CHAPTER IV

RESULTS AND DISCUSSION

<u>Demographic Characteristics of Respondents</u>

The respondents are composed of 456 (54 percent) males and 394 (46 percent) females. The bigger proportion (30 percent) of the respondents' came from 41 to 50 years old followed by the group belonging to 31 to 40 years old (28 percent). The group of 51 to 60 years old composed of 17 percent while 11 percent respondents are within 21 to 30 years old. Whereas 9 percent or 78 respondents are from 61 to 70 years of age.

Most of the respondents reached the elementary level accounting for 52 percent (443 respondents). About 33 percent reached high school. While those who reached college is about 13 percent. As for the household size, 18 percent have 4 family members living with them. Sixteen percent have 6 family members. At the same time, (128 respondents) 15 percent have 5 family members. Family members composing of 3 to 7 members were answered by the remaining 11.29% (96 respondents).

Table 10. Occupation of the Respondents

	No. of Respondents	%
Occupation		
Farmer	656	77.18
Others	118	13.88
Part time farmer	34	4.00
LGU Employee	25	2.94
Driver	5	0.59
Teacher	5	0.59
NGO Employee	3	0.35
Dealer	2	0.24
Contractor	1	0.12
NA	1	0.12
	850	**100**

Large portions of the respondents are farmers (77.17 percent). There are also LGU employees (almost 3 percent); farmers who are also LGU employees (almost 2 percent); drivers (almost percent); teachers (almost 1 percent); farmers who are also drivers (almost 1 percent) and NGO employees (0.30 percent).

Table 11. Respondents' Income

	No. of Respondents	%
Respondents' Average Monthly Income		
Php 0-5T	576	67.76
Php 5.1-10T	175	20.59
Php 10.1-15T	51	6.00
Php15.1-16	18	2.12
Php16.1-20T	9	1.06
Php20.1-25	19	2.24
NA	2	0.24
	850	100

The respondents' average monthly income ranges from 0 to 5 thousand pesos (68 percent). Twenty-one percent of the respondents have income ranging from 5.1 thousand to 10 thousand pesos. Six percent belongs to the respondents who have income from 10.1 thousand to 15 thousand pesos. Most of the number of respondents accounted to 0 to 500 pesos only as their savings. About 1 percent claimed that they have no savings. Sixty percent respondents have savings ranging from 501 to a thousand pesos.

Table 12.Housing

	No. of Respondents	%
Land Tenure (House)		
Owned	534	62.82
Occupied for Free	185	21.76
Lease	65	7.65
Rented	47	5.53
Others	19	2.24
	850	**100**
Type of House		
Wood	557	65.53
Concrete	207	24.35
Sawali/Nipa/Bamboo	73	8.59
Galvanized	5	0.59
Stone	3	0.35
Others	3	0.35
Brick	2	0.24
	850	**100**

Table 12 revealed that 62 percent of the respondents owned their homelot. Twenty-two percent of the respondents are occupying their lot for free. Only 8 percent of the respondents are leasing their lot while 6 percent are renting their lot.

The table also shows that most of the respondents' house structures are made of wood. Twenty-four percent are have houses made of concrete. Nine percent of the respondents have houses that are galvanized while the rest are made up of brick and stone.

<u>Farming as economic activity</u>

From the interview, 71 percent of the respondents' houses are situated in lower areas characterized by less than 16 degrees of slope. Twenty-five percent are in moderate sloping areas (16 to 25 degrees). Three percent are situated in of more than 25 degrees. For the farm size, 244 respondents (42.0 percent) have 1 hectare. About 26 percent have 1.1 to 2 hectares. One hundred respondents have 2.1 to 3 hectares. And about 14 percent have half a hectare.

Most of the respondents have corn as their annual crop. Only 60 respondents (7 percent) have rice or palay as their crop. Forty-one respondents plant legumes. Twenty-nine respondents plant onion. Other crops that can be seen planted in Claveria are cutflowers, watermelon, garlic, sugarcane, tomato, tobacco, etc.

The trees and other permanent crops that are planted in the respondents' farms and around residential lots are shown in Figure 11. These are: Banana, Bamboo, Jackfruit, Lanzones, Marang, Mango, Gmelina, Mahogany, Coconut, Coffee, Santol, Bagras, Rambutan, Durian, Mangium, Cacao and Mangosteen. Banana is the major crop planted in the study site.
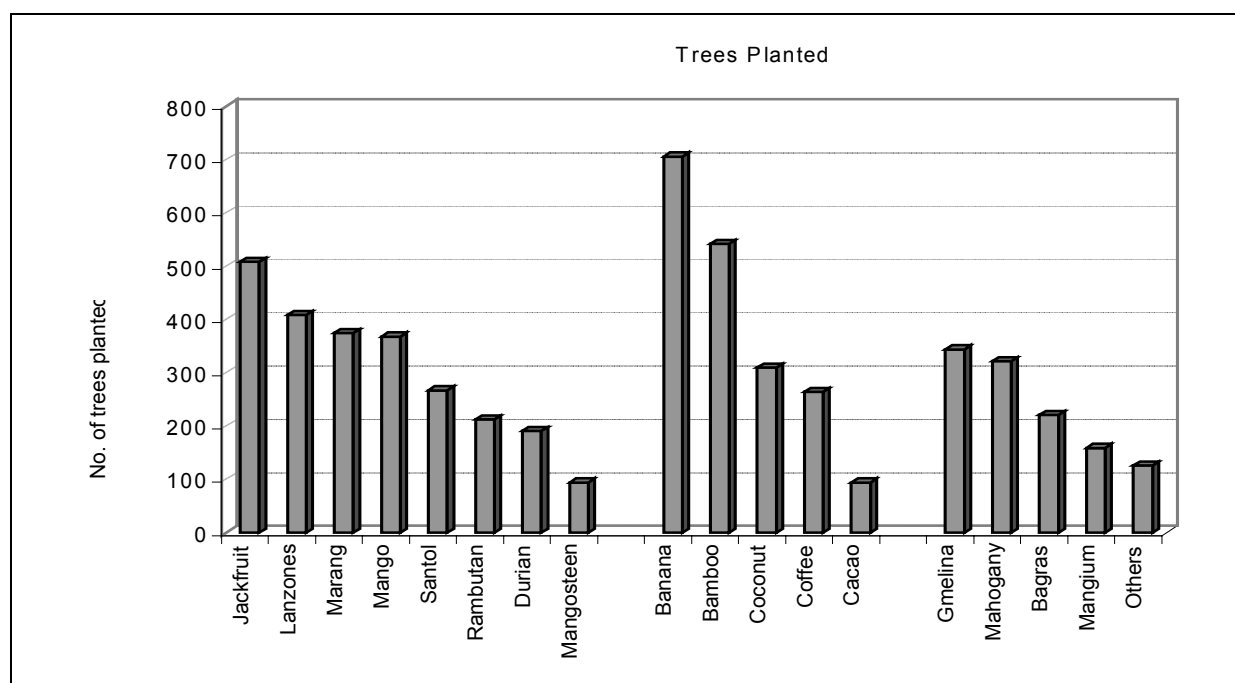

Figure 11. Trees and other permanent crops planted by the respondents

For domesticated animals, 598 respondents have chickens. About 55 percent and 396 respondents are taking care of pigs and cows respectively. Goats are also raised on the farms of 214 respondents (25.17 percent) and about 18 percent have carabaos. Horses, turkeys, ducks and others are also in Claveria farms (Fig 12).
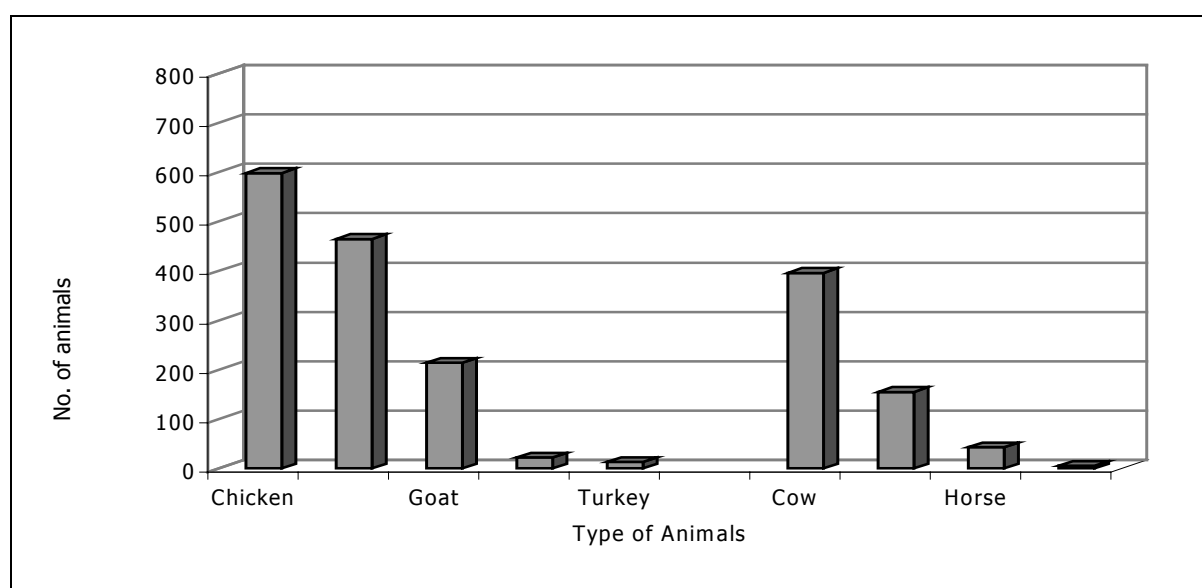
Figure 12. Animals being taken care of by the respondents

Organic farming is popular among 52 percent. Almost 40 percent practice monocropping in their farms. Natural vegetative strips (NVS) which is the preliminary stage for preparing the land for agroforestry is applied by almost 30 percent and about 35 percent have contour farming. Ridge tillage which helps in lessening loss of water and tillage induced erosion were practiced by 10 percent. Almost 17 percent practice trash bonding.

Table 13. Farm practices

	No. of Respondents	%
Organic farming	442	24.7
Monocropping	338	18.9
Contour farming	294	16.4
Natural vegetative filter strips (NVS)	251	14.0
Others	163	9.1
Trash bunding	148	8.3
Ridge tillage	86	4.8
Rock wall	40	2.2
Integrated Pest Management (IPM)	28	1.6
	1790	**100**

Community Services

The municipal's office usually serves as the soirée of people for specific needs. The government programs and activities are posted there. This is also considered as one of the most important place in the municipality. Twenty-nine percent are living 10.1 to 15 kilometers away from the municipal's office. Almost 26 percent resides 5.1 to 10

kilometers away from the office. The farthest respondents interviewed are 100.1 to 150 kilometers away from the office (2.23 percent).

Most of the respondents (95.52 percent) interviewed is 0 to 1 kilometers away from the service road. Almost 2 percent are 5.1 to 10 kilometers away from the service road and about 1 percent is living 10.1 to 15 kilometers away. Others (0.94 percent) live farther than 15 kilometers.

Distance from the market was obtained. This is where the communities normally transact businesses such as selling their crops and buying things. From the result of the survey, most of the respondents (30 percent) are 10.1 to 15 kilometers away from the market. Twenty-five percent are living in the area with 5.1 to 10 kilometers away from the market. About 17 percent being 25.1 to 50 kilometers away from the market follow this.

For transportation, there are public utility jeepneys and "habal-habal" (motorcycles). Walking is the usual means of transport. In transporting crops, "karumata" (cow-drawn cart) is foremost. Horses are famous in Barangay Punong.

Plate 12. Karumata

In Claveria, water is important not only for the people but for the crops as well. The survey showed that most of the respondents (95 percent) 0 to 5 kilometers away from their source of water for both domestic and agricultural use. Some respondents (2.7 percent) are in the area of 5.1 to 10 kilometers away from their main source of water, while the rest (0.02 percent) are very far away from their source, 50.1 to 100 kilometers. Water impounding and rationing (Ane-I and Patrocinio) are widely held in far areas. Barrels and concrete tanks are used in storing rainfall water.

Treatments and care giving of health related problems are being carried out in this place. Almost 30 percent are 10.1 to 15 kilometers away from the hospital. About 25 percent are in the areas that are 5.1 to 10 kilometers away from the hospital. Approximately 14 percent are in the areas that are 0 to 5 kilometers away from the place. Again the farthest distance obtained is 100.1 to 150 kilometers. Ideally, the government provided each barangay a utility vehicle and stationed nurse or midwife for emergency requests.

Table 14. Distance from the Major Key Offices

Distance from:	Number of respondents (Distance in kilometer)								
	0 to 5	5.1 to 10	10.1 to 15	15.1 to 20	20.1to 25	25.1to 50	50.1 to 100	100.1 to 150	na
Municipal's Office	109	217	246	55	26	137	37	19	4
Municipal Market	112	214	253	50	26	143	29	20	3
Main Source of Water	808	23	4	2	-	5	2	-	6
Municipal Hospital	122	211	251	55	30	127	34	15	5
Nearest medical facilities	800	31	2	2	1	5	2	2	5
Service road	812	16	11	3	2	3	-	-	3

n = 850

The medical heath facilities include barangay health centers and the like. First-aides and minor treatments are entertained in this area. Most of the respondents (94.11 percent) are 0 to 5kilometers away. There are about 4 percent who reside 5.1 to 10 kilometers away from the barangay health centers. Unfortunately, there are still some respondents who reside 100 kilometers away from the medical facilities. State of the art medical services are prevalent in the area. There are local medicine men ("mananambal"). The medicine men serve as the midwife, first-aide provider, therapist ("hilot"), and health consultants.

Plate 13. Barangay Road

Plate 14. Public Utility Vehicle

Plate 15. Government Utility Vehicle for Public Service

Photo by: J.D.Villanueva (February 2006)

Health

Figure 13 presents the common illnesses of the respondents. Almost 95 percent answered cough and 709 said it is cold. About 49 percent experiences headache and suffers from diarrhea. Asthma is also included as about 12 percent to go through it, while almost 30 percent mentioned other causes.
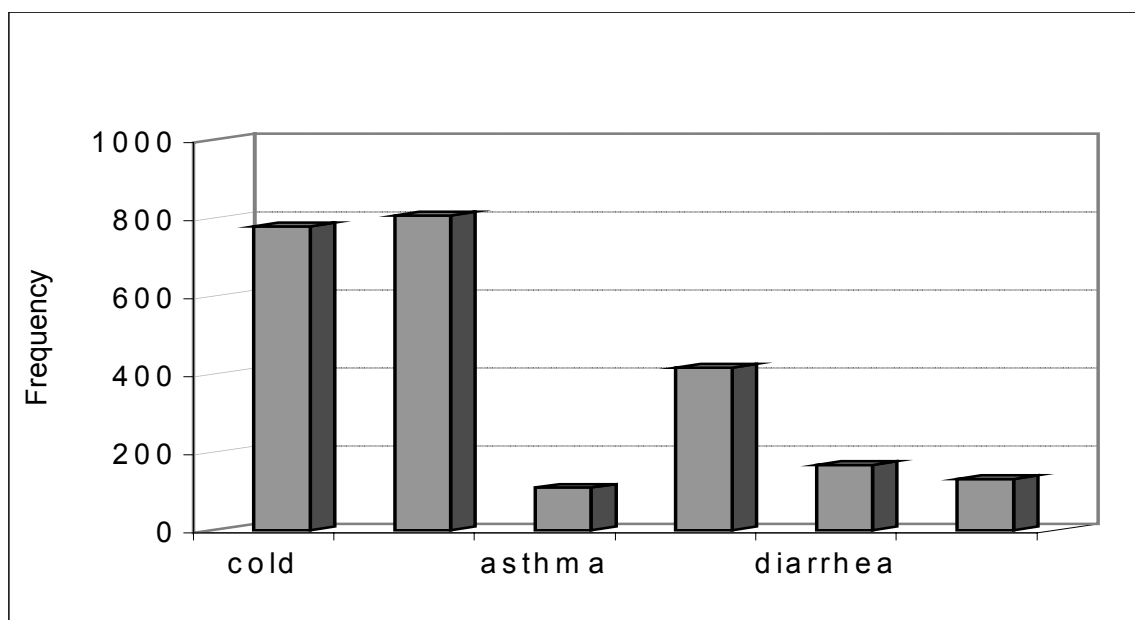
Figure 13. Common illnesses of the respondents

Figure 14 showed the common causes of those identified sicknesses. Climate variability and weather change are the main sources identified by 92 percent. Only 8 percent answered other sources like water contamination, and the like.
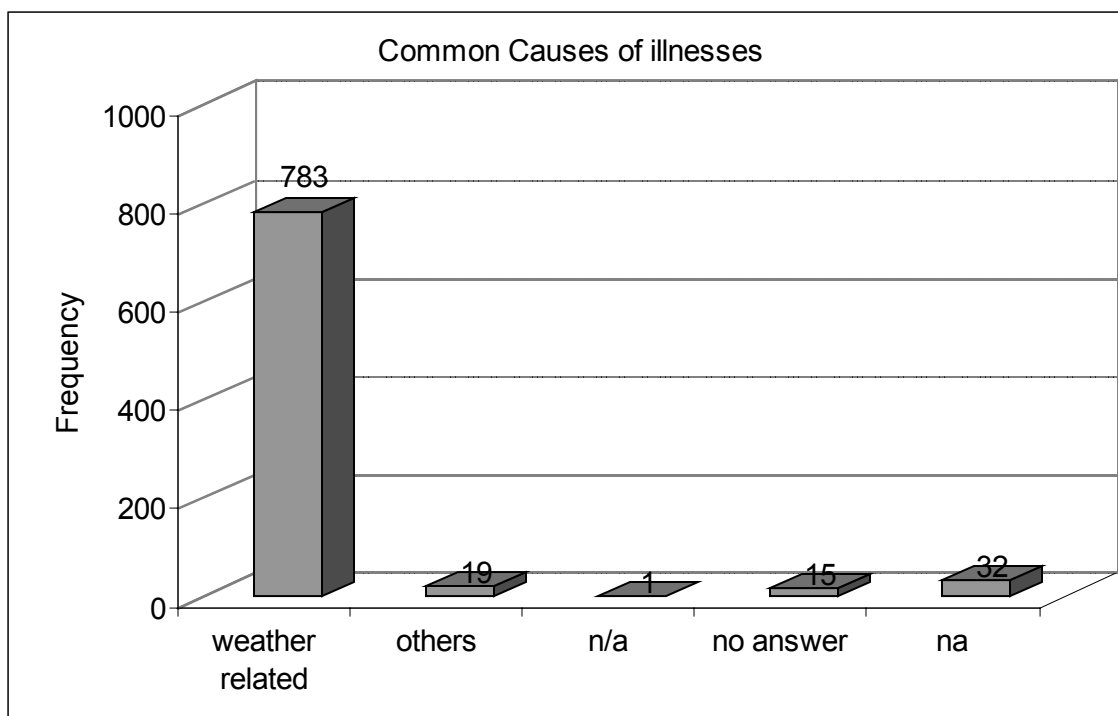

Figure 14. Common causes of respondents' illnesses

In the interview respondents were asked at what quarter do they mostly observe health problems. Responses are: at the 3rd quarter, 41 percent; 2nd quarter, 37 percent; and 1st quarter, 21 percent (Fig 15).

Quarter: health problem occur most

41%

37%

21%
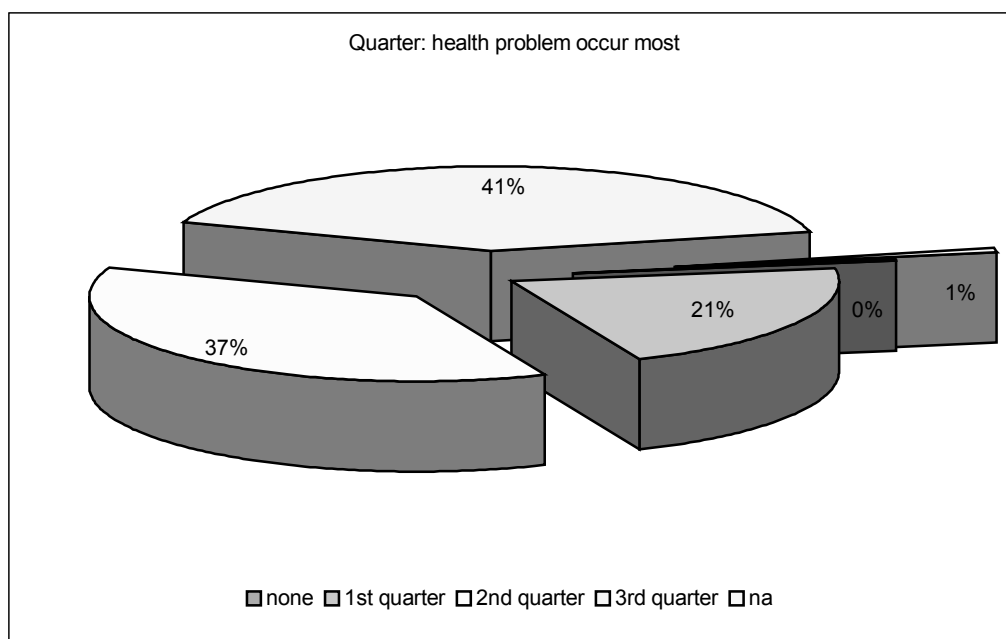
0%

1%

□none □1st quarter □2nd quarter □3rd quarter □na

Figure 15. Quarter when health problem mostly occurred

Water Demand

Water sources were classified into two: (1) the main source and the (2) the local source. Main water sources are those coming from natural bodies of waters like springs, lakes, rivers, etc. Local sources are those from wells and faucets. Three hundred eighty-six respondents (43.29 percent) get water from the main source while 438 (51.53 percent) respondents got their water from local sources. Nineteen respondents get water in both sources (Fig 16).

Based on the survey, water in Claveria is normally used for drinking according to 794 respondents. Seven hundred fifty-six said that they also use it for domestic use. While 327 respondents use their water for agricultural use. The water was used mainly for drinking indicating that the quality of the water is still very good (Fig 17).
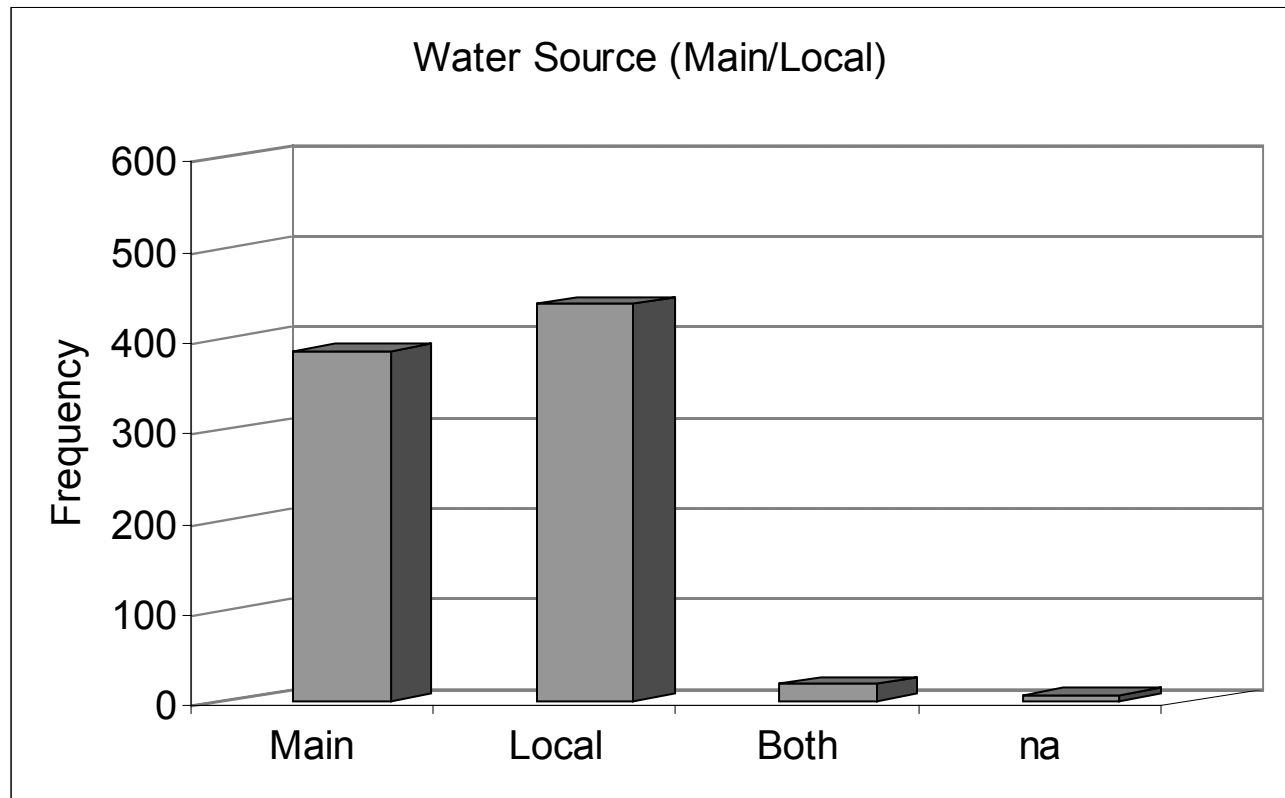
Figure 16. Water source

Plate 16. Water Source

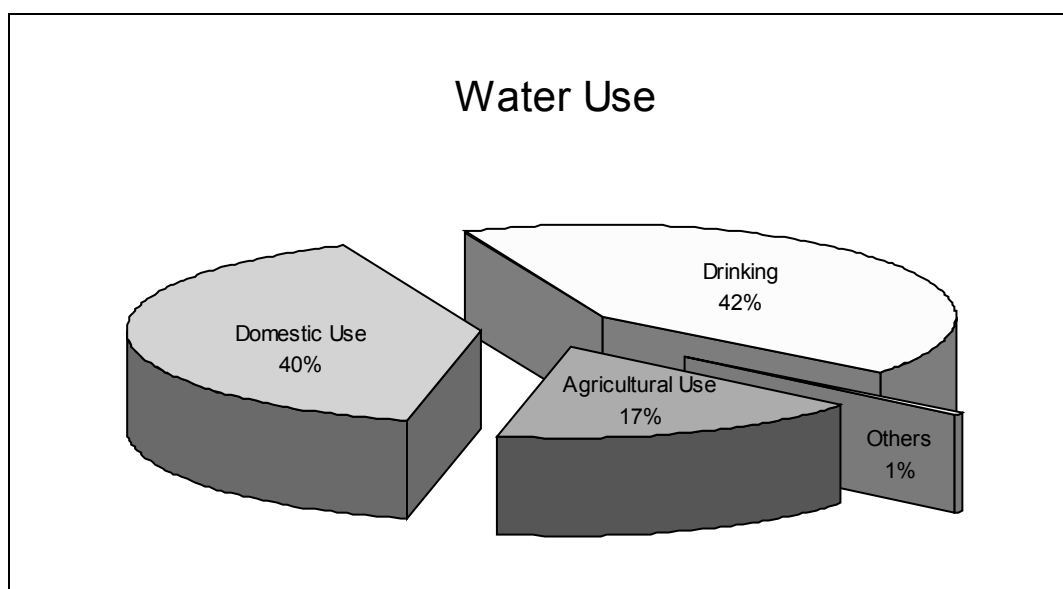Photo by: J.D.Villanueva (February 2006)

Figure 17. Water use

The total daily demand for water in 1999 was 9,014 cu. m. for residential use, commercial use and system loss. Among the barangays, the top barangays users are Poblacion, Patrocinio, Madaguing, Ane-I, and Mat-I. From the total daily demand, Poblacion uses 22 percent or 2000 cu.m., Patrocinio and Madaguing both uses the 13.32 percent or 1,202 cu.m., Ane-I uses the 9.45 percent or 852 cu.m. and Mat-I 5.26 percent or 474 cu.m. However, Hinaplanan's name is entered the top five users in he commercial use.

Figure 18 shows water demand at the community level. Tamboboan have the biggest water demand (20 percent). Madaguing and Patrocinio (both 12 percent) follow this. Luna has the 8 percent share.
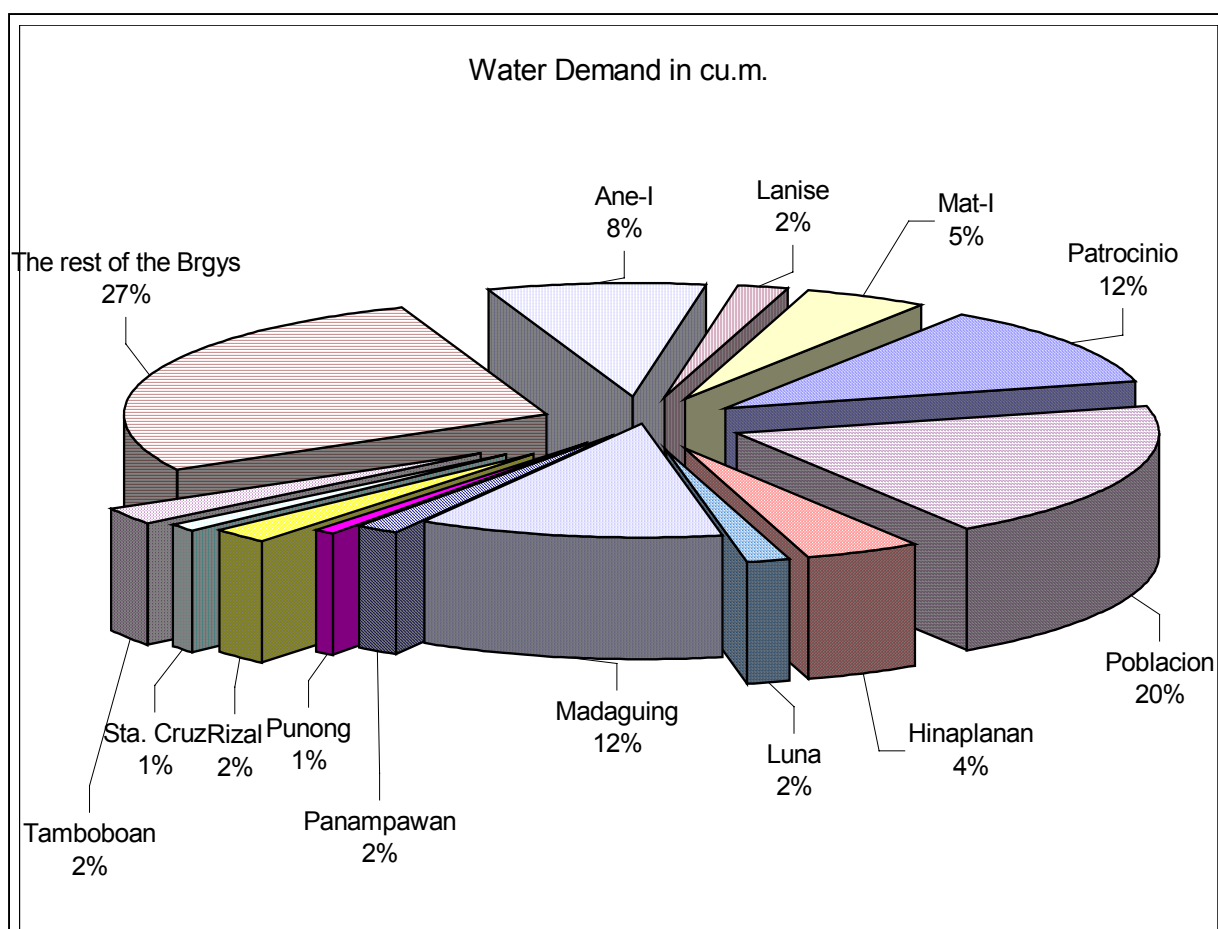

Figure 18. Water demand

The Barangay Nutrition Service of Claveria, Misamis Oriental, conducted a survey on the housing unit by type of source of drinking water. Six percent of the housing unit use the open shallow dug well, 49 percent use spring, 5 percent use artesian well, 11 percent use deep well and 29 percent use piped water work system. Figure 19 shows the water demand. The residential use covers most of the demand. Commercial use accounted 39 percent, while 10 percent is for the loss.
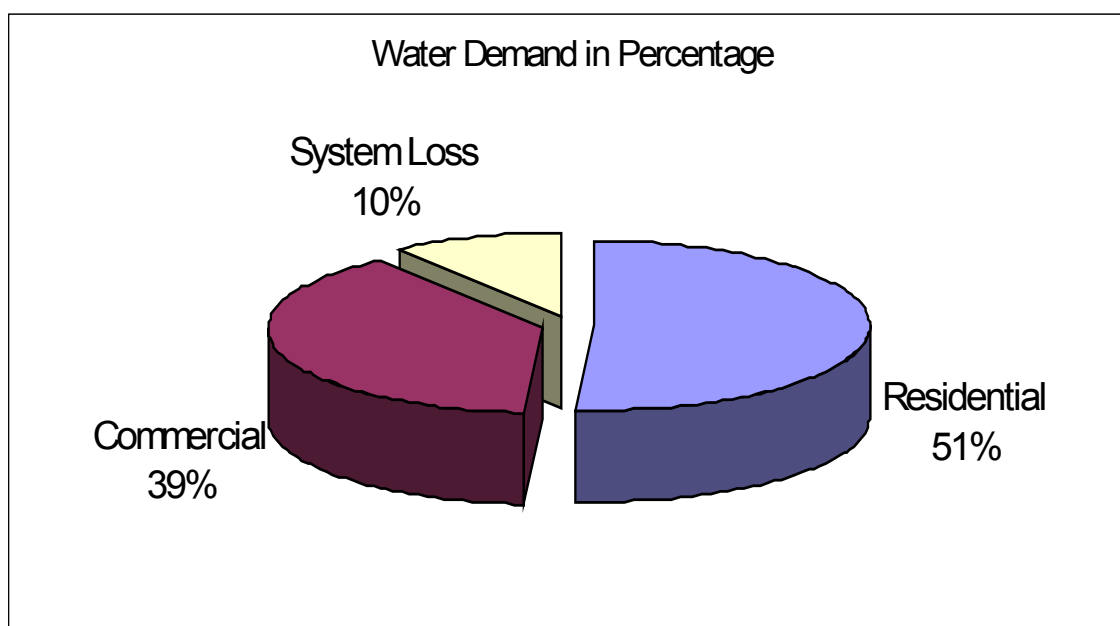

Figure 19. Water demand in percentage

Examining Climate Variability and Climate Extremes in Claveria

Using Secondary Data

Figure 20 shows the climate description of Claveria. The rainfall accounted an minimum of 1,035.5 mm and an annual maximum of 2.187 mm with an annual mean of 1,587.812 mm. The normal is 1,654.4 mm. The rainy days had an annual minimum of 86 days and an annual maximum of 201 days with an annual mean of 79 days. The normal number of rainy days is 140 days.

El Niño is characterized by having below normal rainfall amount for at least 3 consecutive months. The data from PAGASA Cagayan de Oro station showed that for over 43 years (1961 to 2004), only 11 years (1965, 1970, 1971, 1974, 1975, 1978, 1984, 1989, 1991, 1999, and 2001) have no records of the said event. This verified that the area is prone to El Niño. The most number of below normal rainfall amount occurred during 1969 (January to August and October to December) and 1987 (January to June and August to December). This is followed by years with 10 months of below normal rainfall, which occurred last 1998 (January to October). Years 1976 (February to May and July to November) and 1979 (January to April and August to December) experienced 9 months of below normal rainfall amount.
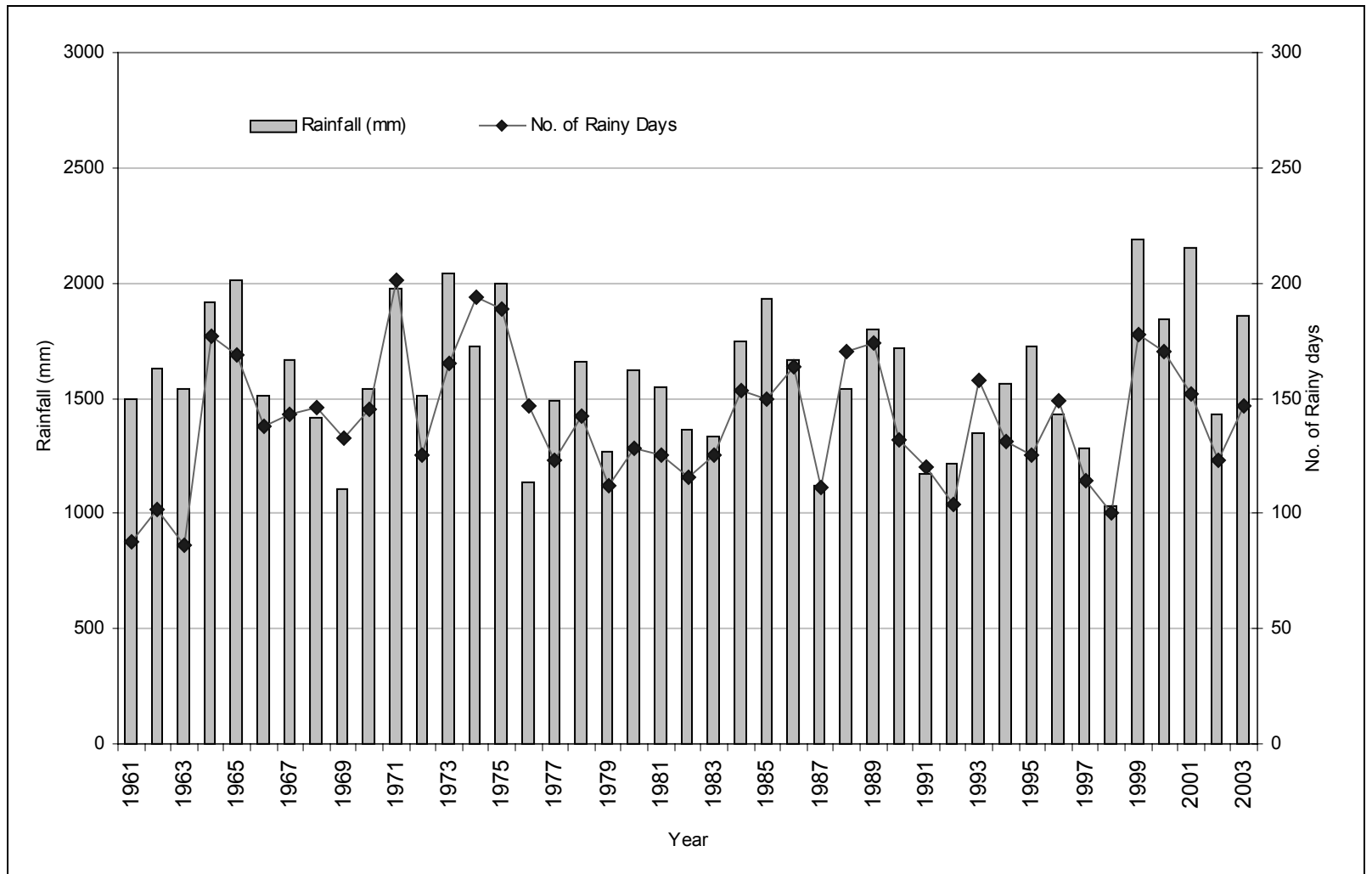
Figure 20. CDO Rainfall and number of rainy days from 1961 to 2004 (mm)

The data on rainy days give indications on whether the area is experiencing drought. For the annual data of rainy days, 3 consecutive months of below normal rainy days could imply drought. Only years of 1964, 1968, 1971, 1974, 1975, 1980, 1986, 1988, 1993, 2000 and 2004 (11 years) show no records of below normal rainy days. The longest year of below normal rainy days have been encountered on the year 1961 (February to April and June to December). Nine months of below normal rainy days occurred in 1963 (April to December), 1982 (May to December) while the years wherein there had been 8 months of below normal rainy days are 1972 (April to August and October to December), 1981 (February to April and August to December), and in 1998 (April to October).

In this study, extreme temperatures are classified as El Niño (warm current) and La Niña. To be able to assess the condition during the given years under each category, the occurrence of a minimum of three consecutive months was examined. The assessment had been taken from the rainfall record of Cagayan de Oro PAGASA Station.

La Niña is classified as having "cold event" or "cold episode". Generally, tropical areas, including the Philippines, commonly experience wetter than normal conditions during cold episodes due to the concentrations of thunderstorm activities. Base on record available for the study area, the occurrence of La Niña

was on the years 1955 to 1956, 1964 to 1965, 1970 to 1971, 1973 to 1976, 1988 to 1989 and 1995 to 1996 (PAGASA 1998). These are shown on Figures 30 to 35.

On the other hand, the most notable El Niño experience in the Philippines was during the years of 1982 and 1983. The country had encountered drought reaching a $ 450 million damage cost. Worldwide the said event caused widespread flooding and drought. The years identified with El Niño records are: 1968 to 1969, 1972 to 1973, 1976 to 1977, October 1982 to Mar 1983, April 1983 to September 1983, April 1987 to September 1987, October 1989 to March 1990, 1991 to 1993, and 1994 to 1995 (PAGASA 1998). Figures 21 to 27 and 36 showed the affected El Niño event.

CDO Rainfall account, 1968 to 1969

Figure 21. El Niño 1968 to 1969
Source: PAGASA, Cagayan de Oro City

Figure 22. El Niño 1972 to 1973
Source: PAGASA, Cagayan de Oro City

Figure 23. El Niño 1976 to 1977
Source: PAGASA, Cagayan de Oro City

Figure 24. El Niño October 1982 to March 1983
Source: PAGASA, Cagayan de Oro City
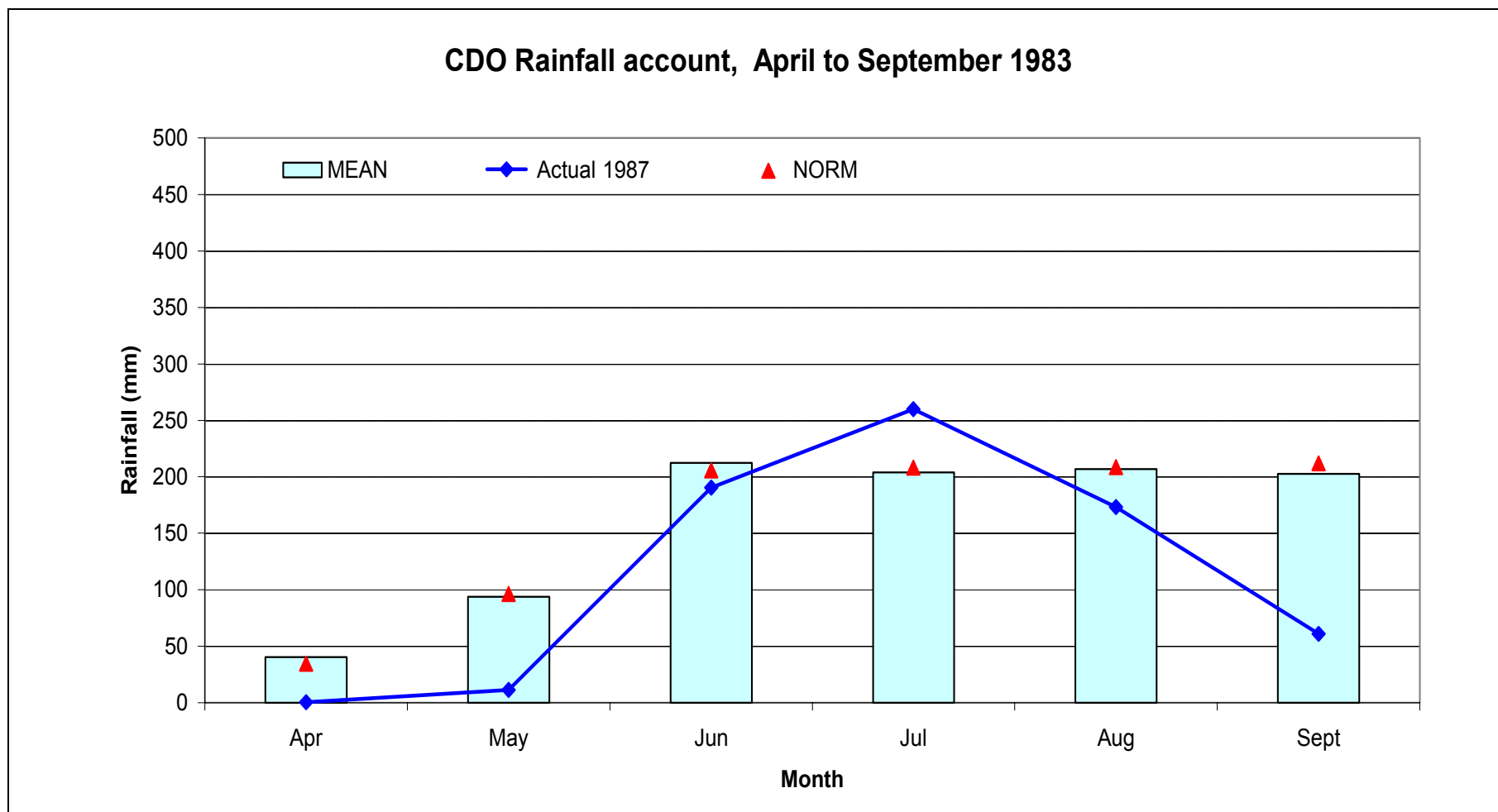
Figure 25. El Niño April to September 1983
Source: PAGASA, Cagayan de Oro City

CDO Rainfall account, Oct. 1989to Mar. 1990
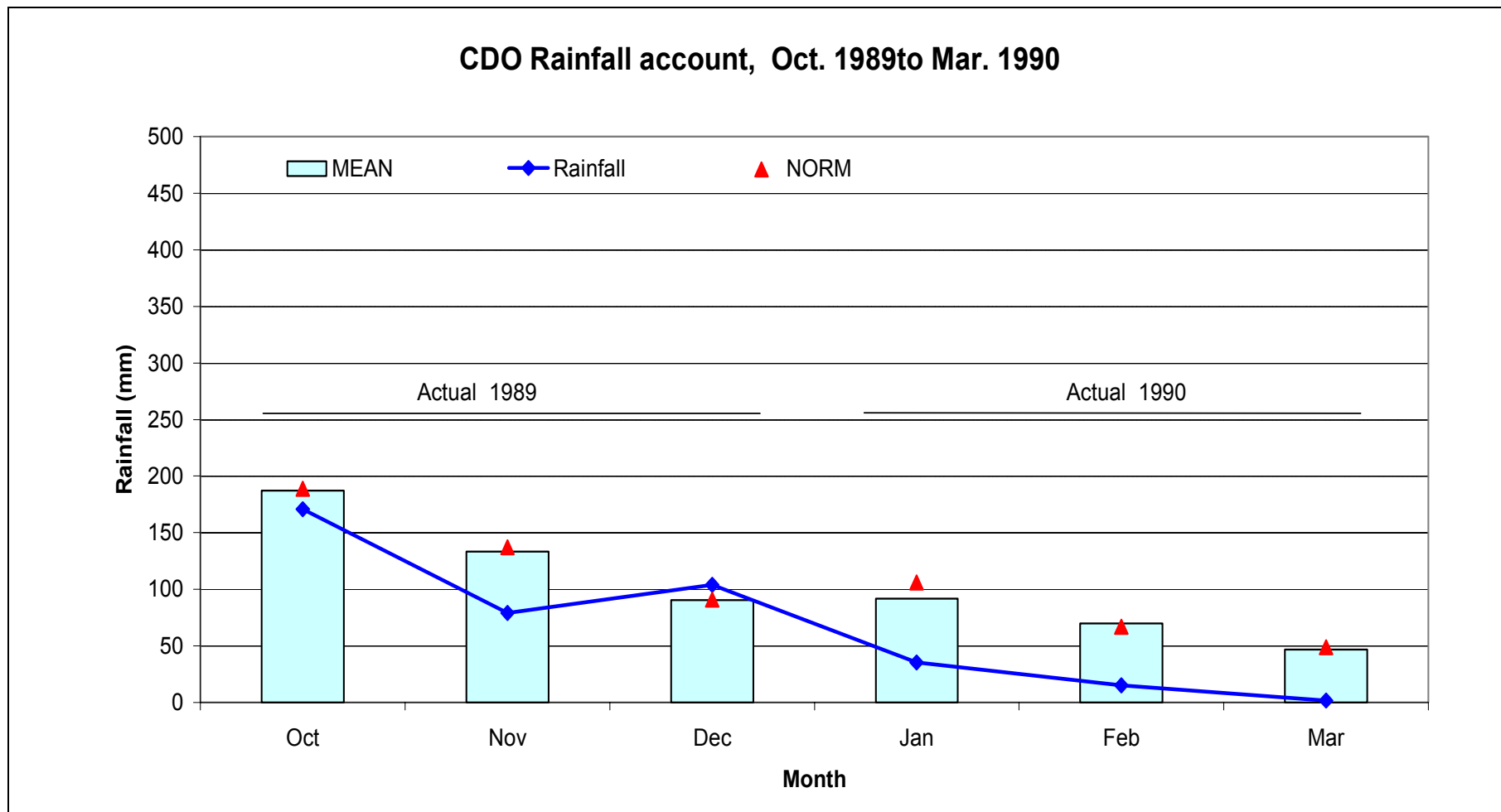
Figure 26. El Niño October 1989 to March 1990
Source: PAGASA, Cagayan de Oro City
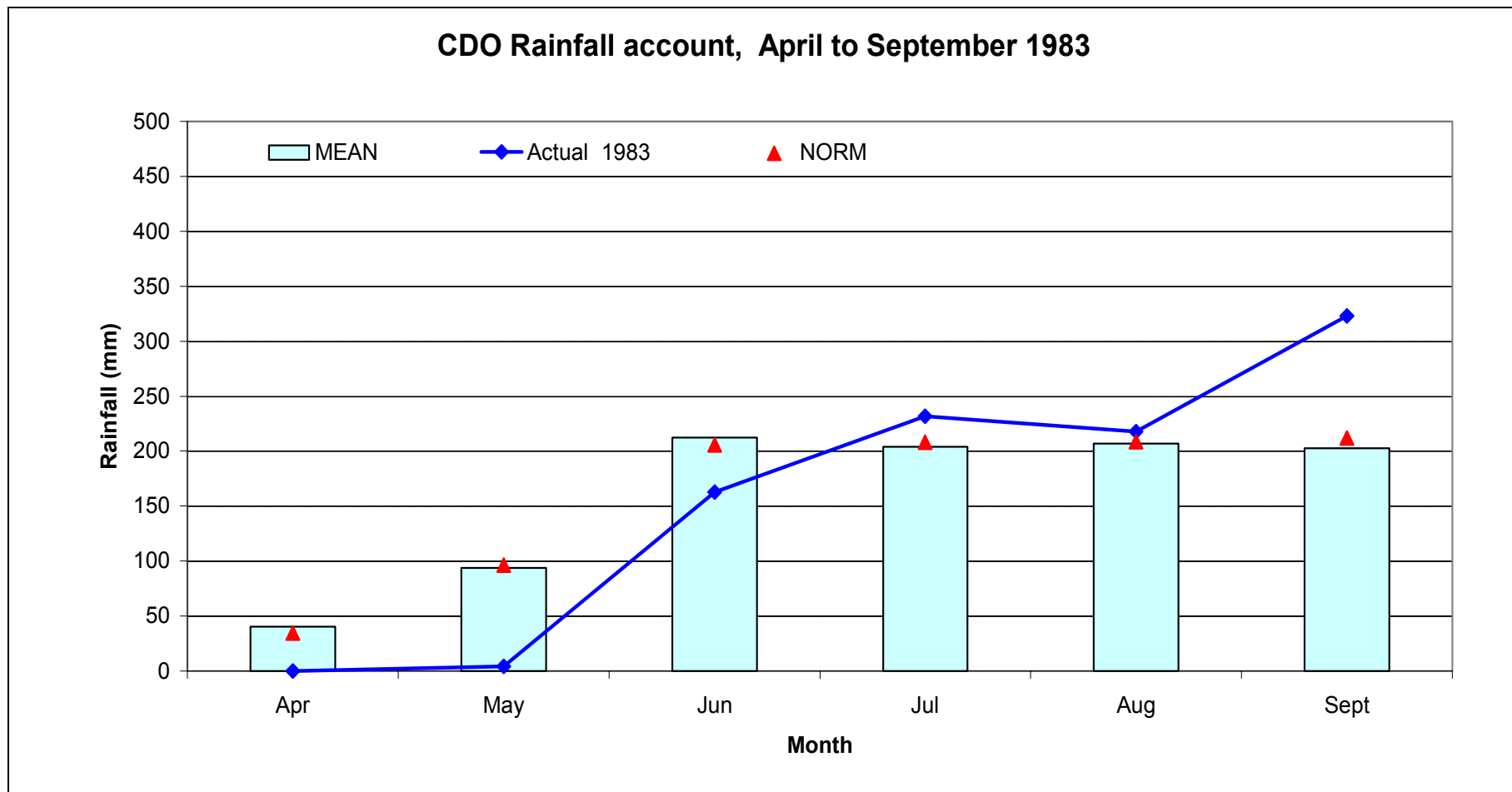
Figure 27. El Niño April to September 1983
Source: PAGASA, Cagayan de Oro City
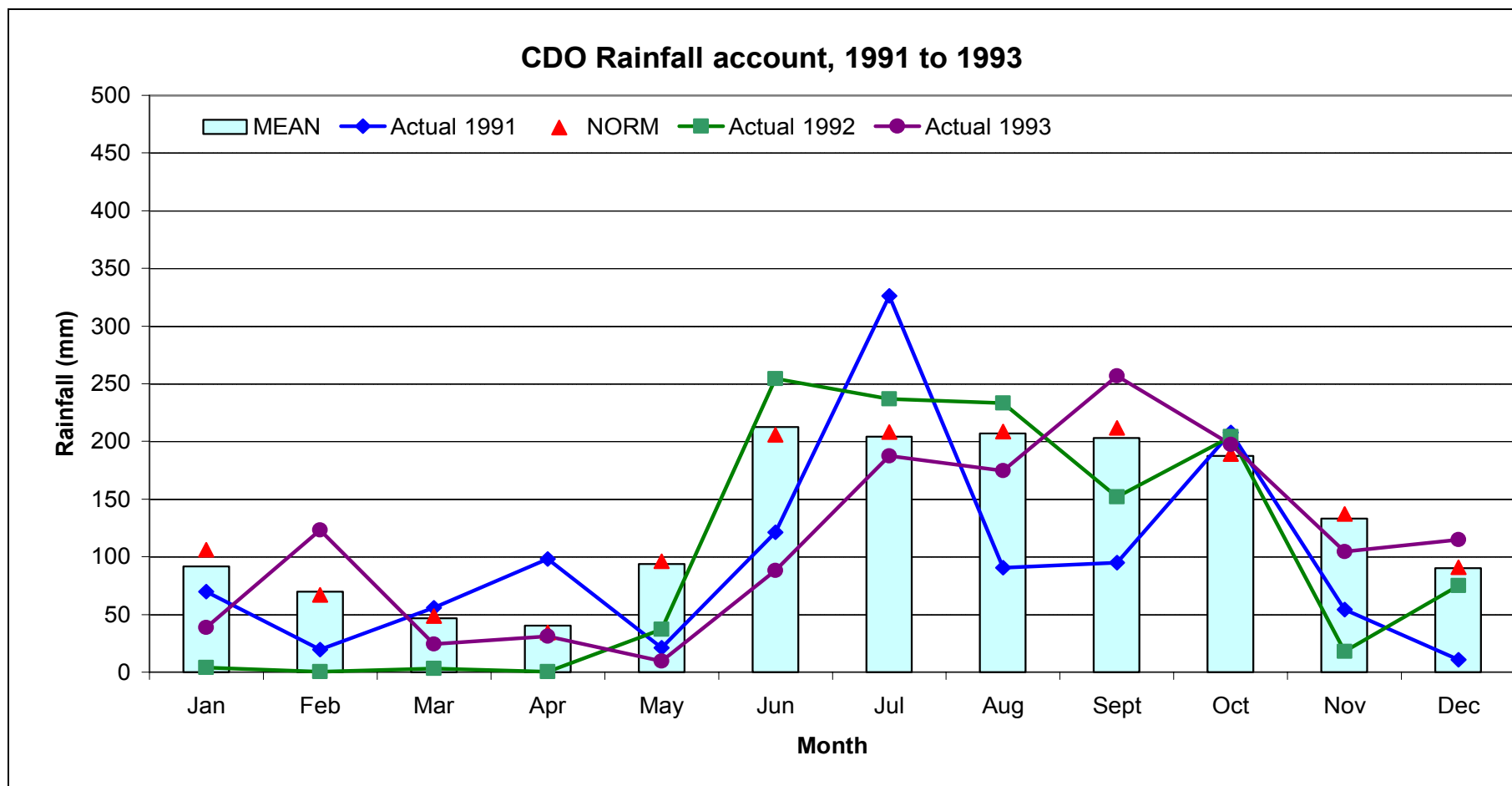
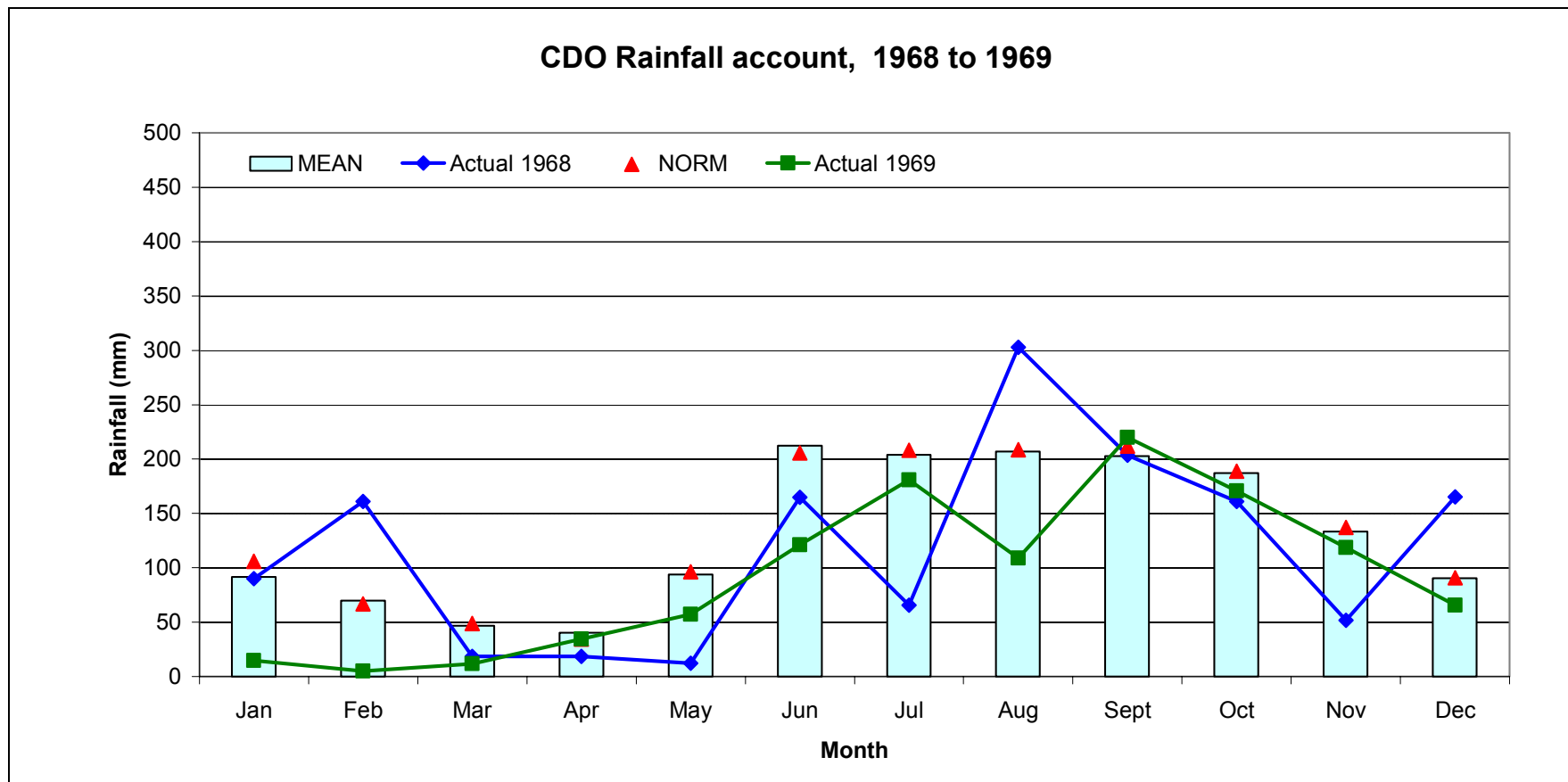Figure 28. El Niño 1991 to 1993
Source: PAGASA, Cagayan de Oro City
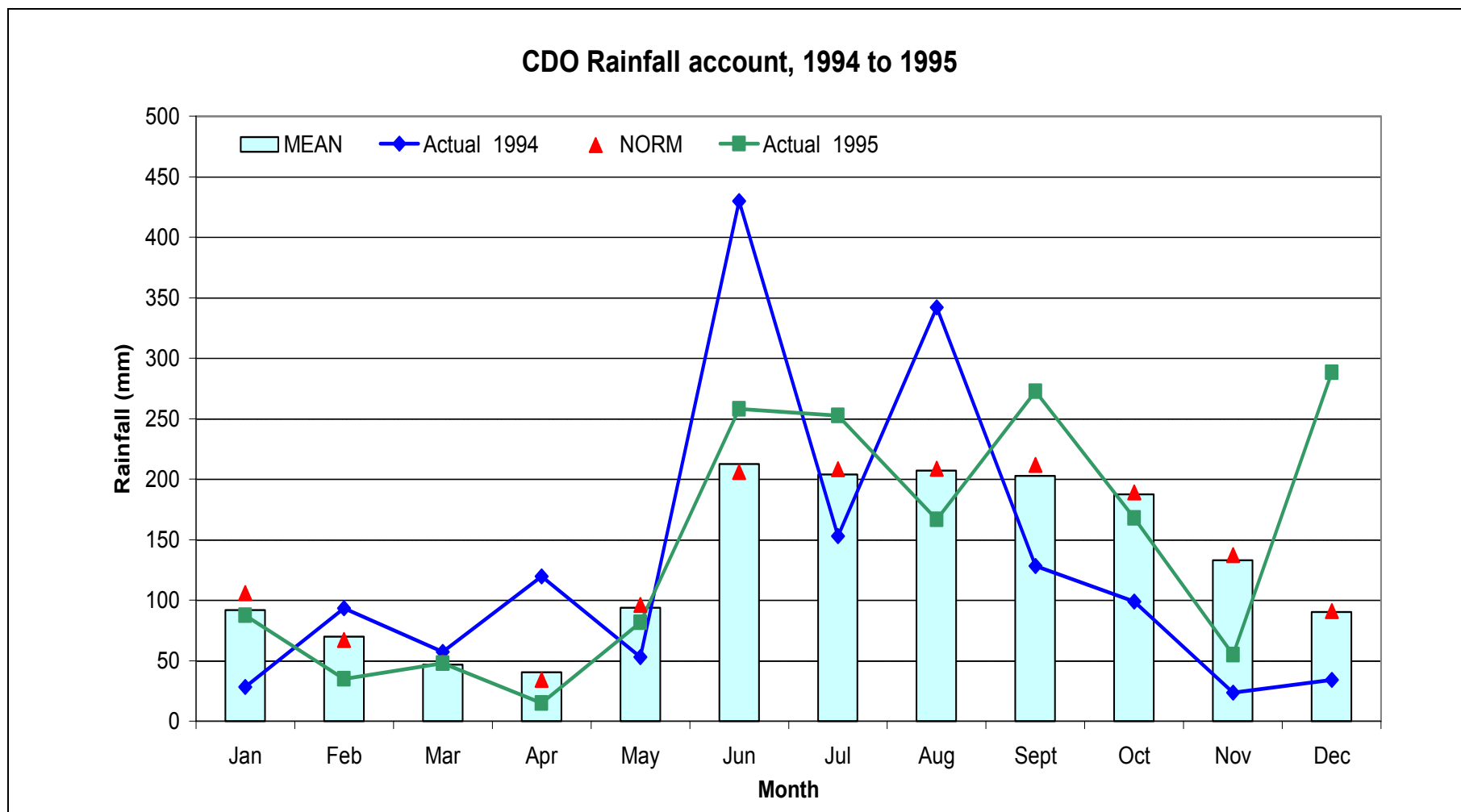
Figure 29. El Niño 1994 to 1995
Source: PAGASA, Cagayan de Oro City
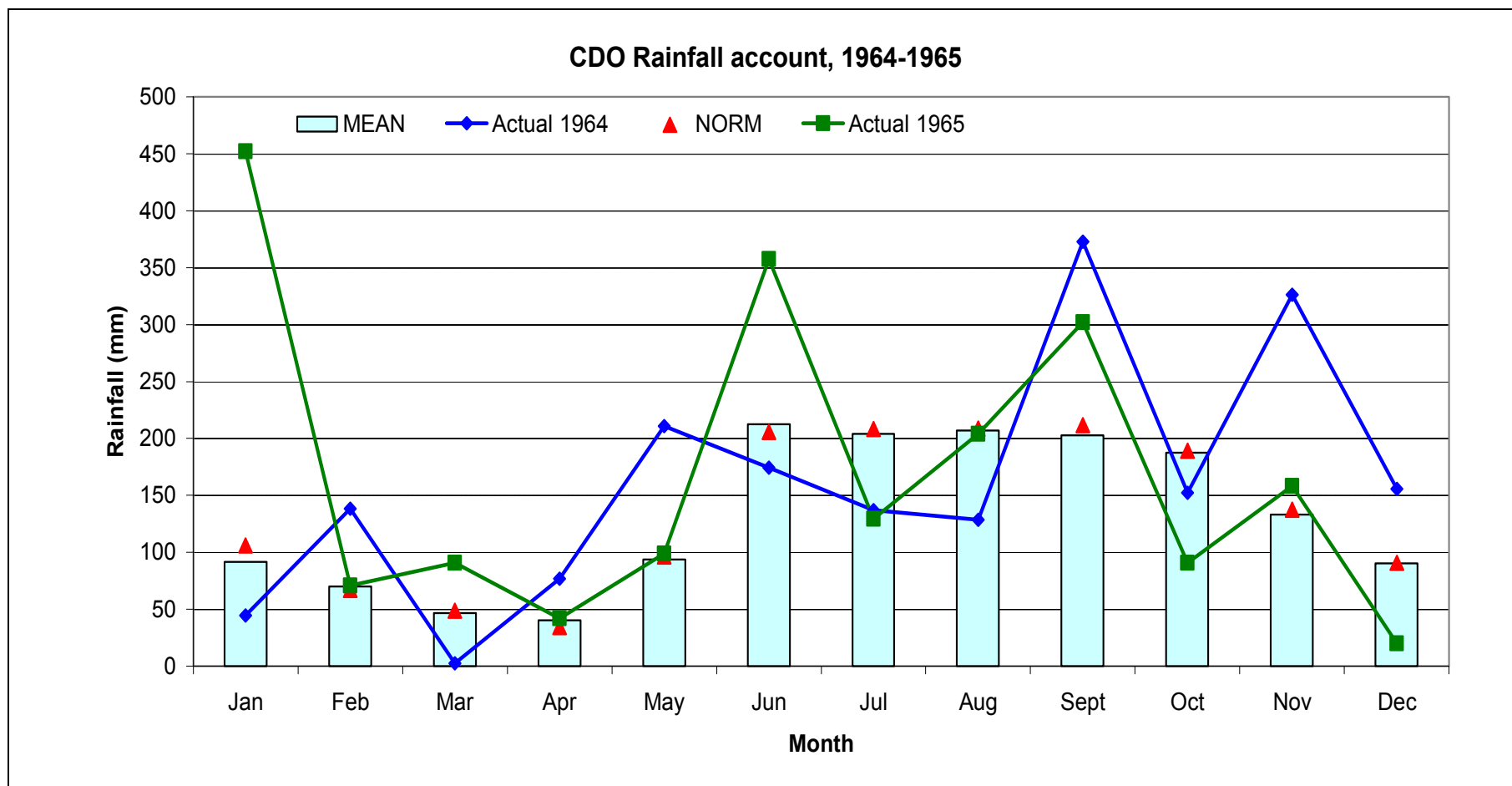
Figure 30. La Niña , 1964 to 1965
Source: PAGASA, Cagayan de Oro City
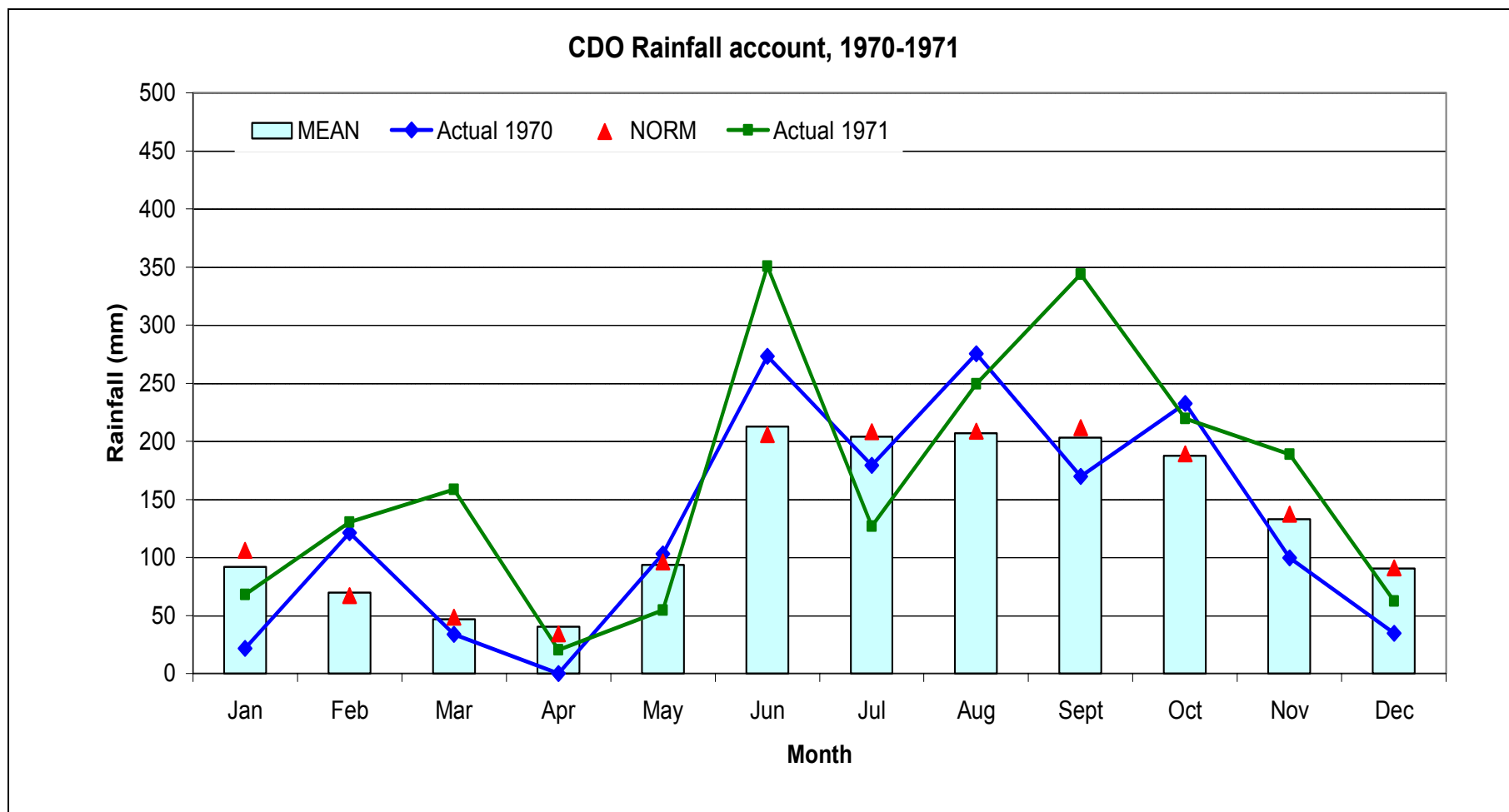
Figure 31. La Niña , 1970 to 1971
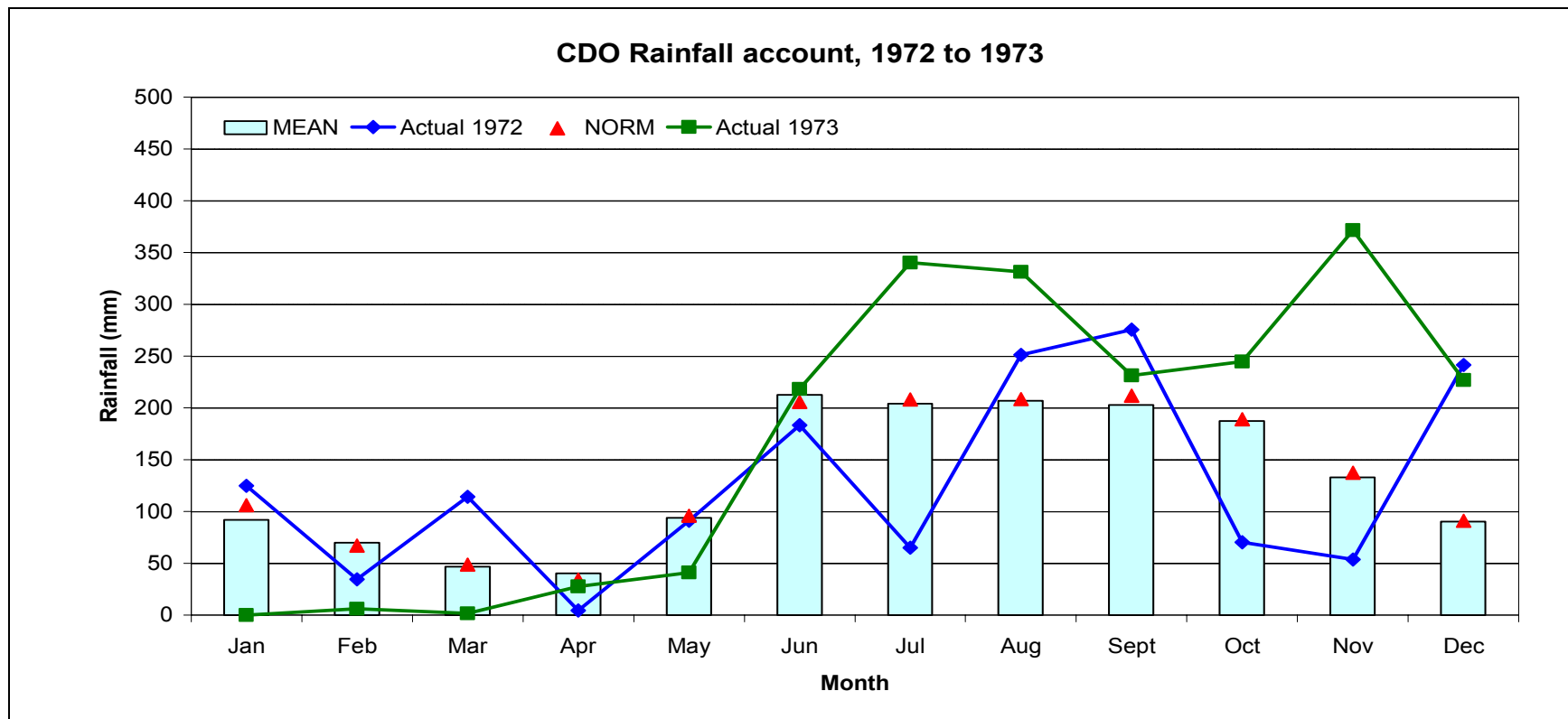Source: PAGASA, Cagayan de Oro City
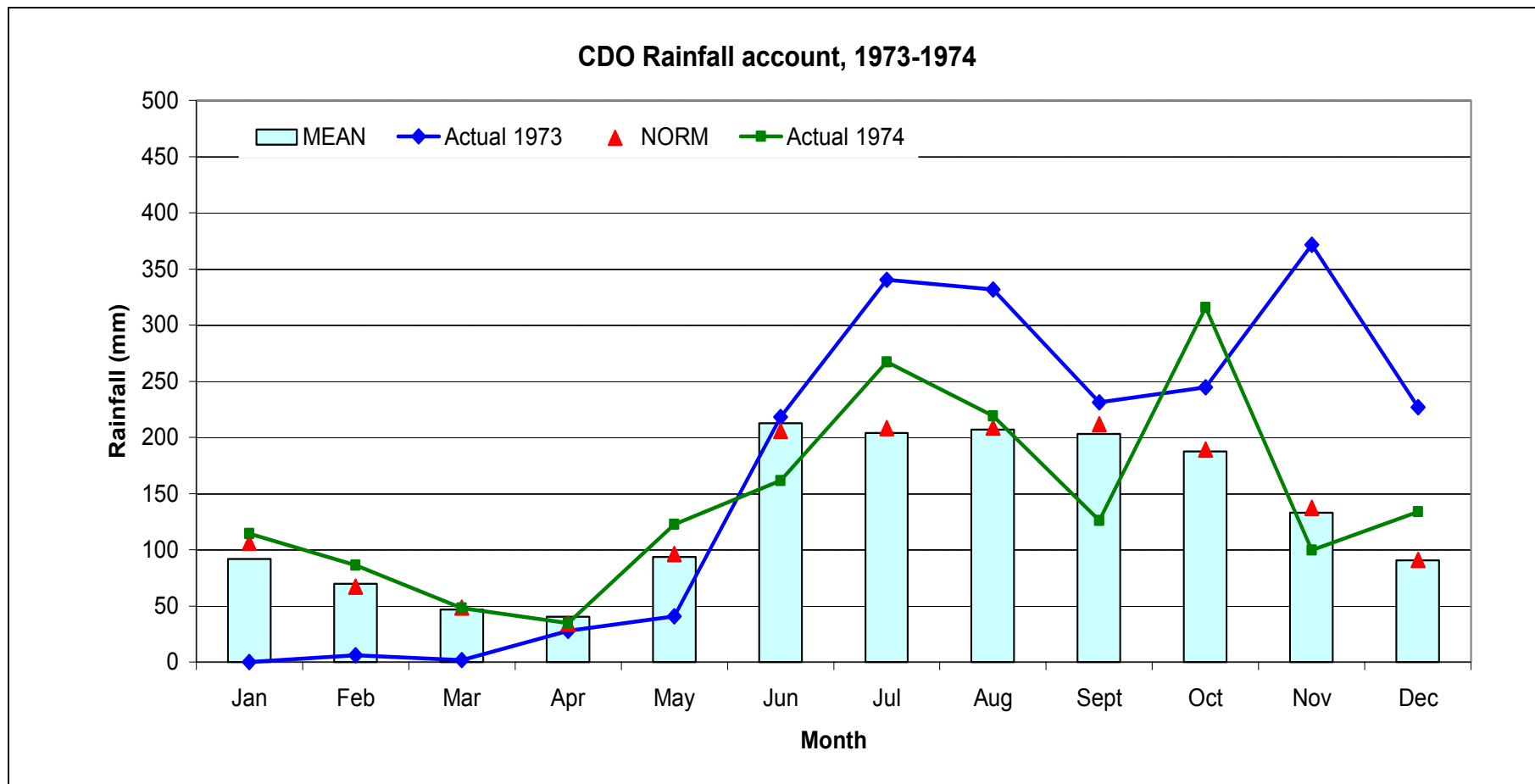
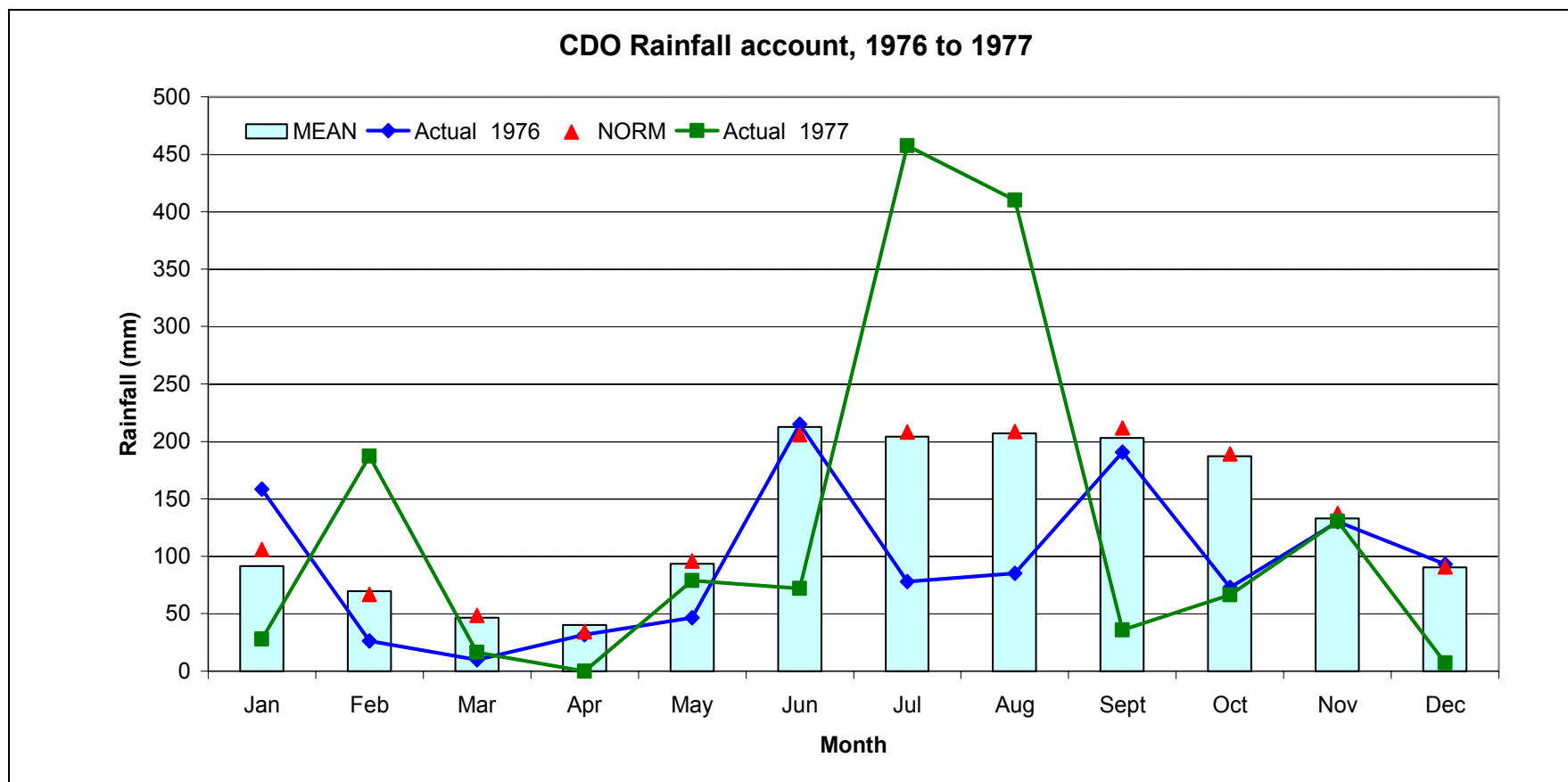Figure 32. La Niña , 1973 to 1974
Source: PAGASA, Cagayan de Oro City
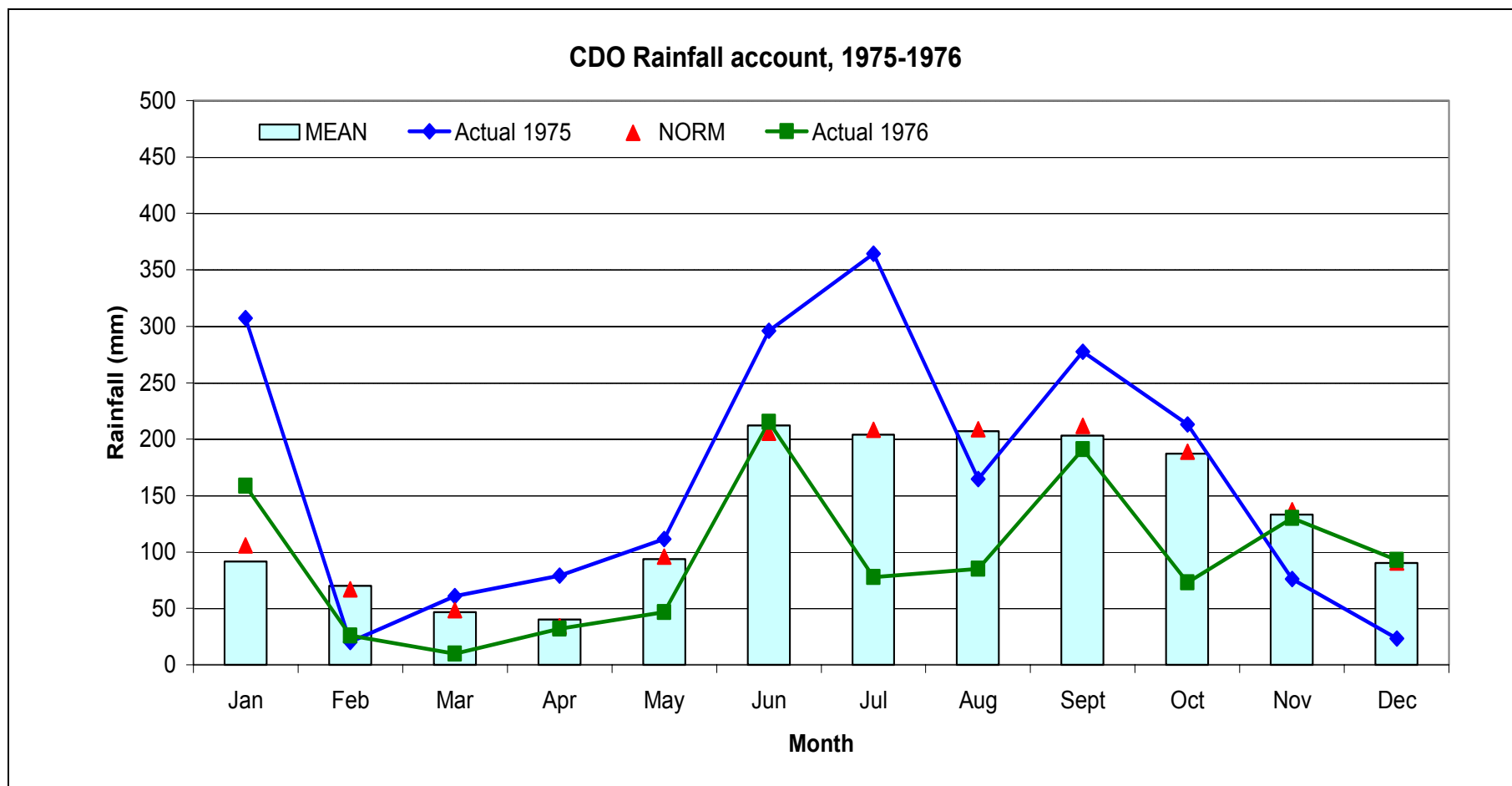
Figure 33. La Niña , 1975 to 1976
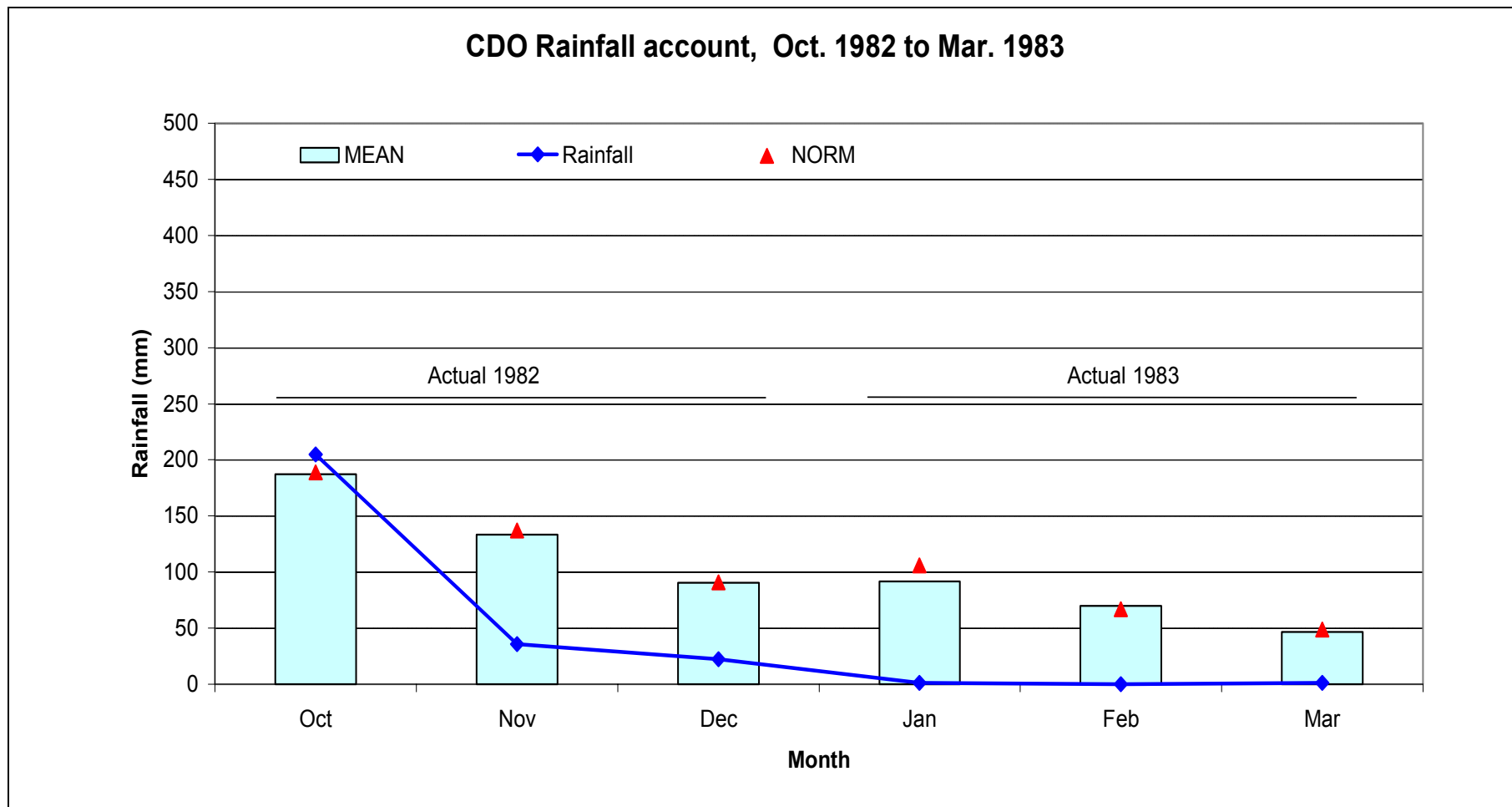Source: PAGASA, Cagayan de Oro City
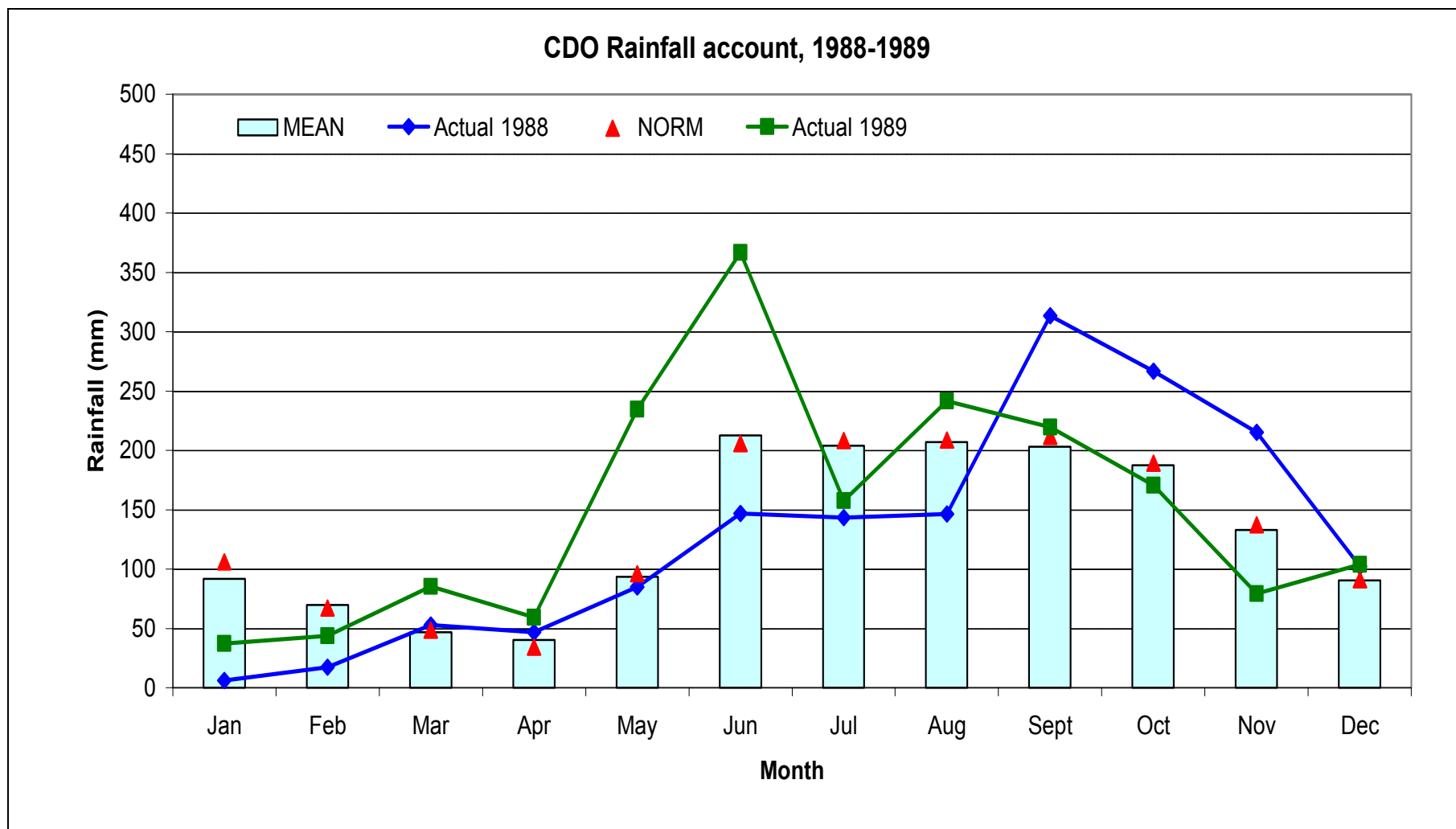
Figure 34. La Niña 1988 to 1989
Source: PAGASA, Cagayan de Oro City
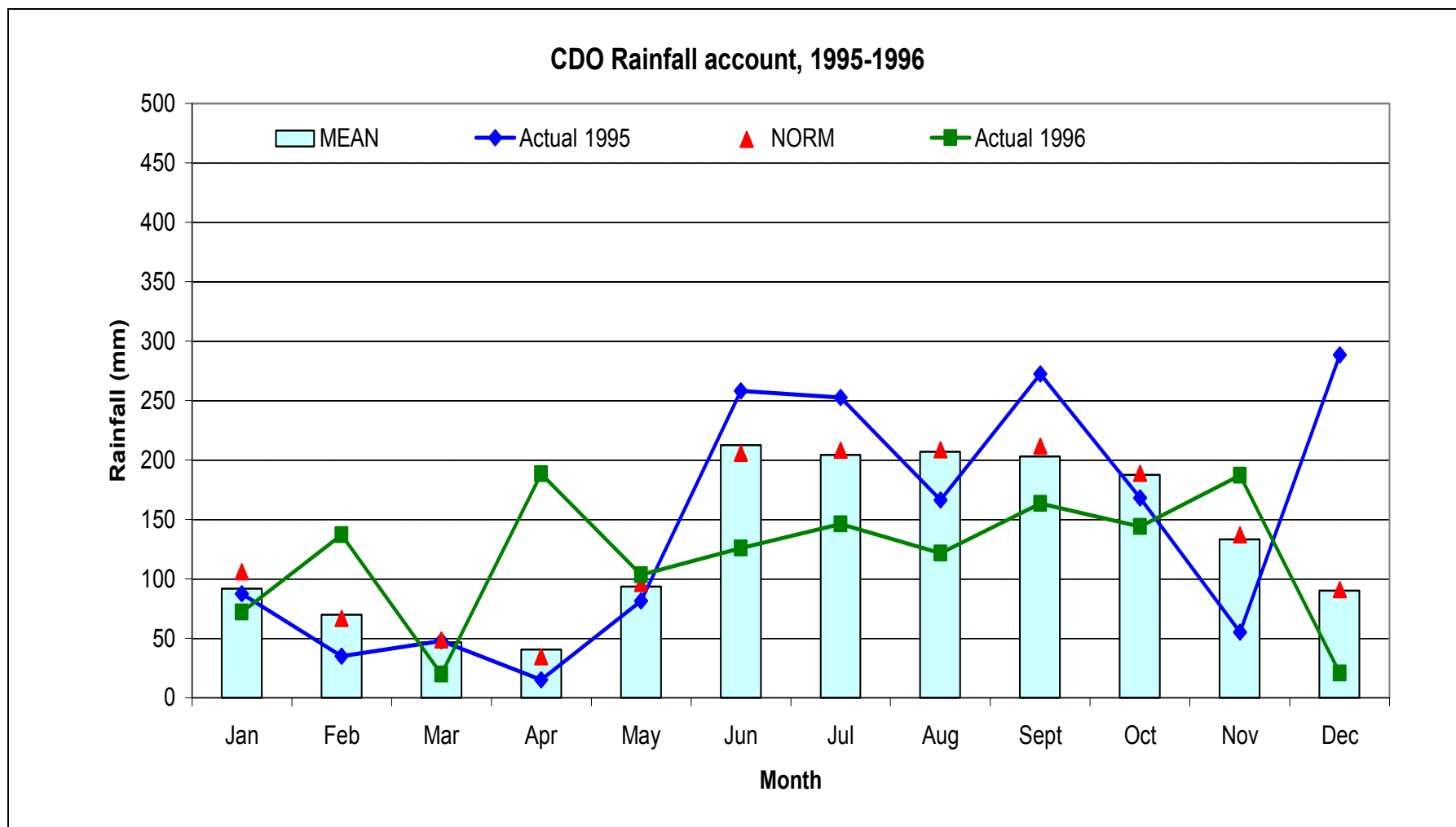
Figure 35. La Niña , 1985 to 1986
Source: PAGASA, Cagayan de Oro City

Climate variability is apparent by the rainfall accounts of Cagayan de Oro. During the El Niño and La Niña years, actual monthly rainfall accounts were compared to the mean and normal records. Only those that fell under the three consecutive months of the categories of below mean, above mean, below normal and above normal were taken. Table 15 shows the description of the rainfall account during El Niño years. Table 16 describes the rainfall data during the La Niña years.

Under the identified El Niño years, only 1991 and 1975 showed no record under the given categories. But remarkably, in 1973, the months of June to December fell on the category of having above normal and beyond mean.

During the La Niña years, actual accounts of the years 1995 and 1996 have no record of above mean and above normal. Ironically, in the years of 1964, 1973, 1989, 1995 and 1996, the actual accounts have three consecutive months below normal.

Table 15. Cagayan de Oro's Rainfall description during El Niño Years

Year/Actual	Below Mean	Below Normal	Above Normal and Mean
1968	March to July October to November	May to August October to December	none
1969	January to August October to December	January to March May to August October to December	none
1972	January to May	January to July April to July	none
1973	January to May	January to May	June to December
1976	February to May July to October	February to May July to October	none
1977	March to June	March to June September to November	none
October 1982 – March 1983	November to March	November to March	none
April to September 1983	April to June	April to June	none
October 1989 to March 1990	January to March	January to March	none
1991	None	none	none
1992	January to May	January to May	none
1993	March to August	March to August	none
1994	September to December	September to December	none
1995	None	none	none
1997	April to June October to December	April to June October to December	none none
1998	January to October	January to October	none

Table 11. Cagayan de Oro's Rainfall description during La Niña

Year/Actual	Above Mean	Above Normal	Below Normal
1964	None	none	January and August
1965	None	none	none
1970	None	none	none
1971	August to November	August to November	none
1973	January to December	January to December	January to May
1974	January to March	January to May	none
1975	March to July	March to July	none
1976	February to May	February to May	none
	July to October	July to October	
1988	March to June	March to June	none
1989	September to December	September to December	May to June
1995	None	none	January to May
1996	None	none	June to October

Community Perception on Climate Variability and Extremes

Climate when defined by the respondents is interchanged with weather. Climate variability is often associated to weather (wet and dry season). Others believed that this is a curse associated with nature "*Gaba tungod kay giabusaran ang kinaiyahan! or Balos sa pag-abusar sa kinaiyahan!* " (It is a curse because nature have been abused.). A number explained that it is the will of God "*Kabubuut-on sa Ginoo!*" Or it is a tragedy because their crops had been ruined, "*Katalagman kay nadaot ang among mga tinanum.*" Many believe that this is harmful for the environment and could also cause harm to farming activities. Several blamed the loggers. Forty-five percent answered that climate change is the change in weather. Thirty-five percent replied that it is a natural process. Some believed that climate change is harmful. A few associated it with causing sicknesses.

Most of the respondents defined El Niño as a prolonged drought. Two hundred eighty respondents (22.86 percent) answered that it is Climate Variability. Others believe that it is an event or a tragedy. Some even answered that it is a curse (Table 17). During the late 1997, El Nino was felt in Claveria and intensified during the early 1998. This was the only extreme climate that most of the communities concretely recalled. Several experiences were felt during those days. The El Niño phenomenon when asked to the respondents seemed very fresh to them. The respondents could easily recall the drought they had experienced. Some experienced cracked soil and vast erosion as the soil became so loose. This event caused the agricultural farms a big loss. The plants have withered.

The crops were damaged. Water had been scarce. When asked what had been their experiences the responses of the communities where as follows: "*Mihit ang tubig*" (Water had been very difficult); *"Nadaot ang akong mga tinanom"* (My crops were devastated); *"Nabalaka ako nga wala nako mapakaon sa akong pamilya, nadaut ang mga tinanum tungod sa grabe nga hulaw*" (I was worried my family would not get any food. There had been a great famine. All my crops were useless.); *"Nangliki ang yuta sa grabe nga kaini."* (Due to extreme heat the land cracked.)

For the effects of the past El Niño, respondents identified them based on their own experiences. Most of the respondents have crops affected El Niño (645 respondents). Others experienced severe drought (123 respondents); famine (124 respondents); flood (115 respondents); water problem (27 respondents); and death of the animals (25 respondents). Flood for the respondents mean the wearing away of the soil.

To cope with the event the respondents had to go to the river and nearby bodies of water to fetch water for their families. Nearby for them is minimum of six kilometers. *"Magsaog-ob og tubig sa suba ug bukal"* (We have to get water from the river or springs.); *"Ang LGU naghatag og rasyon sa tubig matag adlaw"* (The LGUs provided as some water rationed everyday.); *"Nadaut among mga tinanum tungod sa hulaw, busa ang among mga binuhing mananak mao na lang among gikunsumo."* (We resorted to our domestic animals like our pigs, chicken and goats.); *"Nagsalig na lang kami sa pagpalit sa among pagkaon, usahay moadto pa mi sa kasikbit nga lungsod para mopalit sa among*

kunsumo" (We depended on the market. Sometimes we have to go down to the other town to buy food.)

However, when the local government officers had been interviewed they said that it had little impact. That was the time when these officials are busy campaigning for the next election.

Figure 36. El Niño 1997 to 1998
Source: PAGASA, Cagayan de Oro City

The impact of El Niño on the agricultural sector in Misamis Oriental was widely felt. The

agricultural production was severely damaged during the last El Niño phenomenon. The

figures from the Bureau of Agricultural Statistics show that the volume of production of

both palay and corn decreased dramatically in the province of Misamis Oriental during

the years 1997 and 1998.
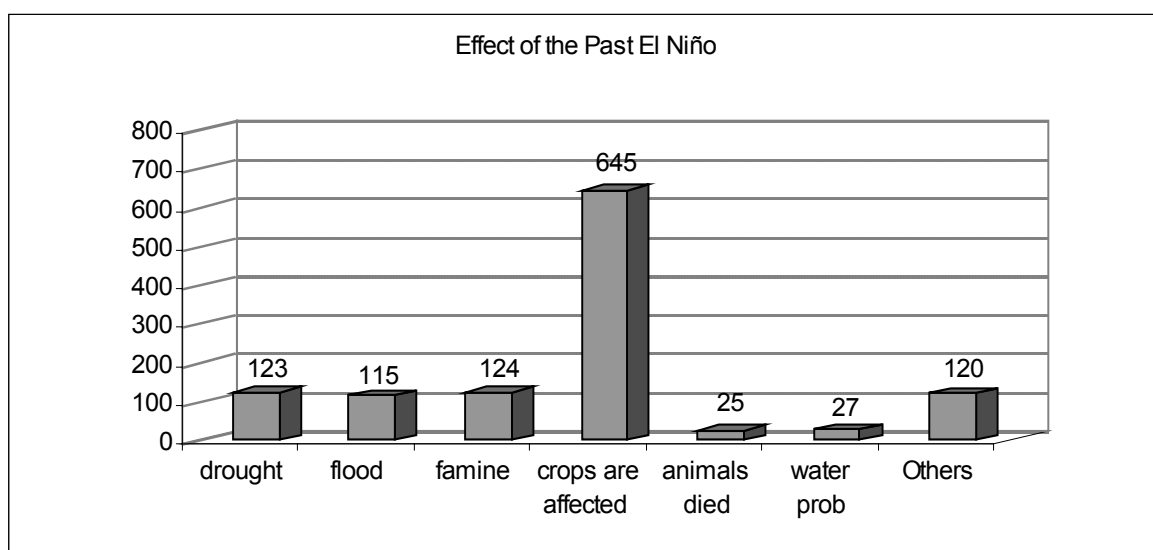
Figure 37. Effects of climate variability on the biophysical component
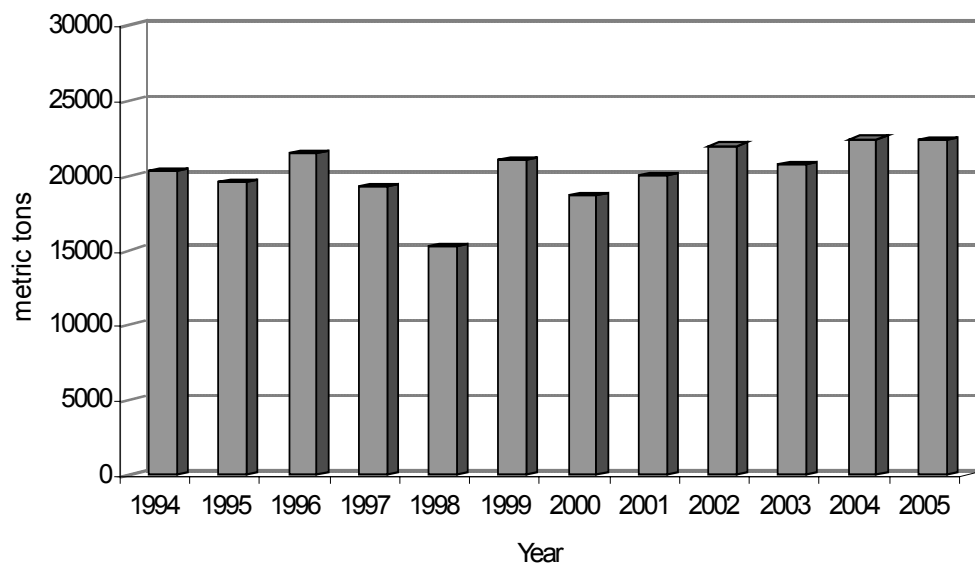
Figure 39. Volume of Palay production (metric tons) of Msamis Oriental
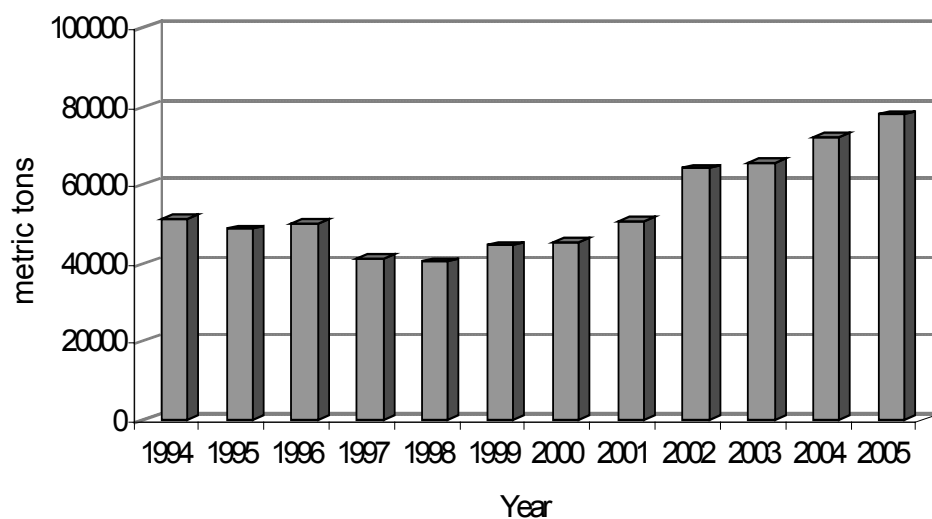
Figure 40. Volume of Corn Production (metric tons) of Misamis Oriental.

Figure 39 shows the palay production of Misamis Oriental from year 1994 to 2005. The data show an apparent reduction in volume of palay production from 21,425 metric tons in 1996 to 19,108 metric tons in 1997 continuing to decrease in year 1998 giving only 15,265 metric tons. Recovering on the following year with 21,008 metric tons.

The same trend can be seen in Figure 40 that indicates the corn production in Misamis Oriental covering year 1994 to 2005. From 49,909 metric tons on 1996, it dropped to 40,991 metric tons in 1997 and then to 40,162 in 1998. A rise in year 1999 to 44,285 was observed.

Topography, Soil Quality, Soil Erosion and Water Quality

The following section discussed the topography of, soil quality, soil erosion and water quality. To be able to conduct the study easily the elevations of the area have been divided. The barangays in Claveria are divided according to elevation. There are three categories. The first category is the lower elevation characterized by the barangays positioned at 500 masl and below. The six (6) barangays under these categories are Punong, Gumaod, Cabacungan, Plaridel, Kalawitan, and Hinaplanan. The second category is the middle elevation distinguished by being located at 501 to 950 masl. The ten (10) barangays belonging to this category are Patrocinio, Ane-I, Poblacion, Minalwang, Sta. Cruz, Madaguing, Rizal, Mat-I, Panampawan and Tamboboan. The last category is the upper elevation wherein the barangays are situated in 951 masl up. For

these categories there are eight (8) barangays involved: Luna, Lanise, Bulahan, Pelaez, Tipolohon, Parmbugas, Malagana and Aposkahoy.

Table 18 shows the soil test analysis conducted during the site survey. Soil samples are taken from various elevations. The analysis showed that the lower slope has the most of the nutrients, higher than the other two sites. This is in terms of available P, exchangeable K and the other P components. The next is the middle portion with the upper elevation the lowest values. These results seemed to indicate that the upper slopes have been affected by constant rainfall and cropping such that the nutrients from the upper slope might have moved to the lower portion of the land (Table 19).

Table 18. Soil analysis result

Elevation (masl)	Soil depth (cm)	pH	MC (%)	OM (%)	N (%)	Avail P (ppm)	Exch K (cmol)	Total P (ppm)	Org P (ppm)
500 and below	0 – 15	5.2	9.31	2.15	0.11	10.05	0.89	22.17	12.12
	16 – 30	4.8	9.65	2.03	0.11	7.22	0.84	18.45	11.23
	31 – 60	4.0	9.98	1.85	0.09	9.17	0.81	15.67	6.50
501 t0 950masl	0 – 15	4.8	10.40	2.07	0.10	8.17	0.84	13.57	5.40
	16 – 30	4.4	11.19	1.74	0.09	7.22	0.71	14.26	7.04
	31 – 60	4.0	11.64	1.57	0.07	6.98	0.69	11.35	4.37
951 and up	0 – 15	4.4	10.82	2.30	0.12	9.57	0.67	17.19	7.62
	16 – 30	4.4	10.29	2.11	0.11	6.54	0.59	12.52	5.98
	31 – 60	4.0	10.61	1.65	0.09	5.22	0.56	11.07	5.85

The results showed that K is high, pH ranges from strongly acidic (5.1 to 5.5) to extremely acidic (below 4.5). This is a normal characteristic of Jasaan clay. Organic Matter (OM) is low (1 to 2) to medium (2.1 to 4.2). Total N ranges from very low (0.60) to low (0.095 to 0.125). Notice that Total N is decreasing as the elevation and depth goes down. This is a fertilizer scenario. Bray is used to get the Available P because the soil characteristic is acidic. Available P is low having value less than 10. Based from the previous studies of Agus (1994) and Mamaril (1984), the soil characteristics of Claveria have improved Potassium. Bray (Avail P) is almost the same with reference to the study of Mamaril and Agus. Total N is decreasing in the horizon but almost the same. K is present at the topsoil (Table 18).

Table 19. Community Elevation

Elevation (masl)	Barangay	Elevation Category
500 and below	Cabacungan	Lower
	Gumaod	
	Hinaplanan	
	Kalawitan	
	Plaridel	
	Punong	
501 to 950	Ane-I	Middle
	Madaguing	
	Mat-I	
	Minalwang	
	Panampawan	
	Patrocinio	
	Poblacion	
	Rizal	
	Sta. Cruz	
	Tamboboan	
951 and up	Aposkahoy	Upper
	Bulahan	
	Lanise	
	Luna	
	Malagana	
	Parmbugas	
	Pelaez	
	Tipolohon	

Soil Erosion as a Hazard

Table 20. Soil loss tons per hectare Claveria, Misamis Oriental.,
Apr 1993 to April2000

	Year1	Year2	Year3	Year4	Mean
Open Field	39.88	37.61	25.05	349.41	112.99

	Rainfall (mm)
Year 1: Apr 1993 - Mar 1994	2062
Year 2: Feb 1994 - Jan 1995	2064
Year 3: Feb 1995 - Jan 1996	1971
Year 4: May 1999 - Apr 2000	5084

Source: Mercado 2000

The table above showed how Claveria is experiencing substantial soil loss. The study was done from year 1994 to 2000. The data indicated the significant correlation between the amount of rainfall and extent of soil erosion. On the 3rd year, has the least amount of rainfall with the least amount of soil erosion. The annual soil loss in these particular years ranges from 25.05 to 349.41 tons per hectare. This gave a mean of an annual soil erosion loss of 112.99 tons per hectare.

Figure 41 shows that the study site has a problem on their soil. Seventy-six percent of the respondents answered that they are encountering soil erosion problems while only 24 percent said they are not experiencing it. According to the respondents, their crop yields are low and consequently have lower income because of soil erosion (Fig 42).
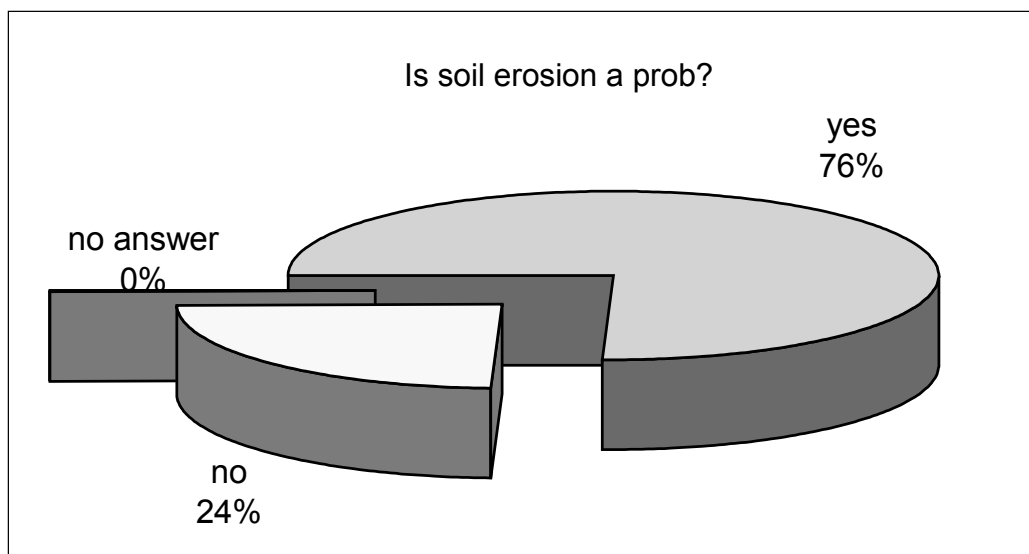
Figure 41. Is soil erosion a problem?
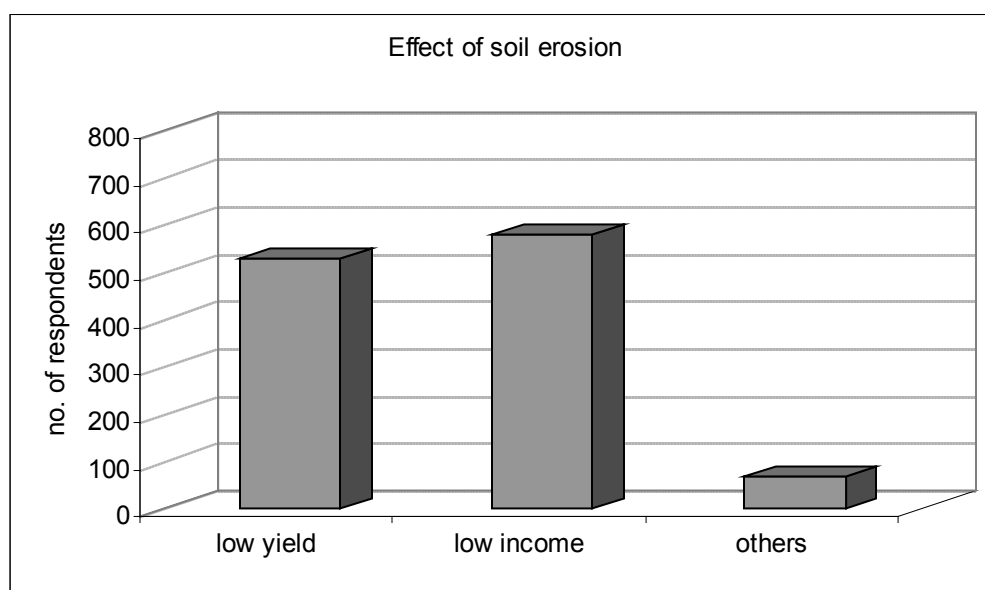
Figure 42. Effects of soil erosion

Water Quality

Water analysis was conducted to assess the water quality of the main water source which is the Cabulig River. The result of the water test analysis is shown in Table 14. Water samples were collected from three sampling sites. Air temperature, water temperature, average water flow, nitrate, phosphate, dissolved oxygen, pH and trace elements are standard parameters in assessing the water quality. In the upper level of the Cabulig River Man-ibay was selected, Luna for the middle portion and Jasaan (next Municipality) for the lower part (map is a good way to shopw sampling points). Table below shows that the water of Cabulig River contains no zinc and manganese. Only small amounts of iron and copper were detected. Water pH ranges from 7.5 to 8. Due to lack of data for comparison the data below served as baseline information. Basically, the results show that the water quality of Cabulig River was in good condition (Table 21).

Table 21. Result of the water sample analysis

Time conducted	Site	Elevation	Width (m)	Average Water flow (in/min)	Turbidity	Air temp (C)	H$_2$O temp. (C)	Nitrate (mg/ml)	Phosphate (mg/ml)	Dissolved Oxygen (mg/L)
10:00 AM	Man-ibay	Upper	17.83	2.836	<10	25	20	0.45	0	8
2:30 PM	Luna	Middle	17.64	3.181	<10	25	22	0.4	0	7.6
9:30 AM	Jasaan	Lower	40.5	2.356	12	26	24	0	0.25	7.8

Barangay	Fe (ppm)	Zn (ppm)	Cu (ppm)	Mn (ppm)	Water pH
Luna	0.06	-	0.02	-	8.0
Man-ibay	0.12	-	0.02	-	8.0
Jasaan	0.32	-	0.01	-	7.5

- not detected

Impacts of Landcare Technologies

Claveria due to its topography, soil quality and patterns of precipitation is experiencing major problem of erosion. Rainfall carries the loose soil down slope soil erosion. The soil problem brought different kinds of problems in the communities like reduced crop yield resulting to food shortage and lower income. The continuing dilemma needs to be addressed so farmers can cope up with the conditions successfully. Hence, installation of adaptive measures is necessary. The IPCC defined adaptive capacity as the ability of a system to adjust to climate change, including climate variability and extremes, moderate potential damages, take advantage of the opportunities, or cope with the consequences. Landcare is an approach to address these conditions.

The following sections report the findings of the analysis to determine the impacts of Landcare on community well being. The type of technologies and adoption were identified. From the interviewed respondents 52 percent are Landcare members while 48 percent are not.

Community Perceptions on Landcare and its Impacts

The majority of the respondents who have joined Landcare said that the main reason why they joined is to learn the technologies (92.70 percent). Others are encouraged by the trainings and seminars conducted by Landcare (40.91 percent). Livelihood programs seem attractive for about 23 percent. Landcare facilitators are good as claimed by almost 16 percent. Roughly 15 percent are attached for networks, friendships and the like.

In the area respondents were asked on their knowledge about Landcare. For them Landcare: provides technical assistance like soil and water conservation, agro forestry, natural resource management, seed technology and others (69.88 percent); conducts trainings and seminars (63.76 percent); conducts cross site or field visits (40.47 percent); establishes nursery (38.82 percent); forms groups (23.17 percent); provides micro-financing (17.53 percent); institutional facilitators (14.59 percent); serves as networkers (11.17 percent); and conducts farm-based researches (4.7 percent).

Farmers who adopted Landcare technologies have varied reasons for adoption: about 70 percent said that with the Landcare technologies their soil condition has improved; 56 percent believed that it helped them increase their income; 44 percent that yield have been increased. On the other hand, 57 percent adopted the technologies for future benefits.

Table 22 shows the Landcare technologies adopted by the respondents are: Agroforestry (49 percent); Soil and water conservation (43 percent); composting (33 percent); management (22 percent); NVS (6 percent); and seed technology and nursery and contour farming (3.52 percent).

Table 22. Community Perceptions on Landcare

	No. of Respondents	Percentage (%)
Reasons in Joining Landcare		
Learn technology	788	49.4
Livelihood program	194	12.2
Trainings and seminars	348	21.8
Facilitators are good	132	8.3
For social capital	122	7.6
Others	12	0.8
	1596	**100**
What Landcare does?		
Provides technical assistance	594	24.5
Conducts trainings/seminars	542	22.4
Conducts cross site/field visits	344	14.2
Establish nursery	330	13.6
Forms groups	197	8.1
Provide microfinancing	149	6.2
They are Institutional Facilitators	124	5.1
Serve as networker	95	3.9
Do farm-based research	40	1.7
Others	6	0.2
	2421	**100**
Why Adopt Landcare Technology?		
Improves soil condition	598	32.3
Increases my income	478	25.9
For future benefits	485	26.2
Increase my yield	273	14.8
Others	15	0.8
	1849	**100**
Landcare Technologies Adopted		
Agroforestry	417	31.0
Soil and water conservation (SWC)	366	27.2
Composting	283	21.0
Seed tech & nursery mgt	183	13.6
Natural vegetative filter strips (NVS)	49	3.6
Contour farming	30	2.2
Others	17	1.3
	1345	**100**

Landcare Members and their Farm

Photo by: J.D.Villanueva (November 2006)

Photo by: J.D.Villanueva (November 2006)

Plate 17. Claveria Landcare Association (CLCA) Board of Directors

Plate 18. Mr. Judito Joban's farm

Photo by: J.D.Villanueva (November 2006)

Photo by: J.D.Villanueva (November 2006)

Plate 19. Landcare Member's farm

Landcare Impacts on the Environment

The type of agroforestry systems adopted by the respondents are: planting trees (72.11 percent); boundary planting (59.76 percent); home garden (19.52 percent); interplanting (14.35 percent); woodlot (7.17 percent); taungya (2.70 percent); parkland and multi-story (almost 1 percent).

With agroforestry, respondents said that they observed that their soil condition has improved (66.47 percent), water condition is better (61.05 percent) and there is increase in crop yield (34.58 percent). However, almost percent said that they have not observed any difference at all (Table 23).

Table 23. Agroforestry system

	No. of Respondents	Percentage (%)
Type of Agroforestry Adopted		
Planting trees	613	40.2
Boundary planting	508	33.3
Homegarden	166	10.9
Interplanting	122	8.0
Woodlot	61	4.0
Taungya	23	1.5
Others	17	1.1
Parkland	8	0.5
Multistorey	6	0.4
	1524	**100**
Observed difference after having Agroforestry		
Improved soil condition	565	26.0
Improved water condition	519	23.9
Improved weather	560	25.8
Increase in yield	294	13.5
Increase in seed stocks	184	8.5
No change	20	0.9
Others	30	1.4
	2172	**100**

Impacts of Landcare on Claveria's Agricultural Landscape

T-test is used in comparing the mean before and after the adoption of Landcare technology. This test was expected to indicate whether the changes in the variables favorable or not. The test was used to examine the following hypothesis: Landcare helps in improving the soil quality, water quality, soil quantity, water quantity, water problems, soil problems, health, income, crops, trees, seeds and lastly human health.

> Ho: LC Technology did not help improve the **_variables_**. (soil/water quality/
>
> quantity, etc)
>
> Ha: LC Technology helped improve the said **_variable._**

The decision rule is reject Ho if (p-value/2) < alpha at 5 percent level of significance. Table 24 showed the results of the T-test. Since most of the variables are less than the level of significance (α), then we rejected Ho. This means that LC and its technology helped improving the said variable(s).

Table 24. Paired Samples Test (T-test)

Pair	Code	Variables (Before and After Adoption)	Sig. (2-tailed)
1	SQLBLC – SQLAFLC	Soil Quality	0
2	WQLBLC – WQAFTLC	Water Quality	0
3	SQNBLC – SQNAFLC	Soil Quantity	0.045
4	WQNBLC – WQNAFRLC	Water Quantity	0.006
5	WPROBLC – WPROBALC	Water Problem	0.001
6	SPROBBLC – SPROBALC	Soil Problem	0
7	HEALTHB – HEALTHA	Health	0
8	INBEF – INAFT	Income	0.016
9	CROPB – CROPA	Crop	0.932
10	TREESB – TREESA	Trees	0
11	SEEDB – SEEDA	Seed	0.028

The test on the crop as a variable before and after adopting Landcare technologies (Pair 9) failed to reject Ho. This is because the communities are still planting the same crops e.g corn, rice although the farming practice is not the same as before. For example, in the area the old practice of monocropping is being discouraged. The communities alter the crops and use crop variation by integrating other crops and trees. This decision consequently helps in improving the variables such as soil quality, water quality, soil quantity, water quantity, water problem, soil problem, health, income, trees and seeds except for the crops.

Correlation

The t-test proves that Landcare has significant effects on the communities of Claveria. Key Informant (KI) indicated that Landcare seemed to play a very important factor in the adaptive capacity of the communities in Claveria to climate variability. Pearson Correlation test was to verify if Landcare has indeed significant relationship to the climate variability. The test used the following variables (1) Landcare membership; (2) climatic condition; (3) drought measures; (4) measures of extreme temperatures; and (5) adoption of Landcare technologies. The Landcare technologies the respondents adopted were (1) natural vegetative strips; (2) soil and water conservation; (3) seed technology and nursery management; (4) Agroforestry; (5) composting; (6) contour farming and (7) others.

The results showed that at the 2-tailed test at 99 percent confidence interval, drought measures have significant relationship to teaching technologies, e.g. AF, SWC, etc; giving information about climate variability; (4) giving the community information on how to protect the environment. At 95 percent confidence interval (2-tailed), drought measures has significant relationship with planting trees. For the temperature measures it has significant relationship at the (2-tailed test) 99 percent confidence interval to: teaching technologies such as AF, SWC, etc; planting trees; giving information about climate variability; giving the community information on how to protect the environment; seed technology and nursery management; composting. Temperature measures have significant relationship at the 99 percent confidence interval (2-tailed) to planting trees; other Landcare services and contour farming.

At the 2-tailed test, 99 percent confidence interval, adoption of Landcare technologies has significant relationship to the variables such as teaching technologies e.g. AF, SWC, etc; planting trees; giving information about climate variability; giving the community information on how to protect the environment; soil and water conservation; seed technology and nursery management; Agroforestry; and composting.

At the 2-tailed test, 99 percent confidence interval, the adoption of Landcare technologies has significant relationship to natural vegetative strips. Landcare membership has significant relationships to the following: variables teaching technologies such as AF, SWC, etc; planting trees; giving information about climate variability; giving the

community information on how to protect the environment; soil and water conservation; seed technology and nursery management; agroforestry; and composting.

The result showed that there is significant relationship between the drought measures of the communities and Landcare services. The extreme temperature measure is significantly correlated with the activities of Landcare such as: planting trees preparing the farm e.g. contour farming (1- percent level of significance). Also at 95 percent confidence interval, extreme temperature measures are correlated to Landcare activities through teaching technologies such as AF, SWC, etc; planting trees, and giving information about climate change. In addition, extreme temperature measures are correlated to the Landcare technology adopted such as seed technology and nursery management; and composting (Table 25).

Table 25. Pearson Correlation

	LCTRU1 teaching tech	LCTRU2 SWC	LCTRU3 Seed tech nursery mgt	LCTRU4 Agroforestry
DROUGHT MEASURE				
R	0.115**	0.091*	0.115**	0.115**
Sig(2-tailed)	0.002	0.012	0.002	0
N	755	755	755	755

	LCTRU1 Teaching Tech	LCTRU2 plant trees	LCTRU3 Give Climate variability info	LCTRU4 Give info on How to Protect the envt	LCTRU5 Others	LCTECH A3 Seedtech_nursery mgt	LCTECH A5 composting	LCTECH A6 Contour farming
TEMPERATURE MEASURE								
R	0.127**	0.11**	0.182**	0.220**	0.103*	0.123**	0.307**	0.221*
Sig(2-tailed)	0.003	0.009	0	0	0.014	0.004	0	0
N	563	563	563	563	563	555	555	554

** Correlation is significant at 0.01 level
*Correlation is significant at 0.05 level

Adaptive Capacity and Resiliency Assessment

Table 26. Stresses in Claveria and adaptation measures

Stress	Adaptation Measures
Extreme (High) Temperature	Irrigation
Drought	Soil and water conservation
Soil erosion	Adoption of:
	• NVS
	• Contour farming
	• Agroforestry
	• Trash Bunding
	• Soil and water conservation
	• Ridge Tillage
Poor soil characteristics	Agroforestry (depends on the tree e.g. nitrogen fixing)
	Land preparation
	Composting
	Mulching

The table above shows the stresses and adaptation measures of Claveria from the surveys and key informant interviews. During extreme temperatures the communities make water irrigation and adopt soil and water conservation. To prevent soil erosion, several methods are used: NVS, contour farming, agroforestry system (esp. tree planting), trash bunding in which farm remains serves as contours, soil and water conservation, and ridge tillage or shortened land preparation reduces plowing. Agroforestry, land preparation, composting, and mulching are being done to the soil to improve the soil characteristics. Widespread adoption of agroforestry is the ultimate goal of Landcare, agricultural crops are combined with trees. The agroforestry system provides short-term and long-term benefits through the income it can potentially generates over time.

Table 27. Claveria hazards and adaptation responses

	Previous	Existing
Adaptation response	Through farmers observation (seasonal change)	Responsive: assisted and facilitated
Hazards	Severe soil loss, extensive rainfall	(controlled) Soil erosion, extensive rainfall
Actors	IRRI, Farmers, LGUs	Landcare primarily and the government, POs, farmers (Landcare triadic approach)
Mechanism to enhance adaptive capacity	SALT Livestock Production	Landcare technologies (e.g. NVS) and services (e.g. seminars, workshops, building social-capital) Coordination of Landcare, the Government, POs, farmers Dissemination of information (environment related)
Coverage	Selected farmers/communities	Claveria communities except for Bulahan and Minalwang

Prior to 1996, Claveria communities' adaptation measures to soil problems are based on the farmers' observation. The International Rice Research Institute (IRRI) promoted the Sloping Agricultural Technology. IRRI introduced hedgerow farming using leguminous tree species such as napier, madre de cacao, etc. among selected farmers of Claveria. The centerpiece of Landcare is the idea that soil problems should be addressed. Assistance and services such as workshops seminars and training were conducted with the participation of LGUs, POs, the farmers themselves and the whole communities. Landcare provided technical facilitators in the area. Unlike SALT, Landcare was able to encompass the whole communities of Claveria except for Bulahan and Minalwang. Bulahan is one of the areas with insurgency problem. The head of the community of Bulahan has not been supportive of the ideas of Landcare. Minalwang on the other hand is inaccessible and is home to the tribal groups known as the Higao-onon. This group is very protective of their culture. The old indigenous practice of farming is ubiquitous and in general fear cultural intrusion.

Climate Variability Vulnerability Assessment

 In order to asses the vulnerability of the area, the type of the system that the area has had been analyzed. This is by examining the socio-economic and biophysical condition of the area. The assessment based on the food, water, livelihood, and health indices.

Descriptive statistics was done to get the basic information such as: age, ratio of population size to land area, educational attainment, occupation, household size, average income per month, average monthly savings, land tenure, type of house and farming land, slope of the land, farm size, and area of farm cultivated. Also the annual crops planted, type of trees and other crops, animals, seed stock, farm yield, farm practices had been taken into account. The accessibility in the service road, market, municipal's office, local and main source of water, hospital, and health facilities on the area had been solicited. Other questions include: causes of family's sicknesses, organization, water usage, measures during water difficulties, measures during increase or decrease of temperature, perspectives on climate variability and El Niño, water demand, soil characteristics and population in each community.

The generated mean (average) was used to have a generalization of the area. Using the means of each community the social and economic aspects are examined on the levels of food availability, water demand, livelihood situation, health condition and accessibility. For biophysical component, soil quality, soil problems and water use are taken into

consideration. The climate variability impacts, its level of awareness and their adaptive measures are also part of this assessment. Ranking includes 1 (low), 2 (moderate), and 3 (high).

In general, the study showed that Claveria is moderately vulnerable to climate variability. Prioritization however showed that barangays of Gumaod, Madaguing, Panampawan, Punong, Plaridel, Poblacion, Patrocinio, and Cabacungan are in the low level of priority. Barangays from Sta. Cruz, Luna, Mat-I, Rizal, Kalawitan, Hinaplanan, Malagana, and Pelaez are in the moderate level of priority. While, barangays from Ane-I, Parmbugas, Lanise, Tamboboan, Aposkahoy, Bulahan, Tipolohon, and Minalwang are in the high level of priority (Table 28).

Table 28. Result of the vulnerability assessment of Claveria, Misamis Oriental to Climate
Variability.

Barangay	Mean Value	Rank (1,2,3)	Level
Gumaod	1.60	1	Low
Madaguing	1.66	1	Low
Panampawan	1.72	1	Low
Punong	1.74	1	Low
Plaridel	1.80	1	Low
Poblacion	1.81	1	Low
Patrocinio	1.83	1	Low
Cabacungan	1.83	1	Low
Sta. Cruz	1.87	2	moderate
Luna	1.88	2	moderate
Mat-I	1.89	2	moderate
Rizal	1.89	2	moderate
Kalawitan	1.93	2	moderate
Hinaplanan	1.95	2	moderate
Malagana	1.96	2	moderate
Pelaez	1.97	2	moderate
Ane-I	1.98	3	High
Parmbugas	1.98	3	High
Lanise	1.99	3	High
Tamboboan	2.02	3	High
Aposkahoy	2.03	3	High
Bulahan	2.06	3	High
Tipolohon	2.15	3	High
Minalwang	2.26	3	High

Over-all
assessment: 2   **Moderate**
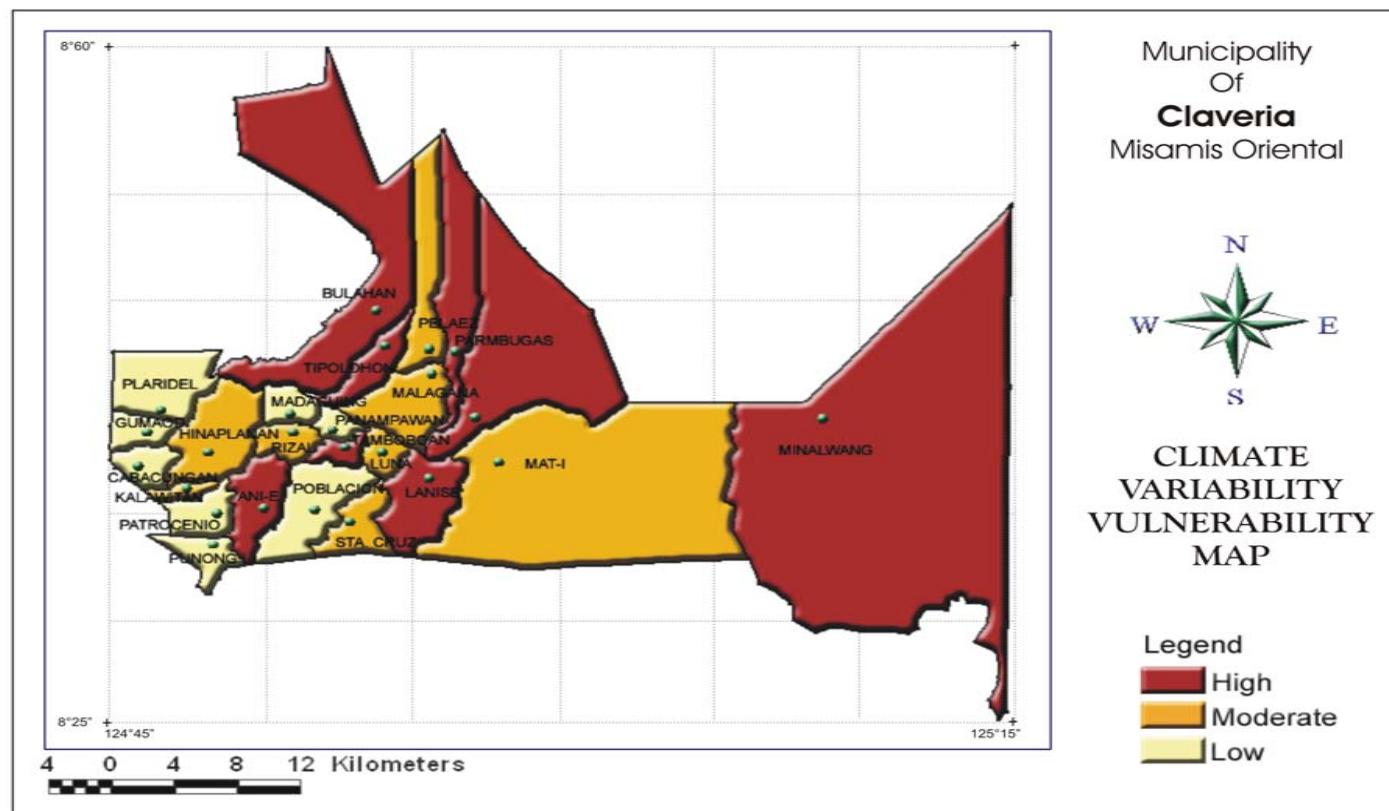
Figure 43. Climate Vulnerability Map of Claveria

The level of vulnerability in each index was computed as well. The variables identified in each index are extracted from the climate variability factors and rank. Each index was treated using same weight. Multipliers were generated using this formula:

Multiplier: 100% ÷ total number of variables

And to generate the assessment, this formula was applied:

Vulnerability: total rank computed x 100%

Food Vulnerability

The multiplier used for the food vulnerability index is 5.88. The variables used are: sex, age, educational attainment, household size, average income, monthly savings, farm size, farm average area cultivated, crops, main crop, number of trees, animal quantity, seed stock, yield, farm practices and elevation. It shows that Ane-I, Malagana, Madaguing, Mat-I, Gumaod, Bulahan, Cabacungan, and Parmbugas are in the low level. In the moderate level the barangays under are Patrocinio, Hinaplanan, Punong, Panampawan, Luna, Kalawitan, Sta. Cruz, and Poblacion. For the high level there are the barangays of Plaridel, Rizal, Minalwang, Aposkahoy, Lanise, Tamboboan, Tipolohon, and Pelaez (Table 29).

Livelihood Vulnerability

The livelihood vulnerability index used the following variables: sex, age, educational attainment, household size, average income, monthly savings, land tenure, farm size, farm average area cultivated, crops, main crop, number of trees, animal quantity, seed stock, yield, farm practices, type of agroforestry systems adopted, distances from the service road, market and municipal office, drought measures, high temperature measures, soil problem, water demand and elevation, and 3.84 as multiplier. The result showed that Mat-I, Madaguing, Gumaod, Ane-I, Cabacungan, Pelaez, Malagana, and Patrocinio are in the low level. Sta. Cruz, Luna, Kalawitan, Rizal, Plaridel, Hinaplanan, Bulahan, and Panampawan are in the moderate level. The barangays that are in the high level are Poblacion, Lanise, Parmbugas, Tamboboan, Minalwang, Aposkahoy, Tipolohon, and Punong (Table 32).

Health Vulnerability

For the health vulnerability index, variables used were: sex, age, educational attainment, household size, average income, monthly savings, distances from the service road, local source of water, hospital, nearest medical services, sicknesses, causes of sicknesses and elevation. The multiplier is 7.6923. Findings present barangays Panampawan, Gumaod, Cabacungan, Ane-I, Rizal, Pelaez, Poblacion, and Kalawitan are in the low level. The barangays in the moderate level are Hinaplanan, Madaguing, Lanise, Luna, Punong, Sta. Cruz, Patrocinio, and Mat-I. High level are recognized in the barangays of Malagana,

Plaridel, Parmbugas, Aposkahoy, Tipolohon, Bulahan, Minalwang and Tamboboan (Table 31).

Water Vulnerability

The assessment using water vulnerability index revealed that Gumaod, Panampawan, Pelaez, Cabacungan, Bulahan, Kalawitan, Punong, and Luna are in the low level. In moderate level barangays Poblacion, Lanise, Rizal, Parmbugas, Madaguing, Malagana, Plaridel, and Aposkahoy were identified. High level are seen on the barangays of Ane-I, Minalwang, Sta. Cruz, Tipolohon, Hinaplanan, Tamboboan, Patrocinio, and Mat-I. Sex, age, educational attainment, household size, average income, monthly savings, daistnces from the local and main sources of water, water quality, measures when encountering water problems, water demand and elevation are the variables used in the water index. The multiplier is 8.33 (Table 30).

Table 33 and 34 shows summary while Table 35 shows the correlation of the vulnerability indices. All of the indices (food, water, health and livelihood) showed positive correlation to the climate variability. This means that a certain increase in the level of each index might imply an increase on the level of the climate variability. Each index showed positive correlation with each other. This implies that the increase in the level of the given index would correspond to an increase in the level of another index. The table shows that water has significant relationship with food, health has significant

relationships with food and water and livelihood has significant relationship with all the indices (food, water and health).

The summary table shows that all the communities in all indices are in moderate level of vulnerability. However, for priority purposes it has been divided into 3 levels (high, moderate and low). The independent variables used for the assessment is not on Landcare alone. Biophysical, Socio-economic and Climate variability were taken also as independent factors for assessing the vulnerability.

Table 29. Food Vulnerability Index

Barangay	Food_index	Rank	Level of Vulnerability
Ane-I	185.3695	1	low
Malagana	188.8712	1	low
Madaguing	189.9377	1	low
Mat-I	190.7361	1	low
Gumaod	195.2614	1	low
Bulahan	197.1429	1	low
Cabacungan	200.6536	1	low
Parmbugas	200.6990	1	low
Patrocinio	201.9925	2	moderate
Hinaplanan	208.9110	2	moderate
Punong	209.3682	2	moderate
Panampawan	212.1539	2	moderate
Luna	212.9493	2	moderate
Kalawitan	213.0634	2	moderate
Sta. Cruz	216.5349	2	moderate
Poblacion	217.1729	2	moderate
Plaridel	221.5398	3	high
Rizal	223.3169	3	high
Minalwang	225.0774	3	high
Aposkahoy	226.5501	3	high
Lanise	229.9690	3	high
Tamboboan	238.5154	3	high
Tipolohon	256.2389	3	high
Pelaez	289.3048	3	high
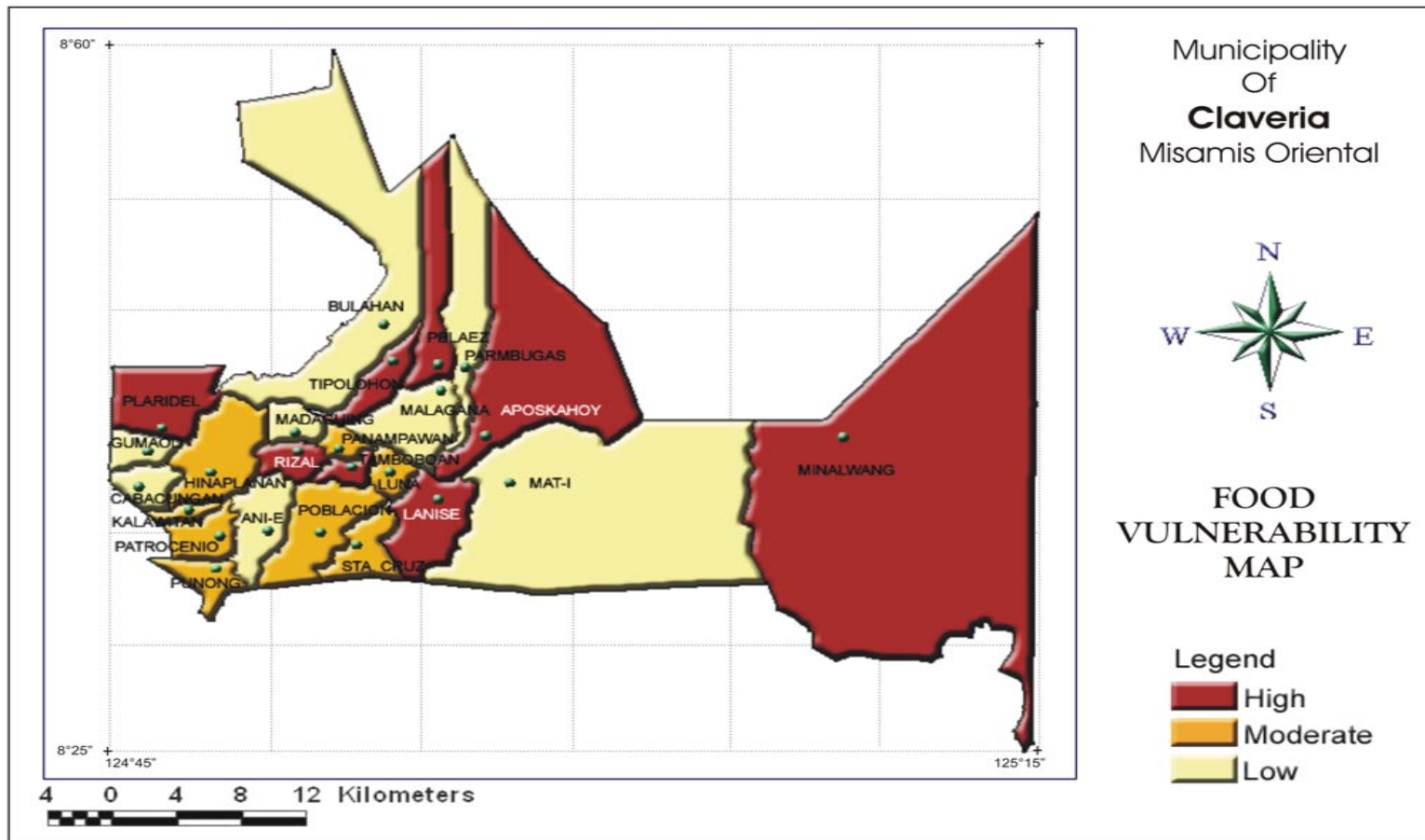
Figure 44. Food vulnerability map

Table 30. Water Vulnerability Index

Barangay	Water_index	Rank	Level of Vulnerability
Gumaod	152.0966	1	low
Panampawan	168.8774	1	low
Pelaez	172.0509	1	low
Cabacungan	178.4722	1	low
Bulahan	182.8211	1	low
Kalawitan	185.3095	1	low
Punong	188.2716	1	low
Luna	188.4838	1	low
Poblacion	193.8244	2	moderate
Lanise	194.7368	2	moderate
Rizal	194.9198	2	moderate
Parmbugas	195.4713	2	moderate
Madaguing	197.5936	2	moderate
Malagana	197.7759	2	moderate
Plaridel	201.4706	2	moderate
Aposkahoy	203.3534	2	moderate
Ane-I	204.2735	3	high
Minalwang	206.6201	3	high
Sta. Cruz	206.6998	3	high
Tipolohon	211.5215	3	high
Hinaplanan	215.2317	3	high
Tamboboan	222.5694	3	high
Patrocinio	222.7503	3	high
Mat-I	227.9877	3	high
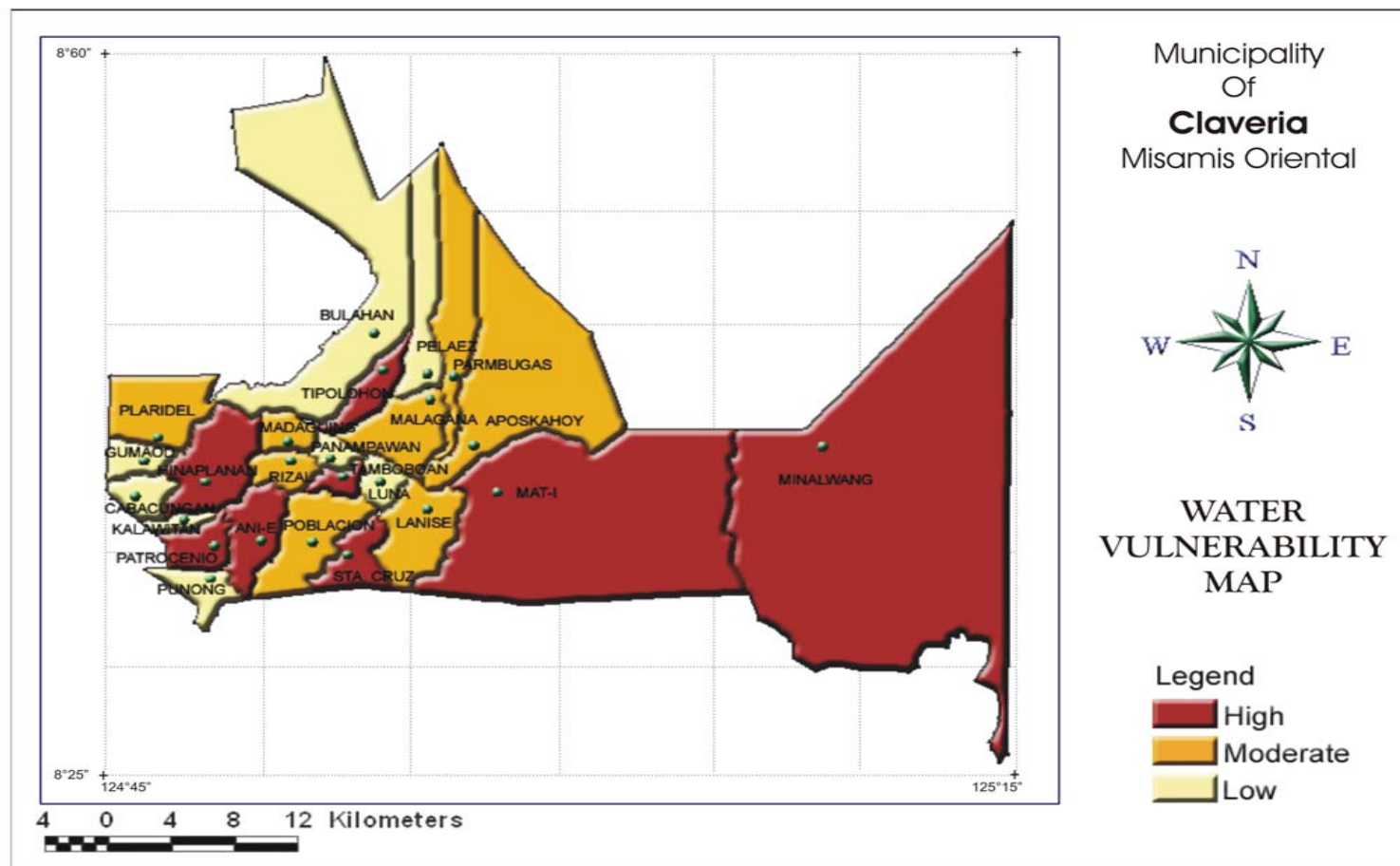
Figure 45. Water vulnerability map

Table 31. Health Vulnerability Index

Barangay	Health_index	Rank	Level of Vulnerability
Panampawan	170.6478	1	low
Gumaod	170.7265	1	low
Cabacungan	177.7778	1	low
Ane-I	180.8679	1	low
Rizal	185.5204	1	low
Pelaez	186.0140	1	low
Poblacion	187.0879	1	low
Kalawitan	187.3626	1	low
Hinaplanan	188.5655	2	moderate
Madaguing	188.6878	2	moderate
Lanise	194.5344	2	moderate
Luna	194.6581	2	moderate
Punong	196.8661	2	moderate
Sta. Cruz	200.2404	2	moderate
Patrocinio	202.6056	2	moderate
Mat-I	207.4725	2	moderate
Malagana	208.5239	3	high
Plaridel	209.5023	3	high
Parmbugas	214.5889	3	high
Aposkahoy	219.3347	3	high
Tipolohon	221.2121	3	high
Bulahan	234.7253	3	high
Minalwang	240.4858	3	high
Tamboboan	242.9487	3	high
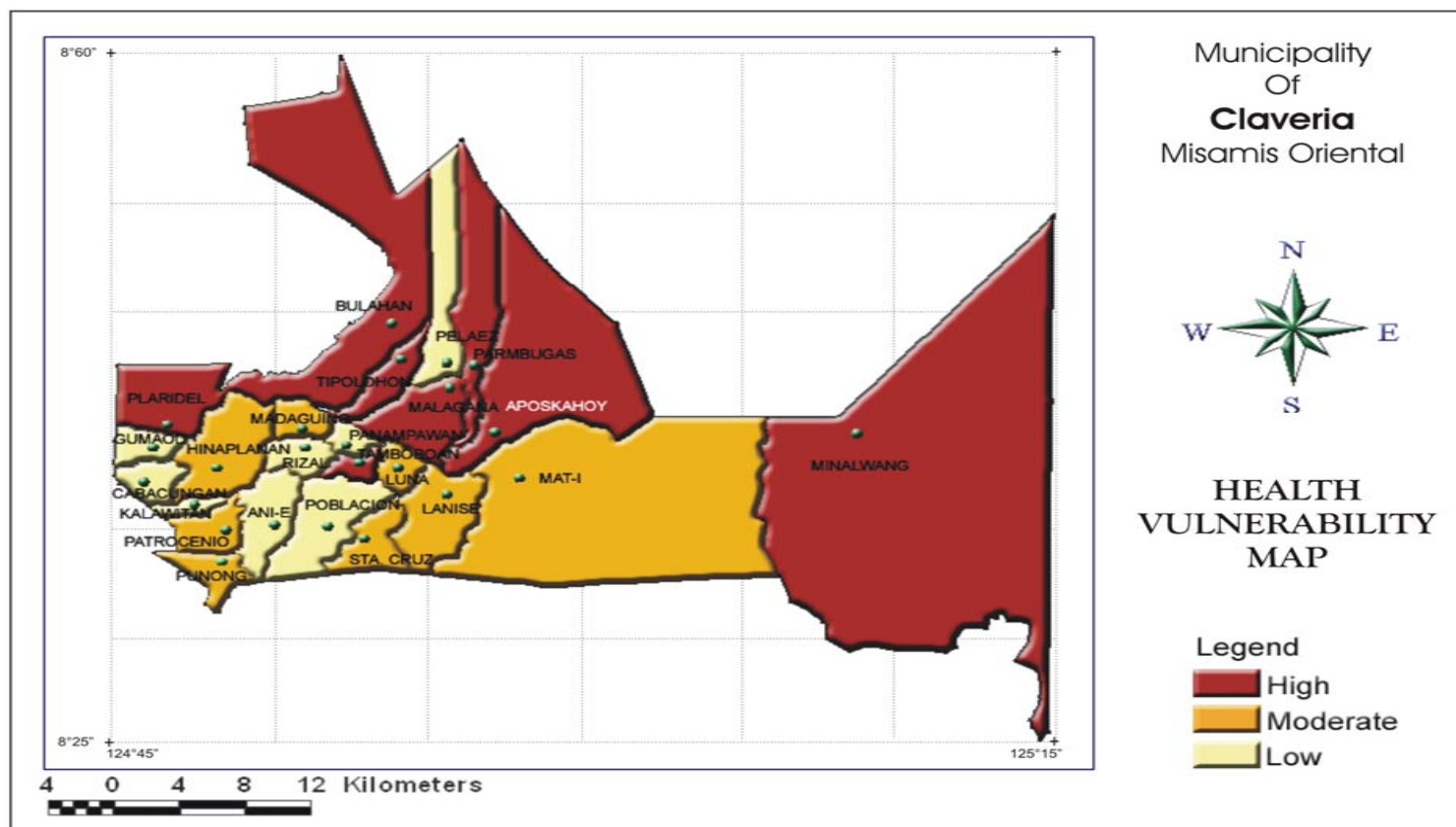
Figure 46. Health vulnerability map

Table 32. Livelihood Vulnerability Index

Barangay	Livelihood_index	Rank	Level of Vulnerability
Mat-I	178.1599	1	low
Madaguing	181.3515	1	low
Gumaod	182.0513	1	low
Ane-I	183.3826	1	low
Cabacungan	193.8034	1	low
Pelaez	193.9977	1	low
Malagana	194.9209	1	low
Patrocinio	195.3857	1	low
Sta. Cruz	196.5546	2	moderate
Luna	201.4400	2	moderate
Kalawitan	201.6733	2	moderate
Rizal	202.9154	2	moderate
Plaridel	203.3371	2	moderate
Hinaplanan	205.0988	2	moderate
Bulahan	208.4753	2	moderate
Panampawan	208.7565	2	moderate
Poblacion	210.9929	3	high
Lanise	213.5223	3	high
Parmbugas	217.5658	3	high
Tamboboan	218.5592	3	high
Minalwang	219.0902	3	high
Aposkahoy	226.0915	3	high
Tipolohon	246.2121	3	high
Punong	297.4359	3	high

Figure 47. Livelihood vulnerability map

Table 33. Vulnerability Indices Summary

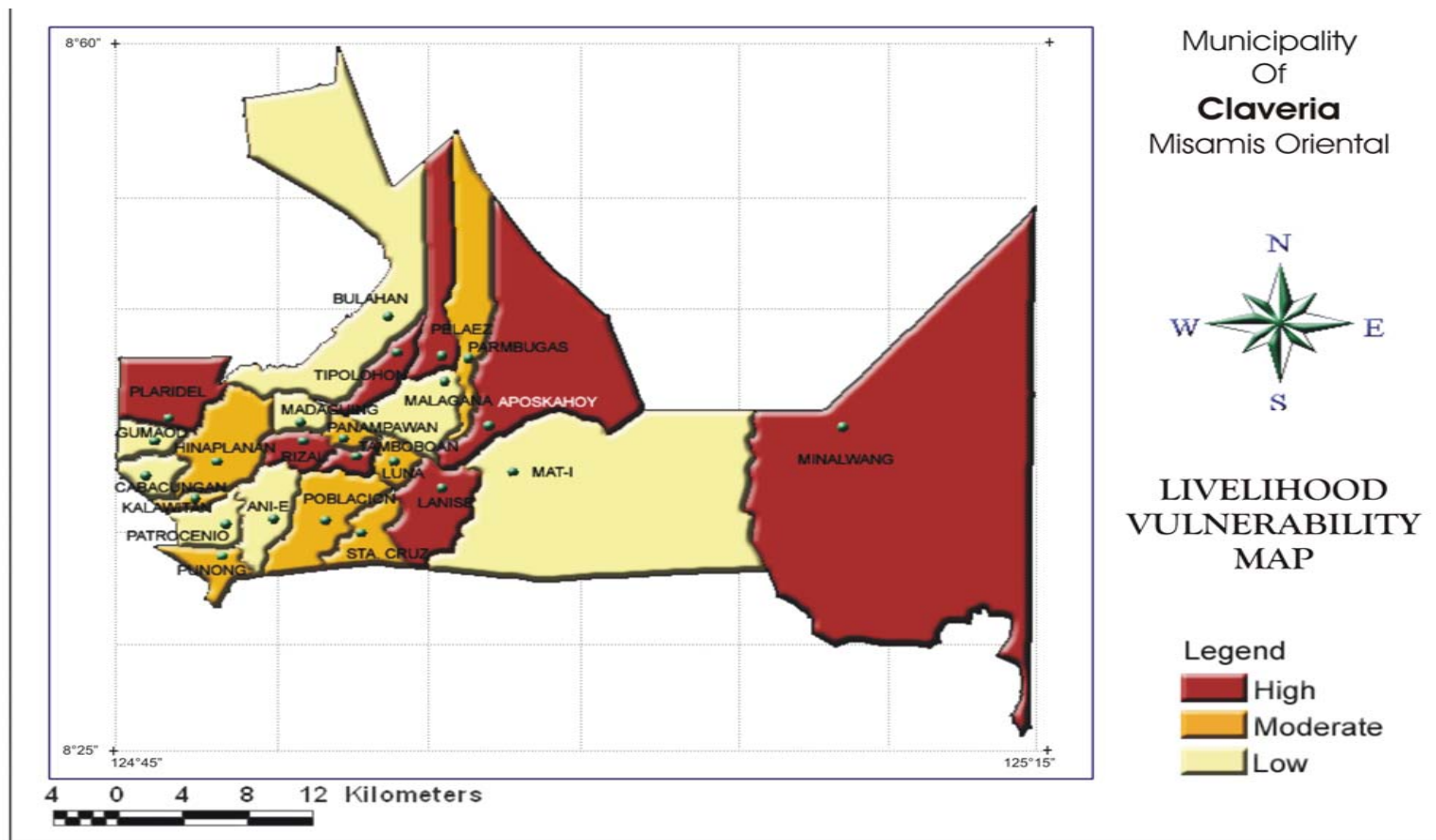| Barangay	GA x mult (GA x 100%)	- Index -			
		Food	Water	Health	Livelihood
Poblacion	181.0000	217.1729	193.8244	187.0879	210.9929
Ane-I	198.0000	185.3695	204.2735	180.8679	183.3826
Hinaplanan	195.0000	208.9110	215.2317	188.5655	205.0988
Mat-I	189.0000	190.7361	227.9877	207.4725	178.1599
Malagana	196.0000	188.8712	197.7759	208.5239	194.9209
Patrocinio	183.0000	201.9925	222.7503	202.6056	195.3857
Lanise	199.0000	229.9690	194.7368	194.5344	213.5223
Aposkahoy	203.0000	226.5501	203.3534	219.3347	226.0915
Bulahan	206.0000	197.1429	182.8211	234.7253	208.4753
Cabacungan	183.0000	200.6536	178.4722	177.7778	193.8034
Gumaod	160.0000	195.2614	152.0966	170.7265	182.0513
Kalawitan	193.0000	213.0634	185.3095	187.3626	201.6733
Luna	188.0000	212.9493	188.4838	194.6581	201.4400
Madaguing	166.0000	189.9377	197.5936	188.6878	181.3515
Minalwang	226.0000	225.0774	206.6201	240.4858	219.0902
Panampawan	172.0000	212.1539	168.8774	170.6478	208.7565
Parmbugas	198.0000	200.6990	195.4713	214.5889	217.5658
Pelaez	197.0000	289.3048	172.0509	186.0140	193.9977
Plaridel	180.0000	221.5398	201.4706	209.5023	203.3371
Punong	174.0000	209.3682	188.2716	196.8661	297.4359
Rizal	189.0000	223.3169	194.9198	185.5204	202.9154
Sta. Cruz	187.0000	216.5349	206.6998	200.2404	196.5546
Tamboboan	202.0000	238.5154	222.5694	242.9487	218.5592
Tipolohon	215.0000	256.2389	211.5215	221.2121	246.2121

Table 34. Vulnerability Ranks Summary

Barangay	Vulnerability				
	Food	Water	Health	Livelihood	Climate Variability
Ane-I	1	3	1	1	3
Aposkahoy	3	2	3	3	3
Bulahan	1	1	3	2	3
Cabacungan	1	1	1	1	1
Gumaod	1	1	1	1	1
Hinaplanan	2	3	2	2	2
Kalawitan	2	1	1	2	2
Lanise	3	2	2	3	3
Luna	2	1	2	2	2
Madaguing	1	2	2	1	1
Malagana	1	2	3	1	2
Mat-I	1	3	2	1	2
Minalwang	3	3	3	3	3
Panampawan	2	1	1	2	1
Parmbugas	1	2	3	3	3
Patrocinio	2	3	2	1	1
Pelaez	3	1	1	1	2
Plaridel	3	2	3	2	1
Poblacion	2	2	1	3	1
Punong	2	1	2	3	1
Rizal	3	2	1	2	2
Sta. Cruz	2	3	2	2	2
Tamboboan	3	3	3	3	3
Tipolohon	3	3	3	3	3

Table 35. Correlation of the vulnerability indices

Correlation	Index				
	Climate Variability	Food	Water	Health	Livelihood
Climate Variability	1.0000				
Food_index	0.1875	1.0000			
Water_index	0.1875	0.3750	1.0000		
Health_index	0.5625	0.1250	0.4375	1.0000	
Livelihood_index	0.2500	0.3750	0.5000	0.4375	1.0000

Conceptual Framework Revisited

Climate Variability
- Extensive rainfall
- drought

Biophysical Problem
- poor soil quality
- sloping/hilly

Extensive soil erosion
Poor soil quality

Problems on:
Yield, income, loss of top soil and nutrients

Landcare Approach

Landcare services
- Seminars/Trainings
  - Cross visit
  - Demonstrations
- On-farm researches
- Technical assistance
- Group formation
- Institutional facilitation

Landcare Technologies
- Agroforestry
- SWC
- Composting
- Seed technology and nursery mgt.
- NVS
- Contour farming

Improved condition on the following:
- Soil Quality
- Water Quality
- Soil Quantity
- Water Quantity
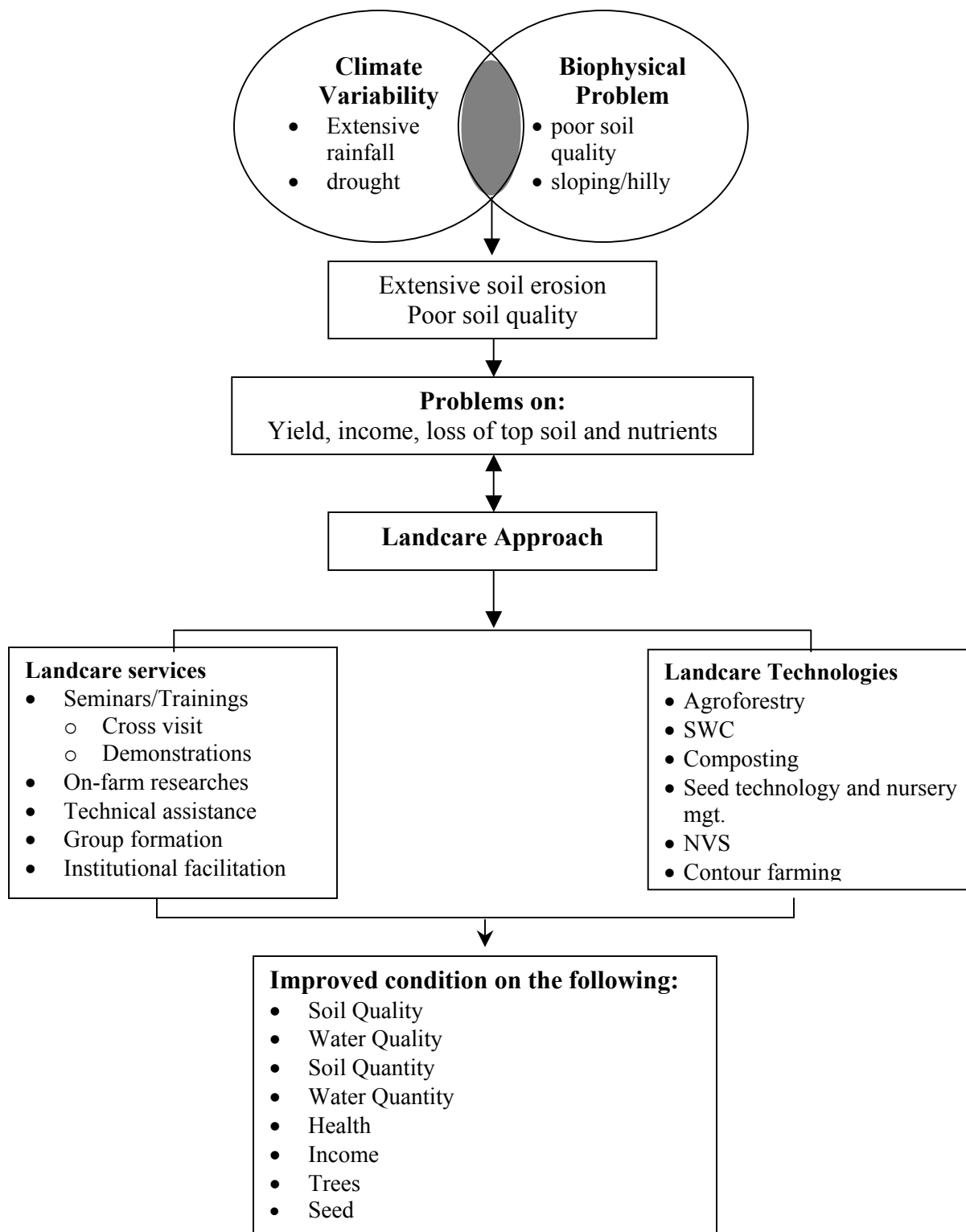- Health
- Income
- Trees
- Seed

Figure 48. The Role of Landcare on Adaptive Capacity

This section was done to clarify the role of Landcare in enhancing the adaptive capacity of the communities in Claveria. While Claveria has experienced intensive rainfall, the climate account of the weather station of PAGASA in Cagayan de Oro showed that the region is experiencing drought most of the time. This situation for the farming communities in Claveria, the soil is poor in nutrients. It has low pH. The soil type is Jasaan clay which becomes loose with drought. This leads to intense soil erosion when the heavy rain come. The situation become more exigent because the municipality is located in sloping region. As a result, farm activity is ow and consequently resulting to low income.

$$Risk = Hazard \ x \ Vulnerability$$

Risk is the product of hazard and vulnerability. For Claveria, Misamis Oriental risk had been reduced by means of using Landcare service. From the above formula, vulnerability factors are the climate variability and extremes plus the intensive rainfall. The hazard is the elements exposed to climate stresses. This time it corresponds to the soil with its component and characteristics. Given that the climate variability and climate extremes are present in the area, hazards had been reduced. Since climate variability is given and is something very difficult to deal with the technique on attacking the biophysical problem.

The presence of the International Centre for Research in Agroforestry (ICRAF) now known as the World Agroforestry was recognized in the area. The farmers asked ICRAF to help them in solving the soil erosion problem. The Landcare triadic approach serves as the guide as the ICRAF technical facilitators together with the farmers and LGUs worked hand in hand to find answer to the problems.

The ICRAF technical facilitators assisted the farmers. Landcare helped in the enhancement of knowledge on how to deal with the existing climate variability and climate extreme stresses and hazards. There had been series of activities from the trainings, seminars and other services to technology adoption.

At the same time technological facilitation gave the people know-how on: agroforestry, soil and water conservation, composting, seed technology and nursery management, natural vegetative strips (nvs) and other contour farming techniques. Agroforestry is the definitive goal of Landcare, employing the integration of trees to the agricultural crops in the farm. This system answers both the short and long-term needs of the communities. NVS is the preliminary stage of agroforestry. The communities cannot immediately establish the agroforestry systems due to several reasons, e.g. consideration of land tenure, size of the farm, cost.

The issue in resolving the problems considered the spatial aspect. Landcare reached the farthest village rapidly through building small groups in each sitios.

As shown in the conceptual framework (Fig 8), adaptive capacity has been a function of the climate variability, biophysical problem, socio-economic structure and the services of Landcare. Any movement in the independent factor could cause a significant effect on the dependent variable, which is the adaptive capacity. Table 26 and 27 explain the adaptation measures on the stresses brought about by the biophysical component and climate variability in the area. The responses include Landcare technologies. And the mechanism to enhance the adaptive capacity is through the Landcare triadic approach.

Adaptive capacity necessitates the potential and capacity of the system to adjust with the existing climate variability and biophysical problems. The result showed that Landcare helped increase the adaptive capacity of the communities. Landcare services have been an effective meachnism. This include: seminars/trainings that includes cross visits, and demonstrations; on-farm researches; technical assistance; group formation; and institutional facilitations. The group formation and institutional facilitation played important factors in disseminating Landcare ideas. These had been the effective instruments to touch every part of Claveria. The spatial distribution has been efficient through the aid of the institutional facilitation. Building social capital had been influenced as well by Landcare. Institutional facilitation and networking made the technology adoption all over Claveria possible.

Resiliency involvs the ability to withstand shocks or change. This also involves the coping mechanism of the system. To examine whether the existence of Landcare made improvements on the lives of the communties, a T-test had been conducted. Responses were gathered in each variable to assess the difference before and after Landcare technologies were adopted. Positive correlation of each variable implies affirmative relationship The results showed that with the presence and help of Landcare the following variables had been better: soil quality, water quality, soil quantity, water quantity, health, income, trees, and seed stock.

Policy

Based on the interviews from key informants and surveys, Claveria, has no clear baseline policy on climate variability adaptation, mitigation or any quantitative database information. The issue of climate variability in the area is not widely known. The only thing that the people are concerned with climate is the intensive rain that most of them are experiencing which is a normal event in the uplands of Mindanao. Most of the time the communities use the term flooding but what they really mean is soil erosion. This is because when soil erodes, some are being swamped by the soil mass. The communities are familiar with the climate extreme especially with El Niño. But this is not part of the priority of the Local Government Units (LGUs). Claveria at present, has no Municipal Disaster Coordinating Council as mandated in the Presidential Decree No. 1566 Section 4c. PD No. 1566 on the Strengthening of the Philippine Disaster Control, Capability and Establishment of the National Program on Community Disaster Preparedness. The last time Claveria had the MDCC was on 1997 which was El Niño hit Claveria.