything. One is that the impact of the climatic event to them is not that much. Another possibility is that they do not have the means to implement the adaptation strategy to cope with the impacts of the climatic event.

Unlike 'early onset of rainy season' where some impacts noted are a combination of both positive and negative, 'delay onset of rainy season' according to the respondents cause nothing but negative effects only. These include: decrease in crop yield, crops dry up, low quality of crops produced, planting is delayed and short period of time that farmers can plant resulting to decreased income. To avoid the crops from drying up, farmers

water their crops. Some farmers on the other hand use early maturing crops instead of the regular crops that they grow. By doing such they said that they have a better harvest. Others ask help from government agencies such as the DA and the local government unit (provincial and municipal). Most of the time, these agencies provide seeds and technical assistance to the farmers. Some farmers use additional fertilizers and chemicals to fight the diseases developing on crops and avoid producing low quality crops. Others diversify their crops to ensure harvest while some engage in off-farm work to earn income for their families. Some people opt to just wait for the rain and pray that the climatic event soon end.

'Prolonged rain' results to decrease in crop yield because crops are damaged, washed out, attacked by pests and diseases and rotten. To cope with this impact, farmers undertake one or a combination of adaptation strategies. One of the strategies carried out by farmers is the shift to water tolerant species. Others construct canal/drainage to avoid accumulation of too much water in their farms that may cause rotting and washing out of the crops while some farmers practice contour farming and plant trees along the contour and boundaries. Some farmers plant crops other than the usual produce in the hope that by doing such they can harvest something at the end of the cropping period even if their original crops fail because of presence of excessive water due to 'prolonged rain'.

Surviving crops during 'prolonged rain' are of low quality because they are attacked by pests and diseases that usually occur whenever there is excessive moisture. Farmers manage this impact by applying chemicals and pesticides.

For farmers who use areas near the river to grow crops, 'prolonged rainy season' result to loss of opportunity to earn income from farming. Such areas are under water whenever there is continuous pouring of rain.

According to the farmers, 'El Nino' has the worst effects on crops. During this climatic event, there is a dramatic decrease in crop yield or at worst there is no harvest at all for most crops as survival rate is very low. According to them, only sugarcane survive and give good yield because it can withstand prolonged dry period. Interestingly only big farmers have the capacity to invest on sugarcane at it requires big capital. Small farmers on the other hand, invest on vegetables, corn or rice or a combination of any of the three crops since such crops give quick returns on investment and do not require much capital. In cases when some crops survived, the farmers noted that surviving crops are damaged, very dry and are of low quality because they are attacked by pests and diseases. Farmers tend to spend more during this climatic event because they have to hire laborers to water their crops and buy chemicals to drive away the pests and diseases damaging their crops. These adaptation measures are undertaken mostly by big farmers because they have the money to provide water for their farms and buy additional inputs. Small farmers, since they have very limited resources, just pray that the dry spell ends. To ensure that their families will have something to nibble, farmers diversify their crops. Most often they plant crops that can withstand water stress such as root crops. In addition, they ask assistance from the local government units. To meet the needs of their families, most of these farmers either work as laborers in sugarcane plantation and poultry or engage in charcoal making. Others sell their livestock or any asset, loan and pawn or rent out their farmlots while some farmers mentioned that they let their wives and other members of the family to work in other towns or provinces or even overseas. Some farmers search for opportunities in other places. Once these

farmers find that these new areas would offer better prospects for them and their families, they leave Lantapan and settle in that new place.

For farmers with rainfed farms, 'El Nino' brings hopelessness because they cannot plant at all during such climatic event. To cope with this impact, similar adaptation measures mentioned in the preceding paragraph are undertaken by these farmers.

Impacts of 'La Nina' are almost the same as those of 'prolonged rain' but the effects brought about by the former are more severe. For instance, the farmers noted that 'La Nina' results to decline in harvest because crops are damaged, decayed and washed out. Adaptation strategies undertaken to reduce this impact are the application of contour farming, planting of trees and planting of more varieties of crops. The last strategy is undertaken in the hope that some of these crops will survive 'La Nina' which in turn will help them secure food for their families.

During 'La Nina' crops are attacked by pests and diseases which reduced the quality of the crops. Adaptation strategy undertaken to reduce this impact is the use of chemicals on crops. Likewise, farmers plant crops that are resistant to pests and diseases.

Other adaptation strategies to reduce adverse impacts of 'La Nina' include: borrowing money from banks or other lending institutions, selling of livestock, work in other place, work as laborers in other farms or poultry within their barangays, pawn farmlot, engage in other livelihood activities and ask assistance from the government.

Farm Income

In general, all the climatic events have almost the same impact on the farm income. As shown in Table 3, farmers accounted that there is a decrease in income during occurrence of the different climatic events. However, they emphasized that during 'El Nino', 'La Nina' and 'prolonged rain' impact is more severe because it not only reduced their earnings from farming but it totally stripped off their income. This happens to vegetable growers and those whose farms are located in low lying areas. As a consequence, some farmers resort to economic activities that may mean more damage to the remaining forests in the area.

Other farmers who preferred to stick to farming opted to work as laborers in other farms while some looked for other place to cultivate. Since there is no longer productive area in the lower slopes, farmers moved in the steeper areas. Others plant again in the same farm lot after their original crops were damaged by the climatic events.

Obviously, the reason why the local communities were engaged only in livelihood activities that are dependent on forests or land was that they had less opportunity to engage themselves in livelihood activities available in the town center or nearby cities. They lacked the credentials that these activities require. Most job opportunities in the town proper or nearby cities required secondary or tertiary diploma. As indicated in the educational background of the farmers, bulk of them had elementary education only.

Another reason why the local communities were engaged only in livelihood activities that are dependent on forests was that they didn't have enough capital to involve themselves in business like operating sari-sari stores, buy and sell and hauling/trucking.

As an alternative to farming, farmers engaged themselves to off-farm work such as charcoal making and planting of bamboos. A number of farmers try their luck in other places while some farmers mobilize other members of the family in earning money by sending out their wives and daughters to other regions of the country or abroad to work as domestic helpers.

Aside from engaging in other economic activities, farmers made use of what they have to produce money. Those who own farm lots, either pawned or rented out their lots. Others who own livestock or other assets, sold such to obtain money so that they could buy food and other needs of their families.

To cope with the limited food available on their tables, some farmers and their families changed their consumption pattern. Instead of eating rice and corn, whose harvests are limited or sometimes nil due to occurrence of climatic events, they consumed root crops. At worst situation where the families no longer have the capacity to buy enough food for the family, they reduced the number of meals taken per day from three to two.

Most farmers asked for help from government agencies and relatives whenever they are affected by the climatic events. When budget permits, the local government provide food subsidies to the local community. Usually, such subsidy is in the form rice and is only given once.

Some farmers loan from banks or any lending institutions to help them meet their needs. Others engaged in gambling to try their luck. This adaptation strategy is very common to most people in the Philippines because they perceive that by gambling they will have brighter future once they win. Others who are more passive do nothing once calamity strikes and just leave everything to God.

It is worthy to note however that not all crops are negatively affected by the climatic events. For instance, 'early onset of rainy season' according to the farmers is favorable to the growth of abaca and banana while 'El Nino' is good for sugar cane. As a result, income for these crops is higher during such climatic events.

Also, increased income is received by farmers whose crops were able to survive the climatic events. Since supply of corn and vegetables in the market is low, farmers were able to command higher prices for the crops.

Domestic and farm water

According to the local communities, 'early onset of rainy season', 'prolonged rain' and 'La Nina' increased the supply of both domestic and farm water while 'delay onset of rainy season' and 'El Nino' reduced the amount of available water.

During the years when there were 'delay onset of rainy season' and 'El Nino', local communities fetched water from springs and rivers, efficiently used available water and constructed deep wells. Others transferred to areas where there is good water supply. In farms, manual sprinklers were used to water the crops.

Quality of water was noted by the respondents to be affected by 'prolonged rain' and 'La Nina'. During such climatic events, quality of water decreased as soil particles mix with water. To address the impacts on water quality, the local communities boiled and/or

chlorinated drinking water, filtered water using cloth and stored water in drums to allow the soil particles to settle. Others who were relatively well off bought purified water.

In farms, farmers constructed canal/drainage to drain excess water caused by 'prolonged rain' and 'La Nina'. Likewise, they practiced contour farming to refrain their crops from being washed out.

Soil

According to the respondents, climatic events have both positive and negative impacts on soil. For instance, 'early onset of rainy season' allowed easier cultivation of the soil while 'El Nino' caused the fungi and bacteria to be eliminated and sterilized the soil. 'Delay onset of rainy season' and 'El Nino' resulted to drying of soil which made it harder to cultivate. Adaptation strategy practiced by farmers to address the problem of dry soil was to water the farm.

'Prolonged rain' and 'La Nina' promoted occurrence of severe soil erosion, landslide, flooding on some farms and turned the soil to become muddy. Occurrence of soil erosion decreased the fertility of the soil. To deal with this impact, various adaptation measures were undertaken by the farmers. These included construction of canal/drainage, practice of contour farming, planting of trees, application of fertilizers and agroforestry.

Other farmers opted to abandon the area while some rented out their farm lots to big companies during 'El Nino'. They thought that by doing such, they would be better off because they do not need any capital to develop their farms and they would receive money from land rent. However, some farmers under this scheme have some regrets now because according to them they no longer have a chance to earn more from their farmlot. They have to be contented with whatever amount they and the big companies have agreed upon. Most often though, once the land rent is given to them, the farmers and their families immediately spend the money leaving nothing for the remainder of the year.

Health

Of the climatic events identified, 'delay onset of the rainy season' was claimed by the respondents as the only one that had no impact on health while the remaining climatic events were noted to cause occurrence of flu, colds, cough and fever. These diseases were handled by the local communities through consultation with medical doctor either in the Barangay Health Center or hospital, consultation with the quack doctor[1], use of herbal medicine and use of commercial medicine. Farmers who had the capacity to pay for professional fees usually consulted with the medical doctors and took commercial medicine. Poor farmers on the other hand, consulted the quack doctor and had herbal medicine as their first aid to diseases.

Aside from the mentioned diseases, 'prolonged rains' and 'La Nina' caused incidence of diarhhea, amoebiasis, and dengue fever. For amoebiasis and diarhhea, adaptation strategies undertaken by the local communities were similar to those they did for flu,

[1] Non-medical doctors who use prayer or alternative way of healing people.

colds and coughs. For dengue fever, routine cleaning of surroundings and spraying to drive the mosquitoes away were undertaken by the local communities.

Apart from cough, colds and flu, ‘El Nino’ also brought sore eyes, migraine, chicken pox, skin diseases, and other heat related diseases. Skin diseases were cured through application of coconut oil while migraine and chicken pox were treated either with herbal medicine or commercial medicine.

Table 11. Impacts of and adaptation to climatic events in Lantapan, Bukidnon.

DIMENSION	CLIMATIC EVENT	IMPACT	ADAPTATION
Crop	Early onset of rainy season	Increased yield for many farmers (+) Early cropping (+) No need to water crops (+) Favorable in some crops like abaca and banana (+) Appearance of blight and fungi (-) Increased pest and diseases (-) Crops are rotten (-) Decreased yield for some farmers(-)	Use of fertilizers and chemicals Loan Prepare for early cropping Crop diversification Construction of temporary drainage/canal Do nothing
	Delay onset of rainy season	Crops dry up (-) Decreased yield (-) Crops produced are of poor quality (-) Delayed planting (-) Short period of time that farmers can plant (-)	Ask help from government agencies Water crops Use of early maturing crops Just wait for rain Apply fertilizer and chemicals Engage in off-farm work Diversification of crops Pray
	Prolonged rain	Damaged crops (-) Crops are rotten (-) Decreased harvest (-) Increased pests and diseases (-) Crops are of poor quality (-) No harvest for farmers planting in areas near the river (-) Crops are washed out (-)	Plant water tolerant species Construct canal/drainage Plant fruit trees Contour farming Spray chemicals and pesticides Diversification of crops Wait for next cropping season
	El Nino	Damaged crops (-) Decreased harvest (-) Only sugarcane survive (-) Increased yield in sugarcane (+) No harvest for most crops (-) Crops dried up (-) Increased pests and diseases (-) Delayed planting (-)	Diversification of crops Transfer to other place Work as laborer in sugarcane plantation and poultry Loan Sell livestock/assets Engage in charcoal making Rent out farm lots Pawn farm lot

Table 11 Continued…

DIMENSION	CLIMATIC EVENT	IMPACT	ADAPTATION
Crop	El Nino	Some farmers cannot plant because their farms are rainfed (-) Increased farm expense (-) Low survival for crops (-) Low quality for crops that survived (-)	Water crops Wives and other members of the family look for other sources of income from other places in the country and abroad Do nothing Apply fertilizer Ask assistance from the government (LGU) Pray
	La Nina	Damaged crops (-) Crops are washed out (-) Decreased harvest (-) Slow growth of crops (-) Increased pest and diseases (-) Low quality of crops produced (-) Crops are rotten (-)	Contour farming Plant trees Loan Spray with chemicals Sell livestock Work in other place Work in other farms/poultry Pawn farm lot Plant crops resistant to pests and diseases Diversification of crops Engage in other livelihood activities Apply fertilizer Ask for government assistance
Farm Income	Early onset of rainy season	Decreased income for vegetable growers because of increased use of chemicals to save crops from blight brought by early onset of rain (-) Increased income for abaca and banana growers (+) Decrease or no income for corn growers (-) Farmers whose crops survived have increased income because there is decreased supply (+)	Contour farming Diversification of crops Do nothing Eat root crops instead of rice or corn Engage in off-farm work Loan Plant again Sell livestock Work as laborer in other farms

Table 11 Continued…

DIMENSION	CLIMATIC EVENT	IMPACT	ADAPTATION
	Delay onset of rainy season	Decreased farm income (-)	Do nothing Engage in off farm work Loan Plant again Plant root crops Rely on gambling to try luck Wait for rainy season to come Work as laborer in other farms
	Prolonged rain	Decreased income for many farmers (-) Increased income for farmers who were able to harvest (Low supply) (+) Increased drying cost for corn (-) Increased cost of farm inputs. Farmers put more fertilizers to replenish nutrients of the soil that are washed out due to prolonged rain (-) No income for farmers in low lying areas (-)	Apply fertilizer Ask help from government agencies Ask help from relatives Contour farming Diversify crops Engage in off-farm work Loan Pawn farm lot Plant again Pray Reduce food consumption Rent out farm lot Sell livestock Work as laborer in other farms
	El Nino	Low Income for corn growers (-) No income for vegetable growers (-) Increased income for sugarcane growers (+)	Ask help from relatives Charcoal making Consume root crops instead of rice and corn Do nothing Engage in off-farm work Government assistance Loan Look for other areas to cultivate Look for work in other place Pawn farm lot Pray Reduce food consumption Rent out farm lot

Table 11 Continued…

DIMENSION	CLIMATIC EVENT	IMPACT	ADAPTATION
Farm Income	El Nino		Sell assets Sell livestock Wait for rainy season Work as labourer in other farms
	La Nina	Decreased income (-) No income (-)	Cultivate area at higher elevation Loan Look for work in other place Plant bamboo to prevent soil erosion and as additional source of income Sell assets Send members of the family to work in other places Shift to different variety of crops
Domestic water	Early onset of rainy season	Increased water supply (+)	
	Delay onset of rainy season	Decreased water supply (-)	Conserve water Get water from other source
	Prolonged rain	Increased water supply (+) Water becomes brownish (-)	Boil water for drinking Filter water Some people buy purified water Put chlorine in water Use rain water
	El Nino	Decreased water supply (+)	Fetch water from springs and rivers Save water Plant trees Buy purified water Construct deep well Transfer to areas where there is good water supply
	La Nina	Increased water supply (+) Water becomes brownish (-)	Boil water for drinking Filter water Some people buy purified water Put chlorine in water Stock water in drum to allow the soil particles to settle down Use rain water

Table 11 Continued…

DIMENSION	CLIMATIC EVENT	IMPACT	ADAPTATION
Farm water	Early onset of rainy season	Farmers need not hire laborers to water the crops (-)	
	Delay onset of rainy season	Decreased water supply (-) Farmers spend more money in hiring laborers to water the crops (-)	Fetch water from river Wait for rainy season to come
	Prolonged rain	Increased water supply (+) Farms in tail end/low lying areas are flooded (-)	Construct canal/drainage along farm boundaries to prevent erosion
	El Nino	No water supply for rainfed farms (-) Limited water supply for irrigated farms (-)	Look for other source of water Instead of using water hose, manual sprinkler is used to water crops Wait for rainy season
	La Nina	Increased water supply (+) Farms in tail end/low lying areas are flooded (-)	Construct canal/drainage Contour farming
Soil	Early onset of rainy season	Easier to cultivate (+)	
	Delay onset of rainy season	Soil becomes dry (-) Hard to cultivate (-)	Fetch water from river/creek Wait for rainy season
	Prolonged rain	Occurrence of soil erosion and landslide (-) Decreased soil fertility (-) Soil becomes muddy (-) Some farm lots are flooded (-)	Contour farming Plant trees Construct canal/drainage Apply fertilizers
	El Nino	Soil becomes very dry and hard (-) Hard to cultivate because soil is very dry (-) Fungi and bacteria are eliminated (+) Soil is sterilized (+) Decreased soil fertility	Water the farm Fertilize the soil with chicken dung Abandon the area Rent out farm lot to big companies Contour farming Wait for rainy season
	La Nina	Occurrence of soil erosion and landslide (-) Decreased soil fertility (-)	Contour farming Plant trees Practice Sloping Agricultural Land Technology (SALT) Apply fertilizer Put compost Construct drainage/canal

Table 11 Continued…

Dimension	Climatic Event	Impact	Adaptation
Health	Early onset of rainy season	Flu, colds, cough, fever (-)	Take herbal medicine Go to Health Center/hospital Go to quack doctor Take commercial medicine Pray
	Delay onset of rainy season	No effect Cough, colds, fever, flu, Stomach pain	Take commercial medicine Take herbal medicines Go to health center Pray Consult quack doctor
	Prolonged rains	Increased incidence of flu, cough, colds, fever (-) Incidence of diarrhea (-) Incidence of dengue (-)	Go to Health Center/hospital Take herbal medicine People with money take commercial medicine Consult quack doctor Spray to drive the mosquitoes away Clean surroundings Pray
	El Nino	Get sick because of insufficient food intake (-) Incidence of sore eyes, migraine, cough, colds, flu, chicken pox, skin diseases, hypertension etc (-) Increased rate of malnutrition (-)	Go to Health Center/hospital Use herbal medicine People with money take commercial medicine Consult quack doctor Use coconut oil for skin disease Eat root crops as food alternative Pray
	La Nina	Increased incidence of diarrhea, flu, cough, colds, fever, dengue, amoebiasis, etc (-)	Go to Health Center/hospital Use herbal medicine People with money take commercial medicine Consult quack doctor Pray Immunization for children Fogging to drive the mosquitoes away Clean surroundings

Description of the Stakeholders Respondents

There are 32 respondents included in the study (Table 12). The respondents compose of key officials from 19 different institutions. These include the private companies engaged in large scale banana and pineapple plantations, non-government organizations working with the local communities in the area, local DENR (Department of Environment and Natural Resources), local government units (LGUs), National Irrigation Administration (NIA), meteorological office, power corporation, agriculture office, disaster coordinating council and local water district.

Table 12. Types of institutions engaged in the project.

Institution	Frequency	Percentage
LGU (Bukidnon, Lantapan, Valencia)	7	21.88
Private corporation (Celebrate life, Dole, MKADC, MKAVI)	5	15.64
DENR (CENRO, PENRO)	4	12.5
NGOs (ESSC, KASILAC, KIN)	4	12.51
NIA	4	12.5
PAG-ASA	2	6.25
Agriculture	2	6.25
NDCC	1	3.13
NPC	1	3.13
Water District	2	6.25
Total	**32**	**100.00**

Age, gender and civil status

Majority of the respondents are 40 years old and above (Table 13). About 44% of whom have ages between 40-49 years old while around 35% belong to age group 50-59 years old. Very few respondents are young since only 21% of the total stakeholders interviewed belong to age brackets of 20-29 and 30-39 years old.

Majority of the respondents are male representing around 72% of the total respondents (Table 13). Results indicate that most key positions in the different organizations are occupied by men.

Almost all of the respondents are married representing around 94% of the total persons included in this study. Only three persons representing 6% of the total respondents are single.

Table 13. Profile of the respondents.

Description	Frequency	Percentage
Age		
20-29	1	3.13
30-39	6	18.75
40-49	14	43.75
50-59	11	34.38
TOTAL	**32**	**100.00**
Sex		
Female	9	28.13
Male	23	71.88
TOTAL	**32**	**100.00**
Marital Status		
Married	30	93.75
Single	2	6.25
TOTAL	**32**	**100.00**

Length of service

In terms of length of service that respondents have with their respective institutions, Table 14 reveals that around 50% are serving their organizations for 16 years or more already. A mere 19% are quite new in their jobs since they are engaged in their work for 1-5 years only.

Table 14. Length of service of the respondents.

Number of Years	TOTAL	Percentage
1-5	6	18.75
6-10	7	21.88
11-15	3	9.38
16-20	6	18.75
>20	10	31.25
TOTAL	**32**	**100.00**

Impacts of and Adaptation to Climate Variability and Extremes of Institutions

Impacts of climate variability and extremes on operations, budget, manpower and programs of the different institutions are shown in Table 15. During delayed onset of rainy season, not all institutions are affected. For instance, representatives from the Bukidnon Environment and Natural Resources Office (BENRO), under the provincial government of Bukidnon; DOLE (private corporation engaged in large scale planting of banana); ESSC, a Non Government Organization working on environmental protection; municipal planning and development office of Lantapan (MPDC); Provincial Environment and Natural Resources Office (PENRO); Philippine Atmospheric, Geophysical and Astronomical Services (PAG-ASA); National Disaster Coordinating Council (NDCC) and water district mentioned that operations, budget, manpower and programs of their organizations/institutions are not at all affected by delayed onset of rainy season. Other institutions on the other hand experienced in varying degrees the impact of such climatic event. For Celebrate Life Agriventure Philippines Inc, impacts on operations by delayed onset of rainy season include implementation of additional activities such as watering and covering of bunches, longer waiting time before bananas ripen because banana plants suffer from water stress and reduction of the quality of bananas produced. This resulted to insufficiency of budget allocation and manpower. The same impact has been observed by MKAVI, another big company growing bananas in large scale on their banana plantations. As a result, the budget allocation has increased to cover the expenses incurred in pumping water from the source. Since watering of banana plantation is undertaken through mechanical process, no additional manpower is required. In the tree plantation program of the company, MKAVI personnel observe that during delayed onset of rainy season, rate of survival of trees planted is lower. For MKADC, delayed onset of rainy season is beneficial since pineapple requires less water.

For the local DENR (CENRO), delayed onset of rainy season resulted to increased mortality of the seedlings planted in their reforestation projects. However, the Environment Officer mentioned that sometimes this climatic event becomes a blessing because most often there is a delay in the release of budget. Thus, by the time that the funds are finally released, rain is already pouring. On budget, manpower and programs, no adjustment is undertaken to cope with the impacts of delayed onset of rainy season. In many government organizations in the Philippines, budget for the following year is allocated few months before the current year ends. Once such budget has been approved, no modification can be made. Thus, even if there is an occurrence of climatic event where adjustment in budget, manpower and program is needed, government organizations cannot do anything but to stick to whatever budget that had been allocated to them and existing manpower and activities set for the year.

For KASILAC (NGO that implements the corporate social responsibility projects of Dole Philippines), delayed onset of rainy season results to high mortality of seedlings planted and increased cost of plantation establishment. As a consequence, this results to increased budget allocation. On programs, delayed onset of rainy season results to delay on delivery of outputs of KASILAC which can result to reduction of budget allocation by Dole Philippines.

Key personnel of the KIN (Kitanglad Integrated Network, an NGO working with the Indigenous people) mentioned that delayed onset of rainy season results to delay on the implementation of agricultural based livelihoods and delay on planting activity. In terms

of budget, this climatic event results to increased expenses and re-alignment of some funds to mitigate the effects of the drought. No impact was noted on manpower and programs.

The agriculture offices under the local government units note different impacts. For instance, the key staff of the municipal agriculture office (MAO) in Lantapan, Bukidnon account that delayed onset of rainy season results to delayed planting of crops and increased mortality rate of demonstration crops. This has resulted to increase in budget to finance measures against infestation and other contingency plan. Despite the impact of delayed onset of rainy season on the operations, no impact is noted on manpower because even with calamity, no additional person is hired. This is typical of most government agencies in the Philippines where hiring extra personnel is very difficult because of financial constraint. On programs, MAO underscored that delayed onset of rainy season makes such programs less effective.

Municipal Agriculture Office (MAO) in Valencia City, Bukidnon accounts a minor effect of delayed onset of rainy season. The only area that is noted to be affected by this climatic event is on 'operations'. According to the MAO in Valencia City, their researches are affected because of decreased water supply.

The Provincial Agriculture Office (PAO) notes that delayed onset of rainy season do not affect their operations because even with the occurrence of such climatic event, their operations are still the same. Since there is no change in the operations, there is no addition also in the manpower allocation. However, with budget, a slight increase is noted to finance program such as dissemination of information to local communities as to what crops to plant. Most often, they advise the local communities to plant root crops and other short gestation crops.

The National Irrigation Administration (NIA) emphasize that delayed planting of rainy seasons causes the following effects on their operations: delayed planting, delayed supply of irrigation water and alteration of cropping calendar. No impact is noted by the climatic event on budget and manpower. In terms of programs, NIA personnel mentioned that their programs are undertaken way behind the schedule.

The National Power Corporation (NPC) being dependent on water for power generation said that delayed onset of rainy season results to shortage of available power and cannot maximize potential energy. Similar to NIA, no impact is noted on budget and manpower but in terms of programs, a delay on training and planting activities are noted as the effects of delayed onset of rainy season.

During early onset of rainy season, only five out of 19 institutions are affected. These include: CENRO, MKADC, NIA, NPC and PENRO. Effects of this climatic event on these institutions are a mixture of both positive and negative. For instance the CENRO and PENRO and MKADC are negatively affected by early onset of rainy season because this results to decrease in the survival rate of the seedlings planted of PENRO and CENRO while for MKADC it causes delay on land preparation and reduces the quality of pineapples. Also, this climatic event causes an increase in budget of MKADC because of high rental cost of equipment incurred and delay in planting. In the case of NIA and NPC, positive impacts of early onset of rainy season are observed. For NIA, this climatic event results to fast operation and farming system while for the NPC, it is favorable to power generation.

During prolonged rain, only institutions such as BENRO, Lantapan-MAO, Lantapan-MPDC, Lantapan-water district, MKADC, MKAVI, NIA, NPC and PENRO are negatively affected. For the environment offices, prolonged rain causes a delay on project implementation (BENRO) and decrease in the survival rate of established plantation (PENRO). In the agriculture office in Lantapan, this climatic event affects both manpower and programs. During such time, there are more absences among the personnel of the institution and less survival rate in their demonstration farm. In Lantapan-MPDC, there is a delayed operation due to flooding caused by excessive rain during this climatic event. Similar to the agriculture office in Lantapan, prolonged rain also results to more absences among its personnel. For private companies, prolonged rain reduces their harvest and quality of their farm produce. Also, this results to increase in budget allocation and less productivity and more absences among personnel for MKADC. Lantapan-Water District on the other hand, note that prolonged rain affects their operations, budget and manpower. During this climatic event, there is a delay in their maintenance activities, an increase in budget allocation to repair facilities damaged by excessive volume of water and slow implementation of maintenance activities because personnel cannot work when raining. For NIA, prolonged rain causes a combination of both positive and negative impacts. NIA personnel mentioned that during this climatic event, there is fast operation and farming system. However, the same climatic event causes damage to irrigation facilities resulting to increased expenses and manpower for repair and maintenance of such facilities. In the case of NPC, prolonged rain results to increase in water level of the dam up to a point that is dangerous. In occasions such as this, NPC releases water to avoid damage to the dam. However, this results to flooding in some communities.

Compared with other climatic events, there are more institutions that are affected during El Nino event. Out of 19 institutions studied, 14 are noted to be affected by this climatic event. In the case of BENRO, El Nino results to delay in their operations, increase in budget allocation and results to less effectiveness of the programs that they are implementing. The local DENR on the other hand notes that during this climatic event, there is delayed in plantation establishment, increased in budget allocation for forest fire protection, realignment of budget because money intended for maintenance is being used for rehabilitation, and programs become less effective because there is low survival of trees planted.

DOLE personnel mentioned that during El Nino, productivity of bananas decrease because of drought associated with this climatic event. This results to increase on budget allocation by 20% and additional manpower requirement to water the crop. In terms of programs, DOLE personnel notes that El Nino causes a delay on their implementation. Similarly, MKAVI personnel note that they are negatively affected by El Nino. For instance in their operations, a delay in their activities occur and they have to maximize the area of irrigation. Like DOLE, this results to increased expenses for water pumping from the source. On programs, MKAVI personnel noted that there is less survival in their tree plantation sites.

For the agricultural offices, PAO personnel only noted one effect of El Nino. This is on budget where a slight increase in allocation is noted. The staff of the municipal agriculture office (Lantapan-MAO) however mentioned that their organization's operations, manpower and programs are affected by El Nino. During this climatic event, they noted that implementation of their operations are delayed, their agricultural

technicians become less productive because they cannot do anything in the field, there is a delay in the implementation of their programs and failure in their demonstration farm occurs. Similar to Lantapan-MAO, Valencia- MAO/MPDC experienced delay on operation during El Nino event. Also, this climatic event results to reestablishment of farm trials when crops fail resulting to additional expenses both for reestablishment of the demonstration farms/plots but also in the gasoline used by the personnel involved in such activity. El Nino also affects the program of Valencia-MAO/MPDC where less productivity in crops and poultry is noted.

In the case of KIN and Lantapan-MPDC, El Nino results to stoppage of planting activities because of unavailability of water supply. Also, an additional on the existing programs of KIN is noted i. e. program on distribution of planting materials for root crops.

El Nino event results to delayed operation of the Lantapan-Water District because of limited water that can be distributed among domestic users. For NIA, El Nino causes negative impacts on operations, budget and programs. On operations noted impacts include: non implementation of planting activities, less water distribution, delayed release of water supply and longer operation since cropping season is altered. On budget, this leads to increased in expenses for monitoring while on programs, there is a change in cropping calendar.

For NPC, unavailability of water for power generation during El Nino event results to non maximization of potential energy. In terms of budget and manpower, no impact of El Nino has been noted. However, in NPC's programs, its personnel said that such programs are less productive and effective during El Nino event.

El Nino causes implementation of additional activities to address the needs of affected families resulting to increased budgetary requirement for the NDCC. In times such as these where budget allocation is no longer sufficient, 5% of the calamity reserved fund is used. During El Nino event, there is lack of manpower to extend assistance to affected families.

While almost all of the affected organizations noted negative effects, MKADC personnel mentioned that El Nino event is not at all a threat to theis organization because limited or no rain associated with El Nino event is favourable to pineapples.

For La Nina, nine out of 19 institutions are affected. For private corporations such as Celebrate Life Agriventure Philippines, Inc., DOLE and MKAVI, La Nina generally reduces productivity of bananas because of occurrence of pest and diseases and longer period for bananas to become mature resulting to delay in their operations. In addition, Celebrate Life Agriventure Philippines Inc personnel mentioned that La Nina also results to fast growth of weeds, occurrence of soil erosion and (4) decreased soil fertility. These effects result to insufficiency of budget allocated for the operations of the three private corporations. For DOLE, an increase on budget by 20% is noted during this climatic event. In terms of manpower, La Nina results to insufficiency of manpower, decreae in productivity and efficiency of personnel in the working in the field since they have to stop working during heavy down pour. In terms of program, only MKAVI noted an impact of La Nina. Such impact is on decreased growth in its tree plantation sites.

Agriculture office and MPDC in Lantapan noted that La Nina results to less effectiveness of personnel because of poor road condition. In addition, Lantapan-MPDC staff

mentioned that their operations are delayed due to heavy rains brought about by La Nina. For Lantapan-Water District, La Nina causes damage to facilities because of too much volume of water.

The NPC is positively affected by La Nina because during this climatic event, there is increase of water in the reservoir. NIA on the other hand is affected by La Nina through its operations, budget, manpower and programs. For its operations, La Nina causes a delay due to flooding and road inaccessibility and damages facilities. As a consequence, an increased in expenses and manpower is incurred for repair and maintenance. In NPC's programs, La Nina causes a delay in implementation.

PENRO's operations and programs are the ones noted by its staff to have been affected by La Nina. For operations, La Nina results to re-establishment of plantation and low survival of trees planted and delay in plantation establishment. Programs during this climatic event becomes less effective because newly planted seedling get drowned and have low survival rate.

Table 15. Summary of the perceived impacts of climate change to different stakeholders.

Nature of Climate Variability and Extremes / Stakeholders	Impacts			
	Operations	**Budget**	**Manpower**	**Programs**
Delayed onset of rainy season				
1. BENRO	• None	• None	• None	• None
2. Celebrate Life Agriventure Philippines, Inc.	• Additional activities such as watering and covering of bunches are undertaken • Bananas require longer period before they ripen because they suffer from water stress • Quality of bananas decrease	• Budget not sufficient	• Current manpower not enough	• Covering of banana bunches and watering of bananas were undertaken
3. CENRO	• Increased mortality of the seedlings planted • Sometimes it is favorable because release of funds is delayed	• None	• None	• None
4. DOLE	• None	• None	• None	• None
5. ESSC	• None	• None	• None	• None
6. KASILAC	• High mortality of seedlings planted • Increased cost of plantation establishment	• Increased budget	• None	• Delay on delivery of outputs which can result to reduction of budget allocation by Dole
7. KIN	• Delay on the implementation of agri-based livelihoods • Delay on planting activity.	• Had to re-align some fund to mitigate effects of the drought	• None	• None

Nature of Climate Variability and Extremes / Stakeholders	Impacts			
	Operations	**Budget**	**Manpower**	**Programs**
		• Increased expenses		
8. Lantapan-MAO	• Delayed planting. • Increased in mortality rate of demo crops.	• Increase to finance measures against infestation and other contingency plan	• None	• less effective
9. Lantapan-MPDC	• None	• None	• None	• None
10. Lantapan-Water District	• None	• None	• None	• None
11. Valencia-MAO/MPDC	• Research is affected because of decreased in water supply	• None	• None	• None
12. MKADC	• Beneficial to pineapple since pineapple has less water requirement	• None	• None	• None
13. MKAVI	• Additional activities such as watering and covering of bunches are undertaken	• Increased expenses for water pumping from the source	• None	• Less survival rate in their tree planting projects
14. NDCC	• None	• None	• None	• None
15. NIA	• Delayed planting • Delayed water irrigation supply • Alter cropping calendar	• None	• None	• Programs are behind schedule
16. NPC	• shortage of available power • Cannot maximize potential energy	• None	• none	• Delayed training and planting activities

Nature of Climate Variability and Extremes / Stakeholders	Impacts			
	Operations	**Budget**	**Manpower**	**Programs**
17. PAGASA	• None	• None	• None	• None
18. PAO	• Operations are the same regardless of climatic event	• Slight increase in budget allocation	• None	• Tell the local communities to plant root crops and other short gestation crops
19. PENRO	• None	• None	• None	• None
Early onset of rainy season				
1. BENRO	• None	• None	• None	• None
2. Celebrate Life Agriventure Philippines, Inc.	• None	• None	• None	• None
3. CENRO	• Decreased in the survival rate of established plantation	• None	• None	• None
4. DOLE	• None	• None	• None	• None
5. ESSC	• None	• None	• None	• **None**
6. KASILAC	• None	• None	• None	• None
7. KIN	• None	• None	• None	• None
8. Lantapan-MAO	• None	• None	• None	• None
9. Lantapan-MPDC	• None	• None	• None	• None
10. Lantapan-Water District	• None	• None	• None	• None
11. Valencia-MAO/MPDC	• None	• None	• None	• None
12. MKADC	• Delayed land preparation, affects	• High rental cost	• None	• Delayed planting

Nature of Climate Variability and Extremes / Stakeholders	Impacts			
	Operations	**Budget**	**Manpower**	**Programs**
	the quality	of equipment		
13. MKAVI	• None	• None	• None	• None
14. NDCC	• None	• None	• None	• None
15. NIA	• Fast operation and farming system	• No impact to them but to the farmers.	• None	• None
16. NPC	Favorable to power generation	• None	None	• **None**
17. PAGASA	• None	• None	• None	• **None**
18. PAO	• None	• None	• **None**	• None
19. PENRO	• Decreased in the survival rate of established plantation	• None	• **None**	• None
Prolonged rains				
1. BENRO	• Delayed project implementation	• None	• None	• None
2. Celebrate Life Agriventure Philippines, Inc.	• None	• None	• None	• None
3. CENRO	• None	• None	• None	• None
4. DOLE	• None	• None	• None	• None
5. ESSC	• None	• None	• None	• None
6. KASILAC	• None	• None	• None	• None
7. KIN	• None	• None	• None	• None
8. Lantapan-MAO	• None	• None	• More absences	• less survival rate in their demo farm
9. Lantapan-MPDC	• Delayed operation due to flooding.	• None	• More absences	• None
10. Lantapan-	• Delayed maintenance	• Damage to	• Slow	• None

Nature of Climate Variability and Extremes / Stakeholders	Impacts			
	Operations	**Budget**	**Manpower**	**Programs**
Water District		facilities if there is too much volume of water.	maintenance	
11. Valencia-MAO/MPDC	• None	• None	• None	• None
12. MKADC	• Affects harvest and fruits quality	• Aggravated due to quality problems	• Less productive and more absences	• None
13. MKAVI	• Poor quality of crops	• None	• None	• None
14. NDCC	• None	• None	• None	• None
15. NIA	• Fast operation and farming system • Damage to facilities	• Increased in expenses for repair and maintenance	• Additional manpower for repair and maintenance	• None
16. NPC	• Too much water, they need to spill water to avoid damage to the dam	• None	• None	• None
17. PAGASA	• None	• None	• None	• None
18. PAO	• None	• None	• None	• None
19. PENRO	• decreased in the survival rate of established plantation	• None	• None	• None
El Nino				
1. BENRO	• Delayed operation	• More budget allocation	• None	• Less effective
2. Celebrate Life Agriventure Philippines, Inc.	• None	• None	• None	• None

Nature of Climate Variability and Extremes / Stakeholders	Impacts			
	Operations	Budget	Manpower	Programs
3. CENRO	• None	• None	• None	• None
4. DOLE	• Decreased productivity of bananas	• Minimal increase of budget (20% increase in budget)	• Increase in manpower	• Delay on the programs
5. ESSC	• None	• None	• None	• None
6. KASILAC	• None	• None	• None	• None
7. KIN	• Stop planting	• None	• None	• Add program on distribution of planting materials for root crops
8. Lantapan-MAO	• Delayed implementation	• None	• Agricultural technicians are less productive because they cannot do anything	• Delayed implementation and less effective • Failure in demo farm
9. Lantapan-MPDC	• No tree planting activities	• None	• None	• No tree planting activities
10. Lantapan-Water District	• Delayed operation • Limited water resources	• None	• None	• Less water for distribution
11. Valencia-MAO/MPDC	• Delayed operation	• If crop trials fail, re-establishment is undertaken resulting to additional expenses. Also increase	• None	• Less productive in crops and poultry in research trials

Nature of Climate Variability and Extremes / Stakeholders	Impacts			
	Operations	**Budget**	**Manpower**	**Programs**
		expenses for gasoline		
12. MKADC	• Favorable to pineapple	• None	• None	• None
13. MKAVI	• Delayed operation • Maximize area of irrigation	• Increased expenses for water pumping from the source	• None	• Less survival rate in their tree planting
14. NDCC	• Additional activities undertaken to address needs of affected families	• Budget allocated become insufficient • 5% of the reserved calamity fund is used if there is a disaster • Budget of NDCC comes from the provincial government, if funds of the provincial government is not enough, we seek help from the regionla and national offices (Department of Civil Defense)	• Lack of manpower to extend assistance to affected families	• None
15. NIA	• Sometimes no planting for other farmers	• Increased in expenses for	• None	• Change in cropping calendar

Nature of Climate Variability and Extremes / Stakeholders	Impacts			
	Operations	**Budget**	**Manpower**	**Programs**
	• Less water/no water for distribution • delayed release of water supply • Longer operation since cropping season is altered.	monitoring		
16. NPC	• Cannot maximize potential energy	• None	None	• Less productive and effective
17. PAGASA	• None	None	• None	None
18. PAO	• None	• Slight increase in budget allocation	• None	None
19. PENRO	• Delayed in plantation establishment	• Budget for maintenance is being used for rehabilitation • Increased budget for for fire protection. Depends on the budget allocated by central office.	• None	• Less productive • Less effective because of the survival rate of the trees.
La Nina				
1. BENRO	• None	• None	• None	• None
2. Celebrate Life Agriventure Philippines, Inc.	• Increased diseases • Fast growth of weeds • Occurrence of soil erosion • Decreased soil fertility • Decreased growth rate • Bananas require longer production time	• Budget not sufficient	• Current manpower not enough • Decrease in the efficiency of the laborers	• None

Nature of Climate Variability and Extremes / Stakeholders	Impacts			
	Operations	**Budget**	**Manpower**	**Programs**
3. CENRO	• None	• None	• None	• None
4. DOLE	• Delay operations • Longer period before bananas become mature • Increased occurrence of pests (fungal)	• Minimal increase of budget (20% increase in budget)	• Increase in manpower	• Planting undertaken earlier than scheduled
5. ESSC	• None	• None	• None	• None
6. KASILAC	• None	• None	• None	• None
7. KIN	• None	• None	• None	• None
8. Lantapan-MAO	• None	• None	• Less effective because of poor road condition	• None
9. Lantapan-MPDC	• Delayed operation	• None	• Less effective because of poor road condition	• None
10. Lantapan-Water District	• None	• Damage to facilities if there is too much volume of water.	• None	• None
11. Valencia-MAO/MPDC	• None	• None	• None	• None
12. MKADC	• None	• None	• None	• None
13. MKAVI	• Decreased productivity and decreased in growth of banana	• Increased expenses for road maintenance,	• Decreased of productivity and efficiency of workers	• Decreased in tree growth in tree planting

Nature of Climate Variability and Extremes / Stakeholders	Impacts			
	Operations	**Budget**	**Manpower**	**Programs**
14. NDCC	• None	• None	• None	• None
15. NIA	• Delayed operation due to flooding and road accessibility • Damage to facilities	• Increased in expenses for repair and maintenance	• Additional manpower for repair and maintenance	• Delayed in implementation
16. NPC	• Increase water in the reservoir	• None	None	• None
17. PAGASA	• None	• None	• None	• None
18. PAO	• None	• None	• None	• None
19. PENRO	• Re-establishment of plantation • Less effective because of the survival rate of the trees. • Delayed operation (i.e. Reforestation, plantation establishment)	• None	• None	• Less effective because newly planted seedlings were being drowned and less survival rate.

To cope with the impacts of climate variability and extremes, set of adaptation strategies are being undertaken by the different institutions. Adaptation strategies carried out depend on the climatic event that is being encountered. For BENRO, monitoring and assessment is undertaken during prolonged rain and El Nino events to determine the impacts of the climate events. Likewise, dissemination of information through broadcasting is undertaken to warn local communities affected. This is undertaken in coordination with PAGASA and LGUs affected.

For Celebrate Life Agriventure Philippines, Inc. and DOLE, adaptation strategies during climatic events related to limited water availability such as delayed onset of rainy season and El Nino include covering of bunches of bananas, watering of the crops and use of water impounding facility. During prolonged rain and La Nina when pests and diseases usually occur, these companies applied pesticides to eliminate pests and diseases and fertilizer to have good yield. For DOLE, they do not cut the leaves of bananas to cover the fruit. These additional activities result to increased budget allocation. In the same manner, MKAVI pumps water from source to water their crops during delay onset of rainy season and El Nino. If situation allows irrigating the banana plantation is undertaken. To increase yield of bananas, fertilization is also undertaken. For MKADC, early site preparation is undertaken in times when rain falls quite early. Likewise, they plan for strategies to help them be prepared for the climatic event. However, MKADC personnel said that they can only do this when there is a warning received from PAG-ASA.

The local DENR (CENRO and PENRO) prepare more on the impacts of drought occurring during El Nino event because they do not have much window to cope with the impacts of other climatic events as their budget and program of activities are already fixed. To combat occurrence of forest fires during extreme drought, the local DENR prepares a forest protection plan, establish fire breaks, trains forest guards locally called as Bantay-Gubat and do constant monitoring of the plantation areas. If there are opportunities where reforestation can be undertaken, they identify potential partners for planting actvities. Since most upland areas in the Philippines are occupied by people, local DENR usually engage the local communities in their reforestation activities. To increase participation of the local communities in the management and protection of the forests, Community-Based Forest Management Agreement is issued. This tenurial instrument is good for 25 years and renewable for another 25 years. They can use the land for free in exchange that they will protect, develop, maintain and utilize well the resources for sustainable supply.

During climatic events when rainfall is very limited, the local Agriculture Offices advice farmers whom they work to plant short gestation crops and root crops so that they will be assured of harvest even when their usual crops fail. They also implement small water impounding projects and use of water pumps to water the crops of the farmers whom they are helping. In addition, other adaptation strategies which have long-term benefits such as non-destructive livelihood projects (planting of abaca in buffer zones in upland areas), planting of trees, application of soil and water conservation technologies (contour farming) and practice of organic farming are promoted. To assist farmers who need capital, these agriculture offices link farmers to lending institutions. Likewise, they conduct trainings such as composting, organic farming, contour farming etc to increase capacity of the farmers and help them cope with the impacts of climate variability and extremes.

For KASILAC, adaptation strategies include replanting of seedlings that did not survive due to low water availability. To finance such activity, additional budget is requested to Dole Philippines. In situations when there is delay of the implementation of planned activities due to a climatic event, justification as to why there is a delay is undertaken.

For KIN, adaptation strategies include: (1) distribution of planting materials for root crops to the indigenous people they are working with; (2) putting up of pipes so that local communities can water their crops when there is limited rainfall available and (3) re alignment of budget to finance unplanned activities but will help reduce the impacts of a climatic event.

Adaptation strategies undertaken by the municipal planning office in Lantapan concern more on the infrastructure. For instance, such office engages in the repair and rehabilitation of farm to market road which is usually damaged during prolonged rain, maintenance of water reservoir and clearing of areas where landslide or similar incidents occur. Also, it is engaged in the development of tree plantation areas. To finance those activities, the planning office is allowed to use the calamity fund which is available only during times when the area experience disasters.

For the water district, adaptation strategies include monitoring of water facilities especially during prolonged rain and La Nina events when excessive rainfall is experienced. Since the water comes from the watershed, water pipes usually burst because of strong pressure during strong storm flows. In cases when facilities are damaged, budget is requested from the local government for their repair.

The NDCC, being the focal organization during disasters, give food assistance to affected families. To finance their activities, the NDCC asks for additional budget allocations from the provincial government because it is directly under the office of the governor.

During occasions when limited water is available, the local irrigation office distribute shallow tube wells in selected areas and implements rotational methods/intermittent irrigation to ensure that all service areas will be supplied with water. To finance the implementation of these adaptation strategies, budget from the Department of Agriculture, its mother agency is requested. In cases when a forecast is provided by PAG-ASA, advanced monitoring and repair of irrigation canals and facilities is undertaken. As a precautionary measure, the local irrigation office undertakes regular maintenance of irrigation and canals.

Recognizing the role of trees in providing environmental service such as water, the NPC engages in tree planting activity as their adaptation strategy. Likewise, they conduct capacity building activities to enhance their capability to adapt to climate change.

Table 16. Summary of the adaptation strategies of different stakeholders.

INSTITUTIONS	ADAPTATION STRATEGIES
1. BENRO	• Monitoring and assessment • IEC on air (through radio) in coordination with PAGASA and LGUs affected
2. Celebrate Life Agriventure Philippines, Inc.	• Watered the crops • Cover the bunches • Increase budget because watering and covering of bunches needs to be done • Old newspaper have to be bought for the wrapping of bunches • Hire more people • Add activities such as application of pesticides, fertilizer and weeding • Request for more budget to buy pesticide and fertilizer
3. DOLE	• Use water impounding facility • Wrap bananas with newspaper • Leaves of bananas not cut off to cover the fruit • Trim the leaves • Spray to eliminate pests • Hire more people
4. MKADC	• Anticipate activities that requires rainfall • Early preparation if there is warning from PAGASA
5. MKAVI	• Pumping from source by gravitational method • Fertigation: use of fertilizer and irrigation
6. CENRO	• Require PO (contractors) to establish firelines and introduce mulching • Identify partners if there are areas for reforestation • Prepare forest protection plan
7. KASILAC	• Replant • Request additional budget from Dole • Justify why there was delay on delivery of outputs
8. KIN	• Put PVC pipes for water • Distribute planting materials for root crops • Realign budget • Add program on distribution of planting materials for root crops
9. Lantapan-MAO	• Distribution of seeds (early maturing variety of seed) • Assist in farm financing through lending institutions • Capacity building/training • Promotion of non-destructive livelihood project (planting of abaca in buffer zones in upland)
10. Lantapan-MPDC	• Use of calamity fund • Maintenance of reservoir • Increased in manpower for clearing operation • Repair and rehabilitation of FMR (farm to market roads) • Increased in manpower to put up tree planting in the affected site.

11. Lantapan-Water District	• Monitoring of water facilities • Increased expenses for damage facilities but they can request for budget.
12. Valencia-MAO/MPDC	• Use of water pump in their demo farms • Seeds subsidy request from DA
13. ESSC	• none
14. NDCC	• Give food assistance to affected families • Look for more budget • Ask assistance from other offices of the provincial government
15. NIA	• Distribution of shallow tube wells in selected areas • Request budget from mother agency (DA) • Additional manpower for the installation of STWs. • Rotational method/intermittent irrigation • Regular maintenance of irrigation and canals • Advanced monitoring and repair of irrigation canals and facilities if there is a forecast. • Additional manpower for repair and maintenance.
16. NPC	• Tree plantation • Capacity building • Tree plant program (every employee should plant 200 seedlings)
17. PAGASA	• None
18. PAO	• Planting of fruits trees. • Soil conservation technology (organic fertilizer application and contour farming). • Small water impounding project (SWIP). • Before occurrence of climatic events (which has minimal effect on them), PAGASA coordinate with them and they will have mitigating measures in advance like planting of root crops which are drought resistant. • Tell the local communities to plant root crops and other short gestation crops
19. PENRO	• Issuance of tenurial instrument (CBFMA) to selected POs. • IEC for employees and Bantay-Gubat. • Establishment of fire break • Constant monitoring of plantation area

Awareness on Climate Variability, Climate Extreme, Climate Change and Greenhouse Effect

Before the conduct of capacity building activities

Farmers

Bulk (82%) of the farmer respondents mentioned that they are aware of the term 'climate variability' (Table 17). Such result can be attributed to the fact that their work is very much affected by climate. In terms of level of awareness, however, around 50% of the total respondents who are aware of the term 'climate variability' have 1-3 level of awareness indicating that in general, the farmer respondents have very shallow knowledge of 'climate variability'. A mere 13% of the total respondents gave a score of '6' to indicate high level of awareness on the term 'climate variability'.

Table 17. Farmers' awareness on climate variability and corresponding level of awareness

Response	Frequency	Percent
No	29	18.47
Yes	128	81.53
Total	**157**	**100.00**
Level of Awareness		
0	29	18.47
1	24	15.29
2	27	17.20
3	25	15.92
4	21	13.38
5	10	6.37
6	21	13.38
Total	**157**	**100.00**

(1-lowest; 6-highest)

Similar to the first term ('climate variability'), most farmers indicated that they are aware of the term' climate extreme' (Table 18). Again the reason for this could be the many encounters that the farmers have with many climatic events since their work is largely dependent on climate. In terms of level of awareness, around 42% of the total farmer

respondents have 1-3 level of awareness while about 32% have 4-6 level of awareness. Results indicate that while the farmers maybe familiar with the term ‘climate extreme’, their level of understanding of the term is not really that deep.

Table 18. Farmers’ awareness on climate extreme and level of awareness

Response	Frequency	Percent
Yes	119	75.80
No	38	24.20
Total	**157**	**100.00**
Level of Awareness	**Frequency**	**Percent**
0	38	24.20
1	17	10.83
2	29	18.47
3	20	12.74
4	28	17.83
5	8	5.10
6	17	10.83
Total	157	100.00

(1-lowest; 6-highest)

As regards the term ‘climate change’, about 62% of the farmer-respondents indicate that they are not aware of it. Those who mentioned that they are aware noted that their level of awareness is low as indicated in Table 19 where 32% of the total respondents have 1-3 level of awareness on climate change. This result can be attributed to the newness of the issue on ‘climate change’.

Table 19. Farmers’ awareness on climate change and level of awareness

Response	Frequency	Percent
Yes	59	37.58
No	98	62.42
Total	**157**	**100.00**
Level of Awareness	**Frequency**	**Percent**
0	98	62.42

1	24	15.29
2	11	7.01
3	16	10.19
4	1	0.64
5	3	1.91
6	4	2.55
Total	**157**	**100.00**

The term 'greenhouse effect' is even more unpopular among farmer-respondents as indicated by the overwhelming 'No' response received when asked about the awareness of the term. Around 93% of the total respondents mentioned that they are not aware of greenhouse effect. Of the 11 farmers who said that they are aware, six of them are in the lowest level of awareness (1). Being a scientific term, greenhouse effect is out of this world based on the opinion of the farmers.

Table 20. Farmers' awareness on greenhouse effect and level of awareness.

Response	**Frequency**	**Percent**
Yes	11	7.01
No	146	92.99
Total	**157**	**100.00**

Level of Awareness	**Frequency**	**Percent**
0	146	92.99
1	6	3.82
2	3	1.91
3	0	0.00
4	1	0.64
5	1	0.64
6	0	0.00
Total	**157**	**100.00**

Stakeholders

Almost all of the respondents mentioned that they are aware of the term 'climate variability'. This is understandable because the respondents are all professionals and aware of the climate related issues. In terms of level of awareness, results indicate that around 75% of the total respondents have high level of awareness (4 - 6) and a small percentage indicated that they have 1 – 3 levels of awareness.

Table 21. Stakeholders' awareness on climate variability and level of awareness

Response	**Frequency**	**Percent**
Yes	31	96.88
No	1	3.125
Total	**32**	**100.00**
Level of Awareness	**Frequency**	**Percent**
0	1	3.13
1	1	3.13
2	0	0
3	6	18.75
4	8	25.00
5	7	21.88
6	9	28.13
Total	**32**	**100.00**

Stakeholders are also very aware of the word 'climate extreme'. Around 94 % of the total respondents representing 30 persons said that they are truly aware of the word 'climate extreme'. Only two persons said that they are not aware at all of the term. In terms of level of awareness, results indicate that similar to climate variability, almost 75% of the respondents have a good grasp of the concept of climate extreme because they indicated that their level of awareness is in the range of '4 – 6'. Only two persons mentioned that their level of awareness is only within the range of '1- 2'.

Table 22. Stakeholders' awareness on climate extreme and level of awareness

Response	Frequency	Percent
Yes	30	93.75
No	2	6.25
Total	**32**	**100.00**
Level of Awareness	**Frequency**	**Percent**
0	2	6.25
1	1	3.13
2	1	3.13
3	4	12.50
4	8	25.00
5	9	28.13
6	7	21.88
Total	**32**	**100.00**

Awareness on climate change is also high among stakeholders as indicated in Table 23. Only one respondent out of 32 individuals mentioned that he/she is not at all aware of climate change. Notably, nearly 60% of the total respondents indicated that they have very high awareness of it since they noted that their level of awareness is between '5 – 6'. Barely 9% of the total respondents have an awareness level of '1 – 2' only.

Table 23. Stakeholders' awareness on climate change and level of awareness

Response	Frequency	Percent
Yes	31	96.88
No	1	3.125
Total	**32**	**100.00**
Level of Awareness	**Frequency**	**Percent**
0	1	3.13
1	1	3.13

2	2	6.25
3	3	9.38
4	6	18.75
5	9	28.13
6	10	31.25
Total	**32**	**100.00**

Similar to the trend observed in the first three terms, awareness about greenhouse effect is also high (Table 24). About 91% of the total respondents mentioned that they are aware of the term 'greenhouse effect'. In terms of level of awareness, more than half of the total respondents (68%) indicated that they have an ample knowledge of its concept. This is understandable because this concept is thought in science courses from primary to university education. Since all the respondents are professionals, they know about the basic concepts in science.

Table 24. Stakeholders' awareness on greenhouse effect and level of awareness

Response	**Frequency**	**Percent**
Yes	29	90.63
No	3	9.38
Total	**32**	**100.00**
Level of Awareness	**Frequency**	**Percent**
0	3	9.38
1		
2	2	6.25
3	5	15.63
4	9	28.13
5	9	28.13
6	4	12.50
Total	**32**	**100.00**

After the conduct of capacity building activities

The farmer respondents' level of awareness on the term 'climate variability' increased after the conduct of capacity building activities. Percentage of people who are aware of the term increased from 82% to 99%. In the same manner, the level of the awareness has also increased. For instance, around 54% mentioned that their level of awareness is from levels 4 – 6. Sources of information include many capacity building activities conducted by the project team which include barangay assembly meetings, focus group discussions, seminars and trainings and distribution of climate change magazine.

Table 17. Farmers' awareness on climate variability and corresponding level of awareness

Response	Frequency	Percent
No	1	0.66
Yes	150	99.34
Total	**151**	**100.00**
Level of Awareness		
0	1	0.67
1	7	4.67
2	9	6.00
3	53	35.33
4	47	31.33
5	16	10.67
6	18	12.00
Total	**151**	**100.00**

(1-lowest; 6-highest)

Similar to the trend observed for the term 'climate variability', number of farmers who became knowledgeable on the term 'climate extreme' also increased. After the conduct of capacity building activities, the number of farmers who are knowledgeable of 'climate variability' rose from 119 to 151. In terms of level of awareness, around 60% of the total respondents claimed that their knowledge of 'climate extreme' fall on levels 4 - 6. This percentage is a lot higher than the percentage (32%) of respondents who have the same level of awareness before the conduct of capacity building activities. Sources of information of the term 'climate variability' include barangay assembly meetings, focus group discussions, seminars and trainings and distribution of climate change magazine.

Table 17. Farmers' awareness on climate extreme and corresponding level of awareness

Response	Frequency	Percent
No	0	0
Yes	151	100.00
Total	**151**	**100.00**
Level of Awareness		
0	0	0
1	7	4.64
2	12	7.95
3	27	17.88
4	52	34.44
5	32	21.19
6	21	13.91
Total	**151**	**100.00**

(1-lowest; 6-highest)

On the term 'climate change' results show that majority of the farmer respondents are now aware of it. Out of the 151 farmer respondents who were interviewed, 136 of them said that they now have knowledge on climate change and barely 10% of the total respondents do not have. This is a big leap from the results obtained prior to the capacity building activities undertaken by the project where 62% said that they are not aware of the term 'climate change'. In terms of level of awareness, however, bulk of the respondents mentioned that their level of awareness is still quite low. For instance, 90% of the respondents mentioned that their level of awareness is '1' only while only 20% claimed that their level of awareness ranges from '4 – 6'. As regards sources of information, respondents mentioned that they gained their knowledge of climate change from barangay assembly meetings, focus group discussions, seminars and trainings and distribution of climate change magazine, television and radio.

Table 18. Farmers' awareness on climate change and corresponding level of awareness

Response	Frequency	Percent
No	15	9.93
Yes	136	90.07
Total	**151**	**100.00**
Level of Awareness		
0	15	9.93
1	47	90.07
2	30	19.87
3	29	19.21
4	13	8.61
5	13	8.61
6	4	2.65
Total	**151**	**100.00**

(1- lowest; 6-highest)

As regards the term 'greenhouse effect' results show that even with many capacity building activities, very few people were able to grasp the concept. Out of the total respondents, 119 farmer-respondents representing 79% indicated that they are not aware of the term and only the remaining 21% claimed that they have knowledge of the greenhouse effect. Of these 32 farmers who said that they are aware, bulk of them (62%) are in the lowest level of awareness (1). Only 12% noted that their level of awareness range from '4 – 6'. Results show that the term 'greenhouse effect' is highly scientific and quite hard to grasp.

Table 19. Farmers' awareness on greenhouse effect and corresponding level of awareness

Response	Frequency	Percent
No	119	78.81
Yes	32	21.19
Total	**151**	**100.00**
Level of Awareness		
0	119	78.81
1	20	62.5
2	5	15.63
3	3	9.38
4	1	3.13
5	2	6.25
6	1	3.13
Total	**151**	**100.00**

(1- lowest; 6-highest)

Conclusion

1. Farmers and institutions are adversely affected by current climate variability and extremes.
2. Adaptation strategies undertaken by upland farmers to cope with the impacts depend on the nature of climatic event and the extent of their dependency on land based livelihood
3. Capacity building activities undertaken by the ACCCA project increased the level of awareness of farmers and stakeholders on climate variability, climate extreme and climate change.

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References

Bellows, B.C., G. Buenavista, and M.T. Rusco (Eds) 1995. Participatory Landscape/Lifescape Appraisal. Volume 1. The Manupali Watershed, Province of Bukidnon, the Philippines SANREM CRSP/Philippines: The Practice and the Process. SANREM Research Report No.2-95.

Burton, I., E. Malone and S Huq. 2004. Adaptation Policy Frameworks for Climate Change: Developing Strategies, Policies, and Measures (Lim and Spanger-Slegfried, eds). Cambridge University Press, UK.

Catacutan, D.C. 2007. Sacling Up Landcare in the Philippines: Issues, Methods and Strategies. World Agroforestry Center. Southeast Asia Regional Research Programme.

Coxhead, I. and G. Shively. 2005. Economic Development and Watershed Degradation. Land Use Changes in Tropical Watersheds: Evidence, Causes and Remedies. CAB International, USA. 18pp.

DENR-PENRO (Department of Environment and Natural Resources-Provincial Environment and Natural Resources Office). 2003. Annual Report. Malaybalay, Bukidnon.

Downing, T and A Patwardhan. 2004. Assessing Vulnerability for Climate Adaptation. In, Adaptation Policy Frameworks for Climate Change: Developing Strategies, Policies, and Measures (Lim and Spanger-Slegfried, eds). Cambridge University Press, UK. Pp,

Egnar, C.M. 2003. The Response of the Local Government Units of Bukidnon on the Challenege of Sustainable Watershed Resources Management in Support to the Land and Water Conservation Programs of the National Government Particularly the Department of Environment and Natural Resources. A Case Study in AlternativeApproaches in Sustainable Watershed Management. Paper presented during the Land Care Conference in Australia, April 2003.

Jones. R and R Boer. 2004. Assessing Current Climate Risks. In, Adaptation Policy Frameworks for Climate Change: Developing Strategies, Policies, and Measures (Lim and Spanger-Slegfried, eds). Cambridge University Press, UK.

Lasco, R.D. F. B. Pulhin, R.V. O. Cruz, J. M. Pulhin and S. S. N. Roy. 2005. Assessment of Climate Change Impacts on and Vulnerability of Forest Ecosystems in the Philippines Using GIS and Holdridge Life Zones. AIACC- AS 21 Working Paper No. 07. Environmental Forestry Programme, UPLB-CFNR.

Lasco, R.D., R.V.O. Cruz, J.M. Pulhin, and F.B. Pulhin. 2006. Tradeoff Analysis of Adaptation Strategies for Natural Resources, Water Resources, and Local Institutions in the Philippines. AIACC- AS 21 Working Paper.

MOL (Municipality of Lantapan). 1994 and 2002. Municipal Annual Report.

Pulhin, J. M. R. J. J. Peras, R.V. O. Cruz, R. D. Lasco, F. B. Pulhin, and M. A. Tapia. 2006. Vulnerability of Communities to Climate Variability and Extremes: The Pantabangan-Carranglan Watershed in the Philippines AIACCWorking Paper No. 44.. An electronic publication of the AIACC project available at www.aiaccproject.org.

Rola, A.C., A.T. Sumbalan, and V.J. Suminguit. 2004. Realities of the Watershed Management Approach: The Manupali Watershed Experience. Institute of Strategic Planning and Policy Studies, College of Public Affairs, University of the Philippines Los Baños. 39pp.


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2008 5 13


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2008 5 12


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