

## **CHAPTER III**

### **METHODOLOGY**

#### **Conceptual Framework**

Figure 8 presents the conceptual framework for the vulnerability assessment of the areas. Claveria is experiencing biophysical problem predominantly by soil erosion and poor soil quality (low soil nutrients). This is exacerbated by the climate variability and climate extreme (El Niño) giving rises to drought in the area. In the hope of coping up with the existing quandary Landcare came in. Landcare as an organization is composed of members and the non-members. But it is also important to note that each category is composed on Landcare technology adopter and non-adopter. Although the expectation is that Landcare members should be a Landcare technology adopter. Non-adoption includes several reasons such as tenure and consideration of the land area. Adoption of non-members ensued because of the information diffusion (among farmers, kins and neighbors).

Landcare endowed the services and technologies to answer the problem. Thus, it is expected to have improvements on the socio-economic condition of the communities considering these factors: food availability, water supply and livelihood situation. Moreover, the existence of Landcare could likely provide enhancement on the biophysical components such as the soil quality and water quality and quantity are expected.

Resilience is one of the indicators necessary to be examined to know if the communities can cope with the present biophysical problems and climatic hazards. But to be able to assess resiliency the system should be in terms of vulnerability. The following questions are necessary:

- What is the nature of vulnerability?
- Who are vulnerable?
- Why are they vulnerable?

This study combined qualitative and quantitative approaches to understand the dynamics. Social and economic aspects were examined in terms of level of food availability, water supply, livelihood situation and health condition. On the biophysical component, the soil quality and water quantity and quality were tested. Based on the results, the degree of vulnerability to climate variability was assessed according to indicators/indices for food vulnerability, water vulnerability, livelihood vulnerability and the combinations for overall vulnerability index.

The following systemic factors were also looked into in terms of: Demographics, Socio-economic, Biophysical, Political, Cultural and Environmental. These are the factors embedded in a certain society.

Resiliency is the opposite of vulnerability. This involves coping mechanisms to withstand the shocks or stresses within the specific system. The coping mechanism implicates

adaptation. There is a necessity to assess the adaptive capacity. With the positive outcome of the adaptive capacity, resiliency increases.

Landcare initiated the adaptation through the technologies and services catered. Thus, resiliency is anticipated.

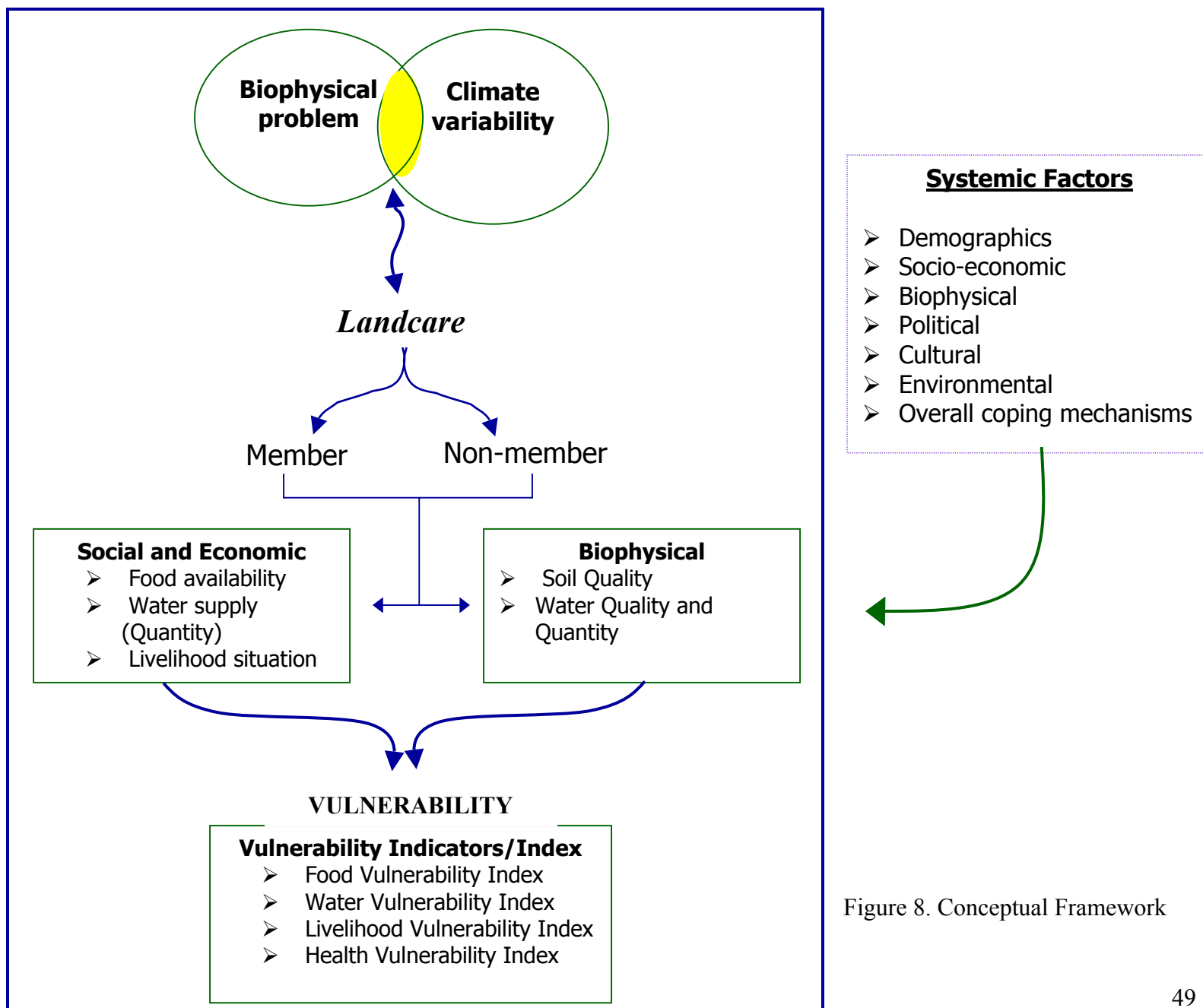


Figure 8. Conceptual Framework

### Operation Research Model

$$A = f \{LC, SE, B, CV\}$$

Where:

A = Adaptive Capacity  
 LC = Landcare Technologies/Services  
 SE = Socio-Economic  
 B = Biophysical  
 CV = Climate Variability

And in which,

$$SE = f \{F, W, L, H\}$$

Where:

SE = Socio-economic  
 F = Food Availability  
 W = Water Availability  
 L = Livelihood  
 H = Health Condition

And

$$B = f \{S, W1, W2\}$$

Where:

S = Soil Quality  
 W1 = Water Quality  
 W2 = Water Quantity

Adaptive capacity is a very important component of resiliency. A high correlation exists.

The higher the adaptive capacity, the higher the resiliency goes. However, *“the higher the resilience, the less likely damage may be, and the faster and more effective recovery is likely to be. Conversely, the higher the vulnerability, the more exposure there is to loss and damage.”* (Buckle 2000)

The study emphasized on the relationship (correlation) of LC to  $AC_{CV}$  in the communities. Therefore:

$$AC_{CV} \sim \{LC\}$$

***Where:***

***$AC_{CV}$  = Adaptive Capacity with regards to Climate Variability***

***$LC$  = Landcare***

### **Data Collection and Analysis**

This study used quantitative research method enriched with qualitative data. Primary and secondary data were gathered. A survey has been made to be specific. The number of representatives was generated using the total household number. In each household a representative had been utilized for the survey. The actual number of respondents was generated using this formula:

$$n = \frac{(N \cdot \sigma^2)}{(N-1) \cdot D + \sigma^2}$$

Where n is the sample size, N is the population size,  $\sigma^2$  gives the variance (based from auxiliary variable on pre-testing) and  $D = b/(Z_{\alpha/2})$ . In getting D, b should be the margin of error and  $\alpha$  is the 5% level of significance (Table 8). The survey utilized 9.88 percent (n=850) of the total household population (8,599) at a margin of error of 7 percent (Table 2). Table 3 shows the sample size per community.

The number of respondents from each barangay is as follows: 49 for Poblacion, 39 for Ane-I, 37 for Hinaplanan, 35 for Mat-I, 37 for Malagana, 39 for Patrocinio, 38 for Lanise, 37 for Aposkahoy, 35 for Bulahan, 36 for Cabacungan, 36 for Gumaod, 28 for Kalawitan, 36 for Luna, 34 for Madaguing, 38 for Minalwang, 38 for Panampawan, 29 for Parmbugas, 33 for Pelaez, 34 for Plaridel, 27 for Punong, 34 for Rizal, 32 for Sta. Cruz, 36 for Tamboboan and 33 for Tipolohon. The survey form used is found in Appendix A.

The adaptive capacity of farmers is assessed based on the climatic hazards (soil stress) having ENSO phenomenon as background. To be able to assess the adaptive capacity of Claveria communities the following indicators of adaptive capacity (Brooks et. al ND) were addressed: (1) the nature of the communities; (2) the principal hazards faced; (3) the major impacts of these hazards and the most vulnerable communities to the hazards; (4) why these elements/groups particularly vulnerable; (5) measures would reduce the vulnerability of these elements; (6) the factors that determine whether these measures are taken; and (7) the external and internal barriers to the implementation of these measures.

Seven enumerators were trained to conduct the survey. They were Marlene Augis as the head of the team, Manong Efren Pagalan, Ramil Adubal, Karl Montejo (Tadoy), Mark Sungkit, Ethel Nabong, Noel Laraga, and Christopher Tangkihay. Michael Jones Ramantin was the encoder. The ICRAF staff referred most of the enumerators. These were the people who had been with ICRAF for several years conducting field interviews and site visits. Others applied for the position and after passing, hired the following day for training. The enumerators were expected to conduct the specified work efficiently. To do so, the subject matter, research objectives, backgrounds and other profiles of the study were explained. The enumerators were given two days to learn by rote. The test was done acknowledging the personal queries of each enumerators and getting them on the field. After each day, the enumerators were asked on what set of questions they have encountered difficulties. In order to estimate the target representative per day, the time



per interview was taken. The enumerators was given chance to ask the ICRAF staff as well for clarification.

Key informant interview was conducted to boot. Guide questions were used for the key informants (Appendix B). A representative on each community was selected that include old residents and most of the barangay officials. In addition, some local government officers (Municipal Mayor, Eng. Dodong Lesaca), ICRAF researchers and Landcare facilitators/officers were also interviewed.

Table 2. Sample size per margin of error

Barangay	Margin of error/No. of Respondents				
	3	4	5	6	7
Poblacion	90	69	56	47	40
Anei	80	64	52	45	39
Hinaplanan	82	64	52	44	38
Mat-I	80	64	52	47	39
Malagana	76	60	50	43	37
Patrocenio	83	65	53	45	39
Lanise	80	62	51	44	38
Aposkahoy	82	64	52	44	38
Bulahan	68	55	46	40	35
Cabacungan	71	57	48	41	36
Gumaod	71	57	48	41	36
Kalawitan	47	40	35	32	28
Luna	71	57	48	41	36
Madaguing	63	52	44	38	34
Minalwang	74	59	49	42	37
Panampawan	53	45	39	34	31
Parmbugas	58	48	41	36	32
Pelaez	60	50	43	37	33
Plaridel	71	57	47	41	36
Punong	46	40	35	31	28
Rizal	66	54	45	39	34
Sta. Cruz	70	53	47	40	36
Tamboboan	71	57	48	41	36
Tipolohan	61	50	43	37	33
<b>TOTAL</b>	<b>1594</b>	<b>1346</b>	<b>1124</b>	<b>970</b>	<b>849</b>

Table 3. Sample Size and Number of Households

Barangay	Sample Size	No. Of Households	Sample Size/No. Of Household
Poblacion	49	1514	0.032364597
Ane-I	39	617	0.063209076
Hinaplanan	37	568	0.065140845
Mat-I	35	617	0.056726094
Malagana	37	368	0.100543478
Patrocinio	39	623	0.062600321
Lanise	38	459	0.082788671
Aposkahoy	37	535	0.069158879
Bulahan	35	235	0.148936170
Cabacungan	36	270	0.133333333
Gumaod	36	275	0.130909091
Kalawitan	28	90	0.311111111
Luna	36	268	0.134328358
Madaguing	34	181	0.187845304
Minalwang	38	321	0.118380062
Panampawan	38	117	0.324786325
Parmbugas	29	145	0.200000000
Pelaez	33	160	0.206250000
Plaridel	34	262	0.129770992
Punong	27	87	0.310344828
Rizal	34	207	0.164251208
Sta. Cruz	32	250	0.128000000
Tamboboan	36	268	0.134328358
Tipolohon	33	162	0.203703704
<b>TOTAL</b>	<b>850</b>	<b>8599</b>	<b>0.098848703*</b>

\*  $\frac{\text{Sample Size}}{\text{Total Number of Household}}$

### **Soil and Water Sampling**

Soil and water analysis were carried out by taking representative samples from the upper, middle and lower elevation of the study area. Upper elevation is characterized by the area having an elevation of 951 masl and above. The middle portion is on the 501 to 950 masl, and the lower elevation at 500 masl and below (Figure 10). The soil type, pH level, available nutrients, texture, moisture content, and taxonomy were analyzed. The soil samples were taken using composite method. In the composite method, there had been three sites chosen in each elevation category. The soil samples from the three sites were combined according to the elevation category. These have given samples from low, middle and high elevation with varying depths. For water, samples were obtained from the Cabulig River. Three sites were chosen: Man-ibay to represent the upper portion, Luna for the middle part and Jasaan (adjacent municipality) for the lower section. Only the pH level, trace elements (Fe, Zn, Cu, Mn) and others such as average water flow, turbidity, air temperature, water temperature, nitrate, phosphate and dissolved oxygen were determined.

### **Statistical Analysis**

The main data sets that used were data from the survey and biophysical accounts from the soil and water analysis. Statistical analysis was done using Statistical Package for Social Science v10. Some of the descriptive analysis and graphs were generated using Microsoft Excel. T-test compared the means of two treatments in relation to the variation in the

data. The Pearson correlation measured the strength or degree of linear association between variables.

### **Assessment of the Vulnerable Communities**

The assessment of the vulnerable communities are obtained using the generated means of the identified factors using the indices such as food availability, water demand, livelihood situation, health condition and accessibility to different assistance areas and other biophysical considerations per barangay. Generated means are taken from the survey and key informants interview. Numeric values had been assigned to formulate codes. To assess each index the selected variables were taken and treated using equal weights.

### **Secondary Data**

The study made use of the secondary data available in the Internet, library, available materials at the World Agroforestry Centre' (ICRAF) offices in Los Baños (IRRI and Forestry at the University of the Philippines, Los Baños) and Claveria. Available resources were taken as well at the Claveria Municipal Planning and Development Office (CMPDO) and Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA) station in Cagayan de Oro. The following section discussed the

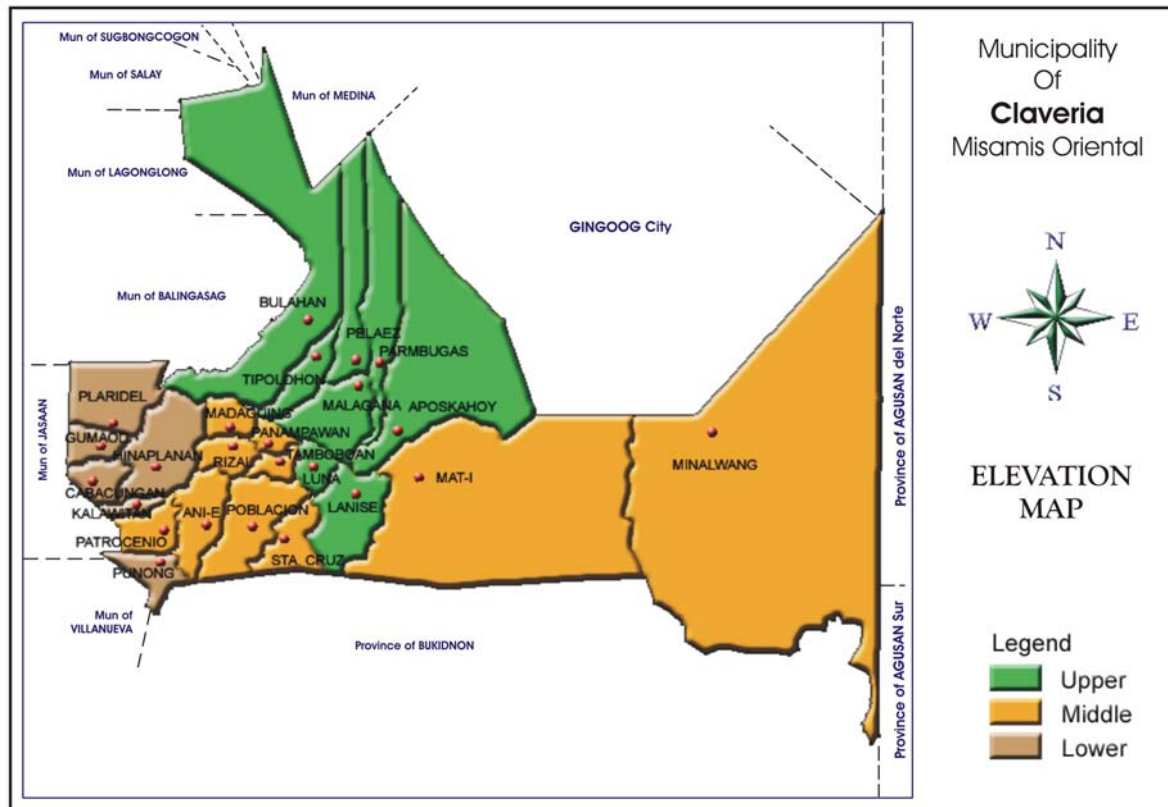


Figure 9. Elevation map of Claveria

### **Description of the Study Area**

Claveria, Misamis Oriental is located at 12°25' E longitude and 8°35' latitude and about 500 nautical miles South of Manila (ICRAF database). It is the largest municipality in Misamis Oriental. The total land area is 82,998 hectares. Public land is composed of 58,800 hectares or 71 percent. The alienable and disposable is of 24,197 hectares or 29 percent (Catacutan 2004). It has 24 barangays composing of Poblacion, Ane-I, Hinaplan, Mat-I, Malagana, Patronicio, Lanise, Aposkahoy, Bulahan, Cabacungan, Gumaod, Kalawitan, Luna, Madaguig, Minalwang, Panampawan, Parmbugas, Pelaez, Plaridel, Punong, Rizal, Sta. Cruz, Tamboboan and Tipolohan. The distance of Claveria to Cagayan de Oro City (provincial capital) is 40.26 kilometers.

### **Water**

Claveria Forest Land Use Plan (FLUP) identified eight major watersheds. These are: (1) Cabulig watershed which has a total area of about 19,460 hectares, covering 13 villages within the municipality plus four more in a nearby Municipality (Jasa-an); (2) Odiongang, 11,782 hectares; (3) Balatocan, 8,180 hectares; (4) Ojot, 7,759 hectares; (5) Siloo, 3,865 hectares; (6) Malitbog, 4,099 hectares as sub-watershed of Tagoloan river (important to Northern Mindanao River system); (7) Ticala-Puga-an, 4116 hectares; and (8) Tagonino-Sagpulon, 8,468 hectares (ICRAF database).

The Cabulig River is one of the major watersheds in Northern Mindanao (DENR-CDO 2004). The location is within the municipalities of Jasaan and Balingasag, Misamis

Oriental. Cabulig River lies at 124° 45" to 125° 25" East longitude and 8° 34" to 8° 55" north latitude. It is bounded by the Balatukan Mountain Range to the East, municipality of Claveria to the west and south, and Macalajar Bay to the north. It is landlocked in the municipality of Claveria, downstream ecosystems. Has stretch of 40 kilometer. The barangays in Claveria that is within the Cabulig River includes: Aposkahoy, Bulahan, Don Gregorio Pelaez, Hinaplanan, Lanise, Luna, Madaguig, Malagana, Mat-I, Panampawan, Parmbugas, Plaridel, and Tipolohon. Other seven barangays are in Jasaan and another two in Balingasag. The average elevation is 1,000 masl. is where The highest elevation, which is 2,400 masl, can be found in Aposkahoy (Mt. Sumagaya). The elevation of the subwatersheds averages from 1,050 to 1,280 masl. Most of the tributaries are located on the eastern side of the main channel. The river has a good profile with its mainstream draining moderately. The steepness is along the watersheds. At the same time the main river channel meanders moderately. Jasaan Clay characterizes the soil composition. The pH level varies from 3.9 to 5.2. Soil physical properties include: 1) very fine, texture; 2) pseudo aggregation; 3) crumb structure; 4) great profile depth; 5) deep root zone; 6) easy water infiltration; 7) good permeability; 8) high water holding capacity and 9) good aeration and workability.

The area is typhoon-free with an average wind velocity of 0.67 meter per second. Annual estimated run-off is 597 million cubic meters. It has about 24 major and minor tributaries mainly from the barangays in Claveria. The biggest tributary is the Mat-I River, which has an average discharge of about 1,529 liters per second. According to the Phil



Environment Quality Report 1995-1996, water is classified as class A. That means the volume is suitable for water supply but would require complete treatment to meet the National Standards for Drinking Water (NSDW).

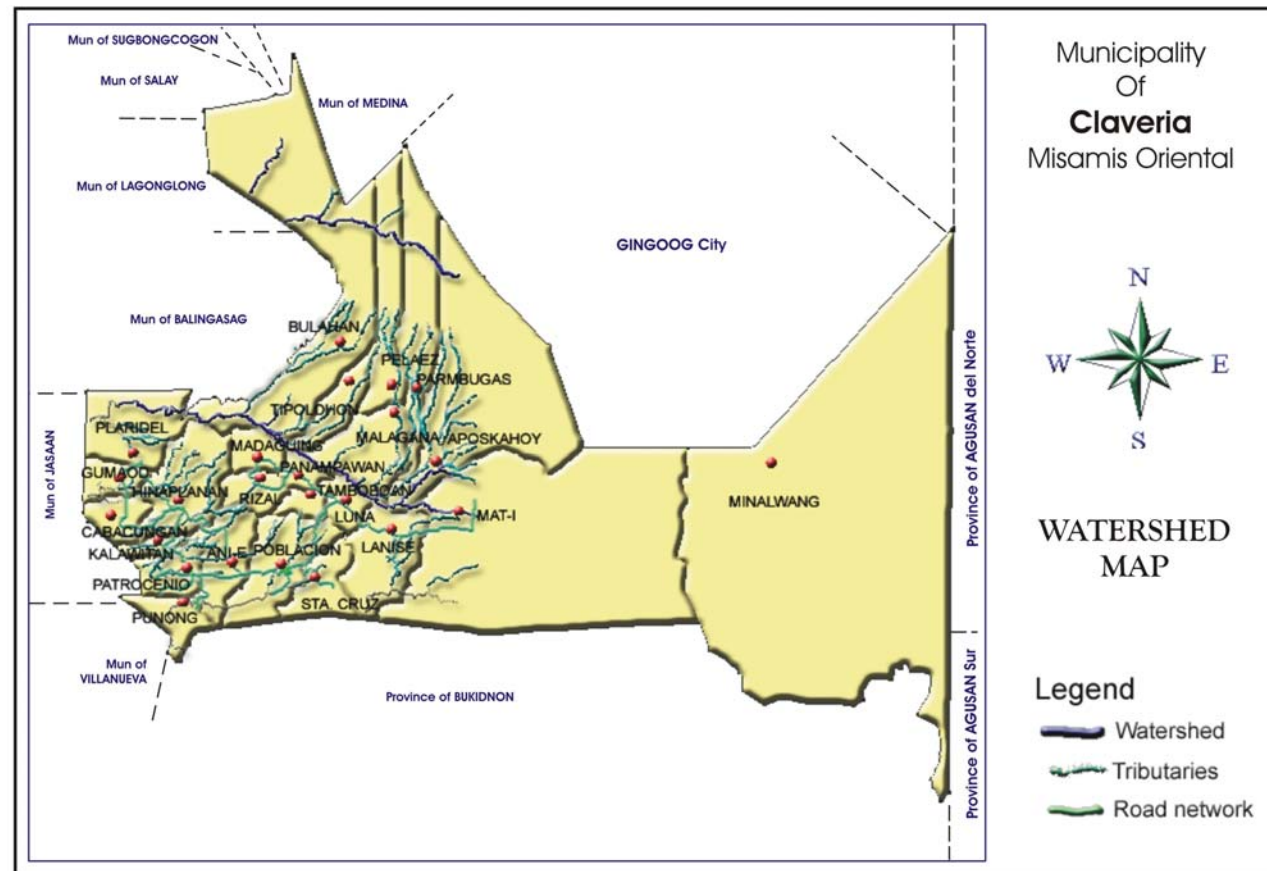


Figure 10. Watershed Map of Claveria, Misamis Oriental  
Source: ICRAF-Claveria Database

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## **Soil**

The soil physical properties of Claveria has: (1) very fine texture; (2) pseudo aggregation; (3) crumb structure; (4) great profile depth; (5) deep root zone; (6) easy water infiltration; (7) good permeability; (8) water holding capacity; and (9) good aeration and workability (CLUP 1999).

Based on the soil order classification in the Philippines, Claveria belongs to the Ultisols. These ultisols are found in areas positioned at elevated terraces, piedmont hills and mountains. But note that these areas are elevated piedmont plains, moderately steep; rolling hills and has the mountain landscape. With ultisols crops suitable for cultivation are pineapple, cassava, sugarcane, banana, and forest tree species (BSWM 2005).

According to the study of Mamaril (1985.) the chemical properties of this soil indicates problems for crop production. This is mainly because large proportions of soils in the area have low pH, low available Phosphorus (P), low to moderate organic matter (OM) content and low exchangeable Potassium. The table below explains this.

Table 4. Chemical and physical properties of the soil profiles at Claveria site

Profile depth (cm)	PH		NaF	Org C (%)	Total N (%)	Exch. Cations (m.e./100g)			
	(1:1) 1N KCl	0.01 M CaCl <sub>2</sub>				Na	K	Mg	Ca
0-11	4.1	4.3	9.3	1.84	0.19	Nil	0.10	0.69	2.74
11-21	4.1	4.3	9.2	1.71	0.18	0.02	0.09	0.52	2.78
21-56	3.9	4.3	9.8	0.56	0.08	0.02	0.03	0.18	1.05

Profile depth (cm)	CEC (m.e./ 100g)	Avail. P		Avail. Zn (ppm)	Exch. Al (m.e./100g)
		(Bray) (ppm)	(Olsen) (ppm)		
0-11	10.6	9.8	6.1	1.3	0.58
11-21	10.5	8.7	3.7	1.2	0.52
21-56	8.0	9.7	3.2	0.08	1.27

Profile depth (cm)	Particle size (%)		
	Clay	Silt	Sand
0 – 11	75	22	3
11 – 21	61	36	3
21 – 56	84	14	2

**Field Classification:** Fine, Mixed, isohypothemic, Ultic Haplorthox  
(Adapted from Mamaril, Raymundo and Estrella 1985).

## **Land Use**

Agustin and Garrity (1994) analyzed the land use change in Claveria over a 40-year period. In 1949 cultivated land was 9 percent, grassland was 59 percent and forest was 14 percent. Then from 1949 to 1967 the cultivated land expanded to 20 percent while the grassland dwindled to less than 50 percent. Forest cover was still the same. Settlements of small-scale farmers started growing. Then from 1967 to 1988 cultivated area became twice as much as the forested area having 41 percent. The drastic changes on the forest cover less significant accounting to 1 percent whereas the perennial croplands augmented to 30 percent mostly of coffee trees. The most affected areas is in the steeply sloping lands. Land conversion to field crop production was 27 percent and 43 percent to the perennial crops.

Table 5. Land Use Plan of Claveria 1998

Land Use Category	Area by Land Classification		Total	%
	Alienable & Disposable	Forestland/ Timberland		
Built-up Area	581.79	39.5	621.29	0.75
Open Cultivated/Agricultural	23, 040.23	3,015.23	26,055.46	31.39
Brushland/Grassland	0	16, 586.60	16,586.60	19.98
Forested	0	39,140.40	39,140.40	47.16
Agri-Industrial	29.72	0	29.72	0.04
Infrastructure (Rd & Bri)	545.9	18.6	564.5	0.68
Total	24, 197.64	58.800.33	82,997.97	100

Source: Claveria - Municipal Planning and Development Office (MPDO) estimates 1998

Table 3 gives an idea about the land use of Claveria since 1998. Nearly half of the land area is devoted to forest at 47.16 percent. This is followed by open cultivated/agricultural at 31.39 percent, brushland/grassland at 19.98 percent. 0.75 percent accounted for built-up areas and 0.68 percent is for infrastructures such as roads and bridges. Lastly, Agri-Industrial use is 0.04 percent.

The breakdown of proposed general land use is shown below (Table 4.). This gives the picture that Claveria Municipality hope to increase its agricultural land use, which includes Agro-forestry, Agro-industrial, etc. Forestland uses encompassing forested and open cultivated areas with protection and production use are planned for expansion as well (CLUP 1999 to 2010).

Table 6. Breakdown of proposed land uses

Land Use Classification	Area (ha)		
	Existing	Proposed	Difference
Built-up Area	621.28	674.36	53.07
Agricultural Land Uses	23, 040.23		-1,142.56
SAFDZ		15, 594.24	
Agro-Forestry		6, 157.46	
Agro-Industrial	29.72	175.69	
Forest Land Uses			1, 078.78
Forested	39, 140.40		
Open Cultivated mixed with Grassland	19, 601.83		
Protection		40, 219.18	
Production		19, 601.83	
Infrastructure (Road & Bridges)	564.5	575.21	10.71
<b>Total</b>	<b>82, 997.97</b>	<b>82, 997.97</b>	<b>0</b>

Source: Claveria MPDO computation



As of 2004, the agricultural lands are 30,130 hectares. 55 percent of which is currently farmed. Some lands are not farmed due to absentee private land ownership and government ownership for reforestation projects. Titled land is 61 percent while the tenanted land is 16 percent. The road network is 439 kilometers but only 10 percent is paved (Catacutan 2004).

68% of the whole landscape is described as having steep mountains and rolling hills. Seven percent are level to gently sloping with slope up to 3 percent (Stark 2000 cited by Catacutan 2004) and the elevation is from 350 to 2,500 meters above sea level (masl). Claveria soils are well drained with moderate depth and various textures (Catacutan 2004).

The area distribution of different slope classes in Claveria is shown below (Table 5). The largest land segment of Claveria composing of 1,633 hectares (22 percent) has steep slope characterized by having 30 to 60 percent slope. Moderately steep slopes cover 20 percent of the land area. Seventeen percent covering 1,305 hectares has very steep slope. The rest of the area is sloping (1,249 hectares), gently sloping (1,153 hectares) and the smallest portion having 10 percent is flat to very gently sloping (Agustin P and Garrity, D. P. 1988).

Table 7. Area distribution of different slope classes at Claveria site.

Slope Classes	Percent		Area <sup>1</sup> (ha)	Percent
	Slope Range	Description		
A	0 to 3	Flat to very gently sloping	730	10
B	3 to 8	Gently Sloping	1,153	15
C	8 to 15	Sloping	1,249	16
D	15-30	Moderately Steep	1,482	20
E	30-60	Steep	1,633	22
F	>60	Very Steep	1,305	17
Total			75,522	100

<sup>1</sup>Measured by planimeter from the map (approx. scale=1:15,000) constructed by uncontrolled methods from aerial photographs of the same scale.

<sup>2</sup>Represents a 10 km x 7 km rectangular block covering Claveria town proper to Bangon-bangon (east-west). The area (7,552 has) is about 17% of the total land area of Claveria municipality (44, 040 has)  
Source: (Mamaril 1985)

The parent material and area coverage of the different landforms in Claveria is identified in table 6. A large percentage covering 38 percent is river terrace/creek terrace escarpment. Volcanic plateau having pyroclastic lava flows as parent material of accounts for 27 percent of the landforms. Volcanic hill covered 5,086 hectares (14 percent). Alluvial plain is divided into two: (1) Mixed and colluvium from young and old volcanic mainly basalt and andesite, which covers 556 hectares and (2) Mixed Alluvium originating from old volcanic materials mainly andesite, which cover a larger portion at 7,176 hectares. (Bureau of Soils Survey 1984)

Table 8. Claveria Landforms

<b>Landforms</b>	<b>Parent Material</b>	<b>Area covered (ha)</b>	<b>Percent</b>
Alluvial Plain	Mixed and colluvium from young and old volcanic mainly basalt and andesite	556	1
	Mixed Alluvium originating from old volcanic mainly andesite	7, 176	19
Volcanic plateau	Pyroclastic lava flows mainly basalt	10, 270	27
Volcanic hill	Mixed alluvium originating from old volcanic mainly andesite, young volcanic and sedimentary mainly sandstone	5, 086	14
River terrace/creek terrace escarpment		14, 203	38
<b>Total area surveyed</b>		<b>37, 291</b>	<b>100</b>

Source: Mamaril 1985

## Climate

The climate of Misamis Oriental estimated annual average of 97.6mm rainfall, 27.6°C temperature, and 80.3% humidity. The average rainfall day was 156 mm. It was in 1992 when the province experienced a maximum wind speed of 17 meters/second, while the slowest rate was on November, 1995 having 6 m/second. (<http://home.websprinter.net/~dti10/mor/dtimor.htm> Oct. 2005) In Claveria alone, from 1997 to 1999, the average annual rainfall was 3,208 mm and average number of rainy days was 271 (Catacutan 2004). It was noted that Claveria experienced a much higher amount of rainfall level and rainy days than the whole of the Misamis Oriental province.

Claveria has two distinct climatological types. Higher elevation areas have type III climate, where wet season is very pronounced with maximum rainfalls occurring from the month of November to January. The monthly rainfall distribution is less than 100 mm/month (March to April) and 100 to 150 mm/month during May. While every June to November, the rainfall is greater than 200 mm/month. And on December to February it accounts to 100 to 150 mm/month. Normally, Claveria has nine months of rainfall, but rainfall patterns vary with elevation, the upper areas receiving a relatively greater amount than the lower areas. Normally the area has no dry season under this type of climate although, the recent observations indicates that rainfall occurs in July and August.

The Western portion is characterized by Type II which is the climate type for majority of Misamis Oriental's municipalities. Type II is characterized by seasons, which is not very pronounced being relatively dry from November to April and wet the rest of the year. The maximum rain periods are not very pronounced although the short dry season lasts from one to three months only.

Claveria is typhoon-free. This site is protected against typhoons originating from Pacific Ocean by mountain ranges along its eastern boundary. The observation was that the rainfall pattern has been consistent for the past years being adequate and equally distributed throughout the year (CLUP 1999).

During the late 1997 and early 1998 "El Niño" phenomenon hit the municipality from November 1997 until May 1998. The worst episode occurred from February to April 1998. The lowest recorded rainfall ranged from 8.25 to 20.15 mm and lasted 1 to 4 days. This is far behind the computed average from July 1997 to June 1999, which was 267.33mm with 18 rainy days (CLUP 1999). Table 8 shows climate account of previous El Niño episodes in the municipality.

Table 9. Climate records of Claveria during the El Niño

Month	Rainfall (mm)	No. of Days	Temperature °C			Wind Speed m/s
			Max	Min	Ave.	
July '97	299.8	26	27.42	21.5	24.46	0.81
August	184.75	10	29.74	20.66	25.2	0.96
September	250.8	22	28.8	20.63	24.72	0.88
October	317.6	21	28.52	19.89	24.21	0.91
November	119.53	14	28.84	19.83	24.34	0.93
December	99.2	13	28.24	19.27	23.76	0.9
January '98	42.8	6	28.5	18.71	23.61	1.05
February	8.25	3	30.03	18.42	24.23	1.04
March	20.05	4	30.64	18.84	24.74	1.16
April	9.75	1	31.75	20.18	25.97	1.16
May	77.1	8	32.02	21.7	26.68	1.07
June	474.75	22	28.85	21.15	25	0.79
July	582.95	28	28.23	20.32	24.28	0.78
August	400.7	30	28.89	20.27	24.58	0.74
September	230	22	29.9	20.46	25.18	0.75
October	464	24	28.73	20.81	24.77	0.72
November	554.5	26	28.33	20.48	24.41	0.58
December	162.8	23	28.31	20.24	24.28	0.74
January '99	197.7	26	27.37	20.27	23.82	0.61
February	314	18	27.57	18.77	23.17	0.85
March	248.75	20	27.44	19.5	23.97	0.74
April	346.3	20	28.11	19.57	23.84	0.77
May	707.3	27	28.65	19.3	23.98	0.79
June	302.5	20	28.58	19.3	23.94	0.79
<b>Annual/Ave</b>	<b>3207.99</b>	<b>217</b>	<b>28.54</b>	<b>20</b>	<b>24.47</b>	<b>0.86</b>

(Source: MOSCAT Agromet, July 1999)

### **Socio-economic Profile**

Claveria is a second-class municipality. In 2002, the annual income of the municipality was Php 50 million. The LGU has 193 municipal employees, 12 special multi-sectoral bodies to handle sectoral concerns. There were also fifty (50) People's Organization accredited by the LGU (Catacutan 2004).

The upper Claveria (eastern part) is the vegetable-farming area whereas the lower Claveria (western part) is cereal-based. Other crops grown are root crops and fruit trees. The dominant crop is corn. Claveria is a major supplier of agricultural products to Cagayan-Iligan-Corridor (CIC), the economic zone of the northern part of Mindanao. When it comes to water, the municipal water system supplies the potable drinking water. It comes from wells and springs (Catacutan 2004).

Catacutan (2004) using the 2003 data estimated 21 persons per square kilometer. The recent population is 44,190 having 8,599 households. Three major ethnic groups are Cebuano having 79 percent; Boholano with 6 percent; Camiguin with 1 percent and the rest composed of Tagalog, Hiligaynon, Ilocano, Waray, and Maranao with 1 percent. Seventy-nine percent of the total households are farming to an average farm size of 3 hectares of land. From the farmers, 6 percent are seasonally employed. Almost all are farm laborers. While from the labor force, 9 percent is employed in business, government, and educational institutions (Catacutan 2004).



Plate 9a. Water sampling  
Photo by: JDVillanueva February 2006





Plate 9b. Water sampling  
Photo by: JDVillanueva February 2006



Plate 10. Soil sampling  
Photo by: JDVillanueva February 2006





Plate 11a. Survey  
Photo by: DFMontejo February 2006



Plate 11b. Survey  
Photo by: DFMontejo February 2006