B. PHYSICAL FEATURES

1. Topography

The municipality of San Vicente has two (2) topographic relief, the flat lowlands, and mountainous area. These rugged mountains and rolling hills that gradually descend to lowlands where majority of the barangay are located.

Table 3
Land Elevation
Municipality of San Vicente

Mapping Symbol	Description	Area (Has.)	Percent
A	0-100 meter (Very Low)	3,178	55.28
B	100-300 meter (Low)	1,412	24.56
C	300-500 meter (Moderately High)	892	15.51
D	1000-2000 meter, (High)		
TOTAL		**5,749**	**100.00**

2. Land Elevation

Two (2) barangays namely San Jose and Iraya Sur are found at the mountainous portion with the highest elevation of which 15.51% of the land area is within 300 to 500 meters above sea level. (Table 3)

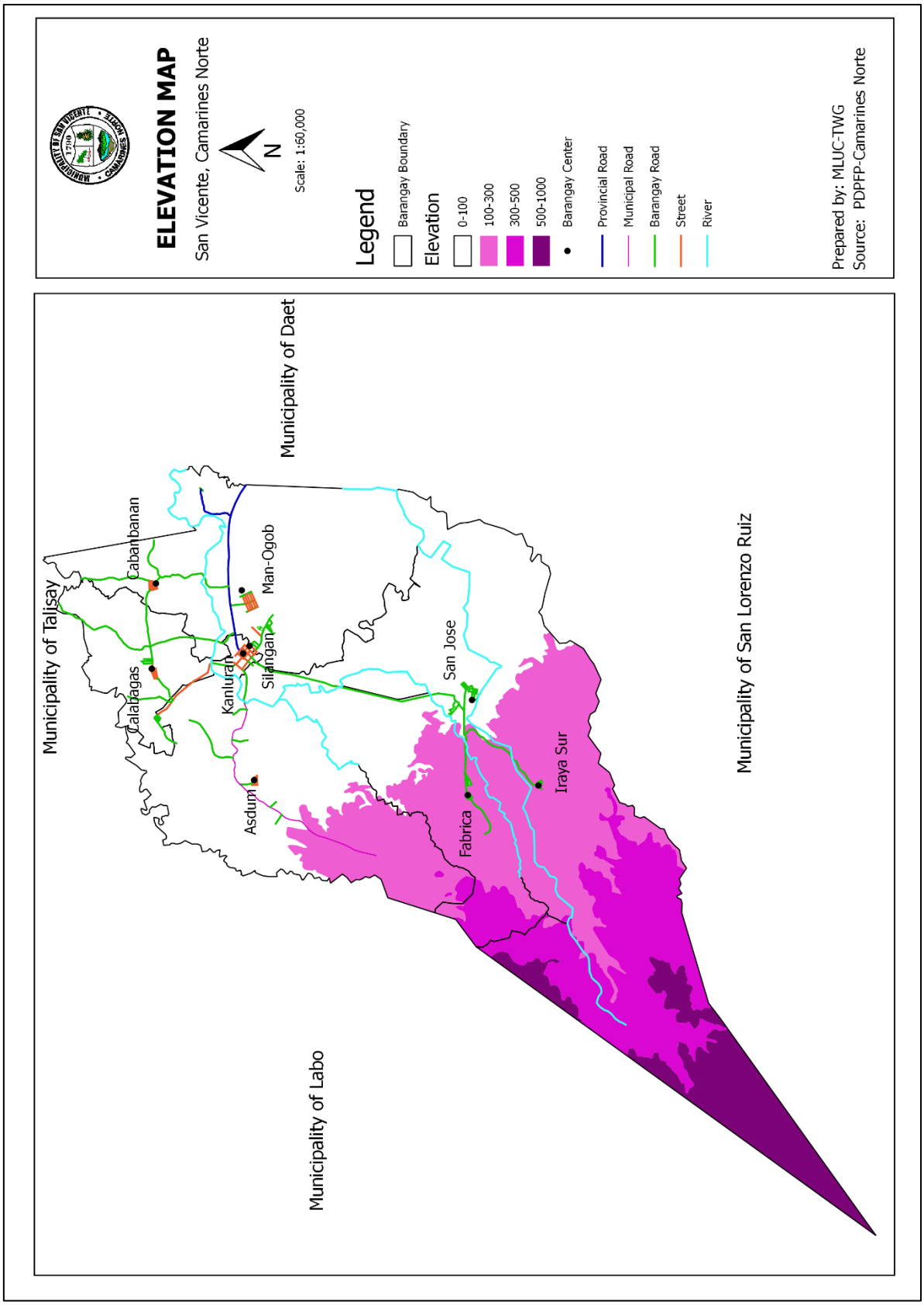
The mountainous area is located within the jurisdiction of Barangays Iraya Sur and Fabrica, which is covered by the forest portions of the said areas. At least 55.28% of the total land area is situated between the low to very low elevation covering the remaining barangays.

Table 4
Elevation by Barangay
Municipality of San Vicente

BARANGAY	TYPE				TOTAL
	0 -100	100 - 300	300 - 500	500 - 1000	
Asdum	917.17	139.24	-	-	1,056.41
Cabanbanan	397.36	-	-	-	397.36
Calabagas	334.43	-	-	-	334.43
Fabrica	199.40	425.83	20.74	-	654.97
Iraya Sur	371.98	499.75	642.93	440.03	1,954.69
Man-ogob	726.50	-	-	-	726.50
Silangan (Pob. I)	9.45	-	-	-	9.45
Kanluran (Pob. II)	22.16	-	-	-	22.16
San Jose	410.62	182.64	-	-	593.26
TOTAL	**1,168.73**	**182.64**	**-**	**-**	**5,749.23**

Source: PDPFP-Camarines Norte: 2013-2033

Figure 5. Elevation Map



3. Slopes

San Vicente is composed of rolling hills and mountainous terrain. Slopes of 0- 3% comprises majority with about 1,676.24 hectares (29.16%), 3-8% comprising about 1,336.22 hectares (23.24%), 8-18% with 4,246.75 hectares (21.69%), and 18-50% slope with 646.90 hectares (11.25%). More than 50% slope comprised 843.12 hectares or 14.66%.

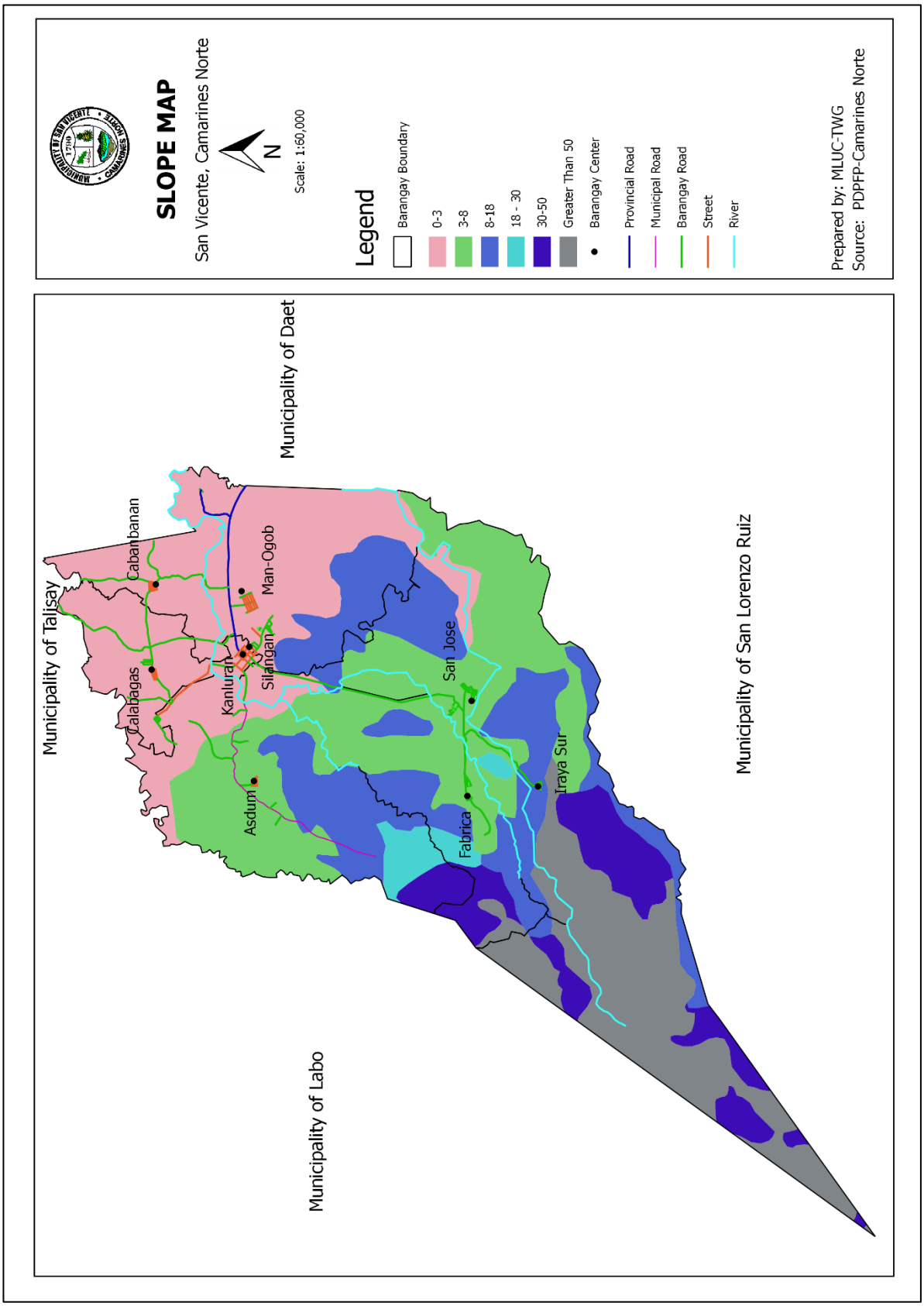
San Vicente has enough areas to accommodate growth considering that around 29.16% (Table 5) of its land area have a slope of 0-3% which is ideal for mixed land uses. By barangay, Man-gob has the highest area of 0-3% with 520.39 hectares followed by Cabanbanan and Calabagas with 397.36 and 334.43 hectares, respectively. The slope map is presented in figure 6.

Table 5
Slopes by Barangay
Municipality of San Vicente

BARANGAY	0-3%	3-8%	8-18%	18-30%	30-50%	>50%	TOTAL
Asdum	287.37	541.64	227.40	-	-	-	1,056.41
Cabanbanan	397.36	-	-	-	-	-	397.36
Calabagas	334.43	-	-	-	-	-	334.43
Fabrica	22.54	212.37	190.52	107.53	103.97	18.04	654.97
Iraya Sur	20.50	353.90	357.14	-	420.04	803.11	1,954.69
Man-ogob	520.39	7.42	198.69	-	-	-	726.50
Silangan (Pob. 1)	9.45	-	-	-	-	-	9.45
Kanluran (Pob. 2)	22.16	-	-	-	-	-	22.16
San Jose	62.04	220.89	273.00	15.36	-	21.97	593.26
TOTAL	**1,676.24**	**1,336.22**	**1,246.75**	**122.89**	**524.01**	**843.12**	**5,749.23**
%	**29.16**	**23.24**	**21.69**	**2.14**	**9.11**	**14.66**	**100.00**

Source: PDPFP-Camarines Norte: 2013-2033

Figure 6. Slope Map



4. Soil Type

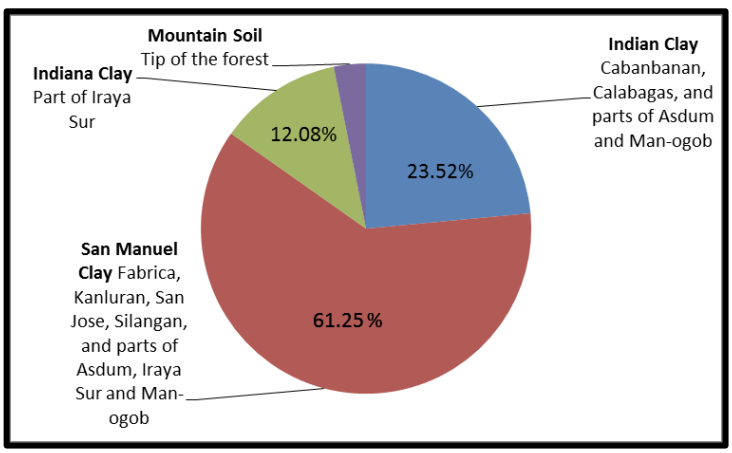
The municipality is endowed with rich type of soil good for crop production (Table 6). Soil at the lowland is classified as Indian Clay, and is most dominant in Barangays Cabanbanan, Calabagas, and parts of Asdum and Man-ogob.

Table 6
Soil Classification
Municipality of San Vicente

Barangay	Soil Type	Suitability	Total Covered Area (Has.)	% Total
Parts of Asdum	Indian Clay	Suitable for Agriculture	1,352.09	23.52
Cabanbanan				
Calabagas				
Fabrica	San Miguel Clay	Suitable for Agriculture	3,521.49	61.25
San Jose				
Kanluran				
Parts of Asdum, Iraya Sur and Man-Ogob				
Parts of Iraya Sur	Indian Clay Loam		694.70	12.08
Tips of Forest	Mountain Soil		180.95	3.15
TOTAL			**5,749.23**	**100.00**

San Manuel Clay type of soil is dominant in Barangays Fabrica, Kanluran, San Jose, Silangan, and parts of Asdum, Iraya Sur and Man-ogob, while Indiana Clay is found in part of Iraya Sur, particularly in the watershed forest reserve. Mountain soil is found at the apex of the watershed. (Fig. 7)

Figure 7
Soil Types by Area

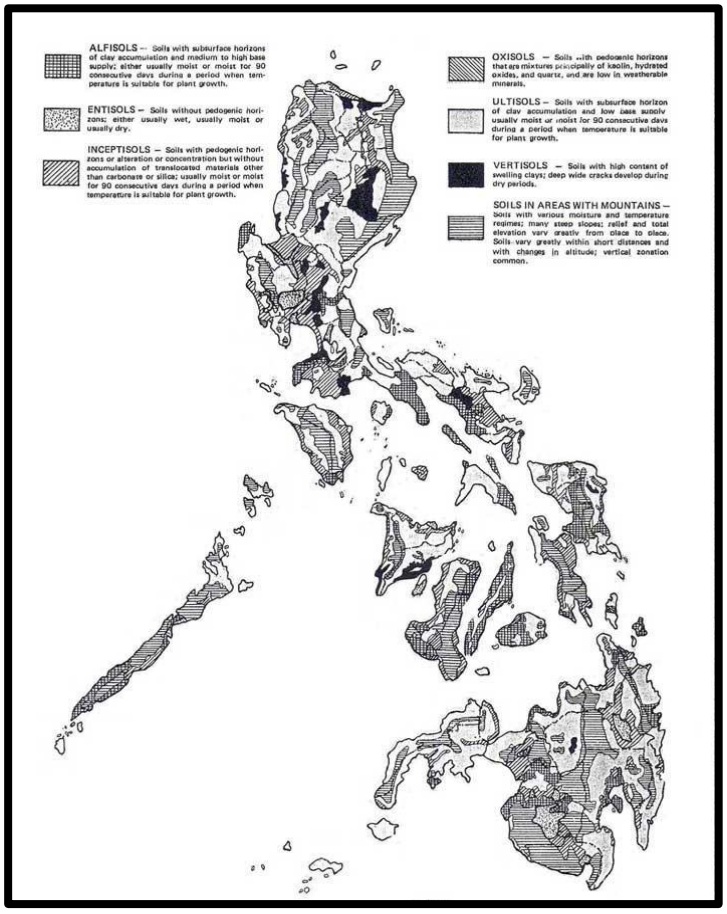


Clay Soil is very fine grained soil and hence there is very less air spaces between the particles. Water clogging might harm the roots of the plant. Clay soil becomes very heavy when wet. Blue or grey clays are poorly aerated and thus must be loosened to support healthy growth of plants. Red colored clay soil has good aeration. Plants grow well in clay if drainage is adequate because of high nutrient levels.

Based on the Soil Map of the Philippines (Fig. 10), San Vicente is composed of inceptisols and ultisols. Inceptisols are ideal for the cultivation of crops; suitable for woodland, leaching, recreation and wildlife while Ultisols are suitable for shifting cultivation and timber, but the municipality has low base status forest soils.

Further, San Vicente has a small portion for rice production which belongs to entisols. These soil types make the municipality basically agricultural.

Figure 8
Soil Map of the Philippines



5. Surface Drainage

There are five (5) river systems in the municipality namely Alinao River (separating Barangays Asdum and Calabagas, San Vicente from the municipality of Labo), Maisog River (separating Barangay Iraya Sur, San Vicente from the municipality of San Lorenzo Ruiz), Mananap River (separating Barangay Iraya Sur from Barangays San Jose and Man-ogob), Nabua River (separating San Jose from Barangay Fabrica), and San Vicente River (separating Fabrica from Barangay Asdum). (Table 7)

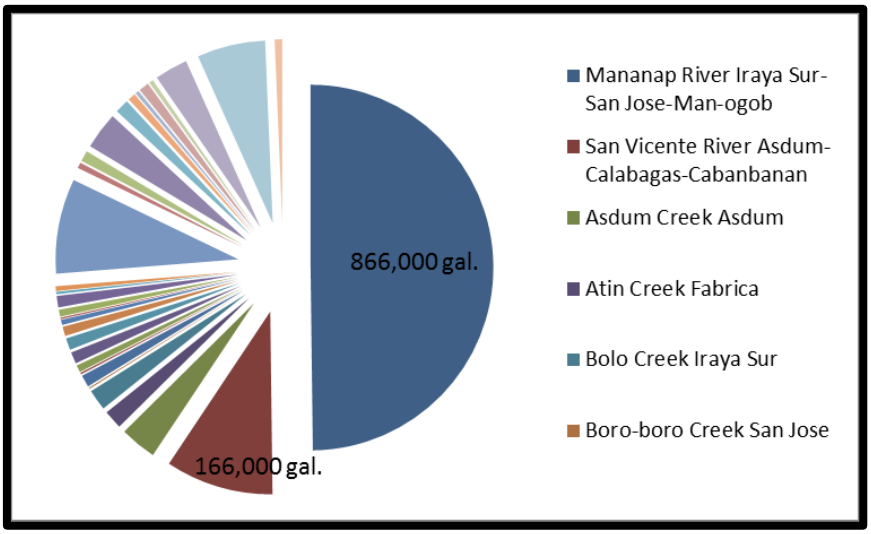
Table 7
Rivers and Creeks
Municipality of San Vicente

SURFACE WATER	LOCATION	VOLUME (gal.)
1. Mananap River	Iraya Sur, San Jose, Man-Ogob	866,000
2. San Vicenter River	Asdum, Calabagas, Cabanbanan	166,000
3. Asdum Creek	Asdum	56,250
4. Atin Creek	Fabrica	28,900
5. Bolo Creek	Iraya Sur	32,250
6. Boro-boro Creek	San Jose	1,680
7. Bulho Creek	Iraya Sur	18,500
8. Camalig Creek	Fabrica	2,430
9. Cogod Creek	Fabrica	10,850
10. Diit Creek	Iraya Sur	17,800
11. Galogo Creek	Iraya Sur	18,100
12. Halabang Bubon Creek	Man-Ogob, Cabanbanan	14,400
13. Mabolo Creek	Man-Ogob, Kanluran, Cabanbanan	7,840
14. Magulpac Creek	Fabrica	2,160
15. Mambunga-bunga Creek	Man-Ogob, Cabanbanan	10,750
16. Manacla Creek	Asdum, Calabagas	17,600
17. Mandamagan Creek	Iraya Sur	3,550
18. Mangho Creek	Asdum	7,250
19. Nabua Creek	San Jose, Fabrica	146,000
20. Nalaw igao Creek	San Jose, Man-Ogob	8,800
21. Palale Creek	Man-Ogob, Cabanbanan	16,660
22. Pangamaman Creek	Iraya Sur	57,000
23. Pangiliw an Creek	Iraya Sur	21,360
24. Sapang Bato Creek	Man-Ogob, San Jose	11,650
25. Sapang Kalaw ang Creek	Iraya Sur	5,550
26. Saroro Creek	Asdum, Calabagas	15,525
27. Sinalpukan Creek	San Jose	6,400
28. Sudita Creek	Asdum	51,000
29. Talisay Creek	Fabrica	105,000
30. Tiasan Creek	Asdum, Calabagas	11,550
TOTAL ESTIMATED VOLUME OF WATER		**1,738,805**

6. Rivers and Tributaries

Shown in Table 7 are 30 known creeks that serve as natural drainage of the municipality carrying excess water to nearby river tributaries. These bodies of surface water accounts for an estimated volume of 1,738,805 gallons of water sufficient for drinking, domestic, irrigation and recreation requirements of the municipality of San Vicente. Preliminary studies also show that the rivers can produce hydro power of significant capacity.

Figure 9
Volume of Water from Major Tributaries



The biggest river in terms of volume of water is the Mananap River (Fig. 9) followed closely by San Vicente River. There are five (5) major creeks which hold more than 50,000 gallons of water; Asdum, Sudta, Atin, Pangamaman and Talisay Creeks.

These 30 water bodies manifested the slopes and elevation of the municipality and the presence of watershed. Considering the observed changes in the land forms along these bodies of water, new investigation to measure volume and volume capacity has to be conducted.

7. NIPAS and Watershed/sub-watershed coverage

Republic Act (RA) No. 7586, issued in June 1992, addressed the problems of environmental degradation and advocated for biological diversity conservation, protected area management and sustainable development. Under the National Integrated Protected Areas System (NIPAS), protected areas were classified into eight categories, namely: (1) Strict Nature Reserve, (2) Natural Park, (3) Natural Monument, (4) Wildlife Sanctuary, (5) Protected Landscape and Seascape, (6) Resource Reserve; (7) Natural Biotic Area; and (8) other categories as established by law, conventions or international agreements.

As of CY 2003, the DENR has proclaimed seventeen (17) protected areas in Bicol covering some 60,485.62 hectares. Fourteen (14) of such areas have organized their Protected Area Management Boards (PAMBs) to ensure the effective implementation of their Protected Area Plans.

Of Bicol's 17 Protected Areas, four (4) were proclaimed as Natural Parks while two (2) others were proposed as Natural Monuments and Protected Landscapes and seascapes, among this is the Bicol Natural Park, under Proclamation No. 431 dated December 29, 2000, within the municipalities of Lupi and Sipocot, in Camarines Sur as well as of Basud and San Lorenzo Ruiz in Camarines Norte, covering an area of 5,201 hectares;

Biodiversity Conservation Priority areas were identified in the Bicol Region under the Philippine Conservation Priorities shown in Table 8.

Table 8
Biodiversity Priority Areas
Bicol Region

Conservation Priority Areas	Priority Level	Estimated Area	Location	Region	Within Biodiversity Corridors
Ragay Gulf	Very High	19,492.04	Cam. Sur & Quezon	V	
Mt. Labo	Very High	74,637.39	Cam. Sur, Cam. Norte & Quezon	V & IV	Bicol Corridor
Caramoan Peninsula	Extremely High Critical	28,896.06	Cam. Sur	V	Bicol Corridor
Catanduanes Island	Very High	63,607.37	Catanduanes	V	
Mt. Isarog National Park	Extremely High Critical	20,882.42	Cam. Sur	V	Bicol Corridor
Lake Nabua	Very High	7,414.69	Cam. Sur	V	
Lake Buhi, Lake Manapo, Lake Katugday	Extremely High Critical	29,076.00	Albay & Cam. Sur	V	Bicol Corridor
Lake Bato	Extremely High Critical	10,500.90	Albay & Cam. Sur	V	
Bacon-Manito	Insufficient Data	20,794.85	Sorsogon & Albay	V	
Mt. Bulusan National Park	Very High	19,053.15	Sorsogon	V	

Mt. Labo covers portion of the protected forest of the municipality. Mt. Labo has a total of 74,637.39 hectares – the biggest biodiversity area in the Bicol Peninsula.

The Bicol Region has eleven (11) proclaimed Watershed Forest Reserve areas as shown in Table 9. Camarines Norte has the second largest watershed forest reserve with 5,545 covered area, the Abasig-Matogdon-Mananap Forest Reserve proclaimed on November, 18, 1991.

Table 9
Watershed Area
Bicol Region

Name of Watershed	Total Area Covered	Proclamation Date	Proclamation Number
Mt. Masaraga Watershed Forest Reserve	810	Oct. 27, 1992	84
Capalonga Watershed Foreest Reserve	762	Nov. 25, 1966	128
Dahican Watershed Forest Reserve	43	23-Jun-33	43
Abasig-Matogdon Forest Reserve	5,545	Nov. 18, 1991	837
Jose Panganiban Watershed Forest Reserve	1,160	Jan. 9, 1998	1151
Lagonoy Watershed Forest Reserve	470	Sept. 26, 1932	500
Catanduanes Watershed Forest Reserve	26,010	23-Jun-87	123
Matang-Tubig Watershed Forest Reserve	1,305	May 2, 1994	368
Tugbo Watershed Forest Reserve	247	May 2, 1994	369
Diwata Watershed Forest Reserve	350	May 2, 1994	370
Magallanes & Juban Watershed Forest Reserve	1,032	Nov. 23, 1992	108
Bicol Region	**37,734**		

Source: Department of Environment and Natural Resources, RO V

Camarines Norte has three (3) watershed areas namely; Abasig-Matogdon-Mananap Watershed, Capalonga Watershed and Jose Panganiban Watershed. These belong to the top five (5) largest forest reserve in Bicol Region.

Per record, San Vicente accounts for 822 hectares (MPDC) or 14.82% of the total forest cover of the said forest reserve. Abasig-Matogdon-Mananap corresponds to around 15% of the total Bicol forest reserves.

8. Land Cover

Reflected in Table 10 is the total land cover of the municipality which shows the forest covered area of 786.35 hectares or 13.68% of the municipality's total land area. Areas devoted to annual crops is estimated at 223.13 hectares, perennial crops with 2,116.32 hectares and shrubs with 568.27 hectares. Among the barangays, Man-gob exhibit the highest areas devoted to agriculture, followed by San Jose, Cabanbanan, Iraya Sur and Asdum. Total built-up is accounted to 104.10 hectares or 1.81% of the Municipal land area. (Figure 10)

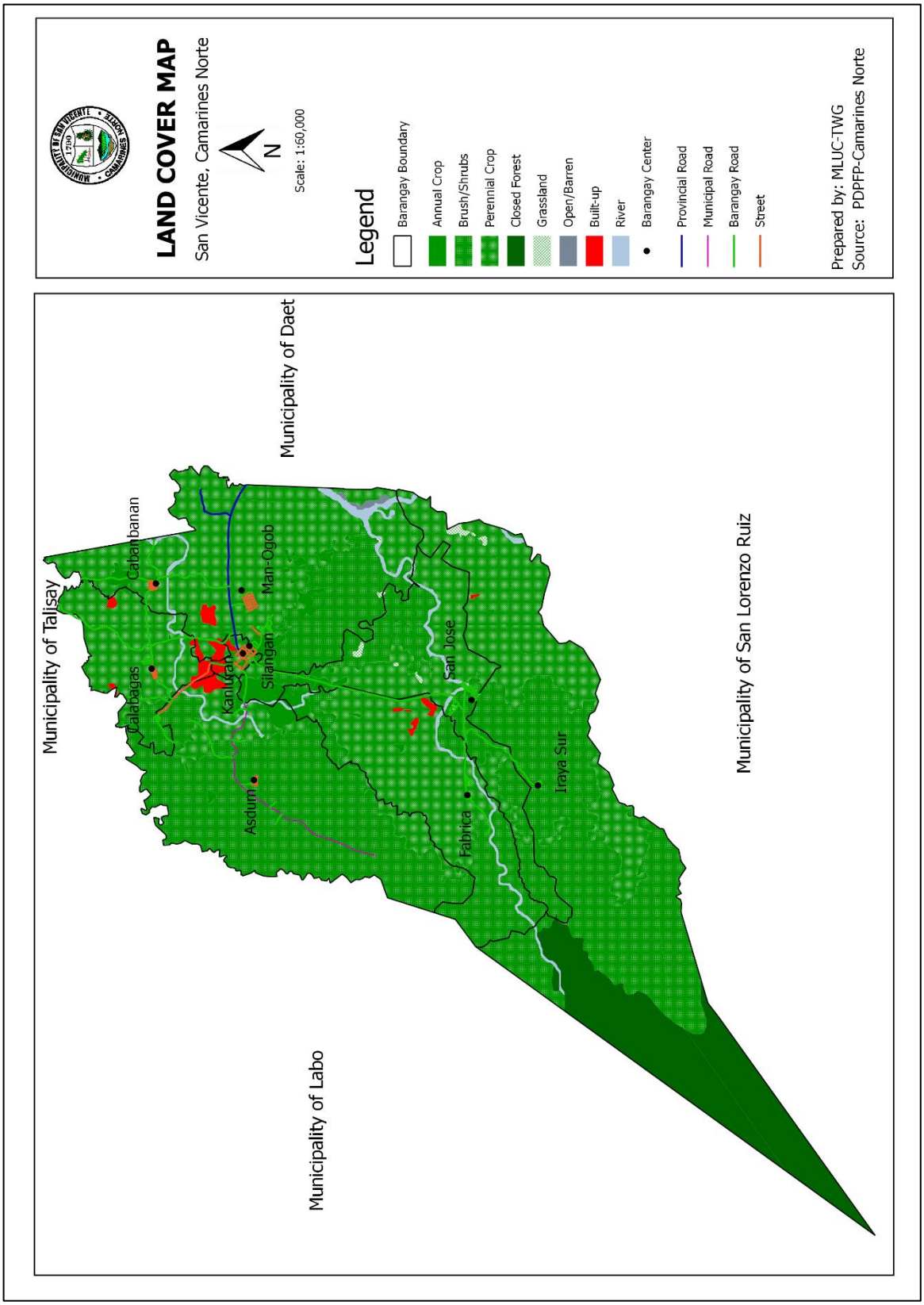
Table 10
Land Cover By Barangay
Municipality of San Vicente

BARANGAY	TYPE (HAS.)									TOTAL
	Annual Crop	Built-Up	Perennial Crop	Open / Barren	Grassland	Wooded Grassland	Shrubs	Closed Forest	Inland Water	
Asdum	-	-	286.48	-	-	769.93	-	-	-	1,056.41
Cabanbanan	31.13	18.73	345.37	-	-	2.13	-	-	-	397.36
Calabagas	62.53	3.71	245.44	-	-	22.75	-	-	-	334.43
Fabrica	16.11	18.55	145.75	-	-	474.56	-	-	-	654.97
Iraya Sur	7.91	4.32	283.51	10.33	-	612.44	242.87	786.35	6.96	1,954.69
Man-ogob	82.15	30.80	427.41	-	-	-	186.14	-	-	726.50
Silangan (Pob. I)	-	6.93	2.52	-	-	-	-	-	-	9.45
Kanluran (Pob. II)	-	7.53	14.63	-	-	-	-	-	-	22.16
San Jose	23.30	13.53	365.21	2.55	7.39	39.36	139.26		2.66	593.26
TOTAL	**223.13**	**104.10**	**2,116.32**	**12.88**	**7.39**	**1,921.17**	**568.27**	**786.35**	**9.62**	**5,749.23**

Source: PDPFP-Camarines Norte: 2018-2033

The forest reserve of which San Vicente has a significant cover is the main source of potable drinking water of the province of Camarines Norte. Inside this reserve are significant number of species and forest vegetation which are guarded and protected by the Wildlife Enforcers Organization (WEO) of the municipality of San Vicente. To date, there is no official record or inventory of wild animals and plant species in the area.

Figure 10
Land Cover Map
Municipality of San Vicente



9. Geology

The underlying conditions for the municipality of San Vicente contains both igneous and sedimentary rock formations (Table 11 and Fig. 11). The igneous rock formation accounts for 18.389661 sq. km. (31.99%). This rock formation is composed of Volcanic Cone (VC) and Pyroclastic (QVP). On the other hand, the sedimentary rock is classified as Recent Alluvium (R) and Shale/Sandstone (N2). Recent Alluvium contains an area of 15.521675 sq. km. (27.00%) while the Shale/Sandstone covers an area of 13.045583 sq. km. (22.69%).

Table 11
Geological Formation
Municipality of San Vicente

MAPPING SYMBOL	DESCRIPTION	AREA (HAS.)	%
IGNEOUS ROCK		3,070	49.60%
VC	Volcanic Cone		
QV	Andesitic		
QVP	Pyroclastic		
QAV	Non-Active Volcanic Cone		
N2V	Basalt Andesite Series		
UC	Ultrabasic Complex		
NI	Diosite/Grand Diosite		
SEDIMENTARY ROCK		2,000	32.31%
R	Recent Aluminum		
N2	Shale/Sandstone		
METAMORPHIC ROCKS		1,120	18.09%
Kpg	Metal Rock		
vc R	Geological Constant		
NI	Strike and Clip of fault		
	Thrust fault (saw teeth or overriding side)		
TOTAL		**6,190**	**100%**

Source: Mines and Geosciences Bureau V

Shown in Fig. 11 is the Geological Map of the Municipality of San Vicente.

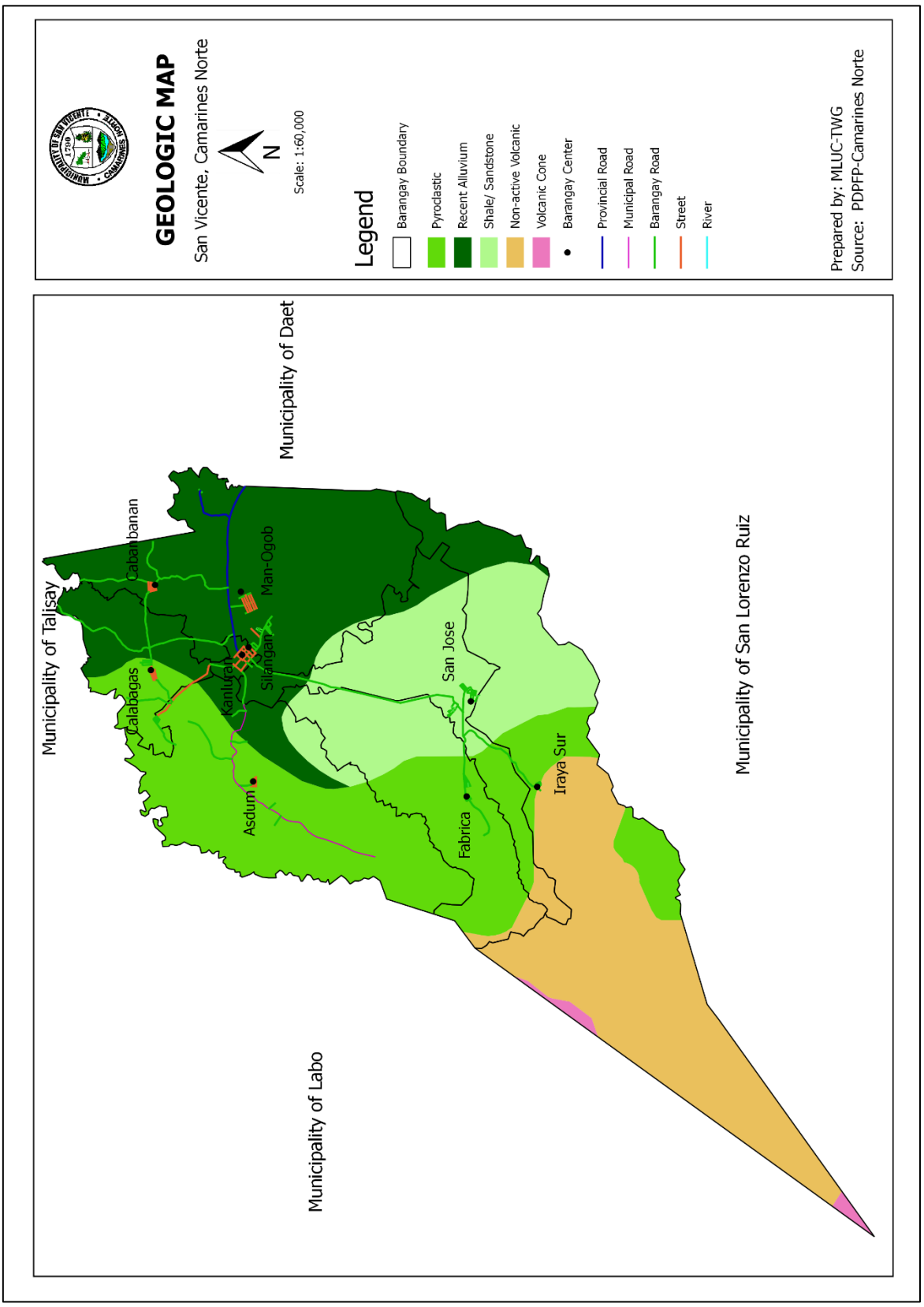
Sedimentary rocks are types of rock that are formed by the deposition and subsequent cementation of that material at the Earth's surface and within bodies of water. Sedimentation is the collective name for processes that cause mineral and/or organic particles (detritus) to settle in place. The particles that form a sedimentary rock by accumulating

are called sediment. Before being deposited, the sediment was formed by weathering and erosion from the source area, and then transported to the place of deposition by water, wind, ice, mass movement or glaciers, which are called agents of denudation. Sedimentation may also occur as minerals precipitate from water solution or shells of aquatic creatures settle out of suspension.

Igneous rock is formed through the cooling and solidification of magma or lava. Igneous rock may form with or without crystallization, either below the surface as intrusive (plutonic) rocks or on the surface as extrusive (volcanic) rocks. This magma can be derived from partial melts of existing rocks in either a planet's mantle or crust. Typically, the melting is caused by one or more of three processes: an increase in temperature, a decrease in pressure, or a change in composition.

Metamorphic rocks are created by the physical or chemical alteration by heat and pressure of an existing igneous or sedimentary material into a denser form. Due to the action of plate tectonics, compression, stress and shearing forces over long periods of time, rocks can be essentially warped and deformed, causing them to be compacted into a smaller volume of space. As a consequence, metamorphic rocks are always more dense than their original material, and also much less susceptible to erosional breakdown.

Figure 11
Geologic Map
Municipality of San Vicente



10. Environmental Hazards

a. Rainfall Induced Landslide

A landslide is a geological phenomenon which includes a wide range of ground movement, such as rockfalls, deep failure of slopes and shallow debris flows, which can occur in offshore, coastal and onshore movements. One of the factors affecting the original slope stability is the varying quantity and duration of rainfall.

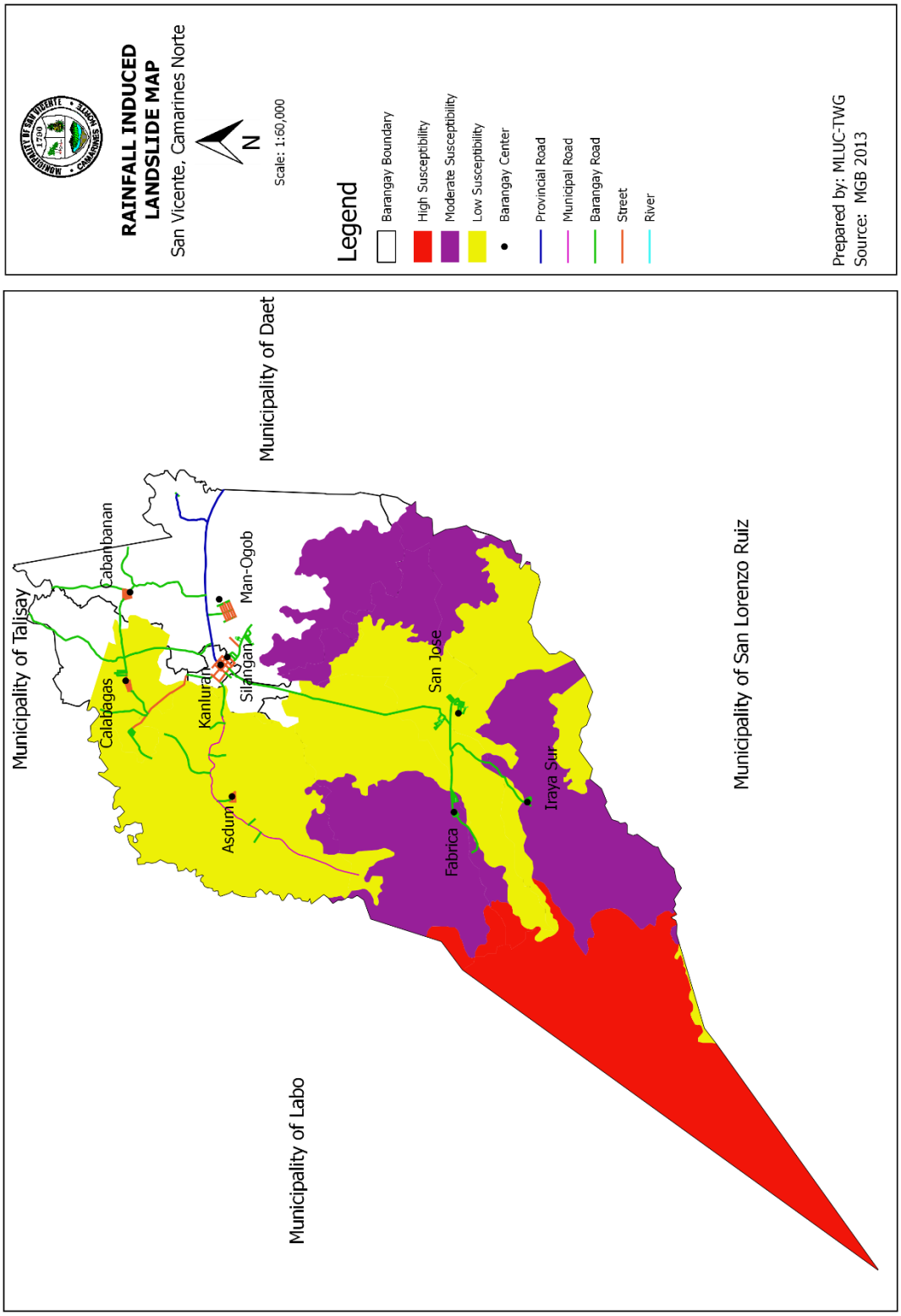
Reflected in Table 12 two (2) barangays are in high susceptibility areas to rainfall induced landslide Barangay Iraya Sur with 1,011.94 hectares and Barangay Fabrica with 5.13 hectares. The total area affected by this hazard is accounted to 1,011.94 hectares or 17.69% of the total land area.

Areas with moderate susceptibility are about 1,506.73 hectares or 26.21% and 2,173.08 hectares or 37.80% have low susceptibility while 1,052.34 hectares or 18.30% are not susceptible to rainfall induced landslide. Map of Rainfall Induced Landslide is shown in Figure 12.

Table 12
Rainfall Induced Landslide By Barangay
Municipality of San Vicente

BARANGAY	SUSCEPTIBILITY (HAS.)			TOTAL
	High	Moderate	Low	
Asdum	-	48.13	995.90	1,056.41
Cabanbanan	-	-	8.04	397.36
Calabagas	-	-	271.51	334.43
Fabrica	5.14	365.99	283.84	654.97
Iraya Sur	1,011.94	689.82	252.93	1,954.69
Man-ogob	-	230.56	1.23	726.50
Silangan (Pob. I)	-	-	-	9.45
Kanluran (Pob. II)	-	-	-	22.16
San Jose		172.23	359.63	593.26
TOTAL	**1,017.08**	**1,506.73**	**2,173.08**	**5,749.23**

Figure 12
Rainfall Induced Landslide Map
Municipality of San Vicente



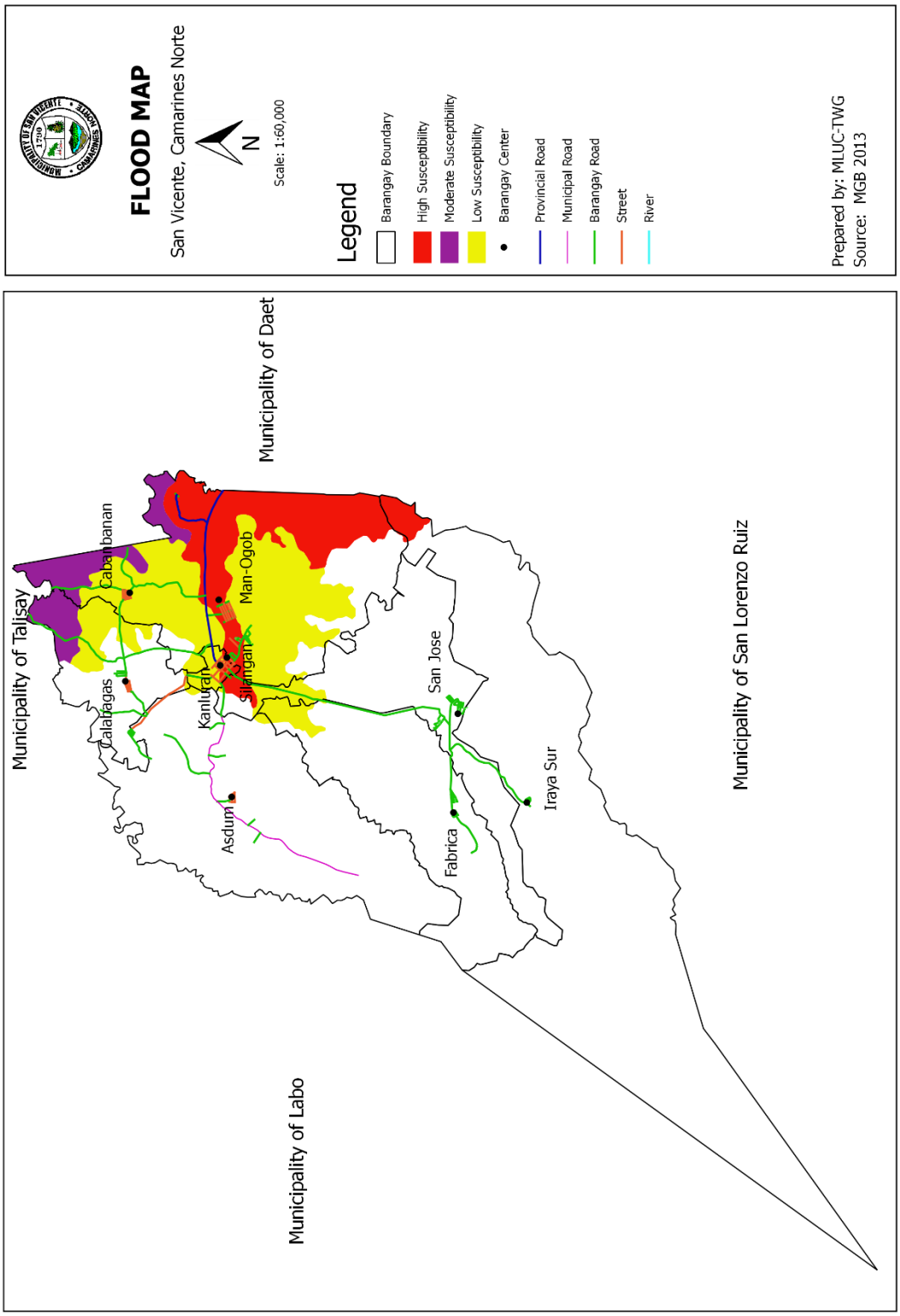
b. Flood

Flooding induced hazard areas comprised of about 1,108.13 hectares or 19.27% of the municipality's total land area. Table 13 and Figure 13 shows that Barangays Man-Ogob, Cabanbanan, Kanluran (Poblacion iI), Calabagas, San Jose and Silangan (Poblacion I) are highly susceptible to flood with a total affected area of 302.95 hectares or 5.27%. Barangays Cabanbanan and Calabagas show to have moderate susceptible with an area of 140.52 hectares and almost eight (8) barangays are low susceptible to flood with a total of 664.66 hectares or 11.56%.

Table 13
Flood By Barangay
Municipality of San Vicente

BARANGAY	SUSCEPTIBILITY (HAS.)			TOTAL
	High	Moderate	Low	
Asdum	-	-	8.51	1,056.41
Cabanbanan	98.47	90.35	204.60	397.36
Calabagas	2.78	50.17	96.47	334.43
Fabrica	-	-	17.85	654.97
Iraya Sur	-	-	-	1,954.69
Man-ogob	182.71	-	279.55	726.50
Silangan (Pob. I)	1.30	-	8.69	9.45
Kanluran (Pob. II)	14.95	-	6.95	22.16
San Jose	2.74	-	42.04	593.26
TOTAL	**302.95**	**140.52**	**664.66**	**5,749.23**

Figure 13
Flood Map
Municipality of San Vicente



11. Climate and Geographical Characteristics

c. Climate and Weather Disturbance

San Vicente falls under the second climatic type consisting of the dry season and a very pronounced maximum rainfall period from November to January. During summer, temperature goes up. Its rainfall pattern could be classified as Type A (Wet), which means it is rainy throughout the year with almost only 1½ dry months.

a. Rainfall

It is brought about by different rainfall-causing weather patterns such as streams, tropical cyclones, thunderstorms, ITCZ, frontal passages, etc. Its intensity or amount is influenced by latitude or geographical setting, topography, exposure and the season. Under certain conditions, a surfeit or rainfall results in potentially disastrous phenomena.

In the absence of current data, Pag-asa 2000 data is used where the average rainfall posted in the province in 1991-2000 was 259.5 mm. The highest is recorded in the month of December with 1,007 mm to as low as 50.5 mm in the month of June. (Table 14)

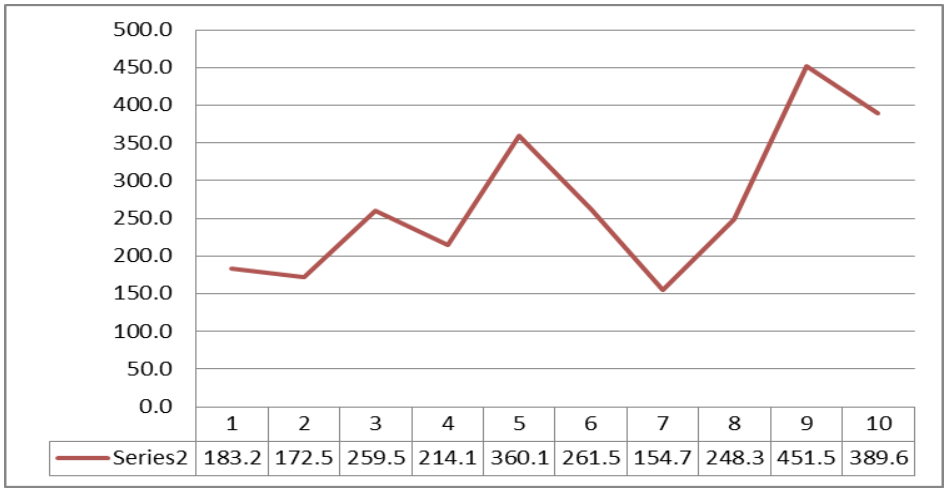
Table 14
Annual Rainfall Distribution, Monthly Average (mm), 1991-2000
Province of Camarines Norte

YEAR AND MONTH	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPT.	OCT.	NOV.	DEC.	TOTAL	YEARLY AVERAGE
1991	150.6	128.6	106.8	113.3	36.6	417.8	173.4	97.2	59.2	169	350.2	395.9	2198.6	183.2
1992	195	55.5	7.6	45.7	34.1	54.8	459.8	73.9	166.9	333.6	370.7	272.1	2069.7	172.5
1993	192.6	125.5	74.3	26.9	62	50.5	78.9	230.5	235.1	535.4	494.2	1007.7	3113.6	259.5
1994	378.2	88.8	105.9	185	122.6	289.7	239.3	61.5	349.6	212	174.2	362.3	2569.1	214.1
1995	171.3	139.6	26.8	61.5	166.2	179.2	203.4	239.3	324.3	444.5	1116.5	1248.1	4320.7	360.1
1996	289.1	176.7	273.9	403.7	310	157.1	112.2	66.1	189.8	287.7	639.1	232.7	3138.1	261.5
1997	128.4	302.3	91.1	4.6	46	67.2	329.5	37.9	286.6	177	185.8	199.4	1855.8	154.7
1998	88.7	38.2	38.4	11.1	74.9	132.2	72.1	220.2	179.4	730	260	1134.8	2980	248.3
1999	892.3	249.4	600.1	346.2	240.3	295.1	46.6	409.7	212.9	564.1	663.7	897.4	5417.8	451.5
2000	344.6	383.2	452.4	131.5	81.7	187.4	266.7	95.6	318	713.8	616.1	1083.9	4674.9	389.6
TOTAL	2830.8	1687.8	1777.3	1329.5	1174.4	1831	1981.9	1531.9	2321.8	4167.1	4870.5	6834.3	32338.3	2694.9
10-YR. AVE.	283.1	168.8	177.7	133.0	117.4	183.1	198.2	153.2	232.2	416.7	487.1	683.4	3233.8	269.5

SOURCE: PAGASA RADAR STATION, Daet, Camarines Norte

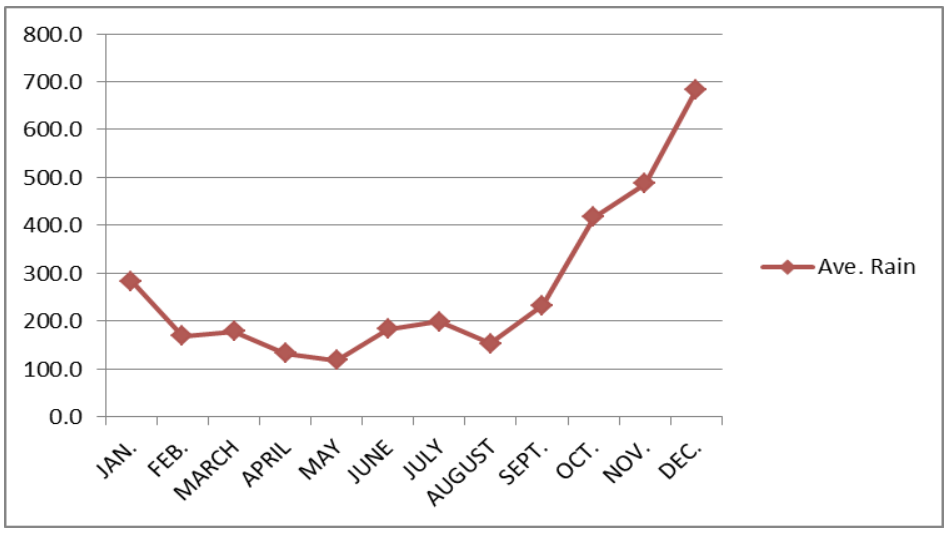
Figure 14 indicates that the biggest volume of rain occurs in 1999 and 2000 which was significantly higher than the rains posted in 1995 of every year as recorded from the monthly rainfall for the period 1990 to 2000.

Figure 14
Annual Rainfall
Province of Camarines Norte



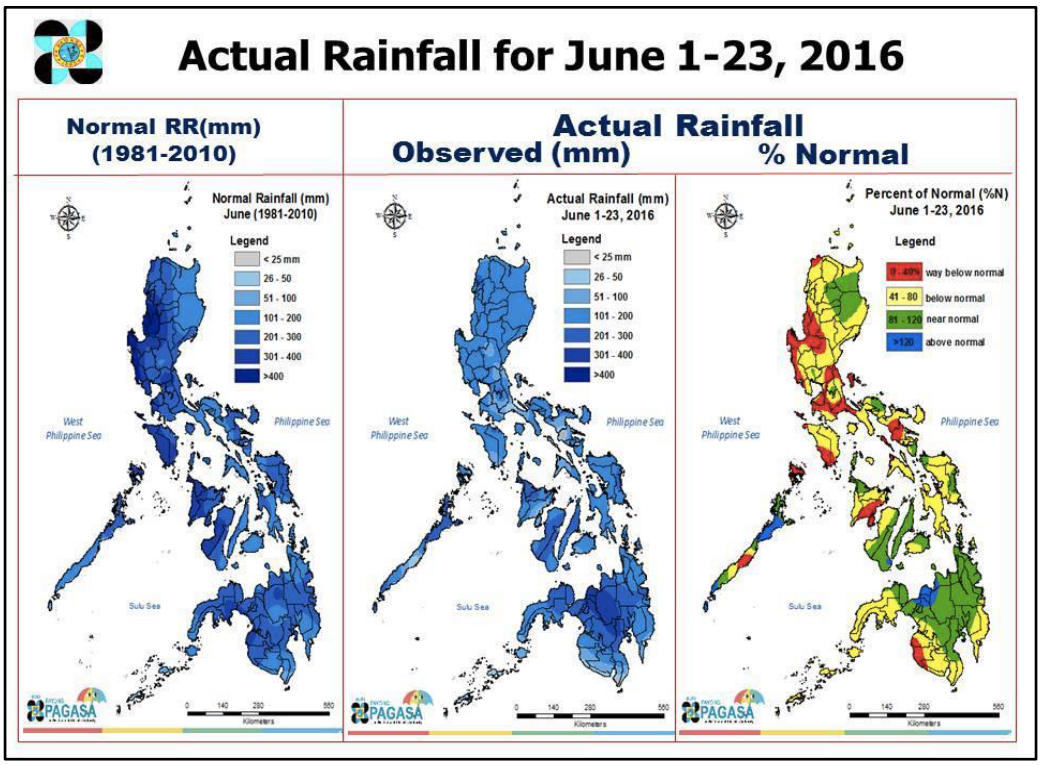
The months of April and May have the lowest recorded volume. Interestingly, the months of November and December posted otherwise (Fig. 15), which is part of summer has changed

Figure 15
Average Monthly Rainfall
Province of Camarines Norte



In the recent report of PAGASA-DOST, Camarines Norte is within below normal and near normal level (41-120 m.m). San Vicente on the other hand as plotted in the Fig. 16 is within near normal level.

Figure 16
Actual Rainfall
Province of Camarines Norte



Source: DOST-PAG-ASA

Projected Rainfall change for 2020 in high and medium range scenario marks 11.7% from December to February to 4.3% from September to November. Under the medium range emission scenario, rainfall change is projected at 0-7.9%, the highest in the months of September, October and November (Table 15)

Table 15
Projected Rainfall (in %) Under High range and Medium Range Emission Scenario in CY 2020 based on 1971-2020 Normal Values

Month	Baseline Observed	High Range Emission Scenario	Medium Range Emission Scenario
December, January, February	1,029.60	-11.70	0.00
March, April, May	398.50	-0.60	-17.80
June, July, August	565.60	3.60	5.20
September, October, November	1,285.70	4.30	7.90

Climate change scenarios are projections of future greenhouse gas (GHG) emissions used by IPCC to assess future vulnerability to climate change.

For year 2050 and based from 1971-2000 observed values, the highest projected rainfall stood at 9.3% in the months of June, July, August and only 8.9% for the same months in the medium range emission scenario. (Table 16)

Table 16
Projected Rainfall Change (in %) Under the High and Medium Range Emission Scenarios in CY 2050 Based on 1971-2000 Normal Values

Month	Baseline Observed	High Range Emission Scenario	Medium Range Emission Scenario
December, January, February	1,029.60	-29.50	5.60
March, April, May	398.50	-25.40	-31.00
June, July, August	565.60	9.30	8.90
September, October, November	1,285.70	-15.50	1.50

The rainfall change will bring damage to agriculture and other sectors in terms of soil erosion, flooding, siltation, landslides, sedimentation and

pollution of water source thereby leading to health problems.

c. Wind Direction and Velocity

Wind is measured in terms of its velocity, which is usually expressed in knot. The prevailing wind direction is generally from northeast to southwest. For the 10-year period (1991-2000), the highest wind velocity in the province was 11.7 knots, observed in the years 1993, 1995 and 1996, while the average wind velocity is 4.2 knots as shown in Table 17 below.

Table 17
Wind Velocity in Knots (m.m.) 1991-2000
Province of Camarines Norte

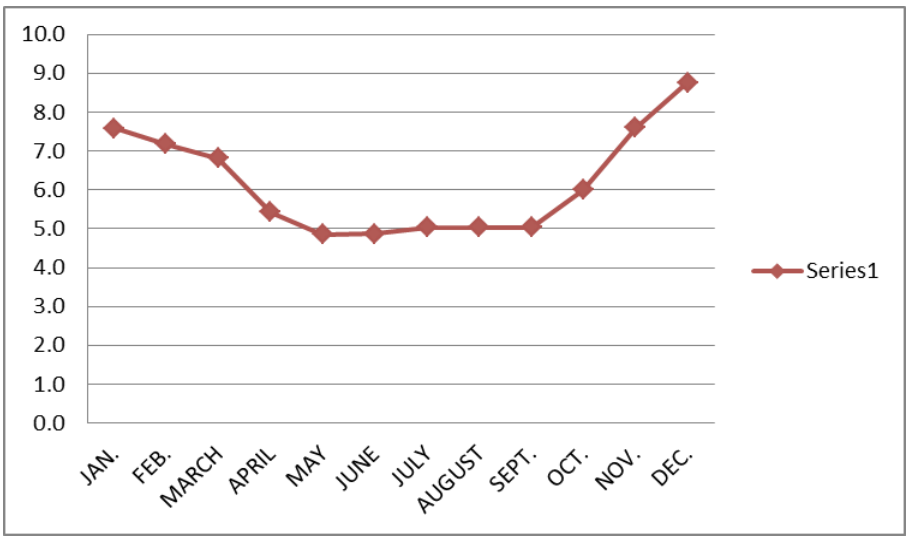
YEAR AND MONTH	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPT.	OCT.	NOV.	DEC.	TOTAL	YEARLY AVERAGE
1991	5.8	5.8	3.9	3.9	5.8	5.8	5.8	3.9	5.8	5.8	7.8	7.8	67.9	5.7
1992	5.8	5.8	5.8	3.9	3.9	5.8	3.9	5.8	3.9	5.8	7.8	5.8	64	5.3
1993	7.8	5.8	7.8	3.9	3.9	3.9	5.8	3.9	3.9	5.8	7.8	11.7	72	6.0
1994	7.8	5.8	7.8	5.8	3.9	3.9	5.8	5.8	3.9	7.8	7.8	9.7	75.8	6.3
1995	7.8	5.8	5.8	5.8	3.9	3.9	3.9	3.9	5.8	5.8	7.8	11.7	71.9	6.0
1996	9.7	11.7	7.8	7.8	5.8	5.8	5.8	5.8	5.8	5.8	7.8	9.7	89.3	7.4
1997	7.8	7.8	7.8	5.8	5.8	5.8	3.9	5.8	3.9	5.8	7.8	7.8	75.8	6.3
1998	5.8	5.8	7.8	5.8	5.8	5.9	3.9	3.9	5.8	5.8	5.8	7.8	69.9	5.8
1999	7.8	9.7	5.8	5.8	3.9	3.9	5.8	5.8	5.8	5.8	7.8	7.8	75.7	6.3
2000	9.7	7.8	7.8	5.8	5.8	3.9	5.8	5.8	5.8	5.8	7.8	7.8	79.6	6.6
TOTAL	75.8	71.8	68.1	54.3	48.5	48.6	50.4	50.4	50.4	60	76	87.6	499.3	41.6
10-YR. AVE.	7.6	7.2	6.8	5.4	4.9	4.9	5.0	5.0	5.0	6.0	7.6	8.8	49.9	4.2

SOURCE: PAGASA RADAR STATION, Daet, Camarines Norte

Wind has something to do with soil formation such as erosion and changes in the structure of lands together with rain and shaking. Wind velocity is the gauge of the strength of typhoons which needs to be projected and prepared for.

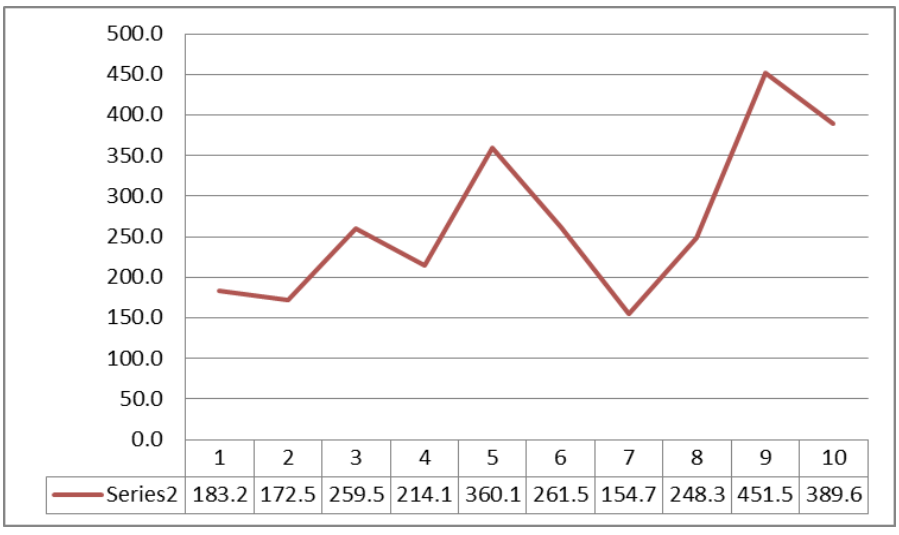
In Fig. 17, it shows that wind velocity is correlated with rainfall, considering that high velocity of wind occurs in the same months when rainfall is of high volume.

Figure 17
Monthly Wind Velocity
Province of Camarines Norte



Said correlation in which the same trend on the average annual wind velocity was recorded in 1991-2000 period perpendicularly with the line graph of rainfall reflected in Fig. 18.

Figure 18
Average Annual Rainfall, 1991-2000
Province of Camarines Norte



b. **Temperature**

For the 10-year period (1991-2000), the average temperature in the province was 27.30C, the lowest temperature was 23.60C, recorded in 1993, and the highest was 29.40 C recorded in the years 1993 and 1998. The coldest month was February, while the warmest were May and June (Table 18).

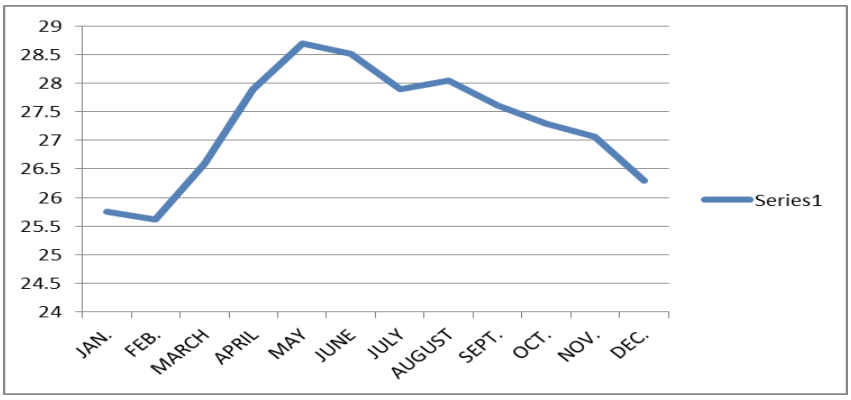
Table 18
Temperature Ranges (°C Reading) Monthly Average, 1991-2000
Province of Camarines Norte

YEAR AND MONTH	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPT.	OCT.	NOV.	DEC.	TOTAL	YEARLY AVERAG
1991	26.2	24.1	26.8	27.8	29.2	29.2	28.2	28.6	28.7	27.3	26.9	26	329	27.4
1992	25.2	27.7	26.7	28.1	29.3	29.2	27.7	28.5	28.2	27.2	26.3	26.3	330.4	27.5
1993	25.2	23.6	26	27.5	28.8	29.4	28.5	28	27.5	26.3	26.8	26.1	323.7	27.0
1994	25.8	25.9	26.9	27.9	28.6	27.9	27	27.7	26.6	27.1	26.6	26.1	324.1	27.0
1995	25.7	25.3	26.1	27.8	28.1	28.8	27.5	27.6	27.3	27.4	27.2	25.5	324.3	27.0
1996	25.6	25.4	26.5	27.2	28.4	28.2	27.8	28.1	28	27.8	27.1	26.3	326.4	27.2
1997	24.4	25.8	26	27.9	28.7	27.4	27.5	28.4	26.9	27	27.3	26.6	323.9	27.0
1998	26.6	26.5	27.4	28.5	29.4	29.1	29	28.3	27.9	28.1	28	26.9	335.7	28.0
1999	26.5	26.1	27.1	27.9	28	27.6	28.2	27.5	27.2	27.5	27	26.4	327	27.3
2000	26.3	25.8	26.5	28.3	28.5	28.3	27.5	27.7	27.7	27.2	27.4	26.7	327.9	27.3
TOTAL	257.5	256.2	266	278.9	287	285.1	278.9	280.4	276	272.9	270.6	262.9	3272.4	272.7
10-YR. AVE.	25.75	25.62	26.6	27.89	28.7	28.51	27.89	28.04	27.6	27.29	27.06	26.29	327.2	27.3

SOURCE: PAGASA RADAR STATION, Daet, Camarines Norte

Figure 19 shows the reverse of rainfall and wind velocity in terms of trend. In this graph the warmest months are April and May and the temperature declines at the end of July down to its lowest level in December. The months of January and February are cold periods.

Figure 19
Average Temperature, 1991-2000
Province of Camarines Norte



As stated in the Enhanced PDPFP, the projected temperature increase in CY 2020 under low-range emission scenario is minimally increasing by barely 0.6°C from December to February and increased by 1.5°C in CY 2025. Under the medium range scenario, temperature is projected to increase from 0.9°C in CY 2020 to 1.8°C in CY 2050. During the months of March, April and May, the climate will be warmer till June, July and August because of higher temperature increase in high and medium range scenarios in 2020 to 2050, which ranges from 0.7°C to 1.1°C (Table 19).

Table 19
Projected Temperature Increase (in °C) under High-Range and Medium-Range Emission Scenarios in CY 2050 based on 1971-2000 Normal Values, Province of Camarines Norte

Month	Baseline Observed	High Range Emission Scenario		Medium Range Emission Scenario	
		CY 2020	CY 2050	CY 2020	CY 2050
December, January, February	25.70	0.60	1.50	0.90	1.80
March, April, May	398.50	0.80	2.00	1.10	2.00
June, July, August	565.60	0.70	1.80	1.00	2.10
September, October, November	1285.70	0.60	1.60	0.90	1.80

Source: Provincial Development and Physical Framework Plan of Camarines Norte

The rate continuously increases in 2050 at a range of 1.8 to 2.1°C in medium- range emission scenario with the highest posted in the months of March to August. Temperature increases during the high-range scenario, and becomes lower especially during the months of December- February and September to October at 1.5 and 1.6°C respectively.

e. Humidity

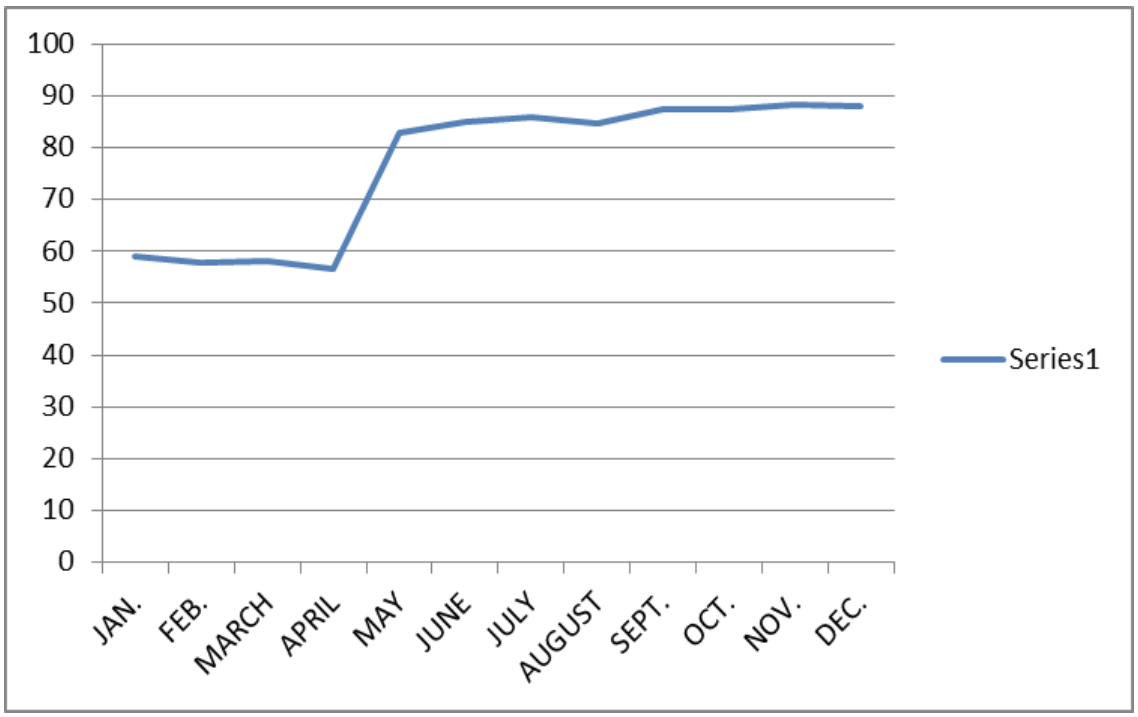
The highest relative humidity of the province for the 10-year period (1991- 2000) was 93% recorded in December of the year 1999, which also posted the highest yearly average of 89.2%. The province's average relative humidity is 85.7% as shown in Table 20.

Table 20
Relative Humidity (%) Monthly Average, 1991-2000
Province of Camarines Norte

YEAR AND MONTH	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPT.	OCT.	NOV.	DEC.	TOTAL	YEARLY AVERAGE
1991	83	82	80	82	79	84	83	84	82	83	90	86	998	83.2
1992	87	82	83	82	81	81	85	86	87	88	86	87	1015	84.6
1993	87	87	85	84	80	81	85	84	88	88	90	92	1031	85.9
1994	88	87	84	84	84	87	88	84	89	84	86	86	1031	85.9
1995	84	86	84	82	85	85	88	87	87	87	87	90	1032	86.0
1996	84	83	86	86	84	85	85	79	84	86	86	79	1007	83.9
1997	82	83	81	79	81	89	88	81	89	85	84	83	1005	83.8
1998	82	86	79	80	79	81	86	89	90	89	91	92	1024	85.3
1999	88	83	91	90	90	91	88	85	89	91	91	93	1070	89.2
2000	88	92	92	87	85	87	84	87	89	92	91	92	1066	88.8
TOTAL	590	579	580	566	828	851	860	846	874	873	882	880	10279	856.6
Average	59	57.9	58	56.6	82.8	85.1	86	84.6	87.4	87.3	88.2	88	1027.9	85.7

The line in Fig. 20 presents a steady humid season beginning the end of May to December with a little increase in humidity.

Figure 20
Average Relative Humidity (%), 1991-2000
Province of Camarines Norte



c. Weather Disturbances

The Bicol Region lies within the so-called typhoon belt; hence, the province is seriously affected by frequent visits of typhoons mostly during the months of April, June, July, October, November, and December. From 1991 to 2000 (Table 19), Typhoon Rosing, which hit the country in November 1995, with a maximum wind of 248 KPH, was the most destructive. It caused the national government to declare the province as one of the calamity areas in the country. A total of 41,542 houses were totally destroyed, 305 persons were confirmed dead, 660 were injured and 12 were missing as reported by the municipalities of the province, including San Vicente.

Table 21 listed the tropical disturbances from 1991 to 2000 which likewise shows the strength of wind. Despite the absence of data from 2000 to 2015, it can be observed that typhoon signals usually include Camarines Norte, but more frequently since 2001 typhoons no longer land fall in the province except for the occasional heavy rains they bring.

Table 21
Tropical Disturbances, 1991-2000
Province of Camarines Norte

YEAR	NAME	DATE	MAXIMUM WIND (KPH)	24-HOUR RAINFALL (MM)
1991	Typhoon Diding	June 13-14	65	322.7
	Tropical Depression Etang	July 9-10	65	24.1
	Typhoon Diding	June 13-14	65	322.7
1992	Tropical Depression Ningning	October 11	43	15.7
	Typhoon Paring	October 25	65	29
1993	Tropical Storm Jusing	November 1	54	13.8
	Typhoon Monang	November 5	173	199.8
	Typhoon Naning	December 7	36	33.2
	Typhoon Naning	December 9	50	48.1
	Typhoon Naning	December 10	22	39.1
	Tropical Depression Oning	December 15	47	26.8
	Tropical Depression Oning	December 16	22	14.8
	Tropical Depression Oning	December 17	18	77.7
	Tropical Storm Puring	December 27	54	201.2
1995	Typhoon Rosing	November 1	248	334.3
1998	Typhoon Iliang	October 12-13	79	133.7
	Typhoon Loleng	October 22	180	189.5
1999	Typhoon Storm Karing	April 9	55	7.1
	Typhoon Diding	April 21	65	Trace
	Typhoon Etang	June 2	65	21.2
	Tropical Storm Renong	October 15	45	50.7
	Typhoon Sendang	November 8	75	41.5
2000	Tropical Storm Gloring	July 12	55	122.3
	Typhoon Reming	October 27	105	106.5
	Typhoon Senyang	November 2	130	238.5
	Tropical Storm Ulpiang	December 7	55	

SOURCE: PAG-ASA RADAR STATION, Daet, Camarines Norte

Figure 21 shows the unpredicted pattern of the emergence of typhoons in the province. It can be observed that the emergence of major typhoons occurs every four (4) years. It can also be noted that tropical disturbance increases towards year 2000.

Figure 21
Typhoon Disturbances, 1991-2000
Province of Camarines Norte