BIBLIOGRAPHY

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ABSTRACT

This study was conducted to determine the socio-demographic profile of the swamp farmers, the level of knowledge of the respondents toward climate change, the effects of climate change to crop production and the coping mechanisms that the respondents employed to counteract the effects of climate change.

The respondents of the study were composed of fifty (50) swamp farmers in La, Trinidad, Benguet. Majority of them were males; married; with an average age of 46 years old; and had finished elementary level. Respondents were engaged in farming for about 10 to 20 years and had major crop which was strawberry. The sources of their capital were from the private financiers.

Results showed that the respondents were knowledgeable and aware in the impact of climate change through watching television and hearing news from the radio.

The signs of climate change that were observed by the respondents in their farms were the occurrence of strong typhoons, increased and decreased of temperature, increased population of insect pests and diseases and smaller sizes of crops.

The effects of climate change experienced by the respondents in the study area includes scarcity of water supply for irrigation during the occurrence of drought, rotting of crops, increased population of pests and diseases and total destruction of their crops during typhoons and floods.

Respondents had employed practices to cope up with the effects of drought, changes in rainfall, typhoons and floods, changes in temperature and emergence of pests and diseases by varietal selection, used of plastic tunneling, adjust planting season and used chemicals to prevent the spread of pests and diseases.

RESULTS AND DISCUSSION

Socio-demographic Profile of the Respondents

The socio-demographic profile of the respondents is presented in Table 1. There were 44% with ages from 41 to51 years old; 26% belonged to the 52 to 62 years old bracket; 20% belonged to the 30 to 40 years old; and only 10% belonged to the age bracket 63 to73 years old.

Majority (70%) of the respondents were males and 30% were females as shown in the same table. This indicates that farming is not only for males but also for females. Majority of them (82%) were married; 14% were single; and 4%, widow. With regard to the respondent's educational attainment, 60% of them finished elementary level; 20%, high school level; 14%, finished college level; and only few (4%) did not go to formal education. This indicates that most of the respondents are literate and could easily adopt new situation brought by climate change.

Table 1. Socio-demographic profile of the respondents

PARTICULAR	FREQUENCY	PERCENTAGE (%)
Age		
30-40	10	20
41-51	22	44
52-62	13	26
63-73	5	10
TOTAL	50	100

Table 1. Continued ……..

PARTICULAR	FREQUENCY	PERCENTAGE (%)
Sex		
Male	35	70
Female	15	30
TOTAL	50	100
Civil Status		
Married	41	82
Single	7	14
Widow	2	4
TOTAL	50	100
Educational Attainment		
Elementary	30	60
High School	11	22
No formal Schooling	2	4
TOTAL	50	100

Crop Produced by the Respondents

La Trinidad, Benguet is known to be the number one producer of fresh strawberries, vegetables, and its processed products such as jams, wines and candies in the Philippines. In order to meet all the demands in the market, majority (66%) of the respondents were planting strawberry, as presented in Table 2. However, there were 22% of them chose to plant lettuce which could be harvested after two months according to

them; 4% planted pechay and onions that could be harvested in less than a month while 2% ventures in planting cabbage and statice cut flower. This implies that all the respondents are maintaining food security to satisfy future demand under predicted climate change scenarios.

Number of Years the Respondents in Farming

Table 3 shows that 64% of the respondents were engaged in farming for the past 10 to 20 years; 24 % who had been farming for 21 to 31 years; 10% were farming for 32 to 42 years; and only 2% of them for about 43 to 53 years. This finding implies that respondents had already enough experience in farming industry thus, have knowledge to identify indigenous coping mechanisms against climate change.

Table 2. Crop produced by the respondents

CROP PRODUCED	FREQUENCY	PERCENTAGE (%)
Strawberry	33	66
Lettuce	11	22
Pechay	2	4
Onions	2	4
Statice (Flower)	1	2
Cabbage	1	2
TOTAL	50	100

Table 3. Number of years the respondents in farming

NUMBER OF YEARS	FREQUENCY	PERCENTAGE (%)
10-20	32	64
21-31	12	24
32-42	5	10
43-53	1	2
TOTAL	50	100

Source of capital of the respondents. Table 4 shows that the respondents pulled out their capital from the different sources. Majority (58%) of the respondents were financed by private financiers like the suppliers or middlemen whom they brought their harvested crops; 26% of them were able to finance their own farms if the respondents were able to hit the high price the time they brought their harvested crops to the market.

Accordingly, the respondents are forced to borrow money from the private financiers whenever they did not gain in the past cropping season whereas the 16% of the respondents had cooperative loans. This indicates that the respondents are able to improve their food production and local economic activity, at least in one or two cropping seasons a year.

Table 4. Source of capital of the respondents

SOURCE	FREQUENCY	PERCENTAGE (%)
Private financing	29	58
Self-finance	13	26
Cooperative loan	8	16
TOTAL	50	100

Awareness on climate change. Table 5 reveals that 33(66%) of the respondents were knowledgeable and aware in the impact of climate change in their environment; and 12(24%) of them were not aware and no idea about climate change. This finding shows that the adverse effects of climate change are experienced by the farmer – respondents in the study area but the few do not notice that there are geophysical changes related to climate change like the global warming and the other negative and positive effects of climate change.

As corroborated by Reynolds (2010) that the consequences of climate change and poverty are not distributed uniformly within communities. Individual and social factors such as gender, age, education, ethnicity, geography and language lead to differential vulnerability and capacity to adapt to the effects of climate change.

Sources of Information.

As shown in Table 6, majority (52%) of the respondents were informed about coping mechanisms toward climate change through watching television and hearing news from the radio; 26% of them were informed by their neighbors; and 24% were reading articles from the newspapers. Therefore, respondents were informed through the different kinds of media as claimed by majority of them wherein they could easily adopt coping mechanisms against negative effects of climate change in their area.

Table 5. Awareness on climate change

INFORMATION	FREQUENCY	PERCENTAGE (%)
Aware	33	66
Not Aware	12	24
TOTAL	50	100

Table 6. Sources of information regarding climate change

SOURCES	FREQUENCY	PERCENTAGE (%)
Radio	26	52
Television	26	52
Neighbors	13	26
Newspapers	12	24

*Multiple Responses

Signs of Climate Change (As observed by the respondents)

In Rainfall. With the changes that were happening in their surroundings particularly in the occurrence of rain, respondents were able to point out signs of climate change as shown in Table 7. Majority (80%) of the respondents noticed the occurrence of strong typhoons, this means that the occurrence of storm in the locality was the main hindrance in crop production; 68%, prolonged La Nina; 48%, early start of rainy season; 46%, changes in rainfall pattern; and rainy weather during summer (16%). We all know, us Filipinos, that in the Philippines, the rainfall pattern is from June to September but due to climate change the rainfall is noticed abnormal.

In Temperature. Climate change affects temperature and temperature extremes. Majority (54%) of the respondents felt that there was a sudden increases and decrease of temperature as being experienced. Excessive increase of temperature during summer as claimed by 52% of which according to the respondents that the heat is often unbearable. During the cold season, particularly in the months of December, January, and February, there had been an excessive decreased of temperature as observed by 34% of the respondents. This implies that due to the observed changes, temperature had become unpredictable. As corroborated

by Espaldon (2009) that there has been a steady increase in global temperature brought about by the greenhouse effect.

Presence of Pests and Diseases. The patterns of pests and diseases may change with climate change as noted by Rosenweig and Hillel (1995). As shown in Table 7, the respondents had noted that there had been an increase in population of pests and diseases in the wrong cropping season, such as the spider mites that appeared during warm weather but now appeared during cold weather.

In Crop Production. Table 7 shows that there had been changes observed in crop production. The respondents, mostly those who planted strawberries and lettuce noticed that their harvested crops become smaller in size (46%) compared to their harvest in their first year of farming. The respondents (44%) had noticed a reductions in terms of their yield.

Table 7. Signs of climate change as observed by the respondents

SIGNS	FREQUENCY	PERCENTAGE (%)
Rainfall		
Strong Typhoon	33	66
Prolonged La Nina	33	66
Early start of rainy season	24	48
Changes in rainfall pattern	23	46
Rainy weather during summer	8	16

Table 7. Continued ……..

SIGNS	FREQUENCY	PERCENTAGE (%)
Temperature		
Sudden increase and decrease of temperature	27	54
Excessive increase of temperature during summer	26	52
Excessive decrease of temperature in cold season	17	34
No signs observed	2	4
Presence of pests and diseases		
Increase population of insect pests and diseases	33	66
Occurrence of new pests and diseases	30	60
No signs observed	4	8
Crop Production		
Crops becomes smaller in size	23	46
Low yield	22	44
No signs observed	10	20

*Multiple Responses

Effects of Climate Change to Crop Production

Effects of drought. As shown in Table 8, all (100%) of the respondents experienced scarcity of water supply for irrigation during the occurrence of drought. This led to decrease in quality of crops (70%) resulting to the abnormal sizes of the harvested crops; plants had shorter life span (52%); cracking of soil (42%); and stunting of crops (20%) due to lack of moisture. Due to drought, some (22%) of the respondents had noticed that the population of pests and diseases had increased. This corroborates by Rosenzweig and Hillel (1995) stated that increased evaporation from the soil and accelerated transpiration in the plants that will cause moisture stress; as a result there will be a need to develop crop varieties with greater drought tolerance.

Changes in rainfall. As shown in Table 8, rotting of crops (82%) was the major effect of changes in rainfall as being encountered by the respondents. This also increases the presence of pests and diseases (30%). Due to unpredictable climate, there had been changes in planting pattern (28%); and changes in crop flowering (18%). This corroborates with the study of Atuban and Ceba (2009) citing that agricultural pattern will change as the weather changes because the farmers will have to adapt their planting and harvest pattern depending on the weather.

Effects of typhoons and floods. Typhoons and floods had great effects on crop production as shown in Table 8. Majority of the respondents (98%) claimed that most of the crops planted were totally destroyed during typhoons and floods. These were experienced by the respondents who had farms located on the low areas at swamp. Seventy percent (70%) of the respondents claimed that they had no yield; 40%, were able to save

some of their crops but had poor yield. These were the respondents who had farms in the higher elevation and were not affected by floods.

Changes in temperature. As shown in Table 8, majority (76%) of the respondents had encountered an increase in population of pests and diseases due to changes in temperature. Some other effects observed by the respondents were rotting of crops (36%); crop dries up easily due to very high temperature (32%); changes in flowering of crops (30%); and stunting of crops (8%). Higher temperatures cause heat stress in plants that will make the plants grow less and produce less crops. Furthermore, very hot and very cold weather can prevent a plant from setting blooms, and it can even cause the plant to start dropping foliage. As cited by Rosenzweig and Hillel (1995), altered wind patterns may change the spread of both wind-borne pests and of the bacteria and fungi that are the agents of crop disease. Crop-pest interactions may shift as the timing of development stages in both hosts and pests is altered.

Table 8. Effects of climate change to crop production

EFFECTS	FREQUENCY	PERCENTAGE (%)
Drought		
Scarcity of water supply for irrigation	50	100
Decreased quality of fruits and vegetables	35	70
Cracking of soils	21	42
Life span of plants become shorter	26	52
Increase population of pests and diseases	11	22
Stunting of crops	10	20

Table 8. Continued …….

EFFECTS	FREQUENCY	PERCENTAGE (%)
Changes in Rainfall		
Rotting of crops	41	82
Presence of pests and diseases	15	30
Changes in planting season	14	28
Affects crop flowering	9	18
Typhoons and Floods		
Destruction of crops	49	98
No yield at all	35	70
Poor yield	20	40
Changes in Temperature		
Increase population of pests and diseases	38	76
Rotting of crops	18	36
Crop dries up easily due to very high temperature	16	32
Changes in flowering of crops	15	30
No effect at all	6	12
Stunting of crops	4	8

*Multiple Responses

Coping Mechanisms of Farmers to Counteract the Effects of Climate Change

Drought. Table 9 shows the coping mechanisms employed by the respondents during the occurrence of drought. Majority (66%) of the respondents selected the variety of crops they are planting because, according to them, this will make sure that their crop will survive inspite of the climate disturbances like the case of the lettuce growers in the

study area, they used the variety Condor XL which is suited most during the dry season. Frequent irrigation was the simplest means by which the 48% of the respondents were able to save their crops; 32% of the respondents were forced to dig up in the rivers and canals in order to sustain the water needed by the crops; only 16 % of the respondents were practicing cover cropping. Accordingly, when the cover crop is incorporated into the soil, or left on the soil surface, it often increases soil moisture and it also helps to conserve water by shading and cooling the soil surface. This reduces evaporation of soil moisture.

Changes in rainfall. As shown in Table 9, there were various ways of how the respondents cope up with the effects of changes in rainfall. Majority (48%) of the respondents particularly the strawberry growers were practicing plastic tunneling to secure their crops from strong rains; 46% of them, varietal selection; 36%, adjusted their planting season due to the altered patterns in rainfall; 18% of the respondents had employed crop diversification that helps in enhancing income opportunities.

Typhoons and floods. As shown in Table 9, majority (46%) of the respondents did not employ coping mechanisms against typhoons and floods because their farms are located in the low areas wherein susceptible to floods; 40% of them used plastic tunneling to secure their crops; 34% tried to adjust their planting season; and only 16%, tried to plant waterlogged resistant crop like the onion.

Emergence of pests and diseases. Majority of the respondents (56%) used chemicals to combat pests and diseases of which they claimed the best remedy; 18%, removal of affected crop and continuous irrigation to prevent the pests and diseases to spread. As corroborated by Anonymous (2007) that in Integrated Pest Management (IPM) has been adopted by the respondents to increase food production and reduce agro-chemical

pollution. Good farm management practices such as use of efficient Nitrogen fertilizer and manure were also practiced by the respondents to improve farm yields, farm energy efficiency, cover cropping, and development of local markets. The use of organic manure reduces pollution, minimize flooding and enhance groundwater recharge. Some of the organic composts used by the respondents like composted farm wastes and PCM (Processed Chicken Manure) were incorporated into the soil to enhance soil fertility and minimizes the occurrence of pests and diseases.

Table 9. Coping mechanisms of farmers to counteract the effects of climate change

COPING MECHANISMS	FREQUENCY	PERCENTAGE (%)
Drought		
Varietal Selection	33	66
Frequent irrigation	24	48
Digging of rivers and canals	16	32
Cover Cropping	8	16
No coping mechanisms Employed	5	10
Changes in Rainfall		
Varietal selection	23	46
Plastic tunneling	24	48
Adjust planting season	18	36
Crop diversification	9	18
Cover cropping	7	14
No coping mechanisms employed	4	8

Table 9. Continued ……..

COPING MECHANISMS	FREQUENCY	PERCENTAGE (%)
Typhoons and Floods		
No coping mechanism employed	23	46
Plastic Tunneling	20	40
Adjust Planting Season	17	34
Planting of Waterlogged Resistant Crop	8	16
Emergence of Pests and Diseases		
Uses Chemicals to kill pests and diseases	38	76
Removal of affected crop	9	18
Frequent irrigation	9	18

*Multiple Responses

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The study on the coping mechanisms of swamp farmers toward climate change in La Trinidad, Benguet was conducted to determine the socio-demographic profile of the swamp farmers, the level of knowledge of the respondents toward climate change, the effects of climate change to crop production observed by the respondents and the coping mechanisms that the respondents employed to counteract the effects of climate change.

The respondents of the study were composed of fifty (50) swamp farmers in La Trinidad, Benguet. Majority of them were males; married; with an average age of 46 years old; finished elementary level while only few of them did not undergo to formal education.

Majority of the respondents were engaged in farming for about 10 to 20 years and had major crop which was strawberry. The source of their capital were from the private financiers while others were able to finance their own farms.

Results showed that they were knowledgeable and aware in the impact of climate change in their environment through watching television and hearing news from the radio as claimed by majority of the respondents.

The signs of climate change that were observed by majority of the respondents particularly in rainfall were the occurrence of strong typhoons and prolonged La Nina while some noticed the changes in rainfall pattern. In temperature, majority of them felt that there was a sudden increased and decreased of temperature and excessive increased of temperature during summer. Also, the patterns of pests and diseases changed with climate change wherein majority of the respondents had observed an increase in population of pests and

diseases in the wrong cropping season. The changes were observed in crop production too, that the majority of the respondents noticed that their harvested crops became smaller in size and reductions in terms of their yield.

The effects of climate change experienced by the farmers in the study area, all of them noted the scarcity of water supply for irrigation during the occurrence of drought that led to decrease in quality of crops, shorter life span of plants, cracking of soil and stunting of crops. Also, the rotting of crops, increased population of pests and presence of diseases. Typhoons and floods were observed that majority of the respondents considered had great effects in crop production because it destroyed totally the crop whereas some were able to save some of their crops.

Respondents had employed practices to cope up with the effects of climate change, majority of the respondents selected the variety of crops to produce, the simplest means to save their crops during the occurrence of drought, they irrigated frequently their farm from the dug rivers and canals to sustain the water needed by the crops. Only few of the respondents were practicing the cover cropping to increase soil moisture and to conserve water in the soil surface. Majority of the respondents particularly the strawberry and lettuce growers were practicing the plastic tunneling and the selection of crop variety hence, the others had to adjust their planting season and had employed crop diversification due to the altered patterns in rainfall.

Majority of the respondents had not employed any coping mechanisms against typhoons and floods. But, there were some of the respondents that used plastic tunneling and had tried to plant waterlogged resistant crop. Respondents used chemicals to combat pests and

diseases. The others claimed the removal of the affected crop and the continuous irrigation to prevent the spread of pests and diseases.

Conclusions

Based on the findings, the following conclusions were derived:

1. Majority of the farmers were males; married; with an average age of 46 years old; had finished elementary level; were engaged in farming for about 10-20 years; had major crops of strawberry; and financed their farm by private financiers.

2. Respondents were aware in the impact of climate change in their environment through watching television and hearing news from the radio.

3. Respondents had observed signs of climate change in their farms like strong typhoons, sudden increased and decreased of temperature, increased population of insect pests and diseases, and their crops became smaller in size.

4. The agricultural productivity of the respondents with climate change depressed by increased climate variability and increased intensity and frequency of extreme events such as drought, and strong typhoons and floods.

5. Respondents were able to employ different coping mechanisms to counteract the effects of drought, changes in rainfall, typhoons and floods, changes in temperature and emergence of pests and diseases by varietal selection, used plastic tunneling, adjust planting season, and used chemicals to combat pests and diseases.

Recommendations

In line with the findings of the study, the following recommendations are forwarded:

1. The Local Government Units (LGU's) should conduct a dialogue with the farmers to keep them aware about the climate change issues and suggest innovative ways of adapting to the climate change impacts.

2. Plant breeders and other agricultural researchers should develop drought and waterlogged resistant variety of crops that can be produced in the area.

3. The farmers should be encouraged to pursue the practice of organic farming to reduce pollution, minimize flooding and enhance groundwater recharge.

4. The Local Government Unit in cooperation with the Benguet State University should provide water impounding system to sustain the irrigation in the farm which is the major problem during the occurrence of drought.

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