NEGOTIATING CLIMATE CHANGE: VULNERABILITIES AND RESILIENCE OF FOUR BENGUET COMMUNITIES

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ABSTRACT

A part of a bigger project titled Enhanced Climate Change Adaptation Capacity of Communities in Contiguous Fragile Ecosystems in the Cordillera under the program Strengthening the Philippine Institutional Capacity for Adaptation to Climate Change, the study is a socioeconomic profiling and assessment of the vulnerability and adaptation mechanisms of Benguet communities to climate change. Conducted with another parallel study, the biophysical characterization of selected Benguet communities was done using key informant interviews, focus group discussions, and survey. Results indicate that Benguet communities with variable sources of livelihood are more resilient. Climatic changes observed and felt by respondents generally agree with observed changes by PAGASA noted as still 'normal' although the temperature and rainfall pattern are pronounced as some of the manifestations of climate change. These communities are also replete with mechanisms both at the farm and household level to negotiate changes in the climate. Such mechanisms, however, are not necessarily sustainable.

Objectives of the Study

Generally, the study aimed to document the local indicators in reference to such effects of climate change in the province of Benguet vis a vis the coping mechanism employed. Specifically, it aimed to:

1.Profile the agricultural attributes of the study communities, namely: Loo, Buguias; Paoay, Atok; Bayabas, Sablan; and Taloy Sur, Tuba.

2.Determine the perception, local knowledge, and observations of community folks on climatic changes in their locality.

3.Determine the effects of climate change on the communities particularly on farming activities.

4.Document the coping and/or mitigating mechanisms practiced by local folks in response to the effects of climate change.

METHODS AND MATERIALS

The study was conducted in four selected communities of Paoay, Atok representing high; Loo, Buguias, mid-; Bayabas, Sablan and Taloy Sur, Tuba as low elevation communities. The observed climatic changes, effects, and mitigating measures were compared among these areas. The study used household surveys, key informant interviews (KII), and focus group discussions (FGD) in gathering and triangulating the data. The unit of analysis was the household since it is here where climate change negotiations are happening and farm dynamics are better understood and captured. As the project focused on vulnerability and adaptation capacities of households, a cross sectional view of the issue was best capture through survey. Data gathered from the survey were complemented and validated by the KII and FGDs.

Respondents for the survey were selected randomly employing fish-bowl technique. Every household of the barangays was numbered and from the numbers, the respondents were drawn. Additional numbers were drawn to have a substitute in case the sampled respondents are not available for interview. Criteria in selecting the respondents were: (≥10 yrs) residents of the community; present at the time of the interview; and willingness to be interviewed.

Demographic Profile of Respondents

From the total of 243 respondents, majority of them are married females, mostly mothers who are wives, sisters, sisters-in-law, mothers-in-laws, or mothers of farmers tending their farms at the time of the interviews. The respondents are mainly Kankana-eys (Atok and Buguias) or Ibalois (Sablan and Tuba), the two main ethno linguistic groups in the province, most of whom are indigenous in their respective barangays while the rest are migrant workers and/ or have got married ("naikamang") in the community.

Based on the interview, majority of the respondents from the four sites are 30-50 years old farmers whose main source of livelihood is farming while the rest of the respondents had other sources of income like "permanent employment", "part-time work", "working for others", and buy and sell". They have an average monthly income of PhP 5,000 based from their monthly net incomes. In terms of education, most of the respondents are high school graduates followed by respondents reaching college level education with some finishing degrees.

According to the National Statistics Coordinating Board (NSCB)-Official Poverty Statistics of the Philippines for the year 2007, the average family size of five must have a household monthly income of PhP 6,967 to meet its food and non-food basic needs. Some of the households surveyed were earning below PhP 5,000.00 with more than five members. These households are therefore considered as living below the poverty threshold. Thus, it could be concluded that half of the household surveyed does not meet the minimum income required for a family and/or individual to meet the basic food and non-food requirements.

RESULTS AND DISCUSSION

Agricultural Profile of the Study Sites

Due to increasing difficulty and losses in agriculture brought about by price fluctuation and increasingly unpredictable climate, households' resilience is seen in their diverse source of household income instead of the traditional agriculture related livelihood. Although the lion share of livelihood source (81.5%) of the households is still in agriculture, a high number of households (65.4%) is now deriving income from other sources. Communities with variable sources of income would later show more resilience with climate change, in this case, Bayabas and Tuba.

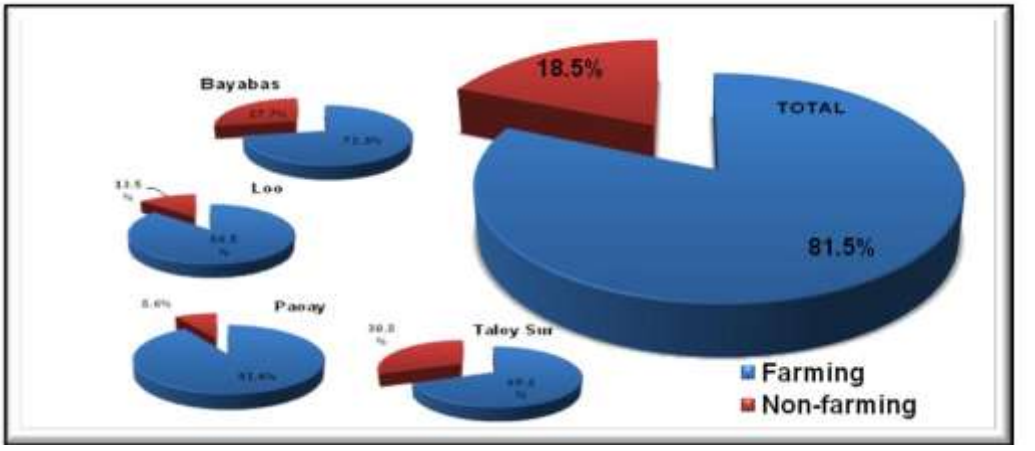

Fig.1. Respondents engaged in farming and non-farming activities

Barangay Paoay had the largest percentage of household engaged in agri-based livelihood but it has the lowest percentage of diversified income sources among the four sites. Barangay Loo ranks second in having the largest percentage involved in agriculture and ranks third on having diversified livelihood base. This can be related to the fact that Barangays Paoay and Loo are involved in the intensive commercial gardening here in the North. Barangays Taloy Sur and Bayabas are mostly in subsistence farming. Others thrive on investing on surplus products for additional cash source.

Barangays Bayabas and Tuba figure as communities with diversified income sources. Entrepreneurship and non-farm employment such as daily paid worker are the other sources of livelihood. From the data, Taloy Sur in barangay Tuba has the least percentage of households involved in agriculture but ranks second in the percentage of households involved in diversified household sources of income.

According to the BNRMP of Bayabas in barangay Sablan, trade and industry in the community includes hog raising, fruit stands, auto repair shop, vulcanizing hardware, poultry chicken supply, and sari-sari store. Por dia or daily paid jobs involve hired labor either on farm or non-farm works. Other sources of income are employment in government or private institutions and/ or working overseas. Serving as creditors or as "suppliers" to other farmers, the so-called "pasuplay" system is another important economic activity.

Table 1. Other sources of income aside from agriculture

Characteristics	Barangay				Total (N=243)
	Bayabas	Taloy Sur	Paoay	Loo	
Family's Other sources of Income*					
1. Business	23.40%	48.1 %	12.90%	28.4%	27.20%
2. formal employment	25.60%	21.1%	20.00%	20.3%	21.40%
3.Hired labor (por dia)	44.70%	23.1%	18.60%	21.6%	25.50%
4. OFW	8.50%	7.7%	10.00%	13.5%	10.30%
5. Lending/ supplier in a 'pa-suplay system'	4.30%	1.9%	2.90%	0%	2.10%

* Multiple responses

Common crops grown. Evidently, many crops are being cultivated in the province. A total of 29 different crops are being cultivated by the respondents (see Table 2). The crops grown vary significantly in each barangay as a function of elevation. Paoay and Loo, located in higher elevation grow semi-temperate vegetables such as potato, cabbage, Chinese cabbage, carrots, radish, celery, and lettuce among others. Rice is also grown in Paoay but only in Sitio Beckes located in the lowest portion of the barangay, albeit for subsistence only.

Table 2. Major crops grown by the respondents

Common Crops Grown	Study Areas				Total (n=197)
	Bayabas (n=35)	Loo (n=45)	Paoay (n=68)	Taloy Sur (n=49)	
Potato	-	82.5%	73.4%	-	50.3%
Carrots	-	25.4%	57.8%	-	26.9%
Cabbage	-	57.1%	76.6%	2.8%	43.7%
Chinese Cabbage	-	50.8%	1.6%	2.8%	17.3%
Beans	11.8%	4.8%	14.1%	52.8%	17.8%
Chayote	8.8%	-	-	27.8%	6.6%
Banana	52.9%	-	1.6%	-	9.6%
Pineapple	55.9%	-	-	-	9.6%
Rice	30.3%	-	9.4%	13.9%	10.7%
Ginger	41.2%	-	-	-	7.1%
Sweet Potato	55.9%	-	3.1%	27.8%	15.7%

On the other hand, Bayabas and Taloy Sur are low elevation areas; thus, common plants grown are lowland crops such as banana, pineapple, rice, tiger grass, and other similar cash crops. However, semi-temperate

vegetables such as chayote, cucumber, and broccoli are also cultivated in Sitio Poyopoy of Taloy Sur, its highest-elevated sitio. Beans, chayote, and sweet potato are the most common crop in the area at 52.8, 27.8 and 27.8%, respectively. In Barangay Bayabas, pineapple (55.9%), sweet potato (55.9%), banana (52.9 %), and ginger (41.2%) are very common. 'Lakatan', a banana variety, used to dominate the area but the outbreak of bunchy top wiped out the banana industry.

Farm area and tenure. The study adopted the Department of Agriculture's 1995 classification of farm size in the Cordillera Administrative Region benchmarked as follows: a) small-scale (A<2,500 m2); b) medium-scale (2,500 m2<A<10,000 m2; and c) large-scale (A>10,000 m2).

Majority of the farmer respondents cultivate medium-scale (48.2%) and small-scale farms (42.1%). In particular, small scale farms predominate in Bayabas (58.8%) and Taloy Sur (74.3%) while medium-scale farms are in Paoay (71.9 %) and Loo (56.3 %). These results validate NSCB 2007 data where a combined area of 6,743ha from the total 29,983ha of Benguet farms, is less than a hectare.

Of these farms, nearly three-fourths (70.1%) are owned by the farmers while the 28.5% are either renting (17.8%) or caretaking (10.7%). Most (54.3%) of the farmers inherited their landholdings.

Cropping pattern. Majority (62.9%) are practicing crop rotation while 21.8% of the farmers are into mixed cropping. Few respondents employ monocropping (9.1%) and intercropping (4.6%). The highest percentage for monocropping was recorded in Taloy Sur (31.4%); crop rotation in Paoay (81.3%) and Loo (73.4%); and mixed cropping in Bayabas (61.8%). This finding is similar with the study of Consolacion (1982) in which mixed cropping and varied vegetables are the common cropping pattern in Benguet.

Fig. 3: Market orientation of the study sites

Overall, half (52.3%) of the farmer respondents grow crops for commercial purposes. Only 8.1% of the farmers, specifically from Bayabas and Taloy Sur grow crops for subsistence or home consumption. Crops produced for mixed intention congregate at 39.1%, equally divided among commercial with limited subsistence (19.8%) and subsistence with limited commercial (19.3%). In subsistence with limited commercial, the household consumption is the priority and only the surplus produce is sold. On the other hand, commercial with subsistence meant that crop yield is the major source of income. Though crops are being consumed in the household level, the bulk of the yield is sold.

The volume of crop yield dictates the market outlet, buyer, and mode of transport of the respondents. Since Loo and Paoay farmers produce crops in tons, the common market outlet is the La Trinidad Trading Post; dominant buyers are the middlemen; and the usual means of transport are hired vehicles. Also, middlemen sometimes provide the capital of these farmers under the "pasuplay system", an informal credit and production system that seem to work effectively in this part of the country. On the other hand, Barangays Bayabas and Taloy Sur generally have subsistence production. The surplus production for sale is minimal; thus, Baguio City market and within the community are the preferred market places because of proximity; most buyers are market stall

owners and direct consumers; and public utility vehicles, the most used mode of transport.

Farm inputs. Farmers in the Philippines were originally devoted to organic agriculture. In studies of Colting (2007) and Colting and Tagarino (2008), the area devoted to organic agriculture in the country was estimated at 5,835 hectares with Benguet having a share of 17.13% or 1000m2 usually planted with salad crops such as chayote, yacon, fruits, and coffee. In the household survey, majority of the farmer respondents (84.8%) do not practice organic agriculture. As shown in Table 4, only few (13.7%) are practicing organic farming mostly from Bayabas (47.1%). The low number of organic agriculture practitioner could be attributed to the massive introduction of agrochemicals and inorganic fertilizers in 1950's tempting farmers to use them extensively until ultimately chemical-based farming become widespread in the country.

Majority of the farmers are using inorganic fertilizers such as chicken dung and complete (14-14-14) fertilizer at 62.4% and 65%, respectively, with Paoay and Loo leading the list. Compost (15.2%) and urea (10.7%) are also applied but mostly in subsistence production barangays. Consistently, Paoay (85.9%) and Loo (92.2%) farmers are the dominant users of insecticides and fungicides for pest control/management. Other pest management practices include manual removal of pests mostly observed with Bayabas farmers (11.8%). For planting material or seeds, Loo and Paoay farmers derive vegetable seeds from farm supply except for potato. In Bayabas and Taloy Sur, farmers utilize their own reserve seeds particularly for subsistence crops.

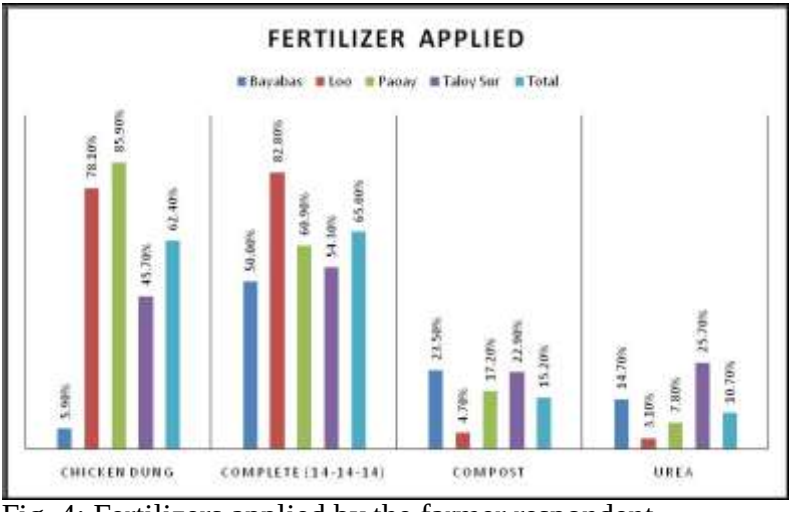

Fig. 4: Fertilizers applied by the farmer respondent

Majority (72.6%) of the farmers pay their farm inputs on cash while 21.8% acquire farm inputs though loan. There are cases where the "pasuplay system" prevails (17.3%) where it is relatively common in Loo and Paoay for 20.3% and 29.7%, of the farmers respectively, using it. It is an agreement between the lender/supplier and the farmer where the lender/supplier provides all farm inputs (seeds, fertilizers, and pesticide) while the farmer do all the labor during the entire cropping. When the crop is harvested and sold, the incurred cost would be deducted and the remaining balance would be divided between the farmer and the supplier as the income. When the price of crop is low ('bagsak'), it often does not cover the farm cost leading to bankruptcy. This explains why most of the farmers in the area are so concern on crop prices as inferred from their comments, "baring tsumamba ti presyo" (So we might be able to chance on the jackpot price).

Farm tools/equipment. Change in farm tools, if any, was also determined since this may indicate adaptation to climatic changes. However, majority are still using the same equipment they have been using in the past five or ten years. Commonly used for watering crops is rain burst in Loo and Paoay but due to the occurrence of drought where there is inadequate water, some farmers use water pump to sip water from the lower slope and/or farther sources. The other farmers, who cannot afford water pumps, manually fetch water to irrigate their farm. In Bayabas and Taloy Sur, most of the swidden farms are rainfed; thus, without rain the farmers cannot crop. For land preparation, spade and "gabion" (hoe) are often used while manual sprayer for pesticide application ('agbomba'). The use of power sprayer, a relatively new tool, is reported by 4.1% of the respondents. Accordingly, big-time farmers in the area are using tractors to farm their wide farms. Other farm facility observed in Loo and Paoay is the increasing establishment of greenhouses.

Local Indicators of Climate Change

The variability of extreme events such as storms and droughts, along with excessive precipitation experienced by certain areas in the country, validates continental and regional trends of climate change impacts. Atmospheric data from 1960 to present indicates increasing trends in temperature, sea level rise, and extreme climatic event that are consistent or even greater than global trends (Jabines and Inventor, 2007).

This trend is consistent with the observations of the respondents (refer to Figure 5 and Table 4). A few, however, claimed that they do not observe climate change believing that the climate is still the same ('so metlang nga isu'). TV and radio are the most common source of information about climate change with 20.2 and 21%, respectively.

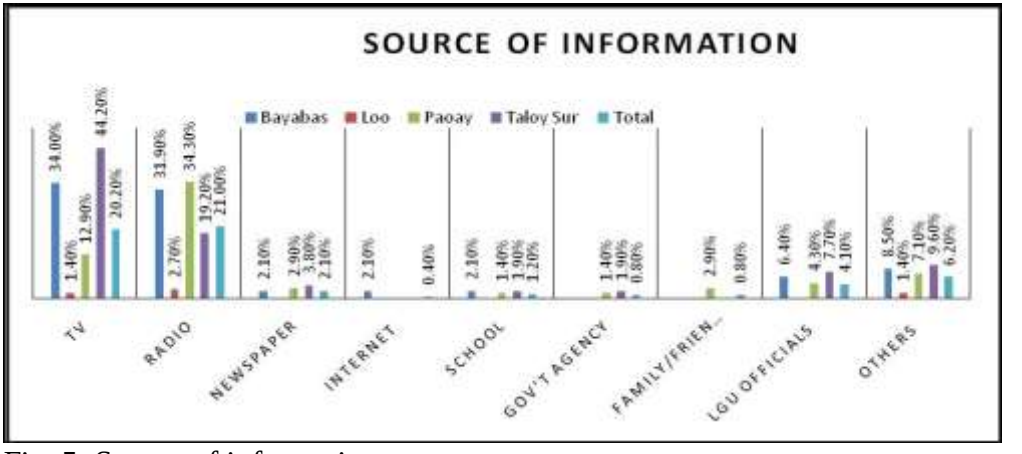

Fig. 5: Source of information

Increasing temperature. In the four study sites, majority (85.2%) of the respondents noted significant increase in temperature. Common comments like - *"grabe nan pudot idwani… idi ket pirmi nan tingnin"* (nowadays, the heat is unbearable… unlike in the past); *"idwani, men sakit nan init"* (nowadays, the sunrays are painful to the skin); *"pirmi pudot… nabetak ti daga"* (it has become very hot…even the soil dries and cracks); and *"haan nga kaya ti pudot, kasla pusot ti baba, pati rabii napudot"* (the heat is unbearable…It's like the temperature of the lowlands… warm or hot even at night) – manifest the steep increase of temperature in the locality. Additionally, an elderly informant narrates that Paoay used to be covered by clouds until 10AM. In the past, *'amog'* (ice crystals) would form on one's eyebrows while walking in the area but nowadays, instead of '*amog'*, one would experience sweating because of warm temperature.

Table 4. Respondents' perception on the observed changes in climate

Observed Changes in the Climate	Elevation				
	Low Elevation	Medium Elevation	High Elevation	Low Elevation	Total
Increase of temperature	83.00%	98.60%	74.30%	82.70%	85.20%
Extreme hot (noon) and extreme cold (am/pm)	46.80%	81.10%	74.30%	48.10%	65.40%
Irregular rain pattern	61.70%	48.60%	62.90%	82.70%	62.60%
Stronger rainfall intensity	61.70%	39.20%	47.10%	55.80%	49.40%
Irregular typhoon pattern	53.20%	43.20%	55.70%	34.60%	46.90%
Stronger typhoon	0.00%	12.20%	15.70%	11.50%	10.70%
Change in wind direction	10.60%	20.30%	28.60%	7.70%	18.10%
Stronger wind	0.00%	0.00%	2.90%	5.80%	2.10%
Longer drought	80.90%	55.40%	64.30%	65.40%	65.00%
Occurrence of hailstone	21.30%	0.00%	10.00%	0.00%	7.00%
Thinner frost	0.00%	0.00%	12.90%	0.00%	3.70%

Secondary data validated these observations. Temperature reading of the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) from 1951 to 2005 had shown that Benguet and Baguio City are experiencing more warm days or periods of maximum temperatures, fewer cold days, or periods of minimum temperature. It is projected that the province would experience an average temperature increase of 0.8 to 10 C by 2020 and from 1.7 to 2.1 0C by 2050. If this trend continues, weather experts of the agency foresee that Benguet and Baguio City would lose their reputation as the country's coldest areas in the next 40 years (Cariño, 2010).

Though Benguet PAGASA verified that temperature increase is mostly attributed to global warming and climate change (Upnorth Tribune, 2010), elders in Loo and Paoay also attribute the increase to forest denudation. They observed that the forests keep the temperature fairly stable but with unabated logging causing denudation, the weather started warming.

Changes in microclimate/erratic weather. Respondents also observed extremes in temperature within a daily scale. At the breaking of dawn, the temperature is cold. However, at midday, the heat of sun is described as "mensakit pudot ay kaman apoy" (painful sunrays like fire). A total of 65.4% of the respondents mentioned this observation. In low elevation sites such as Bayabas and Taloy Sur, this is less observed with 46.8% and 48.1% responses, respectively. Accordingly, the hot weather is experienced all day long in these areas. On the other hand, higher elevation study sites Loo and Paoay have higher responses of 81.1% and 74.3%, in those orders.

This figure indicates that extreme change in temperature within the day is much more felt in communities of Benguet with higher elevation. This erratic weather condition is perceived by 63.8% of the respondents to cause health problems such as upper respiratory problems like coughs, colds, and flu. Also, the sudden changes in temperature cause plant stress as manifested in crop failure or lower production output. FGD data in Buguias, for example, point to the occurrence of 'leaf rusting' due to water shortage and extreme temperature change.

Changes in intensity and pattern of typhoons, rain, and wind. Rain usually starts in May. However, this year 2010, the drought prolonged and the rains came in late. Precipitation, these past two years, are observed to be more intense (by 46.9% of the respondents). Rainfall intensity refers to the volume of precipitation per unit time. In respondents' statement, 'nu agtudo kala agbagbagyo' and 'agbuybuyat ti danum' (rain nowadays is likened to typhoon or the literal pouring of voluminous water), reflects the observed increase in rainfall. Accordingly, rainfall pattern and intensity was more balance in the past.

The rainfall pattern is also observed to be irregular by 62.6% of the respondents as reflected in their statement, "Agtudo nga diretso ken napigsa… bigla nga isardeng na" (It suddenly rains; then it suddenly stops). This often causes health problems such as upper respiratory problems like coughs, colds and flu. Also, materials being sun-dried get soaked by sudden rain since there is not enough time to collect them. Moreover, the rains are scattered and erratic. There are cases where it rains in one sitio only ("Pilpilyin na ti pagtudo-an na"; agtudo ti sabali ng sirtio, kadakami haan."

PAGASA rainfall readings validate these observations of the respondents. It is projected that the seasonal temporal rainfall variation is largest from 35% to 45% during the months of March-August but lesser from 5% to 25% from September to February. Also, the highest increase in rainfall during southwest monsoon season during the months of June-July-August is likely to occur in CAR by 29%. In layman's term, the wet season would become much wetter.

Typhoon pattern, for 46.9% of the household respondents, is observed to be irregular while 30.5% perceived that pattern remains unchanged. This irregularity in the occurrence of typhoon contributed to the disruption of the agricultural calendar. Additionally, typhoons are stronger nowadays as perceived by 10.7% of the respondents.

Accordingly, typhoons this past two years were stronger and occur more often ("sagadsad nga typhoon"). Dr. Comiso, a senior scientist at the National Aeronautics and Space Administration (NASA), explained that stronger typhoons resulted from the process of faster evaporation by the warming ocean. Also, recurring (exit then return behavior) typhoon is more common nowadays resulting to greater damage on agriculture, infrastructure, and human lives as well. One respondent from Palina, Taloy Sur recounted his experience when a typhoon with a whirlwind last 2009 ran over the nipa hut and wood house in his gallery compound. Civil Defence chief Anthony Golez and chief weather forecaster Prisco Nilo stated that typhoons also deviated from their traditional paths during the month of June, traversing the northern and central parts of Luzon for the first time (Philippine Daily Inquirer, 2009).

Typhoon Pepeng is remembered to be the latest typhoon that ravaged the province last 2009. It damaged a lot of crops, infrastructure and highways, and claimed a lot of human lives. The Municipal Agricultural Office of Atok estimated the crop loss of Barangay Paoay from the typhoon as follows: o.27ha planted with cabbaged destroyed; 0.06ha of carrots; 0.8 ha of potato; 0.04ha of radish; 0.09ha of celery; 0.02ha of pechay; 1.16ha of rice; 0.04 ha of cutflower; 0.06ha of broccoli; 0.003ha of cauliflower; and 0.32ha of garden pea amounting to PhP14,901,331.20. In addition, the Municipal Agriculture Office of Sablan reported a total crop damaged by Typhoon Pepeng amounting to PhP3,179,411. Moreover, reports from the Regional Disaster Coordinating Council said heavy rains brought by Typhoon "Kiko" in September 2009 destroyed PhP5.7M from crops and damaged PhP273M on infrastructures in Baguio City, Benguet, and Mt. Province.

Prolonged drought or the El Niño phenomenon. Drought ('kalgaw') occurred last 2010 (the time the study was conducted) due to the El Niño phenomenon affecting 75.3% of the farmer respondents. More households felt this in barangay Bayabas (80.9%) while lesser in Loo (55.4%), Paoay (64.3%), and Taloy Sur (65.4%) – but all resulting to lack of irrigation.

El Niño is the unusual warming of the ocean temperatures in the Equatorial Pacific characterized by below normal rainfall. Benguet Province is one of the areas in the country that experienced three to four months dry spell or below average rainfall and listed under the moderate vulnerable areas against El Niño by PAGASA (Romero, 2010). This phenomenon caused drying up of water sources for vegetable gardens of the province that resulted to huge

agricultural losses and rise in vegetable prices. Also, during El Niño, the temperature is three degrees higher than normal.

Some respondents claimed that the year 2010 has worst drought such that they need to manually fetch water, a chore they didn't need to do in the past years.

Other changes in weather elements. Some respondents observed 'lanti' or hailstone in Bayabas (21.3&) and Paoay (10%). Also, frost occurred in Paoay – tagging the place, as 'Little Alaska'. It usually causes damage to vegetables particularly soaking the leaves or leaving these wrinkled and burnt leading to stagnation and eventual crop senescence. Vegetables and root crops mostly affected are cabbage, garden pea, potato, radish, and Chinese cabbage

According to the barangay officials, the worst frost ("andap") incidence was experienced and recorded in 2007 and 2008 for 4 months (November, 2007 - February, 2008). Usually, frost occurs for two months (December and January) but was prolonged at that time. In 2005, the municipality recorded an estimate of PhP 20 million lost due to frost (Fialen, 2005). Respondents, however, said that nowadays, frost is experienced less in terms of frequency and duration.

Perceived Effects of Climate Change

With the significant variations in climate and its element such as increasing temperature, changing rainfall pattern, and increasing intensity, stronger and ill-timed typhoon, among others, the effects as perceived by the respondents (Table 9) are incredibly phenomenal. In Loo and Paoay, 51.4% and 61.4% of the farmer respondents noted increasing pest and/ or emerging new kinds of diseases infesting plants. In other places, lower percentages are observed in Bayabas and Taloy Sur with 29.8% and 50%, resapectively. Overall, 49.8% of the respondents observed increasing pest and plant diseases. This problem and the coping mechanism employed were discussed in details in the latter pages.

Table 5 presents the perceived major effects of climate change. Overall, 49.8% of the respondents observed increasing pest and plant

diseases particularly in Loo (51.4%) and Paoay (61.4%) but not as much as in Bayabas (29%). Diseases affecting animals were also noted by (12.8%) respondents mostly in Taloy Sur (34.6%) and Bayabas (17%). This is understandable since more respondents are raising livestock in the said barangays.

Table 5. Perceived effects of climate change (%)

	Barangays				
Views on Climate Change	(Bayabas)	(Loo)	(Paoay)	(Taloy Sur)	Total (n=243)
Positive	14.9%	5.4%	12.9%	11.5%	10.7%
Negative	95.7%	98.6%	91.4%	96.2%	95.5%
Effects of climate change					
Increase and/or introduction of new pest and plant diseases	29.8%	51.4%	61.4%	50.0%	49.8%
Increase and/or introduction of new animal diseases	17.0%	0.0%	7.1%	34.6%	12.8%
Lesser crop yield	53.2%	63.5%	40.0%	63.5%	54.7%
Lesser water supply	76.6%	75.7%	77.1%	71.2%	75.3%
Increase of human disease	57.4%	68.9%	65.7%	59.6%	63.8%
Increase forest fire occurrences	17.0%	18.9%	30.0%	11.5%	20.2%

Moreover, forest fires were observed particularly in Paoay (30%) and Loo (18.9%). Records of Atok Municipal Fire Prevention Office showed that Atok registered 9 forest fires from January to June 2010 as compared to only one in 2009. The prolonged drought and higher temperature, previously, have been blamed for these fires but environment officials were shocked to learn that fires that hit Benguet were mostly caused by humans (Cariño, 2010). However, it could be argued that the spark may have been caused by humans but the fuel (dried woods, grass, etc.) that maintain the fire was due to prolonged drought.

Lesser crop yield was also observed at 54.7%. This could be attributed to several factors such as soil fertility degradation, pest and crop diseases, erratic weather, typhoons and others. Hence, it can be inferred as an indicator of climate change.

Effects of Climate Change on the Traditional Agricultural Calendar

Prior to the modern way of weather forecasting, the indigenous people (IPs) of Benguet have their own system of forecasting weather mainly based on the natural phenomenon (biotic and abiotic) on their environment. Under this systems are periodical changes on the behavior of local animals most especially birds, drop and rise of temperature, rainfall and other weather elements. Birds, in particular, are scientifically proven to have the ability to predict shift in the weather/climate through detecting changes in the barometric (air) pressure (Toothman, Undated). For instance, local folks in the province are guided by the behaviour of local birds. As such, they named each month with the local dialects of these phenomenon – so called the agricultural calendar. In the past, the IPs of Benguet plans their agriculture activities on planting and harvesting which help strengthened their community and household food security.

Disruption in the agricultural calendar. With observed changes in the climate, traditional agricultural calendar has been rendered less useful. Results of the household survey showed that majority of the respondents are no longer observing or applying the traditional agricultural calendar as basis of their agricultural activities. With the reliance on weather forecasting PAGASA, the natural weather indicators are no longer observed. Moreover, the significant changes in the climate have rendered the traditional agricultural calendar unreliable for weather forecasting and inapplicable as basis of agricultural activities.

The disruption of the agricultural calendar was one of the many noted impacts of climate change on indigenous peoples in the different ecosystems. In a book 'Guide on Climate Change and Indigenous People' (Tebtebba, 2008), it stated that the change in the behavior and migration patterns of birds which have been traditionally used to guide hunters and mark agricultural seasons causes disorientation of hunters and gatherers and shifting cultivators. Such change makes it more difficult for elders to practice and pass their traditional ecological knowledge to the next generation. Moreover, the practice of rainfed agriculture is highly disturbed because of infrequent rains, shorter wet seasons,

or prolong monsoons leading to lower crop yields exacerbated by longer lives of pest and occurrence of new pest. Schedules and performance of cultural rituals associated with agricultural seasons from planting, weeding to harvest are also disturbed.

Starting from the 1980s, the regular pattern of the "puwek" (typhoons) changed resulting to the less usage of the traditional calendar. The locally experienced regular onslaught of typhoon serves as the reference point for the traditional organic calendar that changes in typhoon pattern has brought about confusion in the use of traditional calendar. In addition, the birds that signal the occurrence of typhoons have disappeared. Some informants attribute it to the changing climate. However, many attribute it to the agro-chemicals the farmers apply in their farm. Larvae that feed on heavily-sprayed crops may have ingested these chemicals thereby poisoning the birds that prey on these pests. It is observed that these birds often flock over the gardens. This leads to the farmers to hypothesize that these birds preys on the pests. Besides the use of agro-chemicals, forest lands conversion to vegetable garden and residential lots has caused the loss of habitat for these birds.

The more reliable aspect of the agricultural calendar being resorted to would be cycle of rainy season and absence of typhoon (usually signalled by the presence of a local bird called "kiling"). The reliance to the rainy and dry season cycle is important especially in a situation where there are limited agricultural services such as irrigation. Others do not observe any basis for their farming activities and rely on chance or what they refer to as 'sapalaran'/'paladan.'

Usually, land preparation and clearing of the garden for the first cropping is conducted in the months of January to February. The crop would be planted in March and April and would be harvested in June or July. In the past, March and April are rainy months; thus, farmers of Loo and Paoay could plant in these months. But with climate change, gardens with no irrigation/ water source are not farmed except for farmers with water pump. The usual first cropping crops would be carrots and cabbage. In Bayabas and Taloy Sur, the month of March would be start of "pinagkakaingin" (swidden farming).

Rainy season usually begins in May. However, it has been observed that the usual cycle for dry and rainy season has been disturbed thereby changing of planting and harvesting schedules. Farmers now would take the risk of planting knowing that the timing of rainy and dry season has been distorted.

The next cropping would start from October to December. The month of August is known to have the strongest typhoons therefore gardens are fallowed in this month. Land preparation starts in the month of September and planting in October or November. In Paoay, cropping starts before the expected time of frost ('andap') formation.

Table 6. Agri-based Livelihood systems in the project sites showing the elevation, terrain, production systems, and crops

Atok		Buguias		Sablan		Tuba	
High Elevation		Mid Elevation		Low Elevation			
➢ 2000 masl		1000-2000 masl		200 – 999			
Rugged terrain with very steep slopes up to 70^{o}		Flat, rolling, hilly steep to very steep terrain (10-60^{o})		Undulating, rolling, hilly steep terrain (10-60^{o})			
Production System	Crops	Production System	Crops	Production system	Crops	Production system	Crops
Mono cropping	Cabbage, Potato, carrot, raddish, cut flower	Mono cropping	Potato (m), cabbage(m), sweet peas (m), carrots (m), snap beans(m/b) , cut flower (m), lettuce (m), onion leeks (i), celery (m)	Mixed cropping	Upland rice Banana Pineapple Sweet Potato Ginger	Mono cropping	Upland rice Sweet Potato Beans
Crop Rotation	Carrots – cabbage-potatoes-	Crop rotation	Beans- cabbage-potato-cabbage	Agroforestry	Tiger grass,(2 yrs) mango jack fruit cacao (citrus Bamboo Banana	Agroforestry	Mango, papaya, guava, other fruit trees
Inter cropping	Cabbage – leeks	Inter cropping* (cabbage - leeks	Cabbage - leeks	Crop rotation	Beans, cucumber, pineapple Pineapple Banana	Mixed planting	Pole beans, yam, banana, taro, ampalaya, ube,
Kaingin	None	Kaingin	None	Kaingin	Upland rice; rootcrops	Crop rotation	Lowland vegetables With baguio beans
Livestock	Chicken , pig (backyard) Goat, cow	Livestock	Poultry, hogs,goat, cow,	Livestock	Poultry hogs cattle, goat,	Livestock	Poultry hogs cattle, goat duck turkey tilapia

Effects on Agriculture

Many respondents attribute the increased pest to the development of pest immunityto pesticides but some to climate change particularly the increase in temperature. Secondary data proved that the increase of temperature allows the migration of insects which become pest for the crops and also cause diseases for the animals and the people (Tebtebba, 2008). This is true in case of leaf miners. Farmers from Paoay and Loo observed seasonal proliferation of leaf miners in the area affecting their vegetable crops.

Also, the rate at which most pests develop is dependent on temperature and every species has a particular 'threshold temperature' above which development can occur, and below which development ceases. As temperatures rise, some pest species may be able to complete more generations in a year. This effect may be most noticeable in insects with short life-cycles such as aphids and the diamond-back moth (Collier, 2008). Some pest insects appear to prosper during periods of drought and cutworms (caterpillars of the turnip moth) appear to be one such example.

Table 7. Common farming problems

Problems encountered	Barangay				Total
	Bayabas	Loo	Paoay	Taloy Sur	(n=197)
Increase in plant pest and diseases	55.9%	89.1%	68.8%	60.0%	71.6%
Lack/no irrigation	47.1%	40.6%	45.3%	54.3%	45.7%
Crop destroyed by typhoons	23.5%	23.4%	40.6%	5.7%	25.9%
Non-viable crop/death of crop	23.5%	3.1%	1.6%	0.0%	5.6%
Erratic weather	14.7%	17.2%	15.6%	8.6%	14.7%
High price of farm inputs	0.0%	46.9%	42.2%	8.6%	30.5%
Low cost of harvested crop ('bagsak presyo')	2.9%	48.4%	42.2%	8.6%	31.5%
No capital/money	5.9%	9.4%	6.3%	2.9%	6.6%
Others	8.8%	12.5%	10.9%	8.6%	10.7%

*multiple responses

Increase in plant pests & diseases. Farmers also observed that the occurrence of pest and crop diseases has seasonality. Accordingly, they need to apply more insecticide in summer for cabbage and crucifers due to proliferation of pest. During this time, rain is welcomed since in a way, rain helps eradicate pest. As reported by Collier (2008), too much water can be devastating for some pests. Raindrops can physically dislodge them from their host plant and behavior patterns can be disrupted.

Some pest infestations are suppressed by periods of rainfall, either because of physical effects or because high humidity leads to outbreaks of fungal disease, often observed amongst aphids on lettuce and brassica crops. However, prolonged wetting of the crop can stimulate the outbreak of clubroot and other fungal diseases. Thus, it could be surmised that both extremes of wet and dry on crop production induced proliferation pests and crop diseases. With the onslaught of climate change which tend to cause wetter wet season and drier dry season, the problem on pest and crop diseases is poised to worsen to worst.

The warmer temperature also causes faster evaporation, thus, more frequent watering of the vegetable crops is required. A local agriculturist reported that warm weather makes crops and animals susceptible to diseases. The hotter the weather, the lower the resistance of the crops and animals is to diseases. This is reflected on responses on the respondents wherein 49.8% perceived greater damage from pest and crop diseases while 12.8% observed increase of animal sickness. Some respondents observed that chicken also exhibits flu-like symptoms (‘mapanatengda metlang’) after being exposed to extreme heat and/or sudden rain.

As shown in Table 8, clubroot, blight, and bacterial wilt, all caused by fungi, are common in Loo and Paoay; bunchy top, on the other hand, practically wiped out the banana plantation in Bayabas and Taloy Sur. Moreover, local term ‘eg-ges’ and ‘peste’ generally refers to the numerous species of larvae/caterpillar that eat and/or bore into the crops. It has been widely acknowledged that colder climate has a limiting effect to the occurrence of pests and diseases; with climate getting warmer, increasing pests is expected.

Crop destruction. Crop destruction by typhoon is also imminent on the study areas. Since the country is visited annually by an average of 20 typhoons (PAG-ASA), it is also expected that crop loss due to this phenomenon is high. Although only 25.9% of the farmers experience this effect, the loss for them could be enormous. Thus, the coping mechanism employed to mitigate the problem was minimal. For example, 5.6% replace the crop destroyed by the storm, 0.5% switch cropping during non-typhoon season, another 0.5% remove destroyed crops, and 1.0% resort to other measures.

Detailed analysis showed farmers producing in commercial scale, experienced greater percentage of crop damaged by typhoons. Perhaps, what could explain for this is the cash investments involved. Key Informants say that this reality becomes starker when seen in the context of 'vegetable production' as a game of chance.'

Lesser crop yield. This reduction was also observed at 54.7%. This is most observed in Loo and Taloy Sur with 54.7% each followed by Bayabas at 53.2% and least in Paoay with 40%. The decrease in yield could be attributed to several factors in any combination such as soil fertility degradation, pest and crop diseases, erratic weather, typhoons, and others. Thus, decrease in crop yield could be roughly estimated as the cumulative effect of these factors and also an indicator of climate change.

In 2009, records of the Bureau of Agricultural Statistics showed that the province incurred decrease of 0.36% on cabbage production, 1.16% on tomato, 0.12% on camote, 1.66% on cassava, 0.74% on lettuce, 0.88% on Chinese cabbage, 1.64% on bell pepper, 0.57%on carrots, 0.52% on potato, 0.98% on chayote, 0.48% on cucumber and 0.43% on sweet peas production. The loss on this crop production is not in kilos but rather in tons, thus, it may appear low in percentage but its highly significant loss in terms of income. Further,data on the crop production was presented in Appendix 1.

Diseases affecting animals was also observed by 12.8% of the respondents. This problem was more common in Taloy Sur and Bayabas with 34.6% and 17%. This is understandable since more respondents are raising livestock in the two barangay. Some respondents observed that chicken also exhibit flu-like symptoms ("mapanatengda metlang") after being exposed to extreme heat and/or sudden rain. Goats raised are also vulnerable to sudden changing weather. Goats got sick when drenched by rainfall. With rain nowadays becoming more and more unpredictable and without prior warning, there is a lesser time to secure the goats to sheltered area thus there's a higher probability of goats getting wet.

Table 8. Common crop pest and diseases in the study areas

Plant Pest and Diseases		Affected Plant/s	Barangay where it occur
Local Name	Common Name		
	Clubroot	Cabbage, Chinese cabbage and other vegetative crops	Loo and Paoay
'kuyos'	Bacterial wilt	Potato	Loo and Paoay
	Leaf miner	Almost all crops	Loo and Paoay
	Blight	Potato	Loo and Paoay
	Diamond back moth	Cabbage	Loo
	Black leg	Almost all crops	Loo and Paoay
	Small brown bettle	Guava and other shrubs	Paoay
'dila-dila'	Slug	Carrots	Loo and Paoay
'Peste', 'eg-ges'	Plant borers	All types of crops	Loo and Paoay
	Tungro	Rice	Bayabas
	Bunchy top	Banana	Bayabas and Taloy Sur

Effects on the Household

Lesser water supply for household consumption and irrigation was also experienced in the four areas during the summer or 'kalgaw' brought by the El Niño phenomenon. Majority (75.3%) of the respondents experienced this problem. Responses per barangay on this problem were at relatively equal percentages. Forest fires caused in part by the El Niñophenomenon were observed particularly in Paoay and Loo. Records of Atok Municipal Fire Prevention Office showed that Atok registered 9 forest fires in January to June 2010 compared to only one in 2009. The prolong drought and higher temperature, previously,have been blamed for the occurrence of these forest fires in the province but environmentofficials were shocked to learn that fires that hit Benguet were mostly caused by humansand not by the prolonged dry spell (Cariño, 2010). The spark may have been caused by human but the fuel (dried woods, grass, etc.) that maintain the fire is by prolong drought.These problems and the coping mechanisms employed by farmers were discussed more in details on the previous pages.

As discussed previously, it has been observed that the erratic and extreme weather conditions cause human diseases. With lesser yield, income gets lesser too. This has been a resounding theme in all the FGDs conducted. Increased pest and crop diseases, high price of farm inputs, crop destroyed by typhoon and low prices of crops in the market lead to lower profit for the household.

Table 8. Summary of observed effects of climate change in the locality

Local Climate Change Indicator	Observed Effect on Agriculture and the Environment	Observed Effect on Socio-Economic Conditions
Increase in temperature	Wilting and drying up of crops Absence of grasses for cattle Drying up of creeks, springs and water bodies Re-arranged farm working hours –early and late hours of the day Fruiting of mango tree and other fruit trees in cold areas More frequent watering due to faster evaporation	Painful & tingling sunrays to the skin Heat stroke The heat makes one lethargic Due to early and late working hours, no time for other chores and responsibilities such as parenting Faster sundrying Cozy weather (for cold areas) Unbearable heat Increase income of cold beverages businesses
Erratic weather	Plant stress resulting to lower yield Wilting and leaf rusting Occurrence of 'dallalo' [hailstorm] becomes erratic too; 'andap' [frost] less frequent & limited sites covered	Increase occurrence of upper respiratory such as flu, cough, etc. 'wait-and-see' attitudes
Intensifying and irregular rainfall pattern	Greater run-off, greater erosion –greater human life and infrastructure damage Late cropping Proliferation of some pest and plant diseases but also destruction of other pest Greater tendency of domestic goat exposed to wet condition	Increase occurrence of upper respiratory such as flu, cough, etc. Soaking up of material being dried up due less time of collecting them
Intensifying and more frequent typhoons	Greater soil erosion resulting to river siltation Greater crop damage	Greater human life and infrastructure damage Landslides limiting marketing of crops due to damage to access roads
Change in wind direction	Unpredictable wind direction	Physical damage to materials such clothes & perhaps even plants ie pollination
Prolonged drought or El Nino Extreme weather temperature	Lack of water for irrigation and human consumption Drying up of creeks, spring and water bodies Uncultivated farm lands resulting to lower crop production Proliferation of pests & diseases Increasing temperature Increasing cost of some crops due to lesser supply Faster water evaporation causing *kuyos or* bacterial wilt Change in work schedule; usually disrupts work too as heat permeates into the head and skin causing pain	Lower or no income for those who haven't cultivated Manual fetching of water resulting to greater household labor & sourcing of water becomes farther Discontinuity of certain beliefs/practices since planting schedule timed with moon shape; presence of migratory birds Heavier workload since frequent watering of plants

Adaptation Mechanisms

Increase use and frequency of pesticide application. To mitigate the pest problem, most (45.2%) of the farmer respondents apply pesticides such as insecticides and fungicides, mainly in Loo (52.4%) and Paoay (53.1%). Manual removal of pest is also being employed, albeit in minimal scale, in Bayabas (5.9%) and Taloy Sur (5.6%). Mechanical innovations such as applying grease to trap pest are also utilized by some respondents in Paoay which lessens the amount of pesticide used ≈reducing cost. Another 10.2% of respondents reported their helplessness against these pest and diseases particularly in Taloy Sur (19.4%) and Bayabas (11.7%).

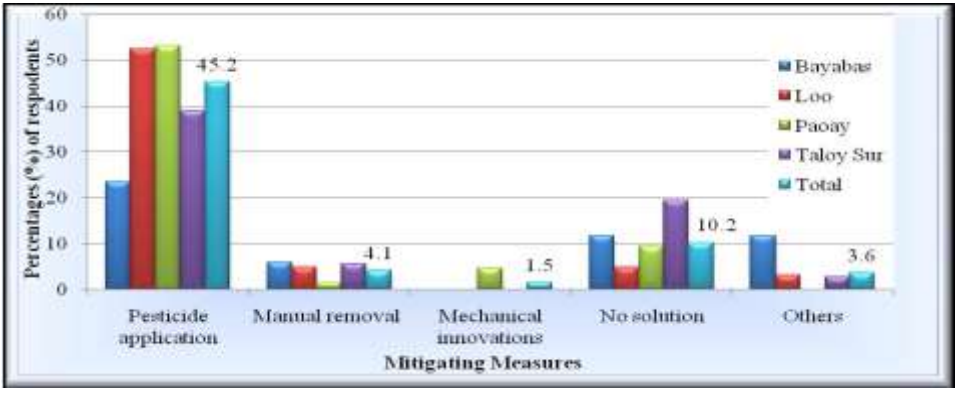

Figure 6. The mitigating measures employed by the respondents against pest and disease proliferation

Most farmers, however are becoming dissatisfied with the efficiency of these mitigating measures. Pesticide, in particular, is observed to be getting less and less effective with repetitive application. This could be attributed to development of pest immunity and climate changes. For example, high temperature is reported to reduce the effectiveness of some pesticides. Humidity levels can also modify their efficacy, as can the timing and amount of rain following their application. If pests are able to complete more generations in a season then this may lead to greater pesticide use, which in turn may lead to the more rapid development of pesticide resistance (Collier, 2008).

Crop rotation and other farm practices. To mitigate clubroot and other fungal diseases, variety of methods are employed by the farmers in Loo and Paoay. Some apply crop rotation (6.6%) and liming (6.1%) while

few employ fallow period for the soil to rest, removal of old soil and/or mixing it with new soil, manual removal of infected plants or plant parts and others at 1, 2, 1 and 2% responses, respectively. However, even with these measures, the problem still persists per cropping in the locality.

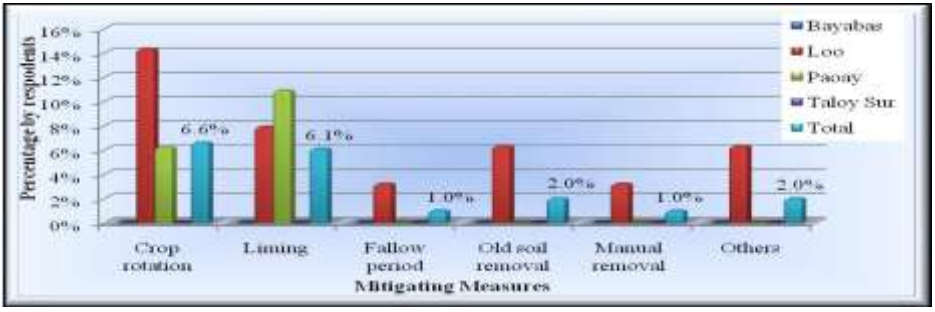

Fig. 7. Mitigating measures employed by farmers against fungi-caused diseases

Drought or 'kalgaw' brought by the El Niño phenomenon has cause lesser water supply for domestic consumption and lack of irrigation for farms, thus, affecting farmers planting cycle. The warmer temperature also causes faster evaporation, thus, requiring more frequent watering of the vegetable crops. To cope up with the problem, some farmers in Loo (4.8%) and Paoay (14.1%) used water pump to suck water from the lower slopes and used it to irrigate their farms (Figure 4). This entails additional cost on the farmers' budget. Others (3.0%) minimize the volume of the crops they cultivated to what the available water can support. Some respondents (13.2%) fetch water manually from sources. Others (10.7%) just waited rain before cropping.

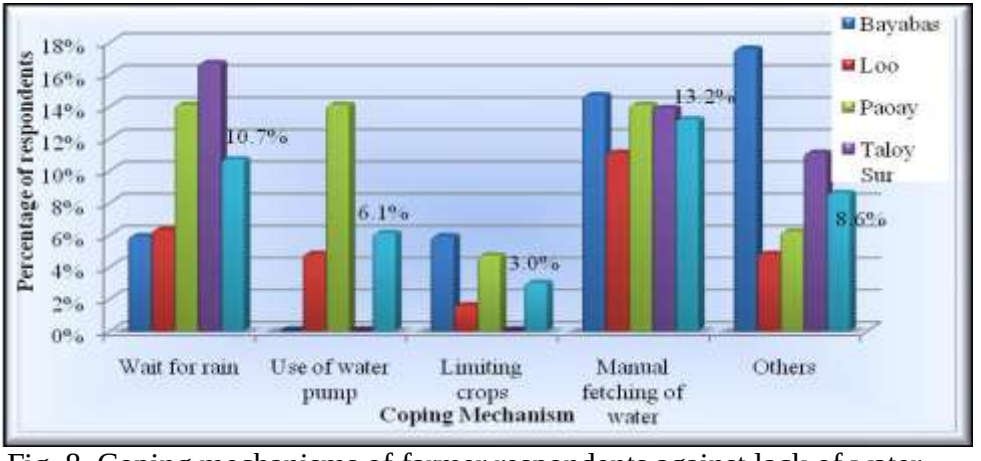

Fig. 8. Coping mechanisms of farmer respondents against lack of water

Crop destruction by typhoon is also evident in the study areas. Since the country is visited annually by an average of 20 typhoons (PAG-ASA), it is also expected that crop loss due to this phenomenon is high. Although only 25.9% of the farmer respondents reported that they are affected, the loss when hit is enormous. Thus, the coping mechanism employed to mitigate the problem was minimal (refer to Figure 5). For example, 5.6% replace the crop destroyed by the storm, 0.5% times their cropping on non-typhoon season, another 0.5% removes destroyed crops and 1.0% applies other measures.

Other farming problems such as high price of farm inputs (30.5%), low price of crops (31.5%) and lack of capital (6.6%) are observed primarily in Loo and Paoay, though not climate change related. This further reflects the high dependency of farmers in the area to synthetic fertilizers and pesticides. Barangay Bayabas, on the other hand, experienced high death of crops (23.5%) in the summer season. Some respondents attributed this to the excessive hot weather as reflected in their statement, "makset den mula".

Diversifying income sources. Diversifying income source is an important mechanism to cope with the effects of climate change. As it is, Bayabas and Taloy Sur that do not depend on farming only as sources of income have proven to be more resilient. This is so because for respondents whose sole income source is farming, when yield drops due to bad weather or increased pests and diseases, the farmer goes broke or makulap in the local dialect, for a cropping period or more. One cropping period means four months of no income. This has been resonated in the interview data coming from Loo and Paoay. For Bayabas and Taloy Sur, the non-farm livelihood becomes the safety net in crisis situation brought about by climate change. Respondents who are solely into farming have been reporting to have experienced a higher degree of vulnerabilities to changes in the climate as compared to respondents whose households do not only depend on farming.

Table 9. Other coping mechanisms

Characteristics	Barangay				Total
	Bayabas	Loo	Paoay	Taloy Sur	(n=197)
Coping Mechanism for Lower Yield					
Seek 'por dia' works	5.9%	0.0%	1.6%	0.0%	1.5%
Change crop	5.9%	0.0%	1.6%	2.8%	2.0%
Coping Mechanism for Soil erosion					
Riprapping	0.0%	1.6%	1.6%	0.0%	1.0%
Installation of diversion canal	0.0%	1.6%	0.0%	0.0%	0.5%

Exploring new crop and/or variety in the last five years. Some respondents (10.7%) shifted to new crops and/or variety. The new crops mentioned include new variety of rice, carrots, radish, cabbage, etc. while others shifted to growing cut-flowers. Reasons for planting new crops and/ or variety were due to higher resistance to pest and diseases, higher yield, lower inputs, fast growing, command higher price and for experimental purposes. On the other hand, reasons for not trying out were the perceived uncertainty of untested crops.

A respondent in Paoay revealed their shift to cut-flower (carnation) as an adaption for the changing climate. Carnation needs full sunlight and does not require too much water. On the other hand, a key-informant in Bayabas reported that the shift to lowland crops was also induced by the warming weather. Accordingly, the highland vegetable they used to grow no longer viable, thus, they must grow lowland crops that are suitable for warmer temperature.

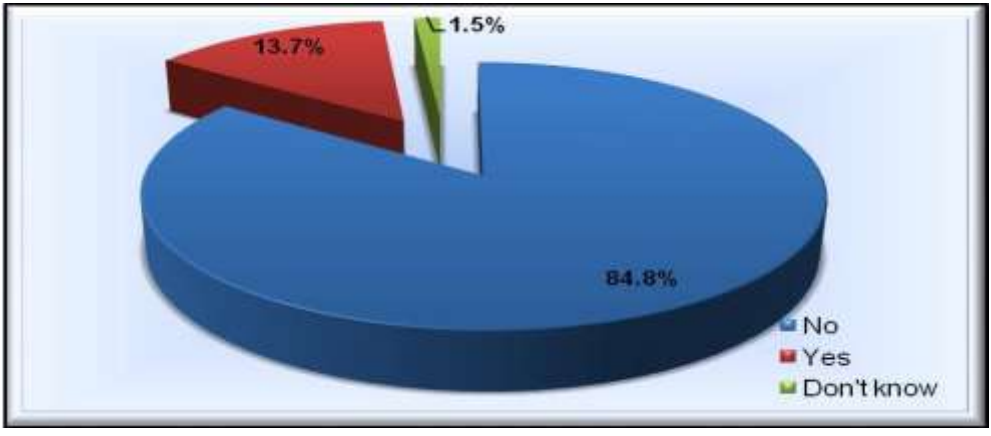

Fig. 10. Proportion of farmers who have planted new crop in the last five years

Correlation Analysis on Agricultural Variables

Correlation analysis was employed to determine which sector is more affected by climate change. In particular, the association of farm land area and market orientation (Table 10) with other agricultural and climate change variable were analyzed. Results of Spearman rho showed that farm land area is correlated with the responses on erratic weather, human sickness and forest fires as effects of climate change; and, farm problems encountered such as pest, high price of farm inputs, typhoons and low cost of crop. As shown in their responses, increasing occurrence of human sickness and forest fires as effects of climate change was perceived greatest by small-scale owners followed by medium-scale and least by large-scale owners. However, increased pest and crop diseases, high price of farm inputs, crop destroyed by typhoon and low cost of crop are observe more by medium and large-scale farm owners than small-scale owners. It is inferred that medium and large-scale farm owners are more susceptible to climate and market related variables.

Table 10. Correlation analysis between farm land area and other variables

Factors	**Land area planted**	
	Spearman's rho	*p*-value
Erratic weather (hotnoon-cold early	.188*	.011
morning/late afternoon)	.164*	.026
Occurrence of human sickness as effects of	.282**	.002
climate change	.151*	.039
Increase occurrence by forest fires as effects	.233**	.001
of climate change	.224**	.002
Increasing pest and crop diseases	.209**	.004
High price of farm inputs		
Crop destroyed by typhoons		
Low cost of yield		
	Market orientation	
Change in the rainfall pattern	-.245**	.001
Irregular and stronger typhoons	-.262**	.000
Increasing rainfall intensity	-.198*	.011
Occurrence of drought	-.156*	.043
Lesser crop yield	-.159*	.030
Increased occurrence of forest fires	-.203*	.027
Cropping pattern	.259**	.000
High price of inputs as problem encountered	-.194**	.008
No capital as problem encountered	.208**	.004
Low cost of crop yield	-.161*	.028

Note: *=Correlation is significant at the 0.05 level (2-tailed).
**= Correlation is significant at the 0.01 level (2-tailed).

Furthermore, market orientation is significantly correlated with responses on change in the rainfall pattern, irregular and stronger typhoon, increasing rainfall intensity, occurrence of drought, occurrence of forest fires, lesser crop yield, cropping pattern, high price of farm inputs, and low cost of crops. Farmers who are into commercial crop production experienced more crop damaged by weather variables such as typhoons, intensity of rain and drought

Market orientation was also correlated with the problems encountered by farmer respondents. High price of farm inputs, lack of capital and low cost of crops is experienced more by farmers producing for the market. Cross-tabulation also show that most of those who have subsistence production have other source of income mostly hired labor or 'por dia'. If their produce is not enough to support the need of the family, the members would look for 'por dia' jobs ('apan maki-por dia'). This variability of income source as well as skills makes these households more resilient.

CONCLUSION

Results show that climate change is indeed a reality in Benguet – both perceived by local folks and as shown by empirical data. Major changes in the climate are temperature increase, erratic microclimate, irregular rain pattern and stronger intensity, longer drought and irregular typhoon pattern which primarily have negative consequences such as depletion of water irrigation, crop and infrastructure damage from typhoons, prevalence of new crop pest and diseases, among others. This is true in all the study sites but crops pest and disease is more prevalent in Loo and Paoay while animal diseases in Bayabas and Taloy Sur. There are few positive consequences primarily attributed to increase of temperature such as viability of lowland plants (chayote and fruit tress such as mango).

Hence, score of coping mechanisms is being practiced to mitigate the above mentioned effects of climate change. Applying suitable farming practices (pesticide application, cropping pattern, and others), growing new crops, and diversifying employment, among others are common. These communities are still resilient to climate change, most especially with respondents whose sources of income are variable.

RECOMMENDATIONS

1. Strengthen IKSP integration in farming practices for popularizing organic agriculture. Organic farming has been gaining increasing support in the recent years.

2. Strengthen organizational capability in responding to the needs of the community; establish mechanisms of ensuring information dissemination; capacity building to farmers to guide them along on decision-making processes;

3. Provide support services such as research and development on testing new varieties of common crops being grown. Research efforts could also include sharing "early maturing" crop seeds and other possible solutions to problems along productivity and economic gains. Conduct research on new pests & diseases considering the more frequent and more destructive pests and diseases and occurrence of low pest tolerance of crops;

4. Heighten awareness on gender issues. Most communities surveyed show resilience of the households; however initial data show that within the household, gender disaggregation on 'who does what in times of vulnerabilities' show that women are burdened more than the male members of the household. Future studies should focus on this gender dimension;

5. Heighten cultural sensitivity as well as sustainable development principles in dealing with IPs [ie FPIC for construction of water sources etc] in development intervention should also be observed at all times;

6. Reduce "risks" from landslides; washed outs; homes destroyed; lives taken by providing infrastructure services that are appropriate and timely.

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