MDG ACHIEVEMENT FUND

(MDG-F 1656 Outcome 3.4)
Climate Resilient Farming Communities in Agusan del Norte
through Innovative Risk Transfer Mechanism

VULNERABILITY AND ADAPTATION ASSESSMENT REPORT

Municipality of Buenavista, Province of Agusan del Norte

A Climate Change Adaptation Project of the
INTERNATIONAL LABOUR ORGANIZATION (ILO),
a specialized agency of the United Nations
with GOP Partners:
DEPARTMENT OF LABOR AND EMPLOYMENT (DOLE)
DEPARTMENT OF TRADE AND INDUSTRY (DTI), and
THE PROVINCE OF AGUSAN DEL NORTE

VULNERABILITY AND ADAPTATION ASSESSMENT REPORT

Municipality of Buenavista, Province of Agusan del Norte

(MDG-F 1656 Outcome 3.4)
Climate Resilient Farming Communities in Agusan del Norte
through Innovative Risk Transfer Mechanism

International
Labour
Organization

DEPARTMENT OF
TRADE & INDUSTRY
PHILIPPINES

Table of Content

Acronyms

A&D	Alienable and Disposable
CLUP	Comprehensive Land Use Plan
CBMS	Community Based Monitoring System
CCAP	Climate Change Adaptation Project
DA	Department of Agriculture
DOLE	Department of Labor and Employment
DTI	Department of Trade and Industry
EWS	Early Warning System
FFS	Farmers Field School
FGD	Focus Group Discussion
FMR	Farm to Market Road
GOP	Government of the Philippines
ILO	International Labour Organization
LGU	Local Government Unit
PAGASA	Philippine Atmospheric, Geophysical, Astronomical Services Administration
UPLBFI	University of the Philippines Los Banos Foundation, Inc.
MFT	Municipal Focal Team
MPDPs	Multi Purpose Drying Pavements
MT	Metric Ton
NGA	National Government Agencies
NGO	Non-Governmental Organization
NIA	National Irrigation Administration
RBO	Rural-Based Organizations
RTR	Remedios Trinidad Romualdez
V & A	Vulnerability and Adaptation

List of Figures

List of Tables

Message

Through the MDG-F 1656 Climate Change Adaptation Project (CCAP), the ILO supported the conduct of the Vulnerability and Adaptation (V&A) Assessments in priority areas in Agusan del Norte, including the Municipality of Buenavista.

Understanding vulnerabilities of farming communities to risks brought about by climate change is a crucial step in the effort to enhance their adaptive capacity and protect their livelihoods. Climate change brings about risks which disrupt not only the environment but also the social and economic systems, threatening lives, properties and livelihoods of vulnerable populations. This report characterizes risks and its impact on farming communities. It also presents current and potential adaptation strategies which provides CCAP, and more importantly, concerned local government unit, a sound basis for pro-active and responsive development action on climate change adaptation.

Aligned with the Global Jobs Pact, this demonstration project provide guidelines aimed at stimulating economic diversification among vulnerable communities, generating alternative livelihoods for vulnerable farmers, thereby providing protection to rural workers and their families. Farmers represent the greater majority of workers in the country. Their livelihood is largely depend on land productivity, labour and good weather. Farmers, in the province of Agusan del Norte, as with farmers in other parts of the country possess limited resources, oftentimes not owning the land they till, and only have labour as their main productive asset.

Adopted at the conclusion of the International Labour Conference in 2009, the "Global Jobs Pact," underlines the need to include green jobs and green technologies in the recovery packages and policies. It stipulates that the “decent work response to the crisis” should contribute to “a fair globalization, a greener economy and development that more effectively creates jobs and sustainable enterprises, respects workers’ rights, promotes gender equality, protects vulnerable people, assists countries in the provision of quality public services and enables countries to achieve the Millennium Development Goals.”

The CCAP implementers and all concerned, therefore, have to consider findings of this V&A Assessment Report. Adaptation options and strategies aimed at reducing risk exposure and averting further deterioration of the environment – the very base of farmers’ livelihood- have to be pursued, including some economic diversification options along with their financing requirements, training and capability building needs.

For its part, the CCAP will develop innovative financial mechanisms, including insurance scheme to support diversification of farmers’ livelihoods along with needed training and capability building initiatives.

At this point, I would like to congratulate the local officials and the Municipal Focal Team (MFT) members of Buenavista for having completed the laudable task of data collection, analysis and the preparation of this report. I would also like to thank the DOLE, DTI, DA and DENR Focal Persons who supported the ILO Project Manager in the Technical Working Group of the V&A as well as the mentors and other collaborators from the University of the Philippines Los Baños, SUCCEED, Inc and the Caraga Learning Service Providers Network.

Lastly, we thank the Spanish Government, which provided the grant to the Joint Programme on Climate Change Adaptation through the UN MDG-Achievement Fund.

Lawrence Jeff Johnson
Director, ILO Manila

Message

There is a great case for an effective public service, more so in the unity of our people to assist the government in bringing the advocacy of how the climate change greatly affects our lifestyle.

God has created the earth and the environment not just to be destroyed but to be protected and be enjoyed by everybody. While we continue to dream, to long for what we would like to achieve in our life, we should also be responsible in the rare opportunity of survival.

This Vulnerability and Adaptation Assessment document is a transparent evidence of the present and future scenario of the life of the people in their struggle for existence amidst the misery of poverty and hunger, the scarcity of the opportunities to uplift their living condition against this global crisis and the effect of climate change in everyone's life.

Ideally, the purpose of this study that is made into a document is to provide an effective tool for a local government unit and every stakeholder to attain wisely the utilization of available resources in times of crisis and calamities, fighting against poverty and enhancing our socio-economic condition towards our common goal.

Let me wish to acknowledge with my heartfelt gratitude to the International Labour Organization (ILO) and the Department of Trade and Industry (DTI), Region XIII in cooperation with the provincial government of Agusan del Norte, to the Municipal Focal Team, to the stakeholders and to everybody involved in the formulation of this document whose paramount interest is to address the vulnerability of the climate change for everybody's welfare.

Let us therefore work together as frontliners in the development of the countryside and finally be enjoying the fruits of our labor in the years ahead.

Francisco Y. Chan, Jr.
Municipal Mayor

ILO CCAP Acknowledgments

This Vulnerability and Adaptation (V&A) Assessment Report is a product of the Climate Change Adaptation Project (CCAP) resulting from collaborative efforts of several stakeholders to include:

Writers and Researchers of Buenavista CCAP Municipal Focal Team:

Led by Alberto C. Mejia, Jr and Jobert Awa, *with additional support from* Eusebio B. Calunsag, Felix Balansag Jr., Jorge L. Comiling, Porferio G. Daguipa Jr., and Virginia Macomao.

Technical Working Group (TWG) and Mentors:

*Led b*y Lurraine B. Villacorta, *CCA Project Manager of the International Labour Organization and* Lauro G. Hinaloc, *Municipal Anchor for Buenavista and also from the Province of Agusan del Norte; together with other TWG members:* Brenda B. Corvera *and* Gemma L. Clarin o*f the Deparment of Trade and Industry (DTI)- Caraga*; Maida Lynn Sanchez *of the Department of Labor and Employment (DOLE)-Caraga;* Rofel C. Cabaltera, Alvin P. Aclan *and* Adela G. Antiga o*f Province of Agusan del Norte (AdN);* Abel F. Wagas *of the Department of Agriculture (DA)- Caraga;* Virgilio G. dela Cruz *and* Jose Salve Cabiling *of the Department of Environment and Natural Resources (DENR)- Caraga.*

Preparation of Geographic Information System (GIS)-Maps was led by Abel F. Wagas *of the Department of Agriculture (DA)- Caraga and* Rosendo P. Adrique *of the Province of Agusan del Norte (AdN).*

Mentoring Support was provided by the University of the Philippines Los Baños (UPLB) V&A Assessment Team for Agricultural Sector led by Dr. Ma.Victoria O. Espaldon, Dr. Felino P. Lansigan, *and supported by* Dr. Jesusita O. Colladilla, Dr. Oscar B. Zamora, Dr. Leonardo M. Florece and Prof. Nelita N. Lalican.

Finalization, Packaging and Process Documentation Team:

Writing, copy-editing and lay-outing support was provided by the Sustainable Cooperation for Equitable Enterprise Development Inc., (SUCCEED) led by Joselito T. Libres, Joseph T. Gloria, Fidelina A. Valle *and* Mario M. Castillo. *Knowledge Management and Process Documentation Support was provided by the Caraga Learning Service Provider's Network (LSPN) led by* Kurt Chino A. Montero *and* Jane B. Huqueriza

LGU Acknowledgments

Among the reasons why this Vulnerability and Adaptation (V & A) Assessment is documented, is mainly to serve as an important guide and a tool to help the local government unit determine the vulnerability of the whole municipality to climate change, especially the marginalized groups, and define the strategies of enhancing the adaptation capacities of various stakeholders.

The study is spearheaded and funded by the International Labour Organization (ILO) in cooperation with the Department of Trade and industry (DTI), Region XII with funding counterpart from the selected municipalities of Agusan del Norte (Buenavista, R.T. Romualdez, Jabonga and Las Nieves) as the pilot municipalities in the Climate Change Adaptation Project

With the Municipal Focal Team (MFT) composed of the chiefs of offices of the Municipal Planning and Development Office, Municipal Agriculture Office, Municipal Environment and Natural Resources Office, Municipal Engineer's Office as the primary actors in the data collection and formulation of this document, it is expected that this effort shall serve the local government unit in the formulation of its strategies and prioritization of projects in fighting the menace of poverty and the impacts of hazards of climate change not only to the vulnerable sectors but to everyone who will be directly or indirectly affected..

We express our heartfelt thanks and gratitude to the spearheading agencies, the International Labour Organization (ILO) in collaboration with Government of the Philippines (GOP) Partners, the Department of Labor and Employment (DOLE)-Caraga Region, the Department of Trade and Industry (DTI)-Caraga Region, Department Agriculture (DA)-Caraga Region, to their unwavering support and commitment, so with the provincial government of Agusan del Norte, the local government officials, the Municipal Focal Team, the concerned barangay officials, the non-government organizations (NGO), the private sectors, and the Key informants. Likewise, the contribution of the University of the Philippines Los Banos Foundation, Inc. (UPLBFI) and Sustainable Cooperation for Equitable Enterprise Incorporated (SUCCEED, Inc.) are also acknowledged here for the assistance they extended in the preparation and finalization of the Municipal Vulnerability and Adaptation Assessment Report. To everybody who worked hand in hand in giving information and sharing their skills and ideas in effect made this planning process more efficient and effective.

We do hope that the issues and concerns discussed in this document will be more workable and doable in the process of change.

The Project Brief

The International Labour Organization (ILO), a specialized agency of the United Nations, in partnership with the Department of Labor and Employment (DOLE), Department of Trade and Industry (DTI) and the Province of Agusan del Norte is implementing a three-year Climate Change Adaptation Project (CCAP) entitled, **"Climate Resilient Farming Communities in Agusan del Norte through Innovative Risk Transfer Mechanisms".** This is under Outcome 3 of the **Joint Programme on "Strengthening the Philippines' Institutional Capacity to Adapt to Climate Change",** a joint programme of the United Nations and the Government of the Philippines implemented with support from the Spanish Government through the UN Millennium Development Goals- Achievement Fund (MDG-F) Thematic Window on Environment and Climate Change.

The CCA Project Objectives

This CCAP in Agusan del Norte aims to showcase key determinants of adaptive capacity at work [economic conditions as well as availability and access to financial and productive resources], where target vulnerable populations are provided access to financial and productive resources for purposes not only of helping them cope in the event of climate change triggered disasters but of improving their socio-economic lot, especially through diversified livelihoods schemes. Livelihood diversification is deemed critical as new types of livelihoods are often required to effectively adapt to disasters and climate change vulnerabilities

Specific Objectives and Expected Outputs

Project's specific objectives are two-folds: (1*) To develop and test financial safety nets for vulnerable population, especially women*, and (2*) To develop the capacities of vulnerable populations to participate and avail of the benefits under economic diversification and a democratized governance system.*

To these ends, under the project, innovative financing and insurance schemes will be developed, tested together with viable climate change adaptation options and documented to aid replication and up-scaling. Specifically, the Project's SMART outputs are:
(1) Guidelines for the Innovative Financing;
(2) Agreement with a Financing Institution to implement the Financing scheme;
(3) Climate Change Adaptation Insurance Fund; and
(4) Knowledge Management products & Policy Paper on possible up-scaling/replication

The Project Sites

The CCAP is implemented by the ILO and its partners in Agusan del Norte, one of the four provinces in the Caraga Region (Northeastern Mindanao) in Southern Philippines which economy is primarily based on agriculture. It is the region's leading rice producer and other major crops include coconut, banana, corn, mango and an emerging crop-abaca. The province continues to be a major timber producer, with plywood plants operating in Butuan City, Buenavista and Magallanes. It has a land area of 273, 024 hectares and a population of 314,027 (2007 Census), 49% of which are women. Approximately 55.6% (or 31,913) of the total households live below poverty line, [more than twice higher than the national average of 24.4%].

Four priority municipalities in the Province of Agusan del Norte have been selected namely: Buenavista, Jabonga, Las Nieves and Remedios T. Romualdez (RTR). These areas were selected on the basis of a set of criteria which included: (a) contribution to provincial agricultural production in terms of area/yield and number of families dependent on farming as a main income; (b) general environmental condition and history of climate risk exposure based on incidence of extreme events and proportion of farming families affected by these events; (c) availability and access to support providers of training, markets and technology; (d) availability and access to financing institutions; (e) availability and access to insurance schemes and other risk transfer mechanisms; (f) level of pertinent knowledge and skills for agribusiness, environmental and resource management; climate and disaster risk management; (g) existence of GO-LGU -NGO/PO and/or collaborative initiatives relating to agribusiness and climate/ disaster risk reduction; (h) poverty incidence; and (i) peace and order issues and concerns.

The priority areas cover 52.39% of the land area in the province or 143,045 hectares which is home to 37.03% of the provincial population or 116,289 people. Likewise, the home of 38.97% (or 12,440) of the households are living below poverty line and 67.35% (2,046 households) of the food-poor in the province. 106 NGOs/POs, including Financing Institutions, are reported to operate within these areas (39.70%) of the reported 267 provincial data.

Foreword

"The changes in temperature and rainfall patterns, along with climate extremes such as droughts and floods, brought about by climate change threaten lives and livelihoods of the vulnerable populations. Men and women living in the rural areas and whose livelihoods are most dependent on weather, such as farmers and fishers, are likely to be most vulnerable".[1]

This Vulnerability and Adaptation (V&A) Assessment of the farming communities of the Municipality of Buenavista was conducted by the *MDG-F 1656 CCAP in Agusan del Norte* as it strives to begin its efforts in enhancing adaptive capacity of these communities with a good understanding of the climatic and natural hazards they face. A characterization of these hazards as experienced by the communities in the past, the present and as projected in the future along with a close look at the adaptation practices and/or coping strategies employed is deemed crucial in the task of enhancing their adaptation to climate change.

A result of the collaborative efforts of the implementers and partners of CCAP, this V&A Assessment report, provides a background to the discussion of the climatic hazards, impacts [to livelihoods, property and lives] and adaptation, and the characterization of the bio-physical, the socio-economic and infrastructural milieu of these communities. In the analysis of future vulnerabilities and potential adaptation options, this assessments looks at climate change scenarios for 2020 and 2050 [PAGASA downscaled climate change scenarios for rainfall and temperature] with focus on the following components: advancement in science and technology, population growth rate, adaptation capacity/ capability building, LGU budget/relevant investments as well as land conversion.

The V&A Methodology

In accordance with the overall approach of the CCAP, this V&A Assessment was done in a participatory and collaborative manner ensuring full participation of all key stakeholders particularly from the LGU and farmers in concerned communities. Moreover, in keeping with the capability-building thrust of the Project, the V&A was conducted through a "***learning-by-doing***" approach with the members of the Municipal Focal Teams (MFTs) and the Partners in the Technical Working Group (TWG) composed of ILO, DOLE, DTI, Province of Agusan del Norte along with DA and DENR, that were trained and mentored on the methodology by V&A experts from the academe (UPLB).

Guided by the TWG and the academe mentors, the MFTs *gathered available written materials, consolidated secondary information sources, conducted Focus Group Discussions (FGDs) and Key Informant Interviews (KIs) in the communities and mapped out production and settlement areas as well as hazards* with farmers. This report, as well as the other three Municipal V&A Assessment Reports were prepared and written by the MFTs. The report is enhanced and finalized through cliniquing sessions with the TWG anchors, V&A mentors and, finalization and packaging support by SUCCEED, Inc.

A full description of the methodology can be obtained in the V&A Toolkit which comes as an accompanying section of this report.

[1]Culled from: a) ILO (2008) Report of the Committee of Employment and Labour Market Implications of Climate Change; b) UNDG (2010) Integrating Climate Change Considerations in the Country Analysis and the UNDAF.

Towards the end, the study presents prioritized options for climate change adaptations in the affected communities, ranging from the social, technological (i.e. production, management of the environment), physical/infrastructural, institutional or socio-political, as well as economic.

The ILO and its partners including the local government unit of Buenavista and other prospective collaborators hope to take off from where this V & A Assessment Report ends. The CCAP will provide support to the farming communities in pursuing selected priority CCA options as provided in this report. Particular focus will be given to options which will have direct impact on the farmers' economic condition and livelihood as well as their ability to access financial and productive resources. As such, while the CCAP would not be able to directly provide financial support to the building of infrastructures, activities will be undertaken to assist the communities in accessing support for these.

Ms. Lurraine B. Villacorta
Project Manager, ILO-MDGF CCAP

Executive Summary

This vulnerability and adaptation assessment is part of a bigger project on innovative financing and insurance schemes of the ILO CCAP. This assessment is viewed to characterize the municipality's climate change vulnerabilities, its current adaptation strategies and point to adaptation options for the future.

Area Characterization

The municipality Buenavista is a coastal town situated at the northern part of the province of Agusan del Norte. It lies 8˚55' North Latitude and 125˚25 ' East Longitude, bounded on the north by Butuan Bay, municipalities of Nasipit and Carmen , on the south by the municipality of Las Nieves, on the east by the City of Butuan and on the west by the municipality of Nasipit and the province of Misamis Oriental.

The second biggest town of Agusan del Norte, the municipality has a total aggregate land area of 54,690 hectares. Its land use is constituted by Forestland/Timberland[1] 43,052.168 hectares (78.72%), agricultural land area is 9,276.30 (16.96%), built up areas at 424.96 hectares (0.78%), and special land uses with 1,918.112 (3.51%).

The town is politically subdivided into 25 barangays. It is composed of 10 urban and 15 rural barangays. About 6 barangays are located along the coast mostly inhabited by fisher folks and informal settlers.

About 13.84 % or 7,571.20 hectares are generally flat to gently sloping areas that can be found in the Poblacion, coastal areas of Matabao, Manapa, Abilan, and Sacol and along the river beds of Malpoc and Rizal with a tiny strip of gently sloping to undulating terrain at Agong-ong, Talo-ao and northern part of Alubihid and Macalang. These areas belong to 0 – 3% and 3 – 8% slope.

The northern part is made up of plain or flat terrain up to the coastal areas while the southern part are hilly, gradual and undulating mountains, plateaus and steep mountains.

Guihao-an River and Manapa River are the two big rivers, coming from many tributaries, that are source irrigation.

[1]Include the production and protection of forests, nature reserved, wildlife sanctuaries, mangroves and swamps and second growth forest.

The municipality is characterized with type IV climate, with evenly distributed rainfall all year round (PAGASA Butuan office), and is not within the typhoon built area.

Observed (2010) average daily rainfall showed heavy downpours (at 13.5 mm) on the period of Jan-Feb, daily average mean temperature at its peak in May-June (29°C), daily average of maximum temperature at 30.2°C in January, and daily average relative humidity is as high as 89% also during the month of January.

The municipality of Buenavista has a total population of 47,957 with a growth rate of 0.68%, with 9,971 households. (CBMS survey, 2007)

Poverty incidence is prevalent with half (49.94%) of the total households living below the poverty threshold and 34.40% below the food threshold.

Rice, coconut and banana are the three major agricultural crops produced in the municipality. Coconut (5,257 has.) is on top in terms of area covered followed by rice (1,137 has.) and banana (631 has.). Annual average yield per hectare was recorded at 3.3 MT and 1.0 MT for irrigated and rain fed rice, 1.6 MT for coconut and banana at 4.4 MT.

There are five (5) coastal barangays in the municipality that are engaged in fishing and three (3) barangays with fishpond, Barangays Abilan, Matabao, and Manapa. The said five barangays are more dependent on fishing using motorized boat.

Other forms of livelihood engage are livestock/poultry production, vegetable and cut flower production, small cottage industry, masonry, carpentry, "Trisikad" driver, etc.

MPDPs, FMRs, mechanical dryers, irrigation system, SWIP, warehouses and slaughter house are the most common facilities available in the area. Communication, transportation, power and water system are also presently servicing the basic needs of the population.

Current Hazards and Observed Climate Change Impact

Floods, drought and soil erosion are the main sources of hazards in the municipality.

Flooding is a regular occurrence every year (from 2003-2009), during the months of December-January. Mostly affected were the barangays of Guinabsan, Rizal, Agong-ong, Malpoc, Poblacion 9 and 10, and the coastal barangays of Sacol, Manapa, Matabao, and Abilan, affecting approximately 58% of the lowland rice areas. In 2009, the MSWD has reported a total of 3,072 houses that got inundated for five (5) days, with 67 houses totally damaged, 26 houses partially damaged, and involving 3,165 families (32%) or 18,468 persons including children. Major infrastructures damaged during flooding are Farm-to-Market-Roads (FMRs), bridges, and irrigation facilities.

During the past six years (2003-2006 and 2009), drought usually occurs in the months of August and September. Rice production in barangays affected, mainly in rainfed areas, included Barangays Alubihid, Agong-ong, Barangay 1, Macalang, Malpoc, Sangay, Manapa, Matabao, and Talo-ao.

Severe erosions are experienced in the upland Barnagays of Guinabsan, Sangay, Olave, Malpoc and Simbalan due to denudation of the forest caused by illegal logging and quarrying.

Adaptation Strategies

The most common past adaptation strategies of the farmers and communities during hazards (both flooding and drought) include adjustment in farming techniques (utilization of drought or flood tolerant plant varieties, change of crops, diversified farming), and engaging into other forms of livelihood (off farm). On the part of the LGU, the declaration of state of calamity and the allocation of 5% calamity fund became an immediate recourse to provide much needed relief goods and other assistance.

Current adaptation measures devised by the LGU include the following: i) Economic – production, marketing and financing support; strengthening of RBOs, and insurance schemes; ii) Physical/Infrastructural – development of road networks (FMRs), Irrigation systems, seawalls and other production and marketing infrastructures; iii) Political/Institutional – strict enforcement of laws and local ordinances, participation of communities in policy formulation and implementation, provision of tax incentives, and establishment of resettlement areas; iv) Social- ensuring access to basic services such as potable water and medical services, and enhancing livelihood skills.

Lack of adequate funds was identified as the major gap in effectively responding to hazards and calamities. Skills and manpower development, food production and relocation of informal settlers and urban slum dwellers are other equally important factors.

Scenario Analysis and Future Adaptation Strategies

PAGASA Butuan office forecasted in the years 2020 and 2050 for the whole province of Agusan del Norte with increasing temperature and rainfall compared with currently observed climate trend. In 2020, the agency projected an optimum increase of approximately 1.3% (or 1.33'C) on the average maximum temperature during the months of April-June, and on the average rainfall, an increase of an average of 9.83% (13.8 mm/day) between the months of October to January. In 2050, it is projected at 2.97% (2.93'C) on the average maximum temperature during, and the average rainfall, at 5.6% (6.1 mm/day), during the same dry and rainy periods (as 2020).

The scenario building for two periods (2020 and 2050) takes into critical account some development variables including; population growth rate, state of development of science and technology, land use pattern (conversion), and LGU budget and overall adaptation capacity. There are also three scenarios in every period.

Probable impact will be mainly weighed on the aspect of food sufficiency and security, livelihood and income, and lives and properties. Over-all impact was rated with Low (30% and below), Moderate (31-60%) and High (60% and above). Calculations of impact also seriously consider the formula (provided by experts) with a range of 8-14% damage to crops in every 1'C increase in temperature.

Given the above considerations, rating of the overall impact in the municipality of Buenavista for the year 2020 was: Scenario 1 with Moderate, scenario 2 as Low, and scenario 3 as High. In the year 2050, scenario 1 is rated as High, scenario 2 as Moderate and scenario 3 as High.

To respond to the predictions of impacts, strategies are pushed thereby enhancing all- sided adaptation capacity of various stakeholders headed by the LGU. From the long list, priorities were identified including, but not limited to: a) Economic – increasing food production and food security, crop and livestock insurance, linkage of farmers to financial institutions, etc; b) Technological – bio engineering technology to control flooding, promotion of organic farming technology, etc; c) Physical/infrastructural – improvement of irrigation facilities and drainage system, maintenance of all-weather FMRs, construction of dikes and seawalls, etc.; d) Political/ institutional - Strict enforcement of laws and municipal ordinance including RA 9003, quarrying, illegal logging and cutting of trees, etc.; e) Social - resettlement of informal settlers and slum dwellers, manpower development, etc.

Mother earth has gone beyond its borders of indulging manmade dreadful activities. Climate change is for real. Its brunt is already felt at varying degree in different parts of the globe. With apparent limitations of the LGU, all the more with the most vulnerable communities and sectors (small farmers and women), it is logical to rally all stakeholders towards a unified strategic thinking and seek external support to realize some critical, abrupt and effective adaptation strategies, to cushion the destructive upshot of global warming and ease the difficulties of the already impoverished population and to survive mankind.

Introduction

The formulation of this Vulnerability and Adaptation Assessment report of the municipality of Buenavista, Agusan del Norte is spearheaded and funded by the International Labour organization (ILO), under its Climate Change Adaptation Project (CCAP), in cooperation with the Department of Labor and Employment (DOLE), Department of Trade and Industry (DTI)-Region XIII and the provincial government of Agusan del Norte. This is inspired by the vision of addressing the needs of the vulnerable sectors of our society in times of crisis that the global warming and climate change may bring, to find effective solutions on how the affected sectors could adapt, henceforth, mitigate the impact and survive that bleak scenario of climate change.

Chapter 1 – narrates the municipality's Area Characterization, covering: the Bio-Physical profile showing its location and topography, land area and land use patterns, geology, slope and elevation, the drainage and river systems, climate and rainfall patterns; Socio-economic Profile such as demography and settlement patterns, income and poverty incidence, agriculture and fishery production, commerce and trade, livelihood; and the Institutional Profile, infrastructure projects and facilities, transportation, communication, power and water supply systems and the support services on the aspect of trading and marketing, credit and financing;

Chapter 2 – the Current Hazards and the Observed Climate Change Impacts, discussed on: the Causes of Hazards (e.g. floods, droughts, typhoons, etc); the Place and Time of Occurrence; and, the Impacts of the Climate Change to crop production, livelihoods, and lives and properties including infrastructures;

Chapter 3 – the municipality's presentation of its Adaptation Strategies: Past and Current Adaptation Strategies; and the Identified Gaps and Requirements to make it more effective;

Chapter 4 – the Scenario Analysis, that tackles: the Components (i.e. assumptions, PAGASA climate forecast for 2020 and 2050, etc.); the Three Scenarios in different periods (2020 and 2050) considering population growth rate, state of science and technology, LGU budget and adaptation capacity, and land conversion; Rating of Vulnerabilities; and, the Future Adaptation Strategies i.e. economic, technological, physical/infrastructural, and political/institutional; And,

Chapter 5 – the Conclusion on the imminent threats of specific hazards in the municipality, considering degree of vulnerabilities, hence, the urgency to act on the recommended adaptation strategies;

The annexes that shows list of maps and tables and references of information are listed on the latter part of the document.

1 AREA CHARACTERIZATION

1. AREA CHARACTERIZATION

The written history of Buenavista starts in the year 1877. It was said that during this time, a group of Nomadic Manobos from the frontiers of Agusan found an ideal place for their temporary fishing retreat and rendezvous. Soon, the village became a settlement by early Christian pioneers. They found the place so abundant with sea tortoise and swamp turtles that they later on named the village as "TORTOSA". Later, the name Tortosa was renamed "KIHAW-AN" by pagan dwellers in memory of a white deer that they held sacred.

A native of Butuan, named Adolfo Calo, together with some natives and Spaniards visited the place, it was told. They have reached not only the hinterlands but also the coastal areas of the town found to be abundant with marine resources where trading business also flourished. They have also gone up to the hilltop overlooking the entire village and the Butuan Bay. They appreciated the beauty of nature and the scenic view of sunrise and sunset that they exclaimed "BUENA VISTA" which means GOOD VIEW, and that's how BUENAVISTA got its name.

On January 1, 1937, the barrio of Buenavista by virtue of an Executive Order No. 65 issued by the Commonwealth President Manuel L. Quezon, became a regular municipality of Agusan del Norte through the efforts of the then Assemblyman Apolonio D. Curato, Governor Jose R. Rosales, Commissioner of Mindanao and Sulu Teofisto Guingona, Sr. and Secretary of Interior Elpidio Quirino, with a set of appointed officials to serve for a period of one year.

Figure 1: The Mt. Mayapay

Source: Buenavista Tourism Module

1.1. BIOPHYSICAL CHARACTERIZATION

1.1.1. Location and Topography

Location

Buenavista is a coastal town situated at the northern part of the province of Agusan del Norte. It lies 8˚55' North Latitude and 125˚25 ' East Longitude, bounded on the north by Butuan Bay, municipalities of Nasipit and Carmen , on the south by the municipality of Las Nieves, on the east by the City of Butuan and on the west by the municipality of Nasipit and the province of Misamis Oriental.

Buenavista is very accessible from all directions by means of land transportation because it is connected by a National Highway that traverses Mindanao. It is only about 129 kms. from Surigao City, about 312 kms. from Davao City and about 182 kms. from Cagayan de Oro City. The town is only 10 kms. from the Bancasi Airport and about 7 kms. westwards to the Nasipit International Port. It can also be accessible by means of small "*bancas"* and fishing boats going to and from the neighboring islands of Camiguin, Bohol and Leyte and other neighboring coastal municipalities in the mainland of Mindanao.

The town is politically subdivided into 25 barangays. It is composed of 10 urban and 15 rural barangays. About 6 barangays are located along the coast mostly inhabited by fisher folks and informal settlers. *(Please refer to Annex A1: Location Map)*

Land Area and Land Use Patterns

The municipality of Buenavista is the second biggest town of Agusan del Norte with a total aggregate land area of 54,690 hectares. It is located in the northern part of the province along the coast of Butuan Bay. The municipality is not within the typhoon belt because it is being protected by the mountain ranges of Hilong – hilong in the north eastern part and Punta Diwata in the western portion. It is politically subdivided into 10 urban barangays and 15 rural barangays. The main source of income of the people comes from agriculture and fishing.

The entire land resources of Buenavista consist of the alienable and disposable lands (A&D), classified timberlands, NALCO- TLA which is now cancelled with some portions turned into barangay settlement and sites, and Ancestral Domain Claims of the IPs and those forestlands covered by various proclamations reserved for such specific purposes.

The total A & D land covers about 11,637.832 hectares or 22% of the total land area of the town. The Forestland/Timberland which includes the production and protection forest, nature reserved, wildlife sanctuaries, mangroves and swamps and second growth forest are about 43,052.168 hectares or 78.72% of total land area of the municipality. The Calayagon watershed is about 15,690 hectares.

The urban land uses are dominated by residential areas with 18.43 hectares and are concentrated in the commercial district, and 4.77 hectares with some that are sparsely located in the urban barangays of the town. The 100-meters strips in both sides along the National Highway are reclassified as commercial area from the boundary of the municipality of Nasipit to the boundary of Butuan City.

The agricultural land area is 9,175.30 hectares (16.96%) mostly located in the rural areas of the town. The institutional area covers about 21.91 hectares. Parks, playgrounds, open spaces and recreational areas, which covers about 19.30 hectares in the strategic location of the town.

Land Cover

The southern part of the municipality is hilly and mountainous. It has a total area of 43,052.17 hectares or 82.43% of the total land area of the municipality. About 23,909.27 hectares are classified as protection forest or the watershed area with a slope of 50% and above.

Presently, the protected forested areas are almost denuded due to illegal logging and "kaingin" with some portion turned into settlements and agriculture production.

The northern part is moderately hilly to flat up to the urban area, and transformed into urban settlements, commerce and trading center, agriculture and fishponds fishing village and beach resorts areas. *(Please refer to Annex 8: Land Cover Map, p.72)*

Existing General Land Use Condition

The municipality has a total built-up area of 424.96 hectares located in the urban center. About 9,276.50 hectares are devoted to agriculture with rice, coconut, and bananas as the main products. About 1,918.11 hectares are classified into special land use for fishpond development, urban development expansion and other purposes.

The forestland/timberland occupies about 43,052.168 hectares with 23,909.27 hectares classified as protection forest or the watershed area. The mountains and rivers are being quarried as sources of construction materials such as rocks, boulders, sand and gravel and barrows. Forestland also became source of timber and lumber.

The coastal areas are made into settlements of informal settlers and fisherfolks. There are also portions of the beaches that are made into resorts and recreation along Sacol, Tinago, and Manapa beaches. Sacol shorelines are quarried, with pebbles an Wetlands and swamps in low-lying and coastal areas that are influenced by the estuarine rivers are sources of mangroves (e.g. Piapes), and Nipa (palm) trees estimated about 406.1654 hectares. Some of these areas are developed into fishponds and fish cages.

Another main land use is the built-up areas for socio-economic activities of the towns-people. This category is considered minor in terms of the socio-economic development as this caters to the settlement needs of the growing population and expansion for the growth of trade, commerce and industries of the municipality.

Other land use that can be affected by the rapid growth of the town are the agricultural lands where portions could eventually be converted for urban land expansion especially the areas adjacent to the urban built-up. *(Please refer to Annex 7: Land Use Map, p.71)*

Table 1: Existing General Land Use Distribution

LAND USE CATEGORY	TOTAL AREA COVERAGE (in ha.)	PERCENTAGE SHARE (%)
Built-up Areas	424.96	0.78
Agricultural	9,276.50	16.96
Forestland/Timberland	43,052.168	78.72
Special Land Uses	1,918.112	3.51
Tourism & Beach Resorts	0.26	0.0004
Quarries	8.00	0.01
Sanitary Landfill area	5.00	0.01
Industrial Areas	5.00	0.01
TOTAL	**54, 690**	**100%**

Source: Municipal Socio-Economic Profile and Ecological Profile

Existing Urban Land Uses

The Urban Land Area has a total of 334.86 hectares only or about 6.12% of the total area of the municipality. About 18.43 hectares are made into residential, 21.91 hectares are distributed for institutional use both government and private, purposely as government offices and school sites.

Commercial area where the commercial district is located has only about 4.77 hectares. The 100 meters strips both sides along the National Highway from the municipal boundary of Nasipit in the west and the city of Butuan in the east are reclassified into commercial zone expansion.

There is also about 254.95 hectares in the urban area mostly planted with coconuts, bananas, and cash crops and still classified for agricultural uses. A vacant and idle land has about 8.60 hectares, the cemetery land area of 3.90 hectares. Parks/Playgrounds and other recreational places occupy 3.10 hectares.

Roads networks and bridges and other infrastructure facilities has a total area of 16.20 hectares crisscrossing the urban areas with the main thoroughfare in the Poblacion connected to the National Highway and beach roads. (*Please see table 3 in p.28)*

Table 2: Existing Urban Land Uses

LAND USE CATEGORIES	TOTAL AREA COVERAGE (in. ha.)	PERCENTAGE SHARE (%)
Residential	18.43	5.50
Commercial	4.77	1.42
Institutional	21.91	6.54
Industrial	3.90	1.16
Parks /Playground and other Recreational Places	3.10	0.92
Infrastructure Utilities & Facilities	16.20	4.84
Agriculture	254.95	76.15
Cemeteries	3.00	0.90
Vacant Lot	8.60	2.57
TOTAL	**334.86**	**100%**

Source: Municipal Socio-Economic Profile and Ecological Profile

1.1.2 Geology

Landforms

The coastal area of the town consists of tidal flats that are characterized by the presence of mangroves (or "*bakawan*", "*nipas*" and "*piape*") as well as swamps and fishponds. The coastal land formation is also composed of beach ridges and swales. This land form is due to fluvial and marine deposits. Heavy river current obstructed by waves at the mouth of the river creates delta formation and siltation.

The coastal barangays of Sacol, Poblacion 9 and 10, Matabao (Tinago), Abilan and Manapa have growing sand formation especially in river mouth of Mahayahay, Pasil and Sabang where sands and pebbles are stocked forming deltas.

The rural barangays with waterfalls, rivers and creeks usually make some soils and deposition forming alluvial plains. This can be found in the barangays Talo-ao, Guinabsan, Rizal, Malpoc, Agong-ong and Sacol. Slopes, undulating terrain and ridges are caused by soil erosions and landslides during heavy down pour. (*Please see table 3 in p.28)*

Rock Formation

Rock formations can be located at Barangay Rizal particularly at Tacub, Barangay Guinabsan (Sitio Mag-atubang and Lombuyan), Barangay Sangay particularly Sitio Puting-Bato or Linao-linao and Bolihon. These areas are best source of rocks and boulders, sand and gravel for building constructions and landfill.

There are also other types of landforms that can be found in the rural barangays like caves, rocky mountains and plateaus especially at Sitio Puting-Bato of Sangay where different rock formations and cliffs can be developed into adventure tourism, mountain trekking and climbing. Caves are also source of guano-fertilizers and also for adventure and leisure tourism. Some rocky areas are also best source of fresh and cool potable drinking water supply from natural springs.

Soil

There as six (6) types of soil found in the municipality of Buenavista identified as follows:

1. Undifferentiated Mountain Soil- covers the heavily forested areas which are not so very accessible to survey. This kind of soil takes the greatest percentage of aggregate of land cover about 46.40% or about 25, 375.61 hectares found in the forestall areas of Sangay , Guinabsan, Olave and Simbalan.
2. Hydrosol – this type of soil is prevalent in Abilan and portion of Manapa and Tinago. Common to this area are swamps where mangrove and nipa thrives and mostly of these areas are converted into fishpond fishponds. This covers only an area of 0.75 % or 407.616 hectares.
3. Isabela Loam/Buguey Loamy Sand – are formed from recent coastal deposits of sandy materials from rivers and oceans. The distinguishing characteristic of this soil type is the presence of marine shells in the substratum. Occurring in the long stretch of beaches from Sacol to Abilan that covers about 2, 207.92 hectares or about 4.03% of the total land area of the municipality.
4. Camansa Clay Loam- this occupies the upland portion of the municipality. It can be found on strongly rolling to hilly and mountainous terrain growing are primary and secondary forests. Its internal and external drainage are good with the low – lying areas are cultivated for rice, corn, coconut, banana, camote, cassava and rootcrops. This is found in Malapong, Alubihid and portion of Rizal and Guinabsan covering a total of 20, 109.056 hectares or 36.76% of the total land area of the town.
5. San Miguel Clay Loam – this type of soil is derived from alluvial deposits washed down from uplands occurring in nearly level to undulating terrain with covering nearly as extensive as hydrosol. This soil type is ideal for rice, corn, coconuts, bananas, rootcrops, legumes and vegetables. This covers and area of 4, 449.808 hectares or 8.16 % of the total land area of the town found in barangays Agong-ong, Malpoc, Talo-ao, Alubihid and portion of Rizal
6. Alimodian Loam – This occupies the upland area with slope 8- 30 with low lying portions are suitable for rice, corn, root crops and vegetables. This soil is also best for coconut and banana plantation.

This is found in barangays Macalang and Rizal. *(Please refer to Annex A3, Soil Map, page 69)*

Slope

About 13.84 % or a total area of 7,571.20 hectares are generally flat to gently sloping areas that can be found in the Poblacion, coastal areas of Matabao, Manapa, Abilan, and Sacol and along the river beds of Malpoc and Rizal with a tiny strip of gently sloping to undulating terrain at Agong-ong, Talo-ao and northern part of Alubihid and Macalang. These areas belong to 0 – 3% and 3 – 8% slope.

Slope 8- 18 is approximately about 12,219 hectares or 22. 34 % of the total land area of the town. These are found in the eastern and southern part of Barangay Sangay. About 17, 524.40 hectares are areas with slope 18-30 located at Barangays Alubihid, Malapong, Macalang, Rizal, Guinabsan and Sangay taking about 32.04 % of the total land area of the town.

Slope 30-50 has a total area of 11, 652.80 hectares at 21.31% of the town's total land area located in the Southern part of Guinabsan, Sangay, Olave and Simbalan area. Slope 75 covers mountainous areas of Guinabsan, Sangay, Olave and Simbalan comprising the watershed and forest areas more or less 5, 722.60 hectares or 10.47 % of the total land area of the town. *(Please refer to Annex A2: Slope Map, p.66)*

Table 3: Slope Ranges and Area Coverage

SLOPE RANGE (%)	BRIEF DESCRIPTION	AREA COVERAGE (HA.)	PERCENT DISTRIBUTION
0 – 3	level to nearly level	5,782.00	10.74
3 – 8	Gently sloping to undulating	1,699.20	3.1
8 – 18	Undulating to rolling	12,219.00	22.34
18 – 30	Rolling to moderate steep	17,524.40	32.04
30 – 50	Steep	11, 652.80	21.31
50 – above	Very steep	5,722.60	10.47
TOTAL		**54,690**	**100**

Source: Municipal Socio-Economic Profile and Ecological Profile

Elevation

The terrain of Buenavista has two distinct features. The northern part is made up of plain or flat terrain up to the coastal areas while the southern part are hilly, gradual and undulating mountains, plateaus and steep mountains. The highest peak of the town is located at the Southwestern part of Barangay Simbalan with an elevation of 673 meters above sea level and the second is in Upper Olave with an elevation of 506 meters. Most of the low-lying areas are in the Poblacion that can easily be inundated during heavy rains and high tide.

The deepest part of the municipal waters of Buenavista is about 205 fathoms about 10 kms. more or less from the shoreline. Some deep portions from 40-51 fathoms between 1–2 kms from the shoreline is located at Sacol where mud sea bed can be found.

Drainage and River Systems

The municipality of Buenavista has two big rivers. One is Guihao-an River and the other is Manapa River. Guihao-an River has so many water tributaries coming from different creeks of Barangays Olave, Sangay, Guinabsan, and Rizal and Malpoc where the Calayagon watershed is located. These accumulated waters from creeks are running down to Guihao-an River with Mahayahay as the outlet to Butuan Bay. The Manapa River has only few tributaries coming from the creeks of Malapong, Alubihid and Talo-ao with main outlet at Sabang, Manapa then to Butuan Bay. Some creek waters from Malapong and Talo-ao including Malpoc and Lawag are drained at Matabao creek to Manapa then to Butuan Bay.

Guihao-an River is used for irrigation covering the ricelands of Olave, Sangay, Guinabsan, Rizal, Malpoc, Lawag, Calayagon, Agong-ong and Cabulacan. Macalang creek is used to irrigate ricefields of Macalang, Piongot and Agong-ong.

The Malapong Dam waters are coming from different small creeks of Malapong, Talo-ao and Matabao. There are also 4 small water impounding projects located at Talo-ao Macalang, Guinabsan and Rizal.

Matabao Creek and Manapa River are used for fishpond development and other inland fishery projects of the municipality. Matabao creek also serves as the main drainage outlet of the drainage system of the urban area including the commercial district center.

Excess water and waste water of Barangays 2, 4, 5, 6, 7, and 9 all of Poblacion are drained towards the Caibitan creek at Pasil then to the mouth of Guihao-an River to Butuan Bay.

Most of the Urban barangays are flat terrain and below sea level and are prone to flooding during heavy rains, high tides and bad weather conditions. Poblacion water could hardly be drained during these conditions. *(Please refer to Annex A10: Drainage and River System map, p.74)*

1.1.3. Climate and Rainfall Pattern

The municipality is characterized with type IV climate, with evenly distributed rainfall all year round. (PAGASA Butuan).

Dry season can be experienced during the months of May to August with scattered rain showers in the Southwest portion of the municipality. Rainy season usually occur during the months of November to the early part of February. Slight rain and rain showers can be noticed from September to November.

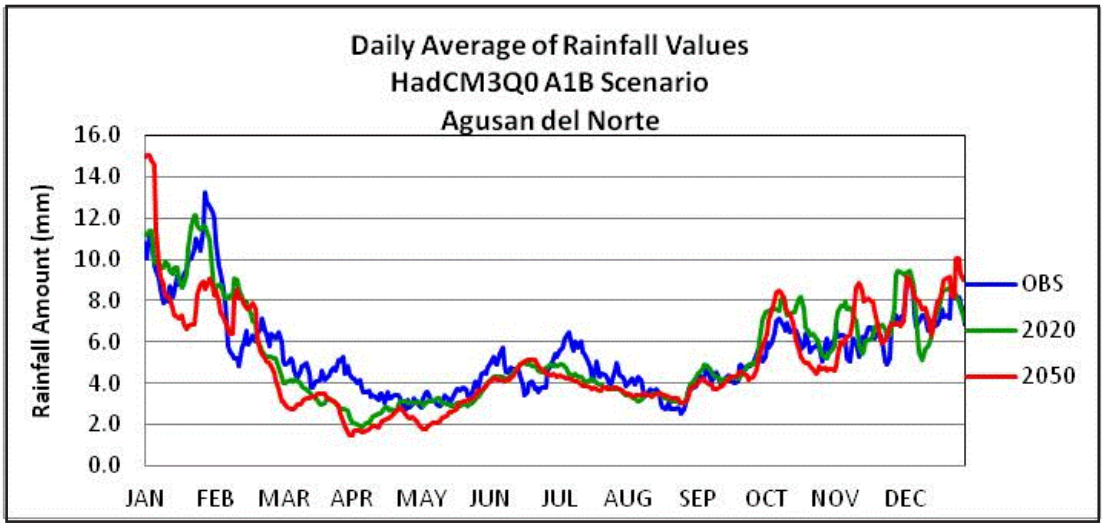
Average Rainfall Data

The average daily rainfall data as observed (2010) shows that there is an increase of rainfall from January to February at 13.5 mm, and went down in the middle of February to approximately 5 mm, moderately increase and decrease every month with the lowest registered rainfall data at 2.3 mm in the early part of September. Then, it gradually goes up to almost 8 mm at the end of December 2010.

Almost the same pattern of rainfall data is predicted and registered by PAG-ASA in 2010 and 2020 from January to December.

In 2050, the rainfall scenario based on the PAG-ASA, showed the average rainfall to a level of 15 mm in the early part of January with the lowest of 1.8 mm in the months of April and May, and gradually increased at almost 10 mm at the end of the year.

Figure 2: Daily Average of Rainfall Values



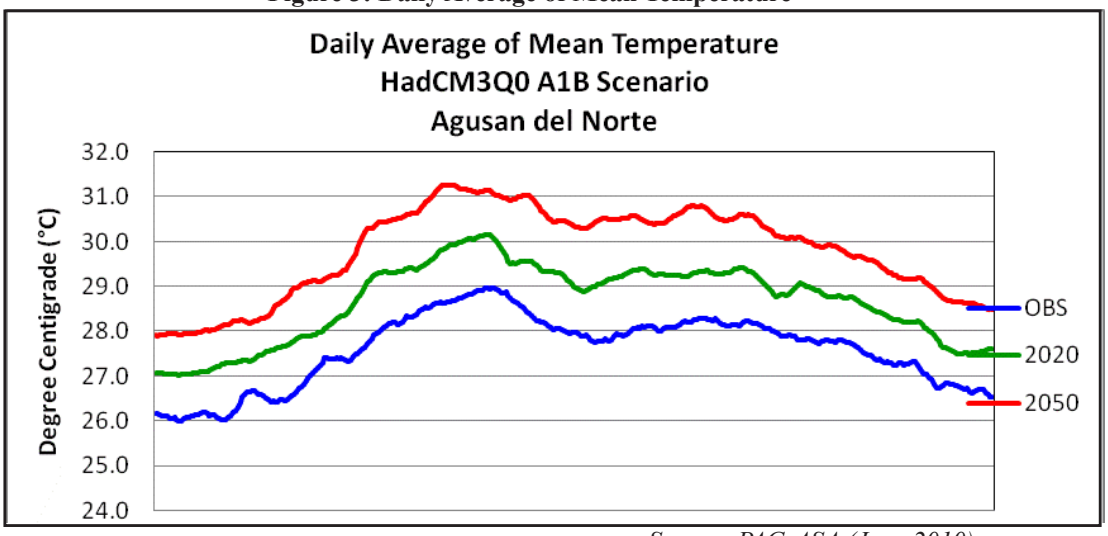
Source: PAGASA (June 2010)

Temperature Change

The registered daily average mean temperature by PAG-ASA, starting January 2010 shows about 26.4°C with an increase to 29°C in May-June or start of summer season. Then it gradually goes down at a significant level in the early part of November, as the start of the rainy season, with 26.5°C in December, 2010.

The temperature change scenario of 2020 shows a slight difference in the increase in temperature at the start of the year to December, 2020 showing almost the same pattern as of 2010. The temperature starts at 27°C in January and an increase of about 32°C during summer and went down again at 27.5°C in December.

Figure 3: Daily Average of Mean Temperature



Source: PAG-ASA (June 2010)

The same is true with the temperature pattern of 2050 that increases to 28°C in January, moderately higher than that of 2010 and 2020. The increase in temperature is likely due to the effect of climate change and global warming that is currently experienced up to the year 2050 and beyond.

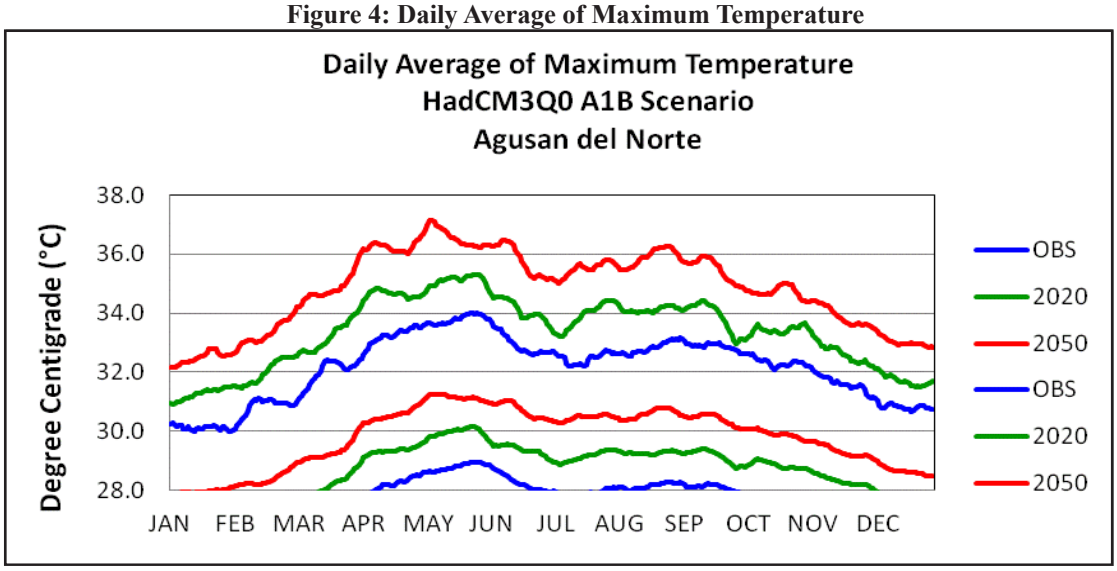
Daily Average Maximum Temperature

The daily average of maximum temperature of the municipality and the entire province of Agusan del Norte at 30.2°C in January of 2010, and increased from February to June (the summer months). The gradual decrease and increase can be noticed from July to October folowed by rain showers in November, the beginning of rainy season and will last till January of following year.

The trend and pattern of temperature scenario for 2020 is almost the same to that of 2010 with a slight increase of temperature from the start of the year till December of 2020.

In 2050 the temperature scenario will increase to 32.1°C in January with a peak at 37.2°C in May, and slightly covers the month of June, the end of summer season. The effect of climate change also directly affects the change in temperature during the month of September to December, the rainy season.

Figure 4: Daily Average of Maximum Temperature

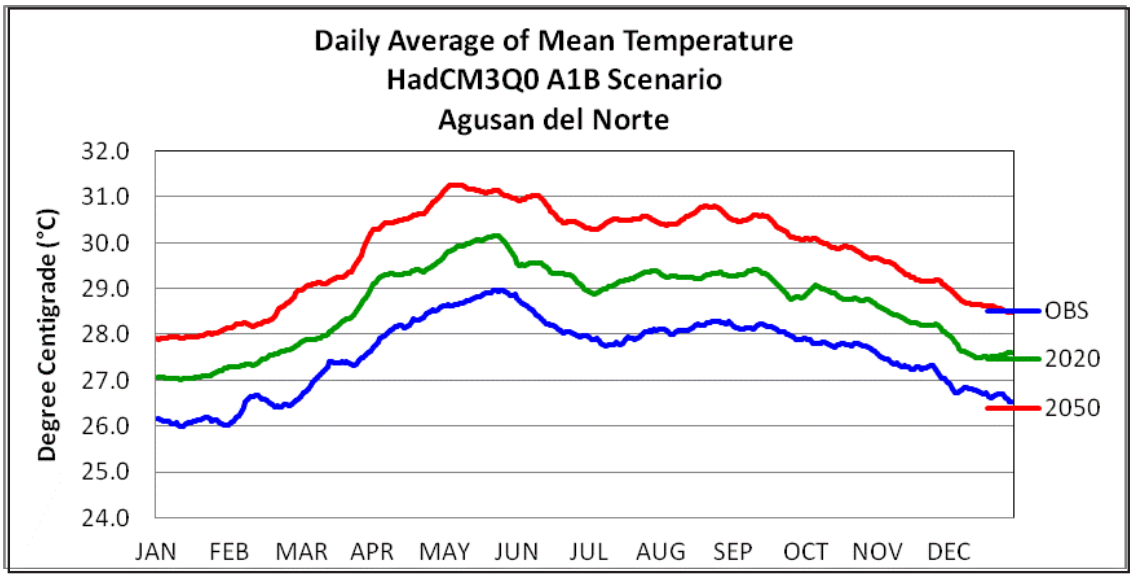


Source: PAG-ASA (June 2010)

Daily Average Minimum Temperature

In 2010, the average of minimum temperature is registered at 23.8°C in the month of June. Almost the same pattern of the scenario of minimum temperature registered in 2020 and 2050 having a slight increase to that of 2010 as shown in the chart of PAG-ASA.

Figure 5: Daily Average of Minimum Temperature



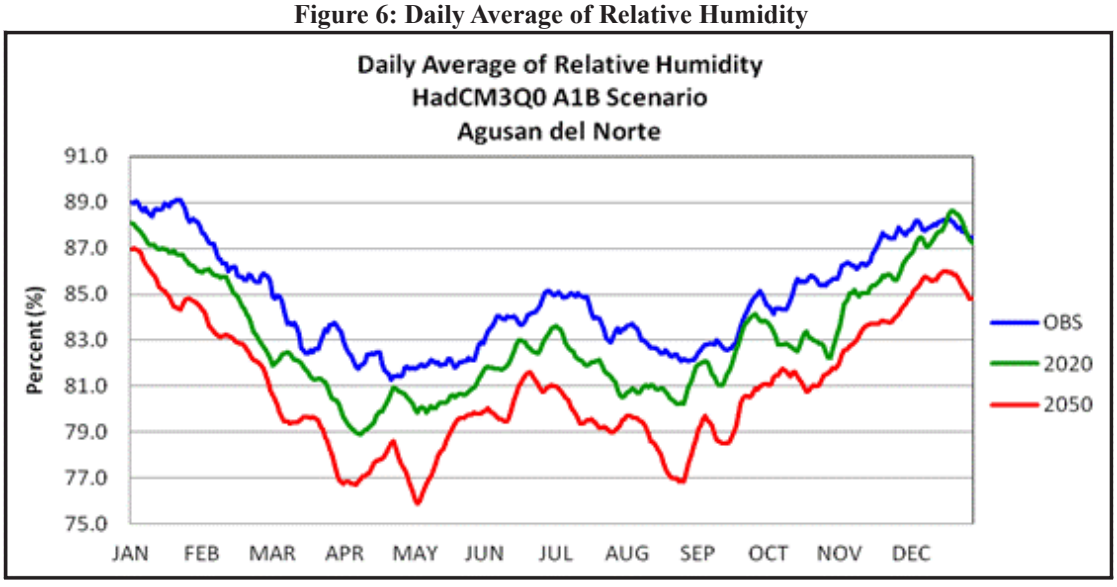
Source: PAG-ASA (June 2010)

Daily Average Relative Humidity

The daily average of maximum temperature of the municipality and throughout the entire province of Agusan del Norte was at 30.2°C in January of 2010. It increased from February up to June (the months of summer). The gradual decrease and increase can be noticed from July to October, even during the rainy season from November till January of the following year.

It is projected that by 2020, the highest perenage of relative humidity will be at 88.0% in the months of December and January, and the lowest at 79% in the month of April. By 2050, it would likely reduce to 87% in januray and the lowest point at 77% by May.

Figure 6: Daily Average of Relative Humidity



Source: PAG-ASA (June 2010)

Cyclonicity

The municipality is cyclone-free because there is no record regarding the occurrence of cyclone in the municipality since time immemorial.

Typhoons (Observed)

The municipality is not within the typhoon-belt area and is protected by the mountain ranges of Mount Hilong-hilong in the east and Punta Diwata ranges in the west.

However, climatic condition of the municipality such as sudden heavy rains that occur anytime of the day are also associated with inter-tropical convergence zones and typhoons that may hit other parts of the country especially in Surigao and Samar-Leyte area.

1.2. SOCIO-ECONOMIC PROFILE

1.2.1. Demograhics

Population and Number of Households

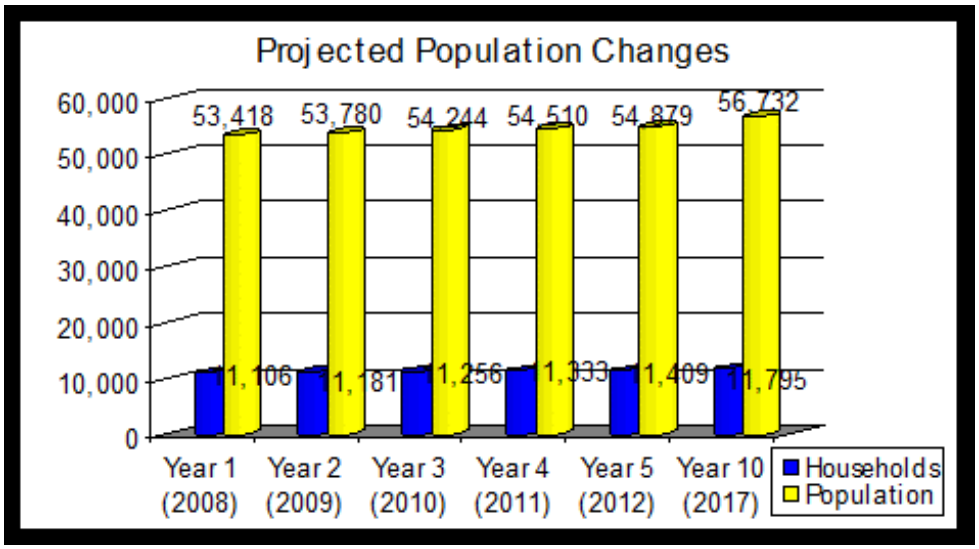
The municipality of Buenavista has a total population of 47,957 with a growth rate of 0.68%, with 9,971 household (CBMS survey, 2007). Though, the NSO recorded the population of the municipality in 2007 at 53,059.

In the urban barangays, there is a total population 14,871 compose of 7307 males and 7514 females and a total households of 3,096. The rural barangays has a total population of 33,136 with 17,206 males and 15,930 females and a total household of 6,875.

The total population density of the municipality per hectare is 62.31. The average family size per household is 5 both urban and rural barangays.

The population of the town increases annually either by natural birth or in-migration. Using the NSO data of 53,059 for CY 2007 and the annual growth rate of 0.68%, the municipality has a projected increase of the population at 53,879 and 56,732 in CY 2012 and 2017, respectively. *(Please see figure 7 below and Annex B2, p.82)*

Figure 7: Project Population Changes



Source: NSO Survey Year 2007

Projected Population Changes

Projected Population and Households

CY 2007 Population	= 53,059
CY 2000 Population	= 50,612
Annual Growth Rate between 2000 & 2007	= 0.68%
CY 2007 Households	= 9,971
CY 2000 Households	= 9,384

The projected population of the municipality in CY 2017 or 10 years later will be 56,732, with a total households of 9,384 in an average family size of 6.

1.2.2 Income and Poverty Incidence

Income Level

The threshold level of the municipality based on the national standard (NEDA) in urban areas is pegged at P14,9464.00 per household per year while in the rural area is at P13,059.00.

The below poverty threshold level in the urban under the NEDA standard is P10,158.00 per household per year in urban, while P9,208.00 in the rural.

Given the said standards, the poverty incidence of the municipality is apparently prevalent with half of the population living below the poverty threshold and 34.40% below the food threshold level.

Housing, Water and Sanitation

Housing

The municipality of Buenavista has a total number of 9,971 households. About 530 (6.1%) households are living in makeshift houses, far below the national average of 29.5%, and about 256 households are considered as informal settlers.

Majority of the total number of households are living in a house constructed or made of strong and light materials from walling to roofing. (Please see Annex B4, p.84*)*

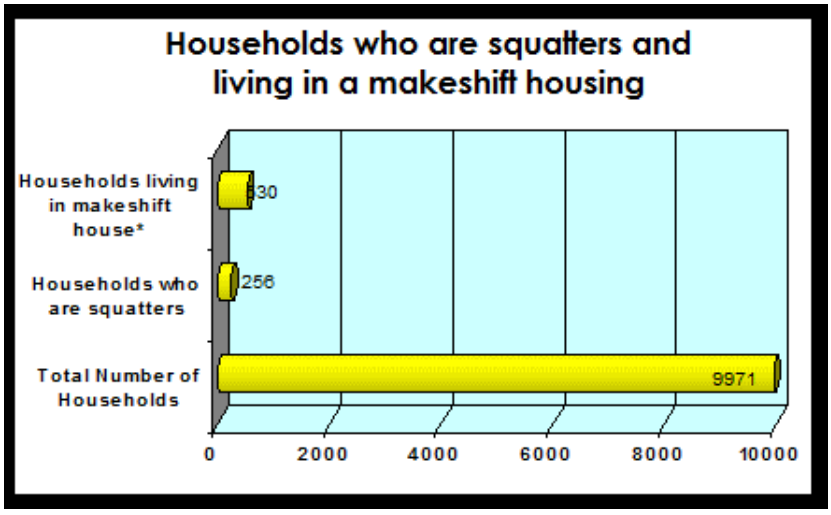
About 30% of the total households have housing components made of strong materials, 30% are with light materials, 18% with mixed materials but predominantly strong, 18% are made of mixed materials but considered light category. There are also about 3% whose housing components are made of salvaged-makeshift materials and about 1% of the total households who are living in mixed but predominantly of salvaged materials. (CBMS Survey, 2007).

Tenure Status of House/Lot

Majority of the total number of households the municipality of Buenavista computed at 5,301 households or (53.2%) are owner/owner-like possession of house and lot. About 2,854 households (or 28.6%) have own house/rent-free lot with consent of the owner, 8.0% own house/rent the lot. A smaller number of households (4.4%) belong to rent-free house and lot with the consent of the owner. And, 3.3% belong to rent a house/ room including the lot.

About 1.9% of the total numbers of households who own a house, without lot rental without the consent of the owner. About 0.6% is renting the house and lot for free and without the consent of the owner.

Figure 8: Households who are squatters and living in a makeshift housing



Source: CBMS Survey Year 2007

Water and Sanitation

Source of Drinking Water

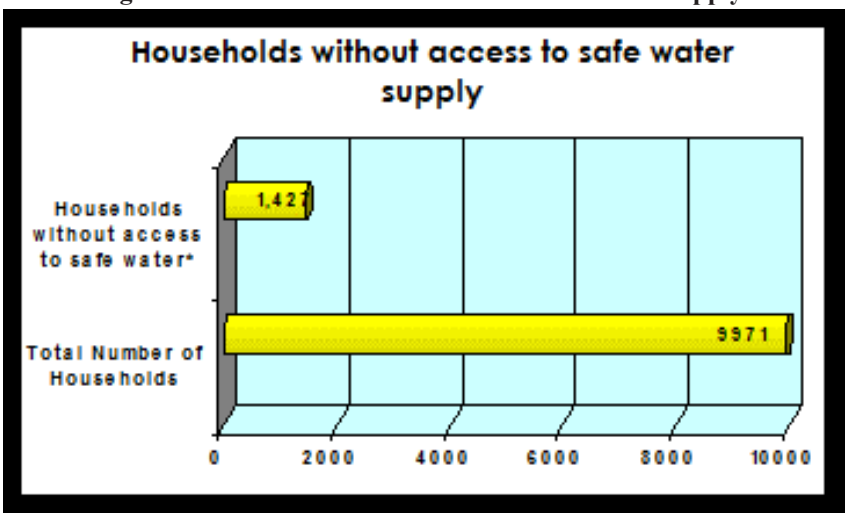
The municipality is in dire need of supply of potable water. Of the total households (9,971), 8,550 households have direct access to potable water under level III and level II water supply system. Almost all households in the urban barangays have availed the services of the Buenavista Water District as source of potable water in the poblacion. Barangay Guinabsan, Alubihid, Lower Olave, Simbalan and Sangay (Sitio New Bohol and Linao-linao) have their existing level II water supply tapping water from springs. Other rural barangays have access to underdeveloped springs and shared deep wells and artesian wells.

Aside from shared water system in the barangay, most number of household have their own jet-matic hand pumps as source of drinking water.

Few number of households or about 1,427 in the rural barangays most especially in the far-flung areas have no direct access to potable water instead they fetch water in the river, stream, open-dug wells and undeveloped springs.

Households in the urban barangays and some in rural areas are using bottled water or purified drinking water commercially sold from water stations established in the municipality or from wholesale and retail stores.

Figure 9: Households without access to safe water supply



Source: CBMS Survey Year 2007

Type of Toilet Facilities

There are about 6,339 households or 63.57% of the total numbers of households in the municipality who have their own water-sealed toilets that directly flush to their septic tank. About 887 households have their own water-sealed toilets with shared or communal septic tank.

Closed pit or covered latrines are still used by 710 households in the barangays and about 129 are still using open pit dug directly to the ground with wooden tunnel type box installed vertically to the toilet house.

Households without toilet facility are those that are located in far-flung rural areas, living along the riversides, in shanties, squatters area and along the shorelines consisting about 1,786 households.

The 120 households belong to the unidentified type of sanitary human waste disposal. *(Please see Annex B5, page 87)*

Health and Nutrition

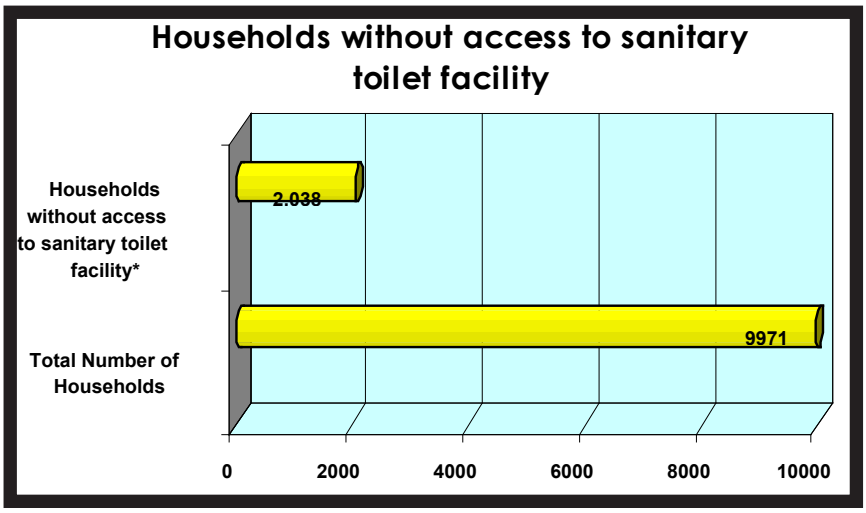
Prevalence of Malnutrition

Based on the 2007 CBMS survey result, the municipality of Buenavista has a total number of children 0-5 years old about 6,639 with male population of 3,385 and 3,254 are female. *(Pls. see table 4 below)*

A magnitude of 324 children population 0-5 years old are considered to be malnourished with 147 males and 177 females.

Most number of related malnourished cases of children 0-5 years old is from the rural areas. This is maybe attributed to lack of health services and facilities of the barangay health centers.

Figure 10:. Households without access to sanitary toilet



Source: CBMS Survey Year 2007

Table 4: Prevalence of Malnutrition

Number of children 0-5 years old			Malnourished children 0-5 years old					
			Magnitude			*Proportion*		
Total	*Male*	*Female*	*Total*	*Male*	*Female*	*Total*	*Male*	*Female*
6639	3385	3254	324	147	177	4.88	4.34	5.44

Source: CBMS Survey Year 2007

Child deaths and women who died due to pregnancy related causes

Out of a total number of the children population 0-5 years old, there are about 68 children who died with unestablished causes, with 31 males and 36 females.

There are also 948 reported child births below 1 year old in the municipality with 10 women who died due to pregnancy related causes.

In the case of mortality rate of pregnant women, this maybe also attributed to the lack of health services and facilities including the attending health personnel during the delivery. This is attributed to unhealthy lifestyle, lack of proper nutrition, lack of medical consultations and information of most poor families in the rural barangays on safe motherhood and family planning.

Table 5: Child Deaths

Number of children 0-5 years old			Children 0-5 years old who died					
			Magnitude			*Proportion*		
Total	*Male*	*Female*	*Total*	*Male*	*Female*	*Total*	*Male*	*Female*
6639	3385	3254	68	31	37	1.0	0.9	1.1

Source: CBMS Survey Year 2007

Table 6: Women who died due to pregnancy related causes

Number of child births (less than 1 year old)	Women who died due to pregnancy related causes	
	Magnitude	*Proportion*
948	10	1.05

Source: CBMS Survey Year 2007

Education

Basic Education and Literacy

The municipality of Buenavista has complete elementary and secondary levels of education, both public and private. There is only one vocational school, the Northern Mindanao of Fisheries at Matabao offering TESDA accredited vocational courses.

The public elementary and secondary schools are divided into three districts, the North Buenavista District, the South Buenavista District and Buenavista District 3.

There are also offered preschools, day care classes or kindergarten both in public and private institutions.

The 2007 CBMS survey has a total registered 6-12 years old school age children population of about 8,563 with 4,429 males and 4,134 females. Out of this elementary school age population, there are about 1,710 or 19.97% who are not attending elementary education. About 937 male population and

773 are females. Most of these children are from rural barangays and far-flung sitios. This situation is attributed to lack of parental interest to educate their children due to poverty and high cost of educational fees even in the elementary level. Some parents are just contented that their children can read and write.

Of the total number 4,765 of children 13-16 years old who are supposed to be in school, 2,118 or 44.45% are not attending high-school education. About 1,272 are males and 846 are females.

Children population aged 6-16 years old is recorded at 13,328, composed of 6,095 males and 6,423 females. Out of these, 1,961 children are not attending school both elementary and secondary.

Another issue on the education sector are the 0 years old and above who are supposed to have proper education but are deprived of their right to learn and to be educated. Out of the 36,329 population of the above mentioned category, about 1,025 are considered illiterate (no read - no write persons), with 578 males and 447 females. *(Please see Annex B7, p.85)*

Highest Educational Attainment

The municipality of Buenavista has a total number of 42,492 population of 5 years old and above with 21.723 males and 20,769 females.

There are about 2,120 who have not completed their elementary education comprising about 1,160 males (2.73%) and 960 females (4.42%). The preschoolers are about 2,344 or 11.24% of the entire school age population.

For the elementary level, Grades 1-64have 8,933 populations and Grades 5-6 have 3,534. In the entire school grade population, only about 5,184 or 24.96% have graduated elementary education.

For High School level, there are about 7,734 who are undergraduate and about 5,994 have graduated from secondary education.

For the post secondary or tertiary education, only about 433 who are undergraduate and 822 who have graduated of any post secondary courses.

There are also about 2,819 who are college undergraduate and about 2,531 who are academically degree holders of 5 year courses in any colleges and universities.

Some of these degree holders/ professionals have pursued post graduate studies/masterals/doctorate/post baccalaureate courses with about 44 graduates. *(Please see Annex B7, p.85)*

1.2.3. Agricultural Production System

Crop Production

Rice, coconut and banana are the three major agricultural crops produced in the municipality. Coconut (5,257 has.) is on top in terms of area covered followed by rice (1,137 has.) and banana (631 has.).

There are two cropping season for rice, during wet and dry (also called "palagad") seasons. Wet season falls during November to April while dry season falls during May to October. The production system adapted for paddy rice is mainly mono cropping, but during the long dry season farmers mostly do not plant and converted their land to other crops like vegetables and corn while some left their land vacant. Thus, it is classified as "rice-fallow" or "rice-other crops".

Inter-cropping system is practiced only under coconut with banana as inter-crop and other related long term crop.

Table 7: Major Crop Production

Major Crops		Barangay	Area		Production		Product Market	
			Hectares	% to Total	Volume (M-T)	Value (Php)	Local	Export
Rice	a) Irrigated	Brgy. 1 and rural barangays except brgys. Olave & Simbalan	741.50	9.01%	3,306.00	42,978,000	W/in the Municipality	-
	b) Non-irrigated	Brgy. 1 and rural barangays except Simbalan, Olave & Agong-ong	396.75	3.15%	1,012.37	13,160,810	-do-	-
Coconut		Municipal - wide	5,257.12	57.34%	1,620.00	24,300,000	-	Misamis Oriental
Banana		Brgy. 1 and rural barangays	631.16	6.88%	4,418.12	22,090,600	-	Luzon

Source: MAO

Crop rotations in the municipality are intermittently practiced by farmers. In some upland areas, however, crop rotations are being practiced occasionally. *(Please see Annex B8, p.86)*

Livestock Production

Farmers in the rural areas raise small and large animals such as swine, goat, poultry, carabao, and cattle in the backyard. Animal raisers usually have a population of 2-3 heads of Carabao , Cattle, and other small animals. The municipality has the biggest population on livestock (of large animals) throughout the province. *(Please see Annex B11, p.87)*

Fisheries Production

There are five (5) coastal barangays in the municipality that are engage in fishing and three (3) barangays with fishponds (i.e. Barangays Abilan, Matabao, and Manapa). The said five barangays are dependent on fishing using self-financed motorized boat. Tilapia fingerlings were dispersed for inland fishing, rivers and ponds.

In 2009, the total fish production of harvested fisheries from the five (5) coastal barangays was more or less 746 metric tons

Table 8: Rice Production

Name of Barangay	Area Planted (Has.)	Average Yield (per ha/ per cropping)	Ranking
Brgy. 1	105.75	3.9	6
Abilan	150.00	3.4	2
Agong-ong	144.75	4	3
Alubihid	141.50	3.2	4
Guinabsan	34.50	3.75	12
Macalang	90.00	3.9	8
Malapong	50.00	3.27	11
Manapa	60.50	4	9
Matabao	103.00	4	7
Malpoc	60.00	4	10
Rizal	152.50	4.2	1
Sangay	28.00	3.8	13
Talo-ao	112.00	3.62	5
Total	1,232.5	3.7	

Source: MAO

(MT) with a total value of P15.45 million. Fish production from inland fisheries (fishponds and fish cages) was recorded at 305 MT valued at P 24.4 million. *(Please see Annex B9, p.86)*

1.2.4. Livelihood

Vegetable Production

Vegetable Production is mostly for subsistence use. Only few farmers engaged in vegetable production as source of livelihood due to climatic condition of the area.

Cutflower Production

Cutflower production is suitable only in one barangay, Barangay Alubihid, identified but due to high risk and high production cost, farmers could not expand the production area.

Small Cottage Industry

There are different types of small-scale cottage industries in the municipality like boat making, furniture, metal and steel fabrications, and basket-making.

1.2.5. Commerce and Trade

Marketing for rice pose no problem in the municipality due to the presence of local municipal traders, provincial traders and those from other adjacent municipalities. Moreover, municipal output for rice is lower compared with actula demand.

Other major commodities produced in the municipality like banana and coconut has not encountered any problem on trade and commerce since agents, assemblers and consolidators also operate in different parts of the municipality absorbing regular harvest of the farmers. *(Please see Annex B10, p.87)*

1.3 INSTITUTIONAL PROFILE

1.3.1 Infrastructure

Agricultural Facilities

Functional agricultural facilities present are small infrastructures such as Multi Purpose Drying Pavements (MPDPs) and mechanical dryers. Some irrigation facilities, however, need rehabilitation particularly the 3 sites of Small Water Impounding Project (SWIP).

Pre-harvest facilities are almost beyond repair such as floating tiller, thresher, etc. given by Department of Agriculture to support their agriculture activities.

Transportation and Mobility

The municipality can be reached by all types of land transportation. All types of vehicles are plying to and from the municipality coming from any point of Mindanao. Passenger jeepneys from Butuan City and Nasipit are loading and unloading passengers with 10-15 minutes interval at the PUJ terminal of the town. Other passenger jeepneys with one round trip per day have parking area at the terminal bound for Lomboyan, Guinabsan, Sangay, Olave and Simbalan.

Other available transportation going to and from the rural barangays of the municipality are "habal-habal" and motorized trisikads. The downtown areas are served by pedicabs and motorized trisikads roaming around picking up passengers anywhere in the urban barangays.

Fishing boats can be rented from fisherfolks of Barangay 10 as sea transportation especially for tourist, beach lovers, divers and underwater explorations and experimentation.

Table 9: Existing Agricultural Facilities

TYPE OF FACILITIES	LOCATION/NO. OF SITES	REMARKS
1. Multi Purpose Drying Pavement (MPDP)	32 sites in urban and rural areas	All Functional
2. Mechanical Drier	1 site Agong-ong – Rice area 1 site Poblacion – Cassava production	Functional
3. Irrigation	4 sites	NIA 1 site for rehab Guinabsan
4. SWIP	5 sites	BSWM-3 sites not functional for rehabilitation
5. FMR	10 sites	Subject for Rehabilitation
6. Rice and corn mills	7 Barangays; 10 units	Privately owned and functional
7. Warehouses	- - -	None
8. Cold storage	- - -	None
9. Slaughter house	Market site; 1 unit	Subject for relocation

Source: MA Office

The existing fish port of Barangay 10, Poblacion is still unutilized commercially because it needs physical improvements but it can cater fishing vessels and other marine transportation from neighboring islands and places via Butuan Bay. Though, the Nasipit International Port is just 6 kilometers away and the airport, located at Bancasi, is only 12 kilometers from the town proper.

Communication Facilities

Buenavista is served by BAYANTEL, a telephone company with 795 actual subscribers. In some rural areas where telephone landlines are not yet available, cellphones and handsets radios are the means of communication. There are about 5 cell sites established in the municipality by Smart, Globe and Sun Cellular. PLDT is also serving the town. There are also several established internet cafes in the poblacion.

Postal service is available in the town catering letters and packages to and from the municipality including postal money order services.

Broadcasts of AM and FM radio stations in Butuan City, Cebu City, Cagayan de Oro City and National Capital are other means of communications and informations that can be accessed. Cable TV owned and managed by Fil-Products with more or less 24 channels is also serving the municipality. Five different national and local newspapers can be subscribed and be served daily thru numerous newstands and newsboys to direct subscribers.

Power/Electricity

All barangays of the town are served with electric power 24 hours a day from Agusan del Norte Electric Cooperative, Inc. (ANECO) with power source from Maria Cristina Hydro Power Plant managed by the National Power Corporation (NAPOCOR) now with TRANSCO. Brown-outs seldom occur and usually did not last long in a day during ocurrence. About 95.19% of the urban households have electricity and 86.97% of the rural households have enjoyed the electric power. About 10.39% of the urban and rural households are not yet served by the power but there are some rural areas like Lomboyan, Langan-langan, Balatakan and Kipundao that are enjoying solar power

system a tie-up project of DAR and LGU funded by the Spanish Government. Most of the far-flung areas of the rural barangays are still using kerosene lamps and crude lighting paraphernalia.

Number of Connections

There are several type of power connections that ANECO has extended to member-consumers of the town. For domestic/ households uses, there are 7,681 household connections with an average consumption of 62 KWH/month. For industrial uses, 41 establishments/industrial buildings are connected with an average consumption of 213 KWH/month. There are 244 commercial buildings connected with an average monthly consumption of 1,037 KWH. For public buildings, 128 connections with an average monthly consumtion of 341 KWH, and for street lightings, about 13 connections with an average consumtion of 158 KWH per month. Others unclassified connections are 4 with an average consumption of 572 KWH/month. A total of 8,111 connections of electric power are enjoyed by households and establishments and other unclassified users of electricity both in urban and rural barangays. For CY 2010 the total power consumption of all users is 627,393 KWH, for CY 2011 is 639,940 KWH, for CY 2012 is 652,740 KWH, for CY 2013 is 665,793 KWH and for CY 2014 is 679,108 KWH. These speculations of increase in power consumption per year could be even higher depending on the trend of development and growth of domestic, industrial, commercial, institutional, and other users of electricity of the town. *(Please see Annex B12, p.88)*

Table 10: Households Served and Un-served by Electricity, Year 2009

	Number of Households			Percentage		
	Rural	Urban	Total	Rural	Urban	Total
Served	5,339	2772	8,111	86.97%	95.19%	89.61%
Unserved	800	140	940	13.03%	4.81%	10.39%
Total	**6,139**	**2,912**	**9,051**	**100%**	**100%**	**100%**

Source: ANECO, Buenavista Sub-office

Projected Power Requirements

The needed power requirements of all the users in the municipality for 5 years based on the current year (2009) as projected by ANECO in 2010 up to 2014 is also based on the present trend of development and growth of the town. The increase in power consumption every year can be attributed to the growth of domestic, industrial, commercial, institutional

Fuel Sources

There are about four commonly used fuels by domestic households in the municipality. About 6,979 or about 70% of the entire households of the municipality are using firewood and charcoal although some of these households especially in the urban areas are also using electricity, kerosene and LPG, recorded at 29% of the total households.

Water Supply/Irrigation System

Table 11: Number of Connections by Type of Users and Average Consumption (KWH/month)

Type of Connection	Number of Connections	Average Consumption (KWH/mo.)
Domestic	7,681	62
Industrial	41	213
Commercial	244	1037
Public Building	128	341
Streetlights	13	158
Public/Others (BAPA)	4	572
Total	**8,111**	**2,383**

Source: ANECO, Buenavista Sub-office

The Municipality has five (5) communal irrigation systems such as Macalang-Agong-ong Irrigation System (MACAGONG-IS) which is located at barangay Macalang funded under National Irrigation Administration (NIA), Calayagon-Agong-ong-Cabulacan-East Agong-ong Irrigation System (CACEA-IS) dam site located at Sitio Calayagon, Rizal-Malpoc-Cogon-Laoag Irrigation System (RIMACOLAO-IS) dam site is located at barangay Rizal, Guinabsan Irrigation System and Taloao-Matabao Irrigation System dam site located at Barangay Talo-ao.

Table 12: Number of households by kind of fuel used

Kind of Fuel Used	Number of Households	Percentage (%)
Firewood and Charcoal	6,979	70%
LPG	2,094	21%
Kerosene	798	8%
Others	100	1%
Total	9,971	100%

Source: NSO, CLUP, MPDO, Buenavista

Other irrigation system catering rice production are Small Water Impounding Project (SWIP) covering 4 barangays namely Malapong which is the biggest water impounding project consisting of 6 hectares impounding and covering 2 barangays with a total service area of 50 hectares approximately. Other site situated at Macalang which is functional while Dalao-an and Alubihid are subject for Rehabilitation.

Building/Shelter

The municipality has 9,971 housing units consisting of 9,133 owned/amortized, 330 units rented, 439 being occupied for free with consent of owner.

1.3.2 Support Services

Trading and Marketing

Trading activity mainly covers agricultural products such as palay, coconut and banana. The presence of numerous rice mills and trading centers for coconut owned by affluent residents have contributed much to the growth of business sector in the area.

The major trading centers on the above mentioned commodities are strategically located in the town and barangays, and are made accessible to the farmer-producers.

Credit and Financing

Famers mostly access their credit and financing from private usurer payable after harvest with interest in kind like for every P1000.00 borrowed the farmer will pay P1000.00 plus 1 sack of palay, or 3-4 sacks of palay without giving back the cash amount.

The existence of several NGOs such as Alterdev, MILAMDEC, BAUG, MPC and CART which offers savings and loan assistance especially to the women sector and micro entrepreneurs in the community through weekly collection.

2

CURRENT HAZARDS AND OBSERVED CLIMATE CHANGE IMPACTS

2. CURRENT HAZARDS AND OBSERVED CLIMATECHANGE IMPACTS

2.1. SOURCES AND TYPES

On the observed climatic changes in the municipality, the increase in temperature was the most prominent difference as observed by 94% of the respondents. More than half of the respondents (53%) had also observed droughts. Other changes include heavy rainfall (33%) and pest infestation of crops (37%). Some farmers (11%) had also experienced big waves, unpredictability of weather conditions, and dried-up rivers, the baseline survey stated.

2.1.1 Floods

Floods were widely experienced in the municipality during the continuous rainfall for 2-3 days. The presence of many tributaries that contributed too much water was causing the overflow of water to the lower portion and affected mostly rice areas. This calamity usually occurs during December-January.

Barangays covered with flooding are Barangays Manapa (severe), Guinabsan (moderate) and Rizal, Agong-ong, Malpoc, Poblacion 6 and other urban areas that is flat and some area below sea level. There is no apparent flooding in rural areas except in areas located near the creeks and rivers that overflow during heavy downpours. *(Please see Annex A4: Flooding Hazard Map, p.68)*

2.1.2 Droughts

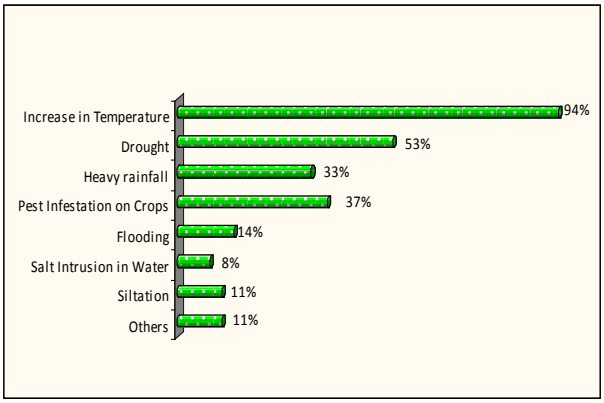
Drought in the municipality is not a year-round occurrence, though the dry time usually occurs within one to two months is a normal weather condition in the municipality. This usually occurs during the month of August when most low land crops that are dependent on water are slightly and moderately affected, but not much on the irrigated low land rice field.

2.1.3 Erosion

Apparent erosion in the urban areas is felt in the barangays along the coast caused by sea tides and waves.

Severe erosion are experienced in the upland Barnagays of Guinabsan, Sangay, Olave, Malpoc and Simbalan due to denudation of the forest caused by illegal logging and quarrying. Some areas of Barangays Simbalana and Guinabsan are likewise prone from slight to moderate erosion. *(Please see Annex A5: Erosion Map, p.69)*

Figure 16: Responses of FGD on the observed climatic changes in the Municipality



2.2. Place And Time Of Occurrence

Flooding hazard occurred in the years 2003, 2005, 2006, 2007, 2008 and 2009 affecting mostly lowland rice areas in Barangay Abilan, Alubihid, Agong-ong, Barangay 1, Macalang, Malpoc, Rizal, Malapong, Talo-ao, Matabao and Manapa. In year 2003 and 2009 flooding were classified as moderate, affected the vegetable production in Agong-ong, Malapong, Malpoc, Abilan, Alubihid, Macalang and Manapa. Also in 2009, livestock and poultry, and even physical infrastructures were affected in Barangays Rizal, Malpoc, Olave, Sangay, Simbalan, Guinabsan and Macalang.

Drought likewise occurred in 2003, 2004, 2005, 2006 and 2009. The rice production affected Barangays Alubihid, Agong-ong, Barangay 1, Macalang, Malpoc, Sangay, Manapa, Matabao, and Talo-ao. It also affects corn areas of Agong-ong, Malpoc, Guinabsan, Abilan, Barangay 1, Macalang, Rizal, Sangay and Simbalan. In 2009, root crops were also severely damaged.

2.3 IMPACTS (EXTENT /DEGREE)

Damage to Crops

Increasing rainfall ("Floods")

Rainfall data shows that during the months of November to January there was moderate to heavy rainfall pattern in the municipality.

Reported damage to agricultural production (i.e. crops, livestocks and poultry) was most felt in Barangays Sangay, Guinabsa, Rizal, Malpoc, Macalang, Agong-ong, Malapong, Talo-ao and Matabao.

During the period 2003 – 2009, rice production in low land areas was heavily affected in 2003 estimated at around 58% of the total areas.

In the same period the increase in rainfall or flash floods also impacted on banana production (computed at 18%), since these are mostly planted besides creeks or water bodies that are more prone to overflowing. (*Please see Annex B17, p.91)*

Increasing temperature (Droughts)

Drought occurrence had affected from moderate to high degree of damage in rice production during the period 2003-2005. In the top three commodities, rice was highly affected owing to the fact that it is water-dependent. There was no recorded extent of damage or yield loss for coconut and banana. *(Please see Annex B21)*

Crop infestation of pest and diseases

There was no major outbreak in infestation during the period of 2003 – 2009 for rice and coconut. However, bunchy top diseases constantly threaten the banana industry which is not controllable by any chemical pesticides, instead by total eradication through burning and resting the whole affected area for a quite time.

Erosion

Erosion usually occurs during the heavy and continues rainfall especially in the higher elevation. It increases the siltation of the river basin and affects the low land areas.

Earthquake

The municipality is not prone to earthquake and had not experienced high intensity.

Damage to Livestock/Poultry

Animals damaged during high rainfall or flooding occurred mostly to poultry which is considered highly vulnerable to climate change. These were mainly due to certain diseases caused by viruses and other chronic respiratory diseases. *(Please see Annex B21)*

Damage to Property

Significant damage to property was noted during flooding occurrence where households much affected those located in coastal and riverbank areas.

In 2009, for example, the MSWD has reported a total of 3,072 houses that got inundated for five (5) days, with 67 houses totally damaged and 26 houses partially damaged.

Loss of Life

The recent disaster that hit the area was brought about by Typhoon Urduja on November 25, 2009. It literally submerged most of the low lying areas particularly the populace living near the river and coastal areas.

During intense flooding the Municipal Disaster Coordinating Council (MDCC) has to evacuate affected residents and temporarily put up shelter for them at the Municipal Gym to prevent further damage and loss of lives. A total of 3,165 families or 18,468 persons were affected including children in 2009.

Relief goods such as rice, canned goods and noodles were distributed for immediate assistance. Among the rural barangays that were most affected, only Barangay Sangay had availed of the assistance. Only 56 families received relief goods from the 204 families in this barangay due to insufficient funds. *(Please see Annex A14, p.78)*

Damage to Infrastructure

Continues rainfall causes flooding and overflowing of the road networks. Major infrastructures affected during flooding are Farm-to-Market-Roads (FMRs), bridges, and irrigation facilities. *(Please see Annex A15, p.79).*

Figure 12: Hazardous face of Climate Change

Barangay Manapa, Sabang (top left), Barangay Matabao, Tinago (top right), Barangay Sacol, Mahayahay (bottom left), and Poblacion 8 Sto. Niño Chapel (bottom right).

3 ADAPTATION STRATEGIES

3. ADAPTATION STRATEGIES

3.1. PAST ADAPTATION STRATEGIES

The most common adaptation strategies of the farmers and communities during hazards (both Flooding and drought) include adjustment in farming techniques (i.e. utilization of drought or flood tolerant plant varieties, change of crops, and diversified farming), and engaging into other forms of livelihood (off-farm). On the part of the LGU, the declaration of state of calamity and the allocation of 5% calamity fund became an immediate recourse to provide much needed relief goods and other assistance.

Table 13: Past adaptation by affected people and places

Past Adaptation by Affected People and Places	Year 2003 – 2009	
	Hazard 1 (Flooding)	Hazard 2 (Drought)
Communities	Shift to labor employment, peddling, trisikad driving, carpentry & masonry, and Fish vending.	Shift to labor eployment, peddling, trisikad driving, carpentry & masonry, and Fish vending.
LGUs	Funding assistance to affected Households allocation of 5% calamity funds	Funding assistance to affected Households allocation of 5% calamity funds
Farmers	Planting of variety of hibrid rice, diversified farming technology and livestock and livestock production.	Planting of corn, squash, melons, and camote livestock and poultry raising
	Vegetable farming, tuba gathering, peddling, trisikad driving, tilapia culture, firewood gathering and labor employment	Tuba gathering, peddling, trisikad driving, firewood fathering, charcoal making, and labor employment

3.2 CURRENT ADAPTATION STRATEGIES

The vulnerability of the agriculture sector to various forms of harsh conditions has made the populace to seek coping measures in order to survive. On the part of the LGU, several strategies were formulated and implemented to mitigate the damaging effects of the climate change.

3.2.1. Economic Strategies

1. Establishment of the marketing outlets of agricultural products and provision of post harvest facilities and farm inputs;
2. Establishment and enhancement of fish sanctuaries in Barangays Manapa and Sacol with corresponding deputation of fish wardens as "Bantay Dagat" and provision and maintenance of patrol boats;
3. Establishment of livestock and poultry breeding projects for high quality breed for livestock and poultry dispersal program to uplift the living condition of the rural folks and indigent families;
4. Promotion of hatchery facilities and fingerling dispersal to fishpond/pen/cage owners/operators including in lagoon, rivers, creeks and dams;
5. Promotion of crop diversification farming system and organic fertilizers and pesticides;
6. Organization and strengthening of cooperatives and farmers-irrigators association with corresponding technology transfer mechanisms like skills trainings and seminars to enhance productive capacities;
7. Promotion of credit linkages for farmers/fishermen organizations to financial institutions and lending firms for the development of agricultural lands, fishponds and fishing grounds; and
8. Implement insurance scheme to secure the farmers from the losses in agricultural production i.e. crops and livestock.

3.2.2 Physical/Infrastructural Strategies

The current situation of the municipality in terms of its physical-infrastructure facilities is evidently inadequate. Road networks that link the urban and the rural areas are not well-maintained, with some parts not passable during rainy days. Shorelines are eroded with low-lying areas that can be over-flooded during high tides and rainy days. Rivers are silted due to indiscriminate quarrying and extraction of sand and gravel and soil erosion from denuded forestlands.

Due to these current realities, some strategies are being formulated to address these prevailing issues and problems of the municipality.

1. Construction, maintenance and improvement of road networks (i.e. FMRs) in the far-flung areas connecting to the market centers;
2. Construction of seawalls along the shorelines and low-lying coastal areas, to protect from soil erosion and flush floods;
3. Construction of causeways and rehabilitation of beach roads;
4. Establishment of agricultural warehouses and drying pavements.
5. Construction and rehabilitation of irrigation dams and canals; And,
6. Rehabilitation and improvement of the existing SWIPs and main canals.

3.2.3 Political/Institutional Strategies

Buenavista has vast resources that can be utilized to attain its ultimate goal of development and self-sufficiency. These ideals and aspirations can only be achieved thru proper planning and application of available resources to fit the needed outputs and improvements with the utmost cooperation and participation of the government and the community in the delivery of the basic services and effective management and utilization of all the resources for the upliftment of the quality of life of the people. Hence, these strategies:

1. Encourage people's participation in government undertakings like policy

recommendation and formulation and in project identification, prioritization, procurement and implementation for a transparent, participative and effective delivery of the needed services and ensure quality outputs and results;
2. Strict enforcement of local ordinances for socio-economic reforms and environmental sustainability in order to address and achieve the holistic needs for development;
3. Strict enforcement of local ordinances on anti-littering, solid waste management and other environmental laws, rules and regulations to promote health and sanitation and address the climate change;
4. Establishment of resettlement areas for people currently living in flood, storm surges and/or sea level rise prone areas; and
5. Conduct public assembly, pulong-pulong and dialogue in the Barangays in order to strengthen the linkages of the government and the community to promote people's participation in order to address true political reforms for development.
6. Promotion of tax incentives to investors to engage in any forms of business and entrepreneurial development;

3.2.4. Social Strategies

The municipality of Buenavista is characterized as a place of peace-loving, friendly and God-centered people. The social goal of the government is to uplift the quality of life of the people thru an effective delivery of services and equal access to opportunities.

Development of all sources of potable drinking water in the rural areas for the improvement of health and sanitation in order to address the prevailing issues on water-borne sickness and diseases;

1. Provision of health and medical services to the poor in rural areas for the improvement of their health and nutritional status;
2. Conduct skills trainings and seminars for small-scale cottage industries and provide funding support for the improvement and enhancement of their manpower skills and capabilities;
3. Establishment of tree parks in the Poblacion Barangays as buffers, greenbelts, bird sanctuaries, recreation and leisure places;
4. Planting of bamboos along river banks and mangroves along estuaries as buffers and protection from soil erosions and protection of agricultural plantations and settlements in critical areas;
5. Promotion of people's participation in health care program making them responsible and accountable in the delivery of health services to the community- "putting health in the hands of the people";
6. Protection of children and weaker sex from labor exploitation and prostitution and provide them access to better education and learning;

3.3 REQUIREMENTS OF THE STRATEGIES

The municipality of Buenavista is pre-dominantly an agricultural town in the province of Agusan del Norte, although it is not located within the typhoon belt, but it is not free from any hazardous effects of climate change. Low-lying areas are prone to flooding and some of rural areas are also affected due to river siltation caused by soil erosion.

Although people affected by flooding and drought hazards have adapted some measures in mitigating the scarcity of food

supply and income, still there are constraints that should have to be addressed to alleviate from the bondage of poverty and hunger.

Some of the needs and requirements to address the present and future strategies are:

1.) Fund sourcing – allocation of sufficient funds for the implementation of the needed infrastructure facilities for the construction of all weather roads (FMRs) in the rural areas, construction of river dikes and seawalls, rehabilitation of the watershed areas, construction and rehabilitation of irrigation facilities and all other programs for human and ecological protection;
2.) Promotion of skills training and manpower development in order to address the pressing problems of underemployment and unemployment in the municipality;
3.) Prioritization of programs and projects that directly address poverty enhancement of the people;
4.) Increase food production thru total development and utilization of potential agricultural areas with financial support from the national, provincial and local government unit;
5.) Promotion of economic enterprise development that will cater the underemployment and unemployment problems; and
6.) Relocation of the informal settlers and urban slum dwellers to eradicate blighted dwelling units within the danger zones, and reclamation of the coastal areas into boulevards and tree parks.

Figure 13: Ms. L. Villacorta, ILO-CCAP Project Manager conferring with Mayor Chan of Buenavista on adaptation strategies.

4 SCENARIO ANALYSIS

4. SCENARIO ANALYSIS

4.1. SCENARIO COMPONENTS

This section will depict different probable scenarios in 2020 and 2050 given some assumptions on some critical variables affecting vulnerability and adaptability of the municipality such as advancement in science and technology, population growth rate, budget allocation of LGUs and land conversion.

The scenario building exercise below was put in a context of the general forecast of PAGASA for the next ten to forty years for the whole country stating that the climate scenario is basically "increasing in temperature and decreasing in rainfall".

Projected hazards in the municipality for the two periods (2020 and 2050) include flooding, dry spell and soil erosion.

In the projection of impacts of global warming, this study has taken into account the agreed assumptions of some climate change experts in the Philippines (i.e. UPLB) setting a formula that "for every 1^0 C increase in temperature will result in decrease in yield ranging between 8% to 14%".

With the changes in climate and subsequent hazards that would result to potential damages, the study will attempt to project possible impact on crop production on three priority crops given focus in this study (i.e. rice, coconut and banana), on food security and sufficiency, livelihood and income, and in the potential threats to lives and properties.

Impact rating will also be done on each scenario according to projected overall cumulative potential damages (i.e. food production and security, lives and properties, and livelihood and income) as follows; LOW with 30% and below, MODERATE at 31% up to 59% and HIGH at 60% and above.

4.1.1 Year 2020

PAGASA Butuan office forecasted in the year 2020 for the whole province of Agusan del Norte a maximum increase of approximately 1.3% (1.33'C) on the average maximum temperature during the months of April-June (with the month of May as the hottest at 33.8'C), and on the average rainfall, an increase of an average of 9.83% (13.8 mm/mo) between the months of October to January. Hence, in the province of Agusan del Norte, during the targeted period it will be hotter during the dry months while also having more rains during wet months.

Dry Spell

Rice production in irrigated areas during dry months will not be adversely affected. It will be harvest season during the months of April to June. Though, the non-irrigated areas are expected to be hit. Total reduction will come from 5% each for the irrigated areas (due to late harvesting) and non-irrigated areas or approximately a total of 10% (or 431 MT/annum)[1] of the total production.

Reduction in Coconut and banana

[1] 4318 MT x 10%

productions will be set at 18% due to 1.3'C increase in temperature (or 14% x 1.3'C). Thus, the absolute volume of reduction will be at 4667.75 MT (25,647 MT x 18%) for coconut and 803.89 MT (4418 MT x 18%) for banana.

Increase rainfall

During rainy period (Oct-Jan), rice farmers are in the land preparation phase though there will be some farmers that will attempt to plant earlier despite the warnings of the LGU. Experience also showed that flash floods had inflicted damage to rice areas, hence, estimating a cumulative reduction for rice at 10% or (431.84 MT).

In the erosion prone barangays can be found coconut and banana. Reduction to both crops due to erosion was set at 10% making production of coconut lesser by 2,565 MT and banana by 442 MT.

Potential threat to lives of population will be minimal. Based on past experiences on flooding the maximum number of people affected due to flooding (Nov. 2009) was at 35% of the total population.

Scenario 1 (2020)

Assumptions for this scenario are:

- advances in Science and Technology are at current level
- population growth rate is 0.68% per annum (current growth rate),
- there is no corresponding increase in budget of the LGU which resulted to low level of adaptation capacity and minimal investment in intervention;
- no land conversion were made (meaning no change in land use).

Projected population is estimated at 56,015 assuming 0.68%/annum growth rate. Rice consumption will be at 7,170 MT at 128 kg/capita consumption (NFA, 2008).

Net rice production of scenario 1 of 2020 is estimated at 3,454 MT, with the estimated consumption at 7,170 MT will mean a shortage of rice for food at 3,716 MT (or 52%). Coconut and banana productions' reduction is computed at 28% (due to 18% increase temperature and 10% erosion) with a net production at 18,465 MT and 3180 MT, respectively, which will consequently translate into lesser income for population increasing further poverty incidence in the municipality. Based on recent experience to flooding potential damage to lives is at moderate level. Hence, overall vulnerability rating in this scenario is considered ***MODERATE***.

Scenario 2: Year 2020

Assumptions for this scenario are:

- There is a marked positive advancement of Science and Technology:
- The population growth rate markedly decreases (down to 0.34% or half of the current growth rate);
- there is an increasing adaptation capacity with increasing budget; and,
- Without land conversion (meaning no change in land use).

Projected population is estimated at 56,015 assuming 0.68%/annum growth rate. Rice consumption will be at 7,170 MT at 128 kg./capita consumption (NFA, 2008).

Net rice production of scenario 2 of 2050 is estimated at 3,454 MT, with the estimated consumption at 6,978 MT will mean a shortage of rice for food at 3,523 MT (or 53%). Coconut and banana productions computed at 28% (due to 18% increase temperature and 10% erosion) with a net production at 18,465 MT and 3,180 MT, respectively, which will consequently translate into lesser income for the population increasing further poverty incidence in the

municipality. Assuming 10-15% increase in production due to advancement of science and technology would still result to insufficiency of rice and reduction to coconut and banana output. Based on recent past experience on flooding potential damage to lives is at moderate level (35% of population). Nevertheless, with increased capacity and budget of the LGU, the overall vulnerability rating in this scenario is considered ***LOW***.

Scenario 3: Year 2020

Assumptions for this scenario are:

- advancement in Science and Technology are at current level;
- population growth rate increased to 1.68% from the current level of 0.68% per annum (current growth rate);
- no improvement in the LGU's adaptation capacity coupled with decreasing budget; and
- there will be aggressive conversion of land from agricultural to commercial and residential use (meaning production areas markedly decrease to give way to other development initiatives), at 10% of total rice area.

Projected population at 1.68% growth rate is computed at 60,624. At this level, projected demand for rice consumption will be at 7,760 MT.

Aggressive land conversion is set at 10% in rice areas constricting the production area at 1,024 hectares with equivalent output of 3,887 MT. Due to dry spell and increased rainfall, additional reduction of 10% (473.2943 MT) will be included making net rice production at 3,109 MT. With increased consumption brought about by growing population, a shortage of 4,651 MT (60%) will still be registered.

Coconut and banana productions' reduction is computed at 28% (due to 18% increase temperature and 10% erosion) with a net production at 18,465 MT and 3180 MT, respectively. Consequently this will translate into lesser income for population increasing further poverty incidence in the municipality.

The increased population, largely in the urban center, that is also within the flood prone area can be one critical factor of vulnerability, considering that in this scenario budget of LGUs will be decreased and adaption capacity is at current level. These factors further aggravate the situation raising the vulnerability rating of the municipality into ***HIGH*** level.

4.1.2 Year 2050

By the year 2050, PAGASA Butuan office forecasted for the whole province of Agusan del Norte an increase of approximately 2.97% (2.93'C) on the average maximum temperature during the months of May-June (with the month of May as the hottest at 35.1'C) compared with the observed (current temperature). On the average rainfall, the same agency also projected an increase of 5.6% (6.1 mm/mo) between the months of October to January. Hence, the province of Agusan del Norte, will be more hotter in the dry months, more wet during rainy months (while with lesser rains compared with 2020).

The increase in temperature of 2.93'C during the dry months would translate to forty one percent (41%)[2] decrease in crop production (at a maximum of 14% per 1'C increase in temp). This phenomenon will bring damage to the three priority crops but most especially with coconut and banana which are grown the whole year round and unirrigated.

[2] 14% x 2.93'C

Potential Impact:

Dry Spell

Rice production in the irrigated areas during dry months will not be adversely affected as it will be harvest season during the months of April to June. Though, the non-irrigated areas are expected to be hit. Total reduction will come from 5% each for the irrigated areas (due to late harvesting) and 41% from non-irrigated areas or approximately 15% (or 431 MT/annum)[3] of the total rice production volume.

Reduction in Coconut and banana productions will be set at 41% due to 2.93'C increase in temperature (or 14% x 2.93'C). Thus, the absolute volume of reduction will be at 4,667.75 MT (25,647 MT x 41%) for coconut and 803.89 MT (4,418 MT x 41%) for banana.

Increase rainfall

During rainy period (Oct-Jan), rice farmers are in the land preparation phase though there will be some farmers that will attempt to plant earlier despite the warnings of the LGU. Experience also showed that flash floods had inflicted damage to rice areas, hence, estimating a cumulative reduction for rice at 10% or (431.84 MT).

In the erosion prone barangays can be found the coconut and banana. Reduction to both crops due erosion was set at 10% making production of coconut lesser by 2565 MT and banana by 442 MT.

Potential threat to lives of population will be minimal. Based on past experiences on flooding the maximum number of people affected due to flooding (Nov. 2009) was at 35% of the total population.

Scenario 1: (Year 2050)

Assumptions for this scenario are:

- advances in Science and Technology are at current level
- population growth rate is 0.68% per annum (current growth rate),
- there is no corresponding increase in budget of the LGU which resulted to low level of adaptation capacity and minimal investment in intervention;
- no land conversion were made (meaning no change in land use).

Projected population is estimated at 68,643 assuming 0.68%/annum growth rate. Rice consumption will be at 12,791 MT at 128 kg/capita consumption (NFA, 2008).

Net rice production of scenario 1 of 2050 is estimated at 3,239 MT, with the estimated consumption at 12,791 MT will mean a shortage of rice for food at 9,553 MT (or 60 %).

Coconut and banana productions' reduction is computed at 51% (due to 41% increase temperature and 10% erosion) with a net production at 12,561 MT and 2,164 MT, respectively. Consequently this translates into much lesser income for a bigger population further raising poverty incidence in the municipality. Based on recent past experience to flooding potential damage to lives is at moderate level. At current adaptive capacity level and low budget, hence, overall vulnerability rating in this scenario is considered ***HIGH***.

[3] 4318 MT x 10%

Scenario 2: (Year 2050)

Assumptions for this scenario are:

- There is marked positive advancement of Science and Technology:
- The population growth rate markedly decreases (down to 0.34% or half of the current growth rate);
- there is an increasing adaptation capacity with increasing budget; and,
- Without land conversion (meaning no change in land use).

Projected population is estimated at 60,363 assuming 0.34%/annum growth rate. Rice consumption will be at 7,726 MT at 128 kg./capita consumption (NFA, 2008).

Net rice production of scenario 2 of 2050 is estimated at 3,239 MT, with the estimated consumption at 7,726 MT will mean a shortage of rice for food at 3,523 MT (or 53%).

Reduction in Coconut and banana productions are computed at 51% (due to 41% increase temperature and 10% erosion) with a net production at measly 12,567 MT and 2,164 MT, respectively, which will consequently translate into lesser income for the population increasing further poverty incidence in the municipality. Assuming 15% increase in production due to advancement of science and technology would still result to insufficiency of rice and reduction to coconut and banana output. Even with increased rainfall and subsequent flooding potential damage to lives is at moderate level. Nevertheless, with increased capacity and budget of the LGU, the overall vulnerability rating in this scenario is considered ***MODERATE***.

Scenario 3: (Year 2050)

Assumptions for this scenario are:

- advancement in Science and Technology are at current level;
- population growth rate increased to 1.68% from the current level of 0.68% per annum (current growth rate);
- no improvement in the LGU's adaptation capacity coupled with decreasing budget; and
- there will be aggressive conversion of land from agricultural to commercial and residential use (meaning production areas markedly decrease to give way to other development initiatives), at 20% of total rice area.

Projected population is estimated at 99,9333 assuming 0.68%/annum growth rate. Rice consumption will be at 12,791 MT at 128 kg/capita consumption (NFA, 2008).

Apart from reduction in rice production due to increased temperature and increased rainfall, additional decrease will be set at 20% due pressure of increasing population resulting to land conversion from agricultural (especially rice areas in the lowland) to residential, commercial and industrial uses. Net rice production of scenario 3 of 2050 is estimated at 3,239 MT, with the estimated consumption at 12,791 MT will mean a shortage of rice for food at 9,553 MT (or 60 %).

Coconut and banana productions' reduction is computed at 51% (due to 41% increase temperature and 10% erosion) with a net production at 12,561 MT and 2,164 MT, respectively. Consequently this translates into much lesser income for a bigger population further raising poverty incidence in the municipality. Based on recent past experience to flooding potential damage to lives is at moderate level. At no improvement of LGU's adaptive capacity level and low budget, hence, overall vulnerability rating in this scenario is considered ***HIGH***.

4.2. SUMMARY OF VULNERABILITY RATING

The above's scenario building and analysis reveal ratings at 2020 as Moderate for scenario 1, Low for scenario2, and High rating for scenario 3. At 2050, overall impact will be High for scenario 1, Moderate for scenario 2 and High for scenario 3. *(Please see Figure 14 below)*

Figure 14: **Summary of Vulnerability Rating**

Year	Scenario 1	Scenario 2	Scenario 3
2020	Moderate	Low	High
2050	High	Moderate	High

(Potential Impact/Damages: Low = 30%; Moderate=31-59%; High= 60% and above)

4.3 ADAPTATION TO CLIMATE CHANGE SCENARIOS

To minimize the impact of climate change and enhance the adaptive capacity of different stakeholders, the following adaptation options are highly recommended: *(Please see Annex B22, p.108)*

4.3.1. Economic

- Maximum utilization of available agricultural lands for food production and sustainability
- Development of Agricultural Demonstration Farm
- Establishment of Agricultural Marketing Outlets
- Promotion of accessible lending institutions to small scale agricultural workers
- Promotion of "One Town, One Product" (OTOP)
- Promotion of Livestock and dairy farms
- Promotion of eco-tourism in the watershed areas
- Institutionalization of crop and livestock insurance
- Provision of financial assistance to farmers and fisherfolks

4.3.2. Social

- Total reclamation and rehabilitation of coastal areas for recreational and leisure tourism development programs
- Purchase of resettlement sites for informal settlers and urban slum dwellers
- Promotion of socialized housing and low-cost housing projects
- Promotion of skills enhancement trainings and workshops to farmers and fisherfolks
- Development of Springs for potable water supply
- Establishment of Municipal Tree Park in the Poblacion

4.3.3. Technological

- Promotion of bio-engineering technology along riverbanks, flood-prone areas and shorelines.
- Promotion of organic farming technology
- Protection and Rehabilitation of the watershed areas thru reforestation and implementation
- Establishment of wildlife sanctuaries

4.3.4 Physical/Infrastructural

- Construction of all weather Farm to Marker Roads (FMR)
- Enhancement of Drainage system
- Enhancement of Irrigation system and facilities
- Construction of river revetment dikes and sea walls
- Construction of coastal roads connecting Punta in Nasipit and Masao-Lombucan Road in Butuan City
- Rehabilitation and improvement of river control diversion channel in Sacol
- Development of Fishport to Domestic port
- Construction of roads in eco-tourism sites
- Enhancement of pre and post harvest facilities

4.3.5. Political/Institutional

- Strict enforcement of RA 9003 (Ecological Solid Waste Management act of 2000) especially on the 3Rs (Reuse, Reduce, Recycle) Solid waste segregation
- Enact Municipal Ordinance requesting quarrying permits for sand and gravel, boulders and pebbles
- Enact Municipal Ordinance prohibiting cutting of trees, hunting of wildlife and endangered species in the watershed areas.
- Enact Municipal Ordinance Prohibiting construction of houses and dwelling units along riverbanks, coastal areas and all identified danger zones.
- Enact Municipal Ordinance of compulsory planting of 1 tree per month of all local government employees including lined agencies stationed in the municipality
- Enact Municipal Ordinance strictly prohibiting construction and putting of structure within the easement of the road-right of way of Municipal streets including required setbacks

4.4. PRIORITY ADAPTATION STRATEGIES

From the long list of adaptation strategies listed above, the priority adaptation strategies are identified below, as follows;

4.4.1. Economic

- Promotion of Crop Diversification and Organic Farming
- Planting of trees in head water, landslide and soil erosion prone areas
- Promotion of eco-tourism in the watershed areas.

4.4.2. Technological

- Riverbank/Coastal Areas protection through bio-engineering technology

4.4.3. Physical/ Infrastructural

- Construction of Additional rain harvesting facilities (SWIP, mini-dams
- Construction of Sea Wall In Barangays 9, 10, Tinago and Manapa and River Dikes in Barangays Sacol, Rizal and Guinabsan
- Development of Agricultural Demonstration Farm in Brgy Dalao-a
- Development of Fishport to Domestic port in Brgy 10

4.4.4. Political/Institutional

- Resettlement of informal settlers and urban slum dwellers

5 CONCLUSIONS

5. CONCLUSIONS

Generally, the municipality of Buenavista is not within the typhoon belt. It is protected by the mountain ranges of Mt. Hilong-hilong in the northern part and by Punta Diwata in the northwestern part. However, during the occurrence of bad weather (i.e. heavy rains), significant damage were inflicted to agricultural production and properties especially on dwelling units located in low-lying areas of the town including those located along the coastal areas and riverbanks.

Vulnerable to these calamities of typhoons, flooding and droughts are marginal farmers, fishponds operators/filters, farm laborers, fisherfolks and informal settlers. They are prone to the hazardous effects of varying forms of climatic changes.

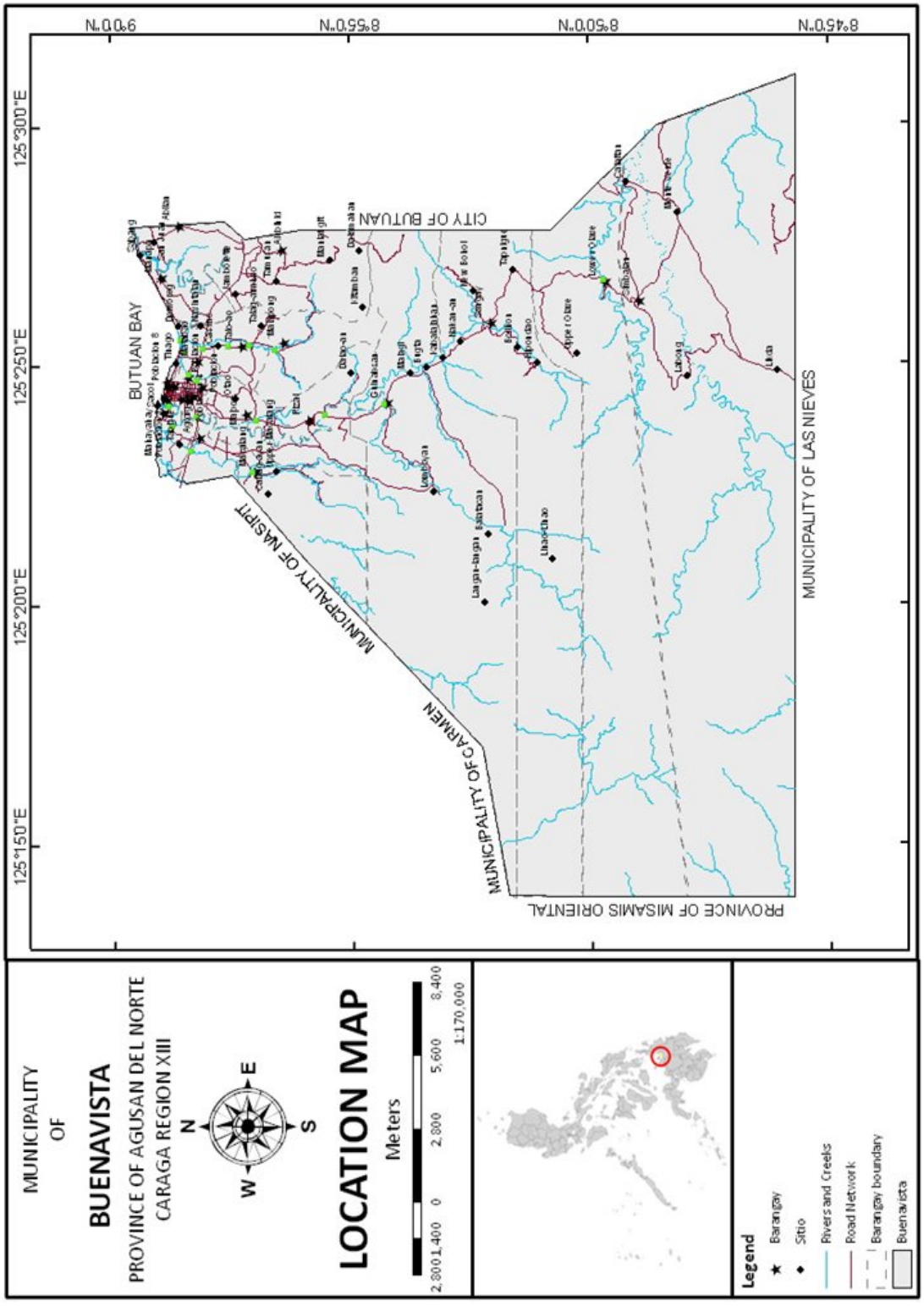
Experiences from all these kinds of hazards, have brought these affected population to adapt all means and measures to earn for a living, such as; driving pedicabs and trisikads, hired laborer in constructions, peddling and fish vending, charcoal making, gathering of firewoods for sale, diversified farming techniques backyard livestock, and poultry raising, carpentry and masonry works, domestic helpers, handicraft making, gathering of shells, oysters, crabs and clams from shores and riverbanks, etc.

The PAGASA (Butuan) forecasted an increasing temperature and increasing rainfall in the province of Agusan del Norte. Scenario building in the year 2020 and 2050 revealed an adverse impact in the aspect of food security and sufficiency, livelihood and income, and seriously damaging the top priority crops in the municipality (i.e. rice, coconut and banana).

Strategies shall be devised and instituted to enhance the adaptive capacity of the communities, the LGU and other stakeholders in the aspect of Physical/ infrastructural, economic, technological, social and political/institutional to mitigate the harmful effects of climate change.

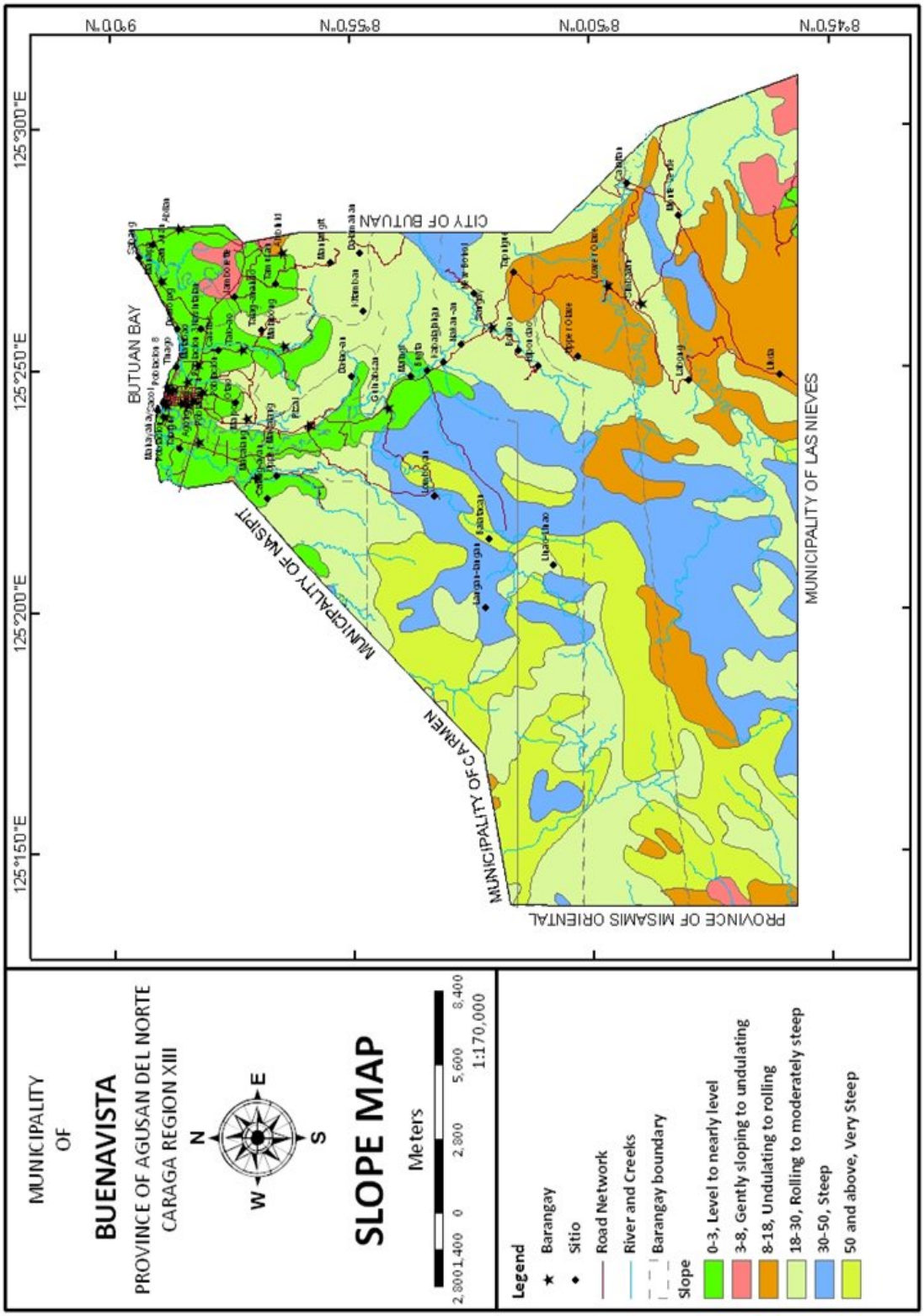
ANNEX A

List of Annexes (A) -Figures



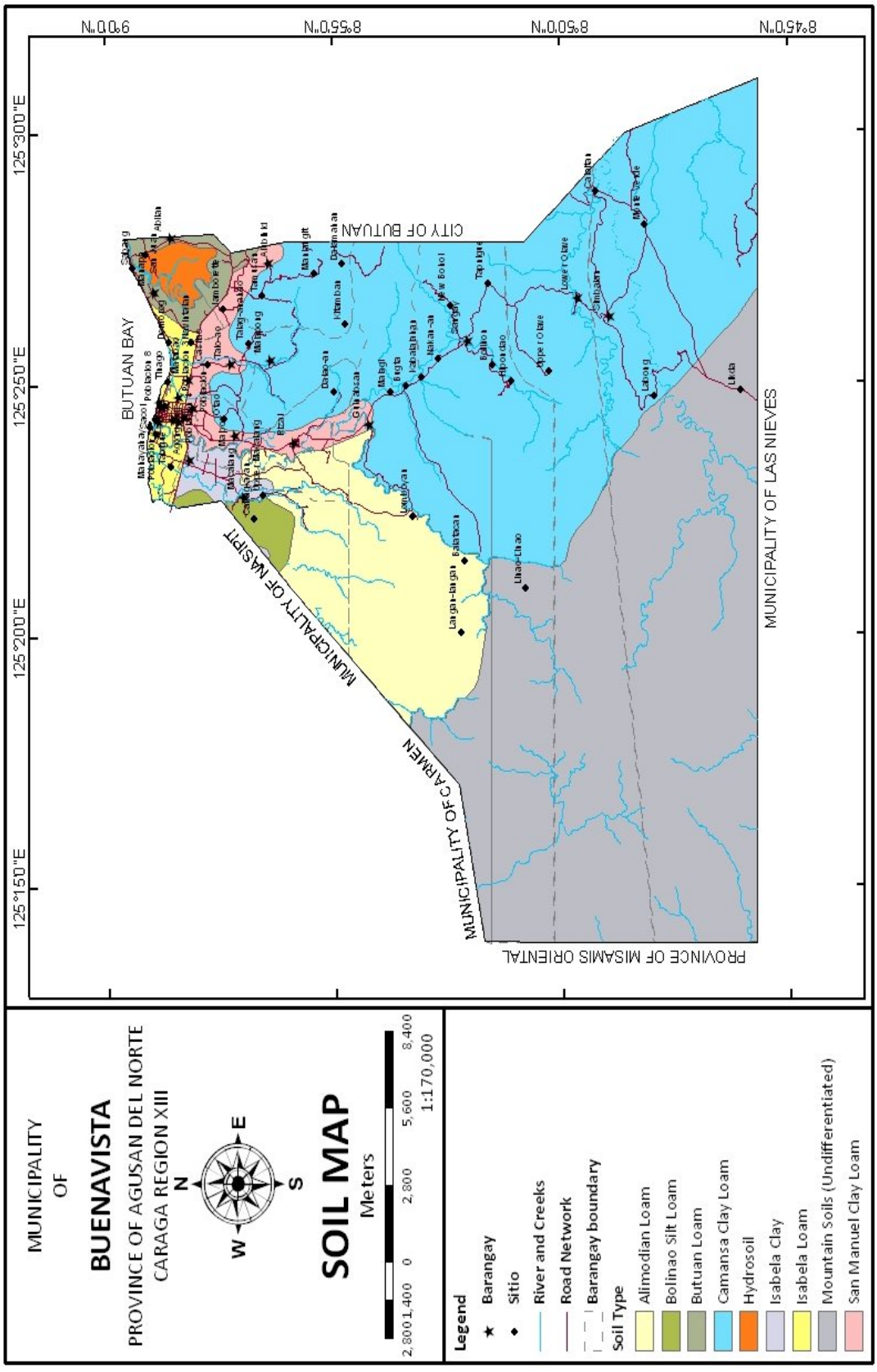
Source: ArcGIS 9 ® - ArcMap Version 9.3(PPDO)

Annex A 1: Location Map



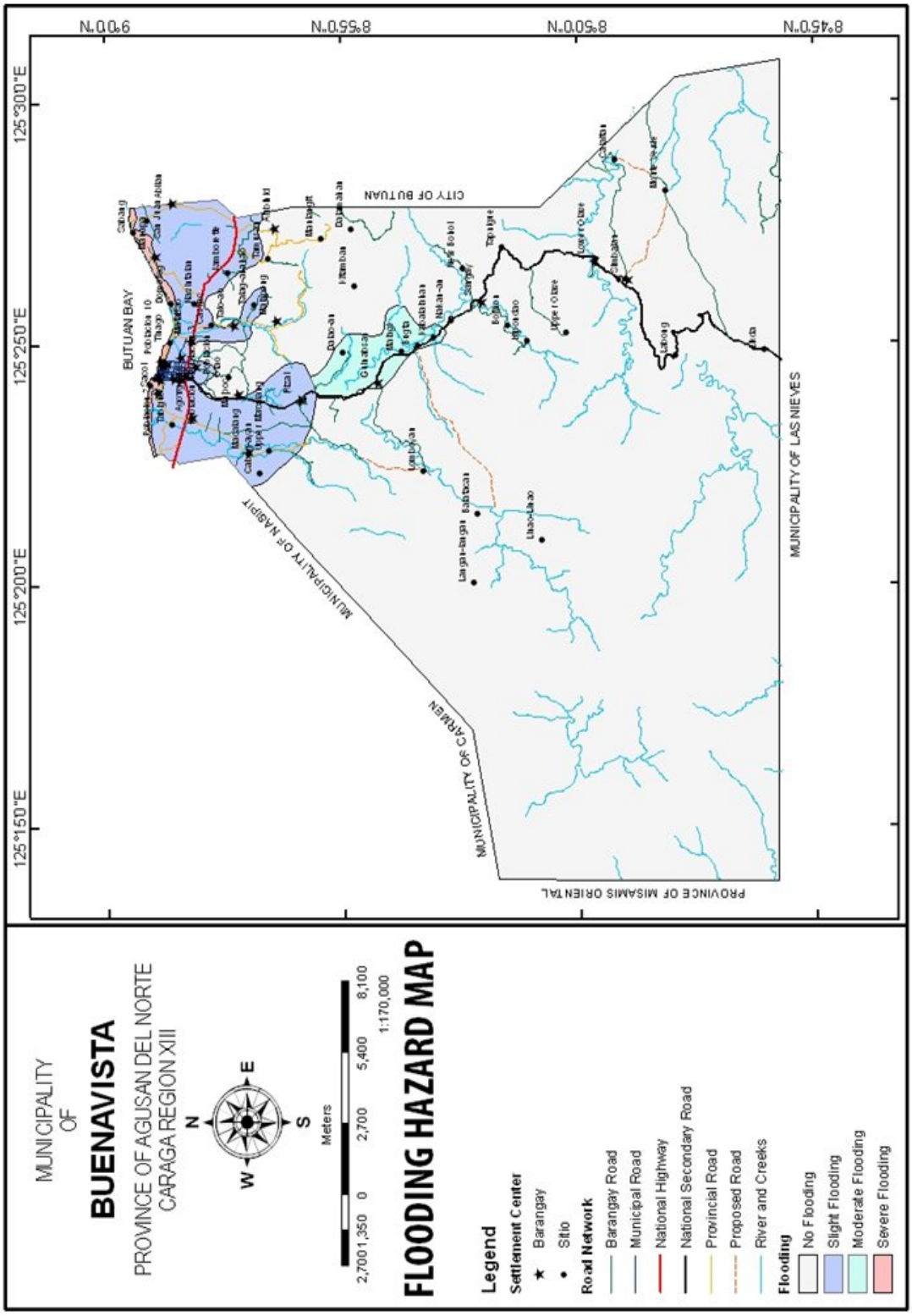
Source: ArcGIS 9 ® - ArcMap Version 9.3(PPDO)

Annex A 2: Slope Map



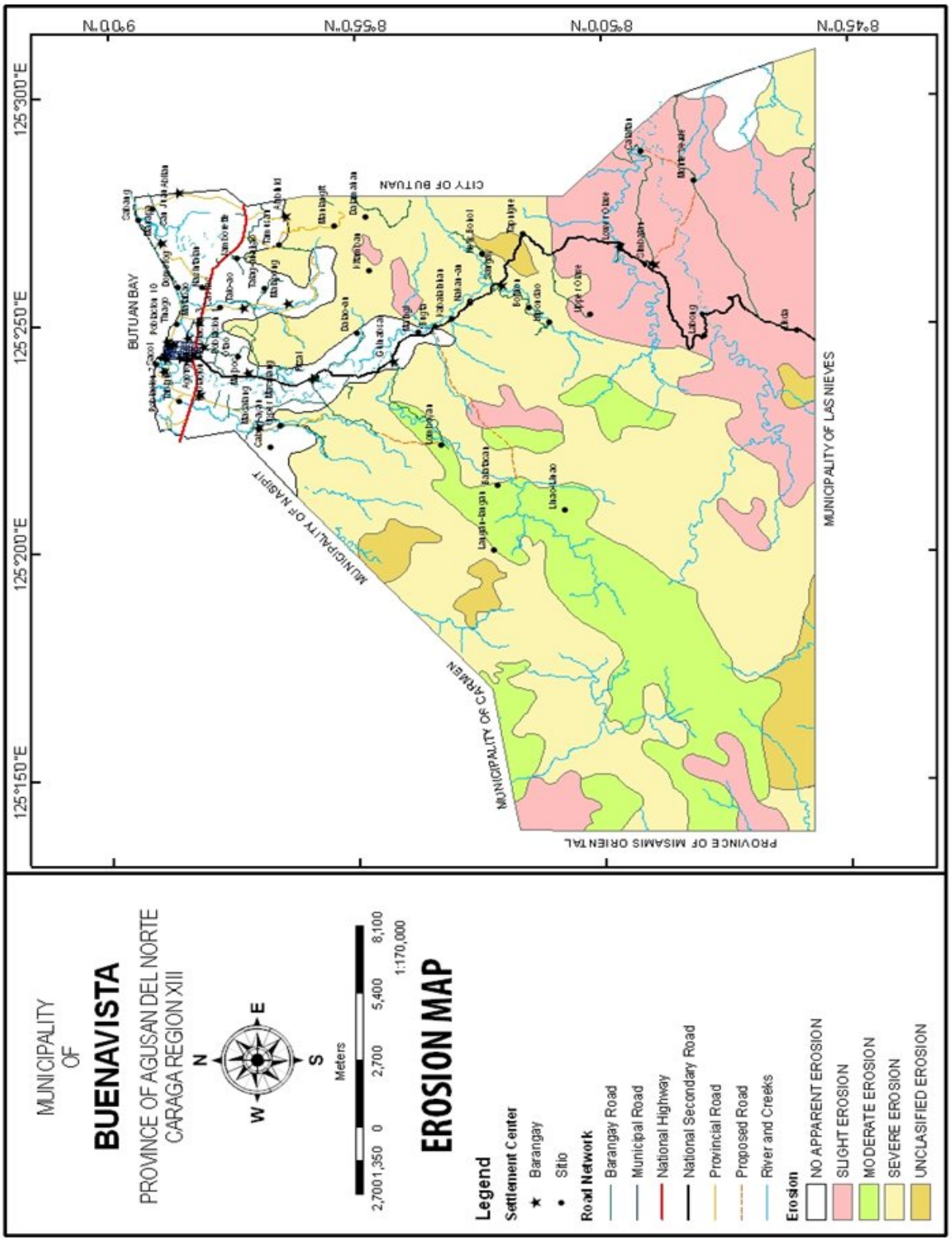
Source: ArcGIS 9 ® - ArcMap Version 9.3(PPDO)

Annex A 3: Soil Map



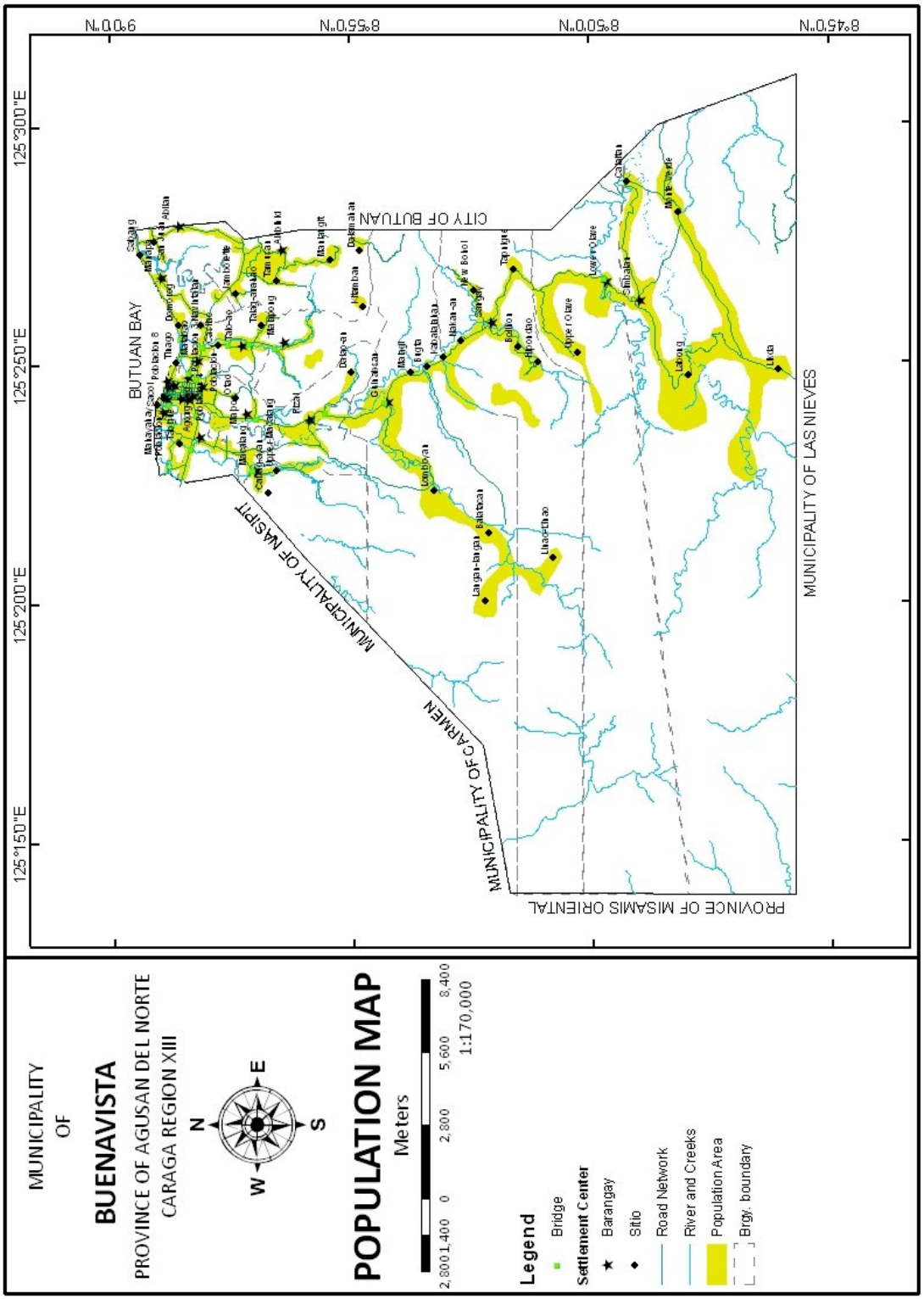
Source: ArcGIS 9 ® - ArcMap Version 9.3(PPDO)

Annex A 4: Flooding Hazard Map



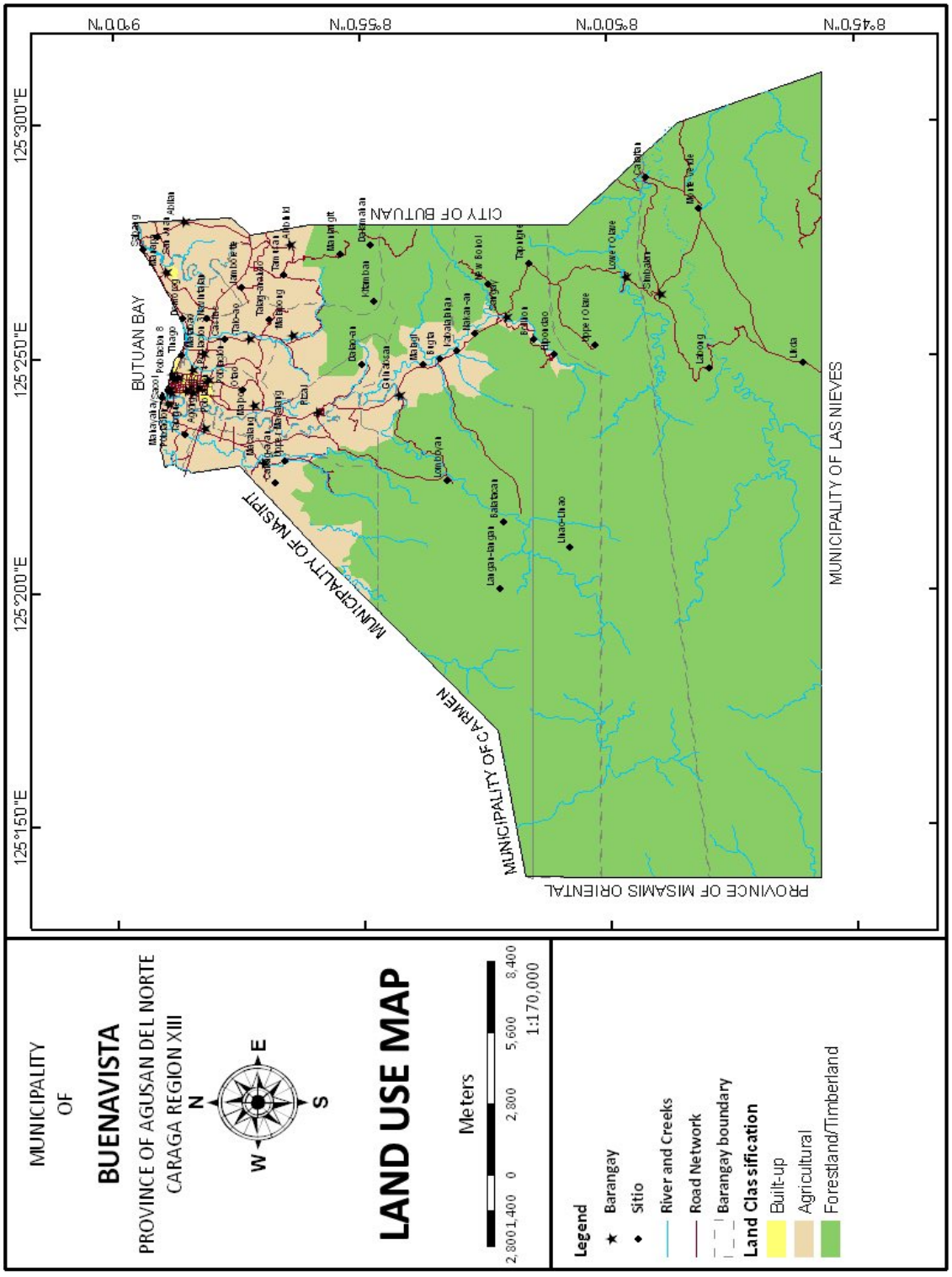
Source: ArcGIS 9 ® - ArcMap Version 9.3(PPDO)

Annex A 5: Erosion Map



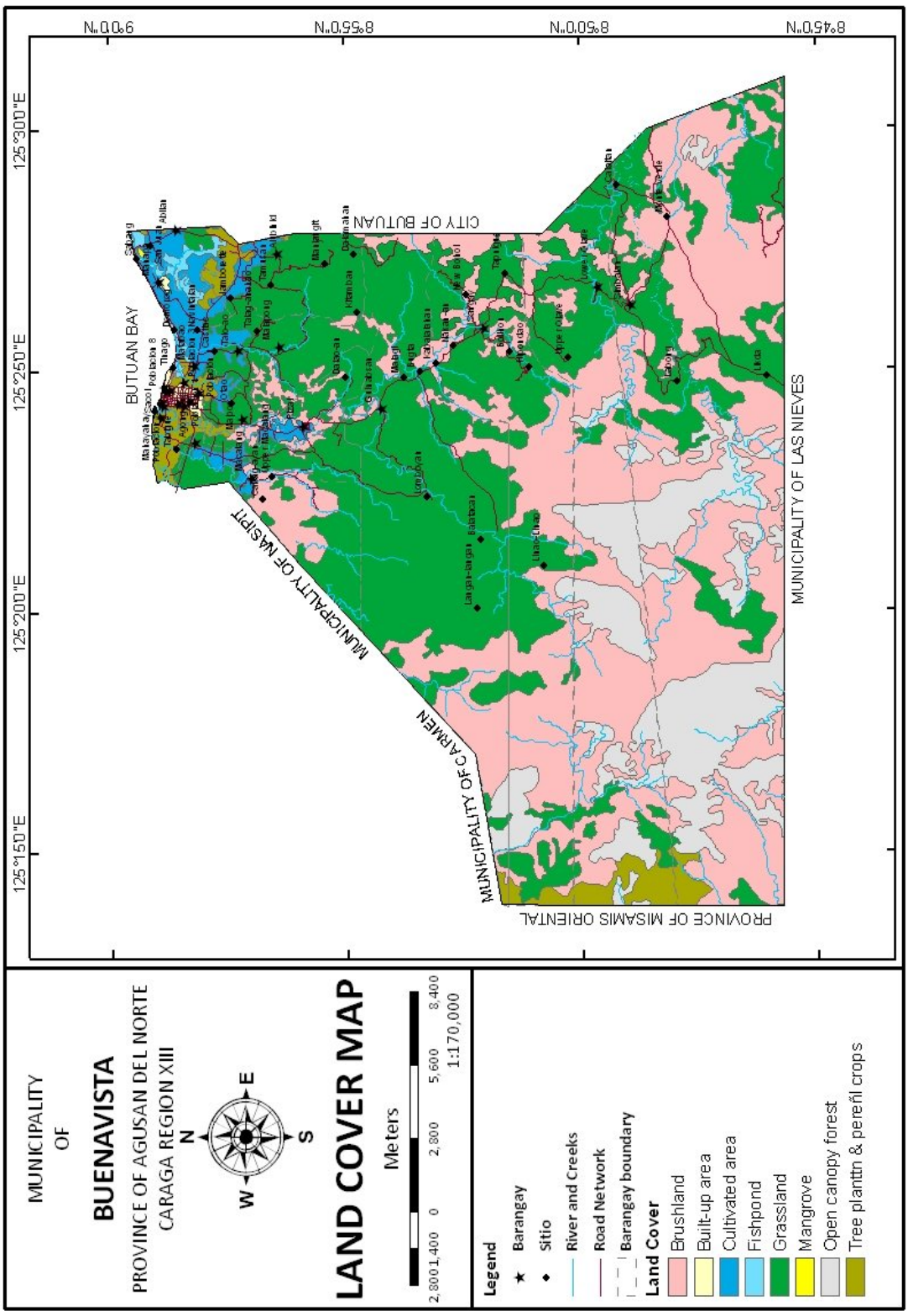
Source: ArcGIS 9 ® - ArcMap Version 9.3(PPDO)vt

Annex A 6: Population Map



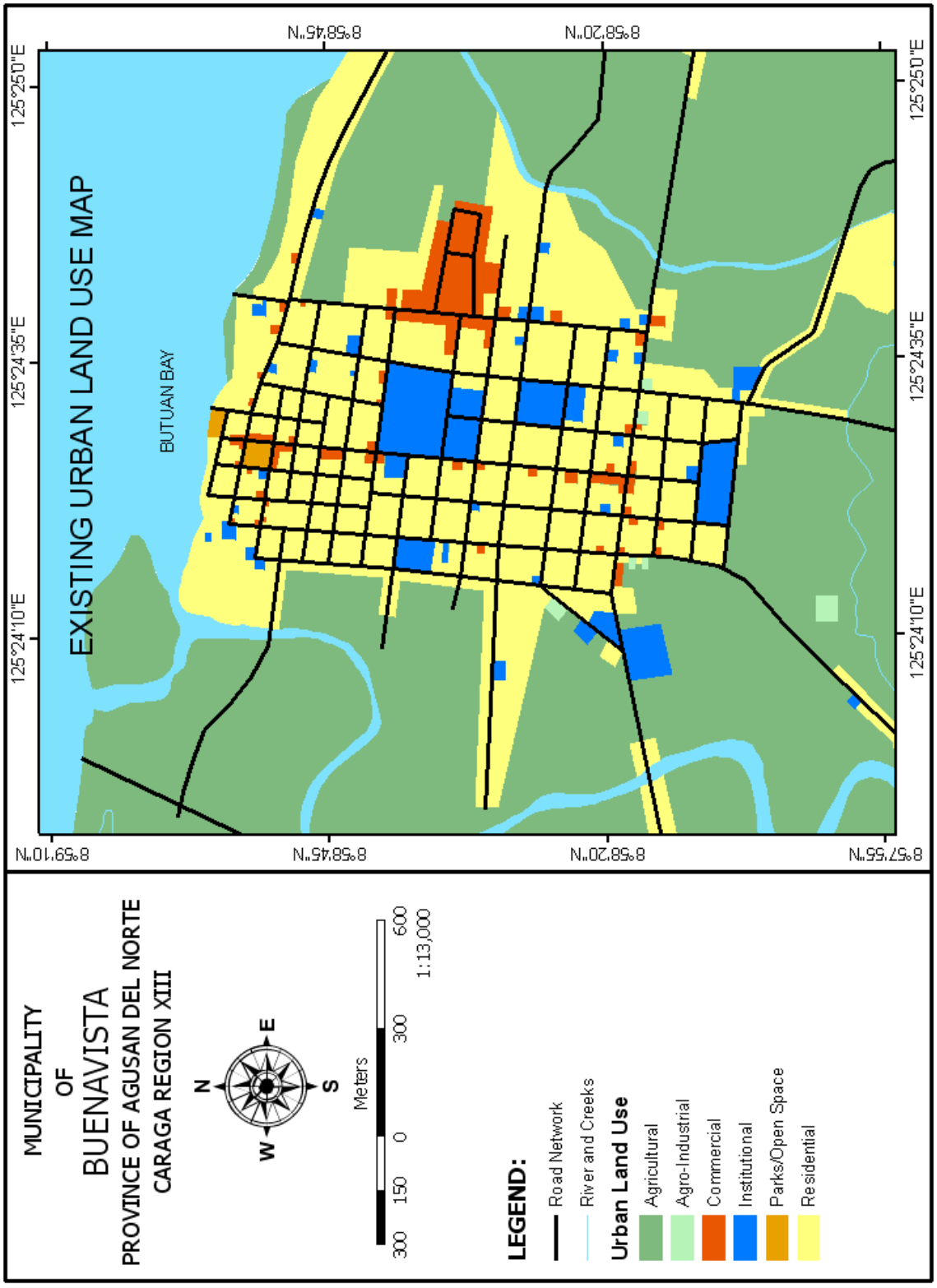
Source: ArcGIS 9 ® - ArcMap Version 9.3(PPDO

Annex A 7: Land Use Map



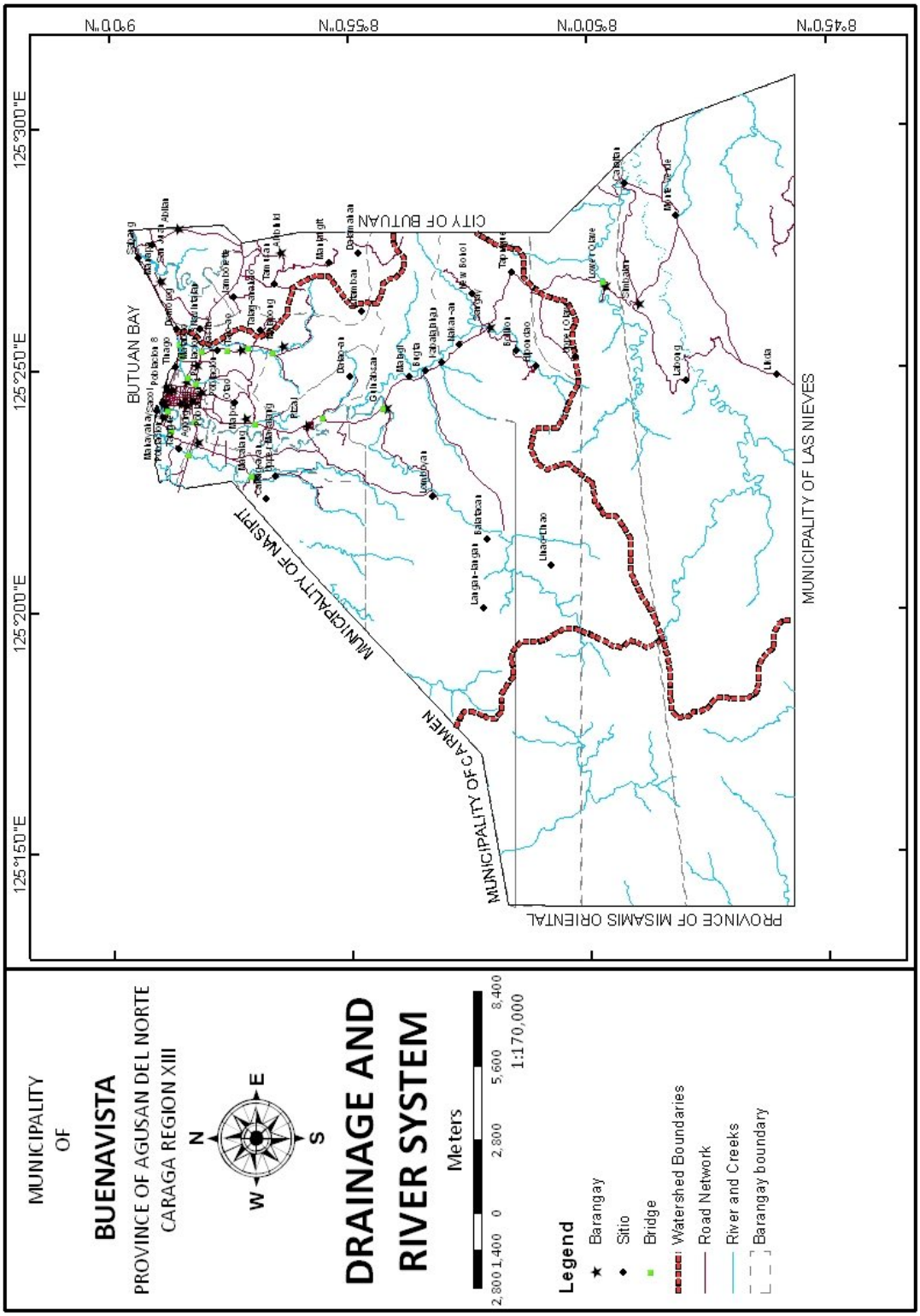
Source: ArcGIS 9 ® - ArcMap Version 9.3(PPDO)

Annex A 8: Land Cover Map



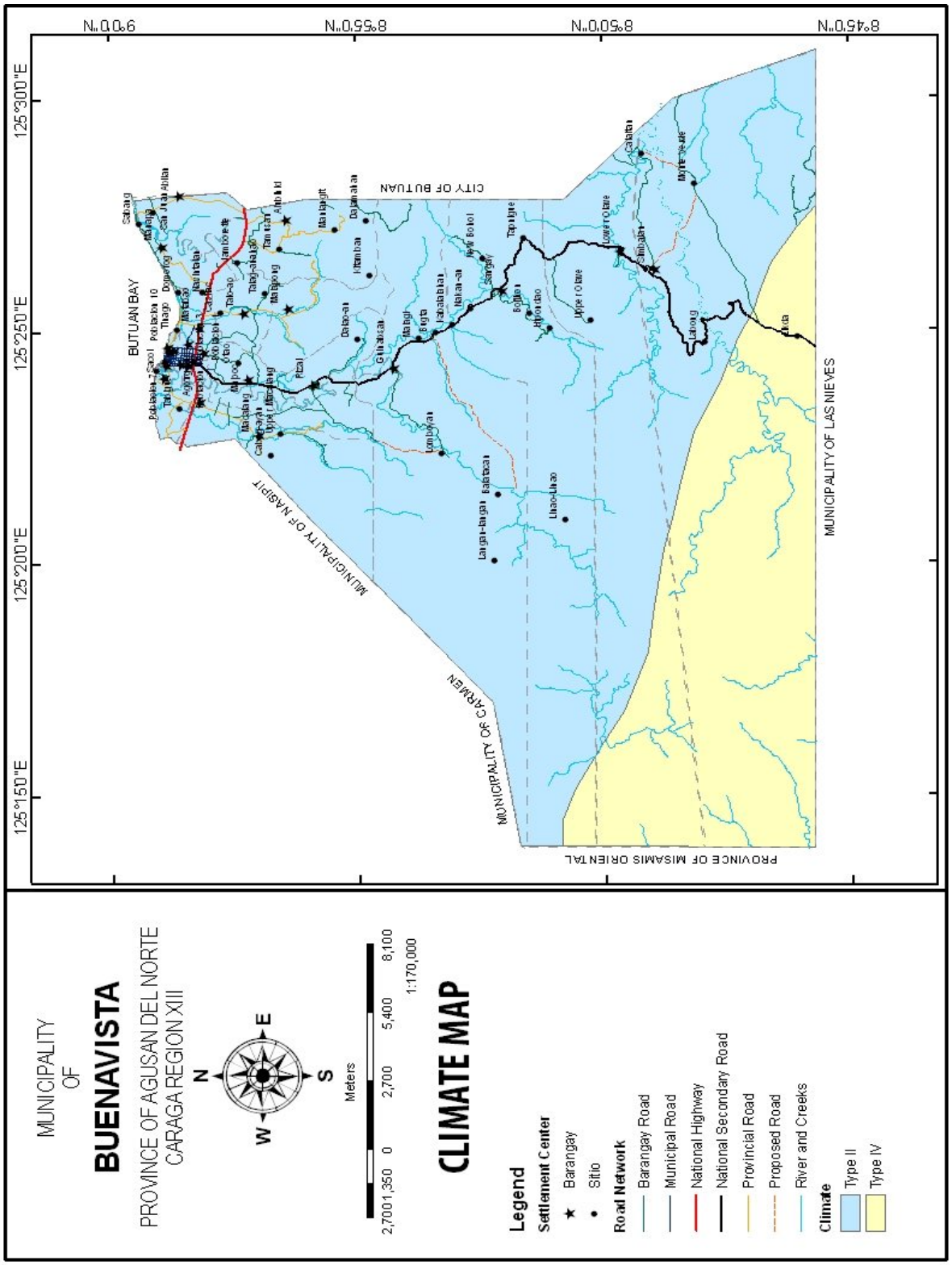
Source: ArcGIS 9 ® - ArcMap Version 9.3(PPDO)

Annex A 9: Existing Urban Land Use Map



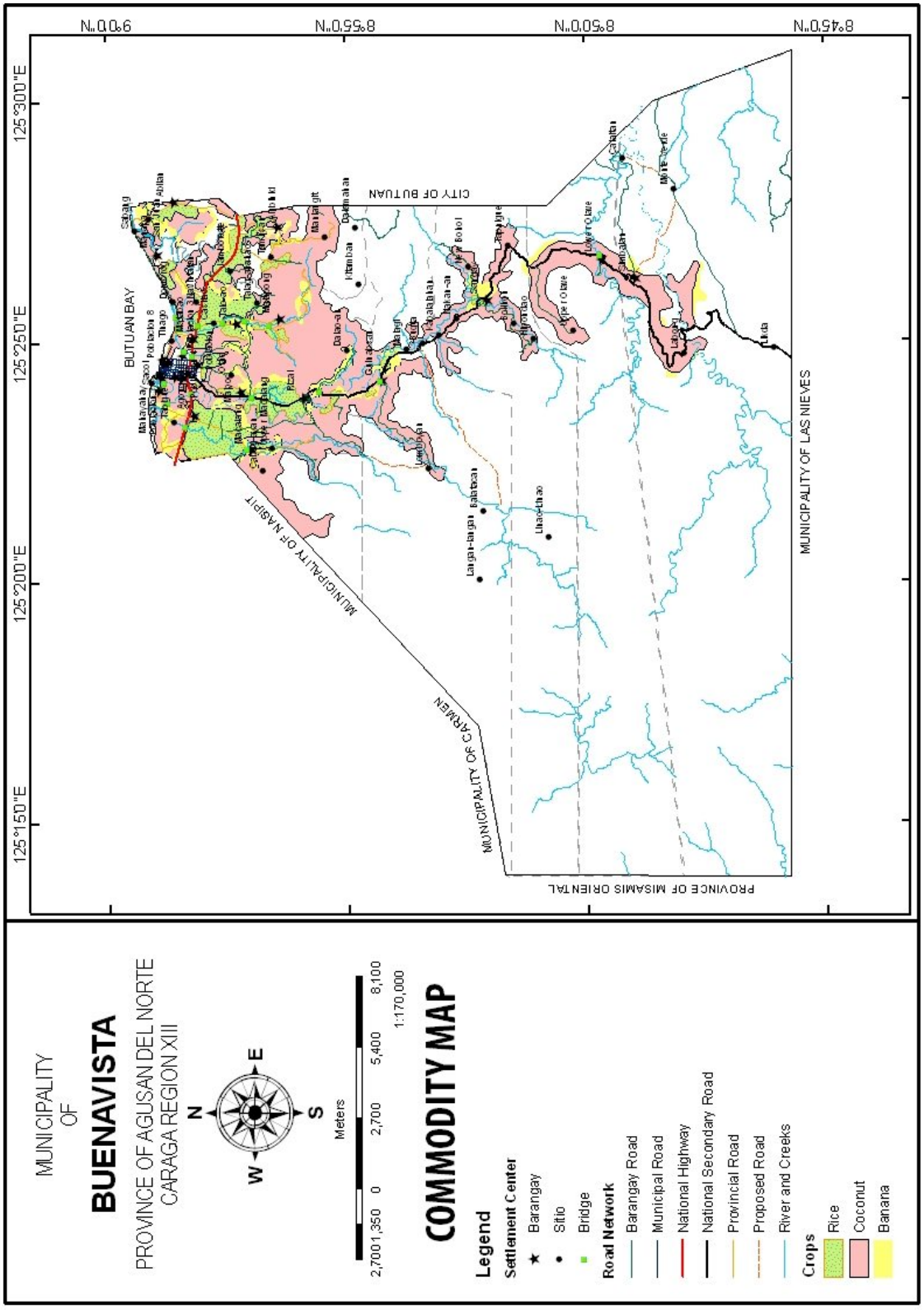
Source: ArcGIS 9 ® - ArcMap Version 9.3(PPDO)

Annex A 10: Drainage and River System Map



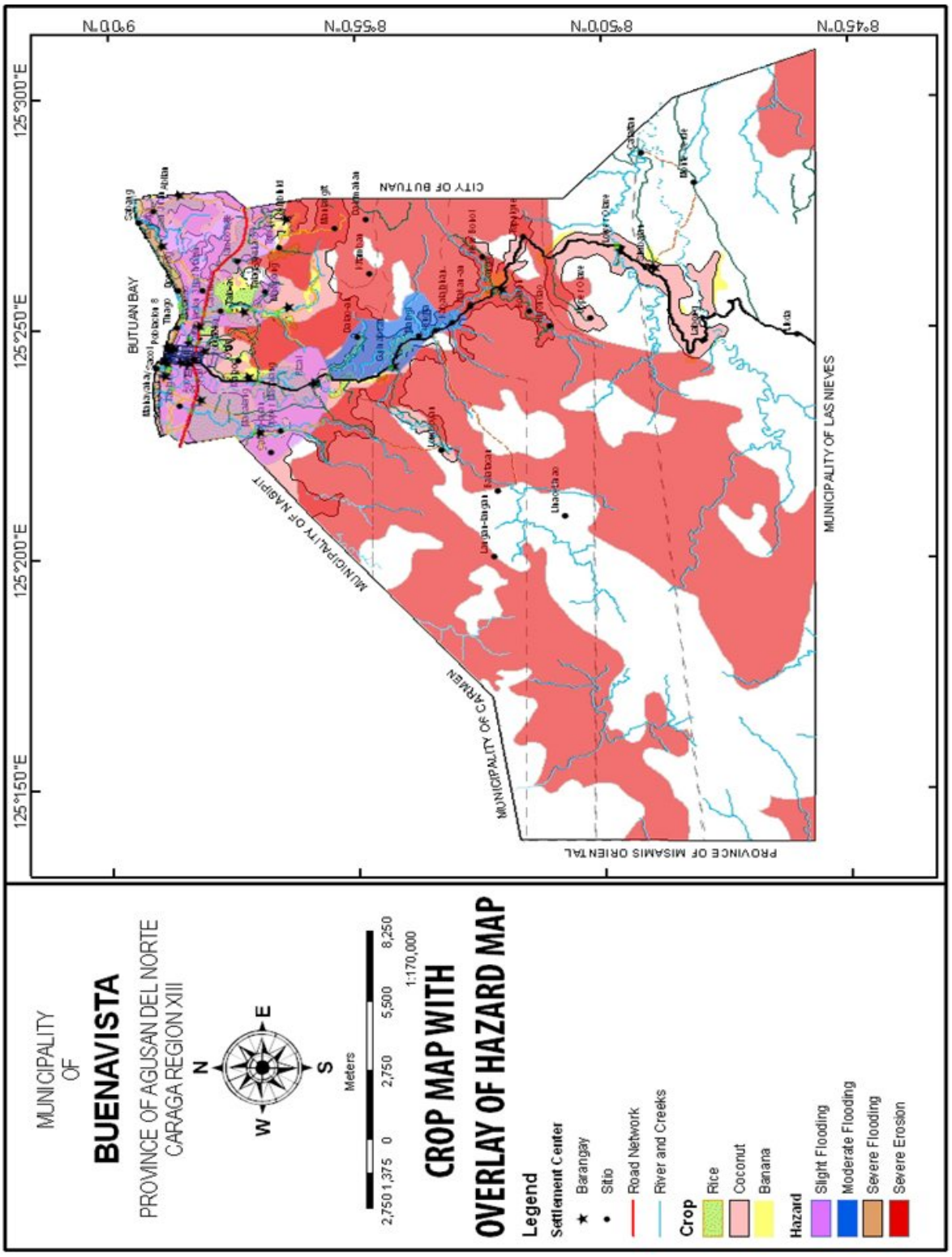
Source: ArcGIS 9 ® - ArcMap Version 9.3(PPDO)

Annex A 11: Climate Map



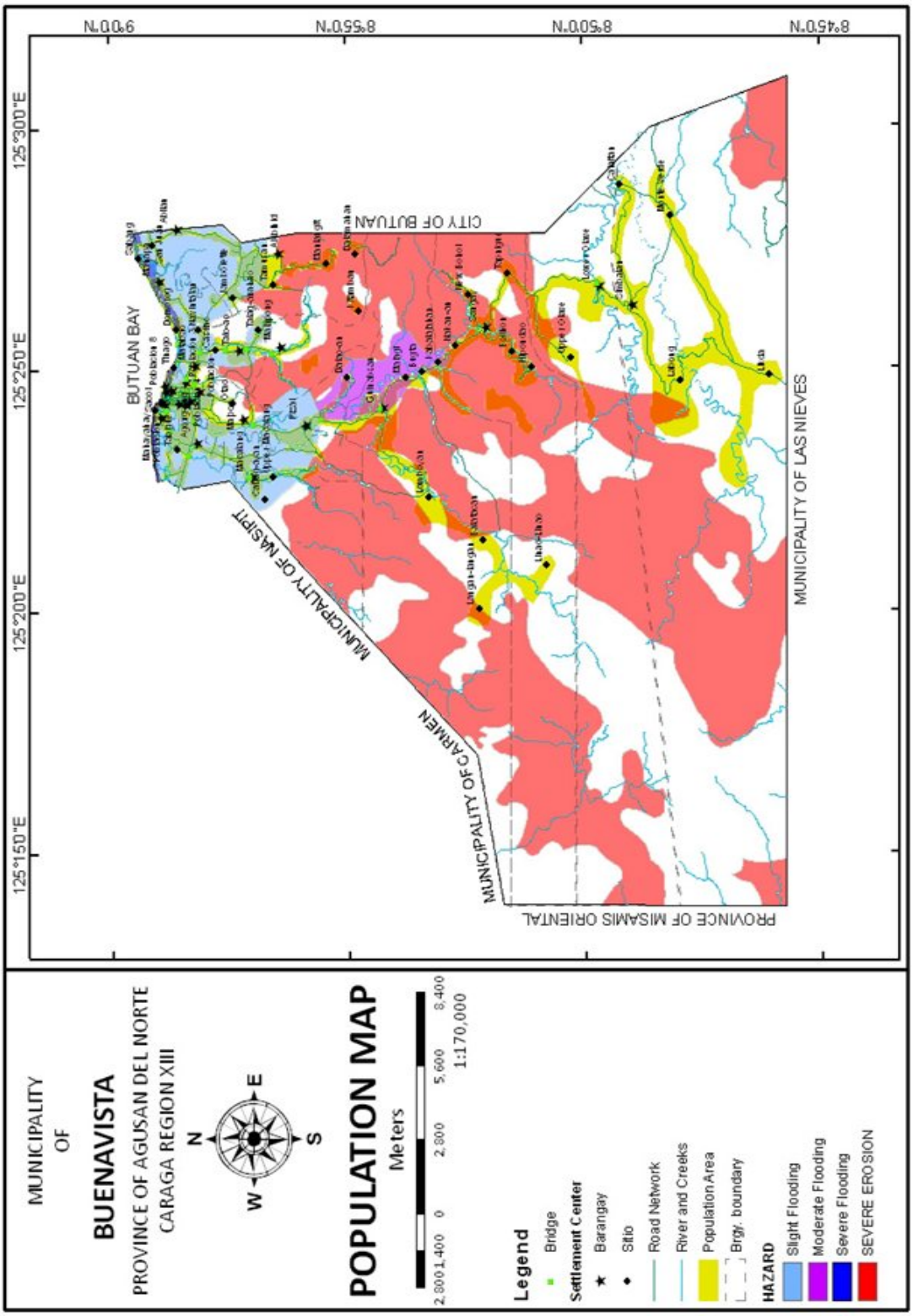
Source: ArcGIS 9 ® - ArcMap Version 9.3(PPDO)

Annex A 12: Commodity Map



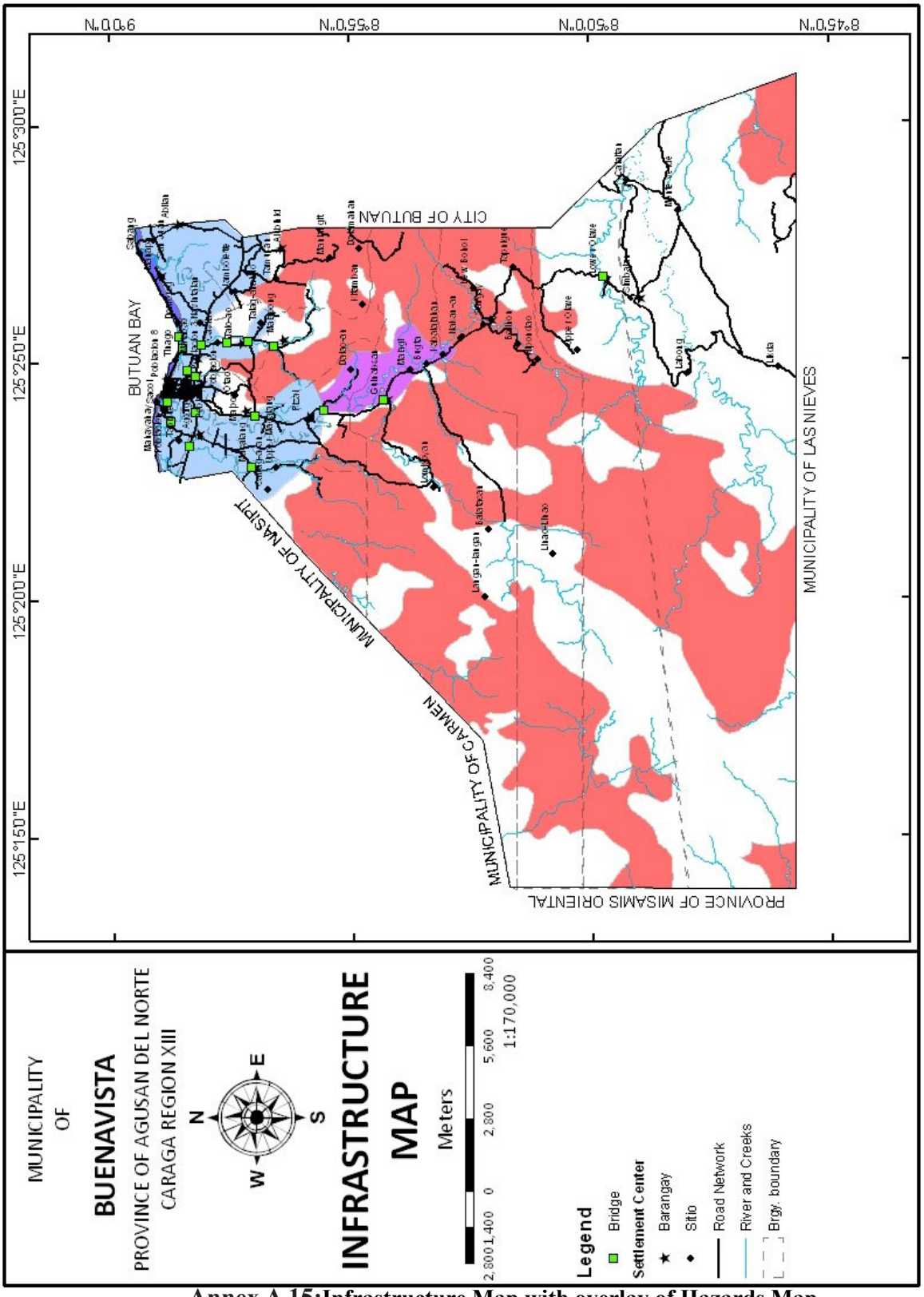
Source: ArcGIS 9 ® - ArcMap Version 9.3(PPDO)

Annex A 13: Crop Map with overlay of Hazard Map



Source: ArcGIS 9 ® - ArcMap Version 9.3(PPDO)

Annex A 14: Population Map (Vulnerable Areas with overlay of Hazard Map)



Source: ArcGIS 9 ® - ArcMap Version 9.3(PPDO)

Annex A 15:Infrastructure Map with overlay of Hazards Map

ANNEX B

List of Annexes (B) - TablesFigures

Annex B 1: Main Landform and Area Coverage

Main Land Form	Sub- Land form Description	Area Coverage (in has.)	Percentage Distribution
Recent	Tidal flat, fluvio- marine, level to nearly level, broad plain , beach ridges	3, 004.95	5.49
Upper Miocene	Broad alluvial plains, low relief andesitic hills, slightly rolling terrain	35,458.35	64.84
Pliocene – Pleistocene	Low relief hills, sloping to strongly rolling terrain, mountainous	15, 158.28	27.72
Cretaceous	strong rolling to steep hilly, mountainous high relief andesitic hills	1,068.42	1.95
Paleogene	-	-	-
TOTAL		54, 690	100

Source: Municipal Socio-Economic Profile and Ecological Profile

Annex B 2: Population, Population Density, Households and Land Area

Name of Barangay	Total HH	Population			Land Area (has.)	Population Density (#/ha)
		Total	Male	Female		
RURAL						
Abilan	339	1,659	893	766	727.91	2.28
Agong-ong	250	1,117	551	566	266.12	4.2
Alubihid	568	2,558	1,341	1,217	1,244.56	2.42
Guinabsan	701	3,484	1,808	1,676	2,448.04	1.72
Lower Olave	293	1,514	809	705	2,105.14	0.72
Macalang	345	1,623	837	786	1,135.02	1.34
Malapong	221	1,065	539	526	727.93	1.46
Malpoc	235	1,067	566	501	660.73	2.43
Manapa	732	3,481	1,767	1,714	340.31	10.23
Matabao	692	3,247	1,665	1,582	5,296.00	0.61
Rizal	510	2,360	1,223	1,137	1,337.16	1.76
Sacol	521	2,508	1,253	1,255	261.17	9.6
Sangay	563	2,721	1,447	1,274	20,468.13	0.13
Simbalan	552	3,140	1,687	1,453	17,000.00	0.18
Talo-ao	353	1,592	820	772	443.56	3.59
Total	**6,875**	**33,136**	**17,206**	**15,930**	**54,461.8**	**4.27**
URBAN						
Poblacion 1	313	1,571	803	768	20.41	76.98
Poblacion 2	291	1,434	686	748	37.95	37.79
Poblacion 3	547	2,715	1,366	1,349	59.27	45.8
Poblacion 4	286	1,342	642	700	30.53	43.96
Poblacion 5	222	1,025	492	533	36.91	27.77
Poblacion 6	311	1,424	657	767	13.39	106.33
Poblacion 7	185	889	446	443	9.72	91.5
Poblacion 8	220	1,120	539	581	7.09	158.04
Poblacion 9	308	1,439	728	711	8.76	164.34
Poblacion 10	413	1,862	948	914	4.13	451
Total	**3,096**	**14,821**	**7,307**	**7,514**	**228.16**	**120.35**
Grand Total	**9,971**	**47,957**	**24,513**	**23,444**	**54,689.9**	**62.31**

Source: CBMS Survey 2007 and Ecological Profile

Annex B 3: Profile (2007)

Name of Barangay (1)	Total HH (2)	Rural (3)			Urban (4)			Land Area (has.) (5)		Population Density (#/ha) (6)		Age Structure (NSO Categories) (7)	Employment * (8)			Average Income (9)	Poverty Incidence ** (10)	HDIs and MDGs *** (11)
		Total (3.1)	Male (3.2)	Female (3.3)	Total (4.1)	Male (4.2)	Female (4.3)	Rural (5.1)	Urban (5.2)	Rural (6.1)	Urban (6.2)		Govt. Employees	Small Business	Farm Labor			
Abilan	339	1,659	893	766				727.91		2.28			x	x	x		143	
Agong-ong	250	1,117	551	566				266.12		4.20			x	x	x		90	
Alubihid	622	3,016	1,558	1,458				1,244.56		2.42			x	x	x		194	
Guinabsan	701	4,202	2,102	2,100				2,448.04		1.72			x	x	x		401	
Lower Olave	293	1,514	809	705				2,105.14		0.72			x	x	x		58	
Macalang	345	1,523	837	786				1,135.02		1.34			x	x	x		99	
Malapong	221	1,065	539	526				727.93		1.46			x	x	x		90	
Malpoc	221	1,607	566	501				660.73		2.43			x	x	x		83	
Manapa	235	3,481	1,767	1,714				340.31		10.23			x	x	x		145	
Matabao	836	3,247	1,665	1,582				5,296.00		0.61			x	x	x		86	
Rizal	510	2,360	1,223	1,137				1,337.16		1.76			x	x	x		250	
Sacol	521	2,508	1,253	1,255				261.17		9.60			x	x	x		222	
Sangay	503	2,721	1,446	1,274				20,468.13		0.13			x	x	x		267	
Simbalan	748	3,140	1,687	1,453				17,000.00		0.18			x	x	x		400	
Talo-ao	353	1,592	820	772				443.56		3.59			x	x	x		111	
Poblacion 1	313				1,571	803	768		20.41		76.98		x	x	x		138	
Poblacion 2	291				1,434	686	748		37.95		37.79		x	x	x		87	
Poblacion 3	547				2,715	1,366	1,349		59.27		45.80		x	x	x		88	
Poblacion 4	286				1,342	642	700		30.53		43.96		x	x	x		29	
Poblacion 5	222				1,025	492	533		36.91		27.77		x	x	x		13	
Poblacion 6	311				1,424	657	767		13.39		106.33		x	x	x		52	
Poblacion 7	185				889	446	443		9.72		91.50		x	x	x		30	
Poblacion 8	220				1,120	539	581		7.09		158.04		x	x	x		71	
Poblacion 9	303				1,439	728	711		8.76		164.34		x	x	x		225	
Poblacion 10	413				1,862	948	914		4.13		451.00		x	x	x		63	

Source: CBMS 2007

Annex B 4: Housing Construction Materials of Roof and Walls

Construction materials of Walls			Construction materials of Roof		
	Total Number of Households	**9971**		Total Number of Households	**9971**
	Strong materials	2983		Strong materials	2855
	Light materials	2999		Light materials	3599
	Salvaged/ makeshift materials	232		Salvaged/ makeshift materials	206
	Mixed but predominantly strong	1816		Mixed but predominantly strong	1474
	Mixed but predominantly light	1822		Mixed but predominantly light	1667
	Mixed but predominantly salvaged	119		Mixed but predominantly salvaged	170

Source: CBMS Survey Year 2007

Annex B 5: Source of Drinking Water and Type of Toilet Facility

Source of Drinking Water			Type of Toilet Facility		
	Total Number of Household	9971		Total Number of Household	9971
	Community water system-own	1148		Water-sealed flush to sewerage/septic tank-own	6339
	Community water system-shared	1401			
	Deep well-own	792			
	Deep well-shared	3130			
	Artesian well-own	233		Water-sealed flush to sewerage/ septic tank-shared	887
	Artesian well-shared	1148			
	Dug/shallow well-own	127			
	Dug/shallow well-shared	334			
	River, stream, lake, spring	906		Closed pit	710
	Bottled water	695		Open pit	129
	Tanker truck/ Peddler	27		No toilet	1786
	Other	30		Others	120

Source: CBMS Survey Year 2007

Annex B 6: **Basic Education and Literacy**

Number of children 6-12 years old			Children 6-12 years old not attending elementary					
			Magnitude			*Proportion*		
Total	*Male*	*Female*	*Total*	*Male*	*Female*	*Total*	*Male*	*Female*
8563	4429	4134	1710	937	773	19.97	21.16	18.70
Number of children 13-16 years old			**Children 13-16 years old not attending high school**					
			Magnitude			*Proportion*		
Total	*Male*	*Female*	*Total*	*Male*	*Female*	*Total*	*Male*	*Female*
4765	2476	2289	2118	1272	846	44.45	51.37	36.96
Number of children 6-16 years old			**Children 6-16 years old not attending school**					
			Magnitude			*Proportion*		
Total	*Male*	*Female*	*Total*	*Male*	*Female*	*Total*	*Male*	*Female*
13328	6905	6423	1961	1212	749	14.71	17.55	11.66
Number of persons 10 years old and above			**Illiterate persons 10 years old and above**					
			Magnitude			*Proportion*		
Total	*Male*	*Female*	*Total*	*Male*	*Female*	*Total*	*Male*	*Female*
36329	18597	17732	1025	578	447	2.82	3.11	2.52

Source: CBMS Survey Year 2007

Annex B 7: **Population Aged 5 and Above by Highest Educational Attainment**

Highest Educational Attainment	Male		Female		Total	
	No.	%	No.	%	No.	%
Population aged 5 and above	21723		20769		42492	
No Grade completed	1160	2.73	960	4.42	2120	10.21
Pre-School	1249	2.94	1095	5.04	2344	11.29
Elementary						
Grade 1-4	5058	11.9	3875	17.84	8933	43.01
Grade 5-6	1939	4.56	1595	7.34	3534	17.02
Elementary Graduate	2630	6.19	2554	11.76	5184	24.96
High-School						
Under Graduate	3741	8.8	3993	18.38	7734	37.24
Graduate	2843	6.69	3151	14.51	5994	28.86
Post Secondary						
Undergraduate	213	0.5	220	1.01	433	2.08
Graduate	414	0.97	408	1.88	822	3.96
College Undergraduate	1380	3.25	1439	6.62	2819	13.57
Academic Degree Holder	1072	2.52	1459	6.72	2531	12.19
Post Baccalaureate	24	0.06	20	0.09	44	0.21

Source: CBMS Survey Year 2007

Annex B 8: **Existing Major Agricultural Crops by Area, Production and Market, Year 2009**

Major Crops		Barangay	Area		Production		Product Market	
			Hectares	% to Total	Volume (M-T)	Value (Php)	Local	Export
Rice	a. Irrigated	Brgy. 1 and rural barangays except brgys. Olave & Simbalan	741.50	9.01%	3,306.00	42,978,000	W/in the Municipality	-
	b. Non-irrigated	Brgy. 1 and rural barangays except Simbalan, Olave & Agong-ong	396.75	3.15%	1,012.37	13,160,810	-do-	-
Corn		All rural barangays except Matabao	367.50	3.08%	282.25	1,975,750	-do-	
Coconut		Municipal - wide	5,257.12	57.34%	1,620.00	24,300,000	-	Misamis Oriental
Banana		Brgy. 1 and rural barangays	631.16	6.88%	4,418.12	22,090,600	-	Luzon
Mango		Brgy. 1 and rural barangays	299.50	3.27%	5,990.00	269,550,000	W/in the Province	
Cassava		Rural barangays	300	3.27%	6,000.00	9,000,00	-	SMC, Cagayan de Oro City
Durian		Simbalan, Sangay, Guinabsan	31.00	0.34%	No Data	No Data	W/in the Municipality	
Pineapple		- do -	20	0.22%	ll	ll	-do-	
Coffee		Simbalan	21.00	0.23%	ll	ll	-do-	
Vegetables		All rural barangays except Alubihid & Agong - ong	101.75	1.11%	ll	ll	-do-	
Non-classified Crops		All rural barangays	803.22	8.76%	ll	ll	-do-	
Fishpond		Brgys. Matabao, Abilan & Manapa	306.00	3.34%	489.60	44,064,000	-do-	
TOTAL			**9,276.50**	**100.00%**				

Source: Municipal Socio-Economic Profile and Ecological Profile

Annex B 9: **Existing Fishing Ground and Aquaculture Production, Year 2009**

Fishing Ground	Barangay	Production		Product Market	
		Volume	Value	Local	Export
Marine		746 mt	P15,450,000.00	P10,815,000.00	P4,635,000.00
1. Butuan Bay	Manapa	172 mt			
	Tinago	53 mt			
	Brgy. 10	288 mt			
	Brgy. 9	128 mt			
	Sacol	105 mt			
Inland					
1. Fishponds/Cages	Abilan, Manapa, Sacol	305 mt	P24,400,000.00	P17,080,000.00	P7,320,000.00

Source: Municipal Socio-Economic Profile and Ecological Profile

Annex B 10: Existing Programs and Plans for Commerce and Trade

Programs/Projects	Location	Budget Allocation	Schedule of Implementation	Funding Sources	Implementing Agencies
Const. of Block Tiendas	Public Market Area	P500,000/yr.	Implemented Annually	LGU	LGU
Farmers Trading Center	Public Market Area	P800,000/yr.	- do -	LGU / GEM - USAID	LGU / NGO
Commercial District Area Expansion	Public Market Area	P500,000/yr.	- do -	LGU	LGU
100mtrs. Strip both sides along the National Highway Nasipit to Butuan boundaries for Commercial Area Expansion	Agong – ong to Abilan	-	Approved per Zoning Ordinance No. 3 Series of 2000	Local/ Prov'l./ National & Foreign Funding	LGU & National & NGOs
Public Transport Terminal	Poblacion	P 20 Million	Proposed	Local/ Prov'l./ National & Foreign Funding	LGU / National

Source: Municipal Socio-Economic Profile and Ecological Profile

Annex B 11: **Existing Livestock and Poultry Farms, Year 2009**

Type	Barangay	Classification	Production	
			Volume (no. of heads)	Value (Php)
Cattle	Brgys. 1,2,3,4,5 & 6 and 15 Rural Brgys.	Backyard	1,810	24,887,500
Carabao	Brgys. 1,2,3,4 & 5 and 15 Rural Brgys.	Backyard	2,056	37,008,000
Goat	Brgys. 1,2,3,4 & 6 and 15 Rural Brgys.	Backyard	1,737	6,253,200
Sheep	Brgy. 1 & Sangay	Backyard	31	99,200
Swine	Brgys. 1-10 and 15 Rural Brgys.	Backyard	9,927	63,284,625
Chicken	Brgys. 1-10 and 15 Rural Brgys.	Backyard	81,849	29,465,640
Turkey	Brgys. 1,2,3,4 & 9 and 7 Rural Brgys	Backyard	266	255,360
Geese	Brgys. 1 & 3 and 6 Rural Brgys.	Backyard	173	155,700
Duck	Brgys, 1, 2, 3,4,5,6 & 7 and 12 Rural Brgys.	Backyard	2,865	859,500
Ostrich	Brgy. Malapong	Backyard	6	30,000
Horse	7 Rural Brgys.	Backyard	39	1,560,000
Dog	Brgys. 1-10 and 15 Rural Brgys.	Backyard	5,810	871,500

Annex B 12: **Projected Power Requirements by Type of Connections (KWH)**

Connection/User	Projected Power Requirements					
	Current year	Year 1 (2010)	Year 2 (2011)	Year 3 (2012)	Year 4 (2013)	Year 5(2014)
Domestic	474,977	484,476	494,165	504,048	514,129	524,412
Industrial	40,413	41,221	42,045	42,886	43,743	44,618
Commercial	51,797	52,832	53,888	54,966	56,065	57,186
Institutional (Public building)	43,568	44,439	45,328	46,235	47,160	48,103
Institutional (Street lights)	2,052	2,093	2,135	2,178	2,221	2,265
Others(BAPA)	2,287	2,332	2,379	2,427	2,475	2,524
Total	615,094	627,393	639,940	652,740	665,793	679,108

Source: ANECO, Buenavista Sub-office

Annex B 13: Damage to Crops Caused by Increasing Rainfall

Commo-dity	Rice			Coconut			Banana		
Occur-rence (Year)	Baseline Data	Extent of Damage (Yield loss)	Analysis/ Evaluation of impacts	Baseline Data	Extent of Dama-ge (Yield loss)	Analysis/ Evaluation of impacts	Base-line Data	Extent of Damage (Yield loss)	Analysis/ Evalua-tion of impacts
2003	1,175.25	620.2	High	25,647.95	0	Low	432.5	1.25	Low
2004	- - -	- - -	- - -	25,647.45	0	Low	- - -	- - -	- - -
2005	723	15.4	Low	25,667.45	0	Low	- - -	- - -	- - -
2006	1,082.75	138.8	Low	25667.45	0	Low	475.64	5.25	Low
2007	498.75	34.5	Low	- - -	- - -	- - -	- - -	- - -	- - -
2008	983.75	81.65	Low	- - -	- - -	- - -	- - -	- - -	- - -
2009	420.5	10.7	Low	- - -	- - -	- - -	716.64	38.18	Low

Source: ANECO, Buenavista Sub-office

Annex B 14: **Damage to Crops Caused by Increasing Temperature**

Commo-dity	Rice			Coconut			Banana		
Occur-rence (Year)	Baseline Data (mt.)	Extent of Damage (Yield loss mt.)	Analysis/ Evaluation of impacts	Baseline Data (mt.)	Extent of Damage (Yield loss mt.)	Analysis/ Evaluation of impacts	Baseline Data (mt.)	Extent of Damage (Yield loss mt.)	Analysis Evaluation of impacts
2003	722.50	145.00	High	25,647.95	0	Low	432.5	0	Low
2004	1,088.00	110.15	Moderate	25,647.45	0	Low	- - -	- - -	- - -
2005	915.50	130.25	Moderate	25,667.45	0	Low	- - -	- - -	- - -
2006	- - -	- - -	- - -	25667.45	0	Low	475.64	0	Low
2007	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
2008	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
2009	- - -	- - -	- - -	- - -	- - -	- - -	716.64	0	Low

Annex B 15: **Damage to Livestock Caused by Increasing Rainfall**

Exposed Group	Poultry		Swine		Goat		Carabao		Cattle		
Occur-rence (Year)	Base-line Data	Extent of Damage (Yield loss)	Base-line Data	Extent of Damage (Yield loss)	Base-line Data	Extent of Damage (Yield loss)	Base-line Data	Extent of Damage (Yield loss)	Base-line Data	Extent of Damage (Yield loss)	Analysis/ Evaluation of impacts
2003	26,689	532	6,453	24	1,298	- - -	1,563	1	1,380	1	Low
2004	28,908	112	8,732	- - -	1,920	- - -	1,762	- - -	1,420	- - -	Low
2005	32,190	240	7,821	19	1,562	9	1,908	- - -	1,508	- - -	Low
2006	33,029	317	9,019	32	2,055	7	1,546	1	1,792	3	Low
2007	31,965	93	8,976	- - -	1,982	- - -	1,927	- - -	1,725	- - -	Low
2008	34,578	72	9,230	- - -	1,897	- - -	1,862	- - -	1,756	- - -	Low
2009	36,549	446	9,927	11	1,737	7	2,056	2	1,810	4	Low

Source: MA Office

Annex B 16: **Production Losses per Year**
(Crop: Vegetable)

Brgy. Name	Average Yield Per Barangay per Year													
	2003 (year 4)		2004 (year 5)		2005 (year 6)		2006 (year 7)		2007 (year 8)		2008 (year 9)		2009 (year 10)	
	Ha.	Yield	Ha.	Yield	Ha.	Yield	Ha.	Yield	Ha.	Yield	Ha.	Yield	Ha.	Yield
Abilan													2.5	12.5
Alubihid													16.5	99.0
Agong-ong	7.85	43.28											2.5	12.5
Laoag, Barangay 1													-	-
Macalang													4.75	20.43
Manapa													8.375	41.815
Matabao													4.25	17.0
Malapong	1.0	5.5											18.5	92.5
Talo-ao													4	8
Malpoc	1.25	6.9											3.5	3.5
Rizal													13.0	67.6
Guinabsan													10.25	51.25
Sangay													22.13	110.65
Olave														
Simbalan														
TOTAL	**10.1**	**55.68**											**110.255**	**536.745**

Annex B 17: **Production Losses per Year**
(Crop: Banana)

Brgy. Name	Average Yield Per Barangay per Year													
	2003 (year 4)		2004 (year 5)		2005 (year 6)		2006 (year 7)		2007 (year 8)		2008 (year 9)		2009 (year 10)	
	Ha.	Yield	Ha.	Yield	Ha.	Yield	Ha.	Yield	Ha.	Yield	Ha.	Yield	Ha.	Yield
Abilan													6.0	32.0
Alubihid														
Agong-ong														
Laoag, Barangay 1														
Macalang														
Manapa	0.25	1.5												
Matabao														
Malapong													3.0	18.0
Talo-ao														
Malpoc													3.0	18.0
Rizal							5.0	3.0					4.0	24.0
Guinabsan	1.0	6.0					0.25	1.5					4.5	27.0
Sangay													10.13	60.70
Olave														
Simbalan													7.55	45.3
TOTAL	**1.25**	**7.5**					**5.25**	**4.5**					**38.18**	**225.0**

Annex B 18: Production Losses per Year
(Crop: Rice)

Brgy. Name	Average Yield Per Barangay per Year													
	2003 (year 4)		2004 (year 5)		2005 (year 6)		2006 (year 7)		2007 (year 8)		2008 (year 9)		2009 (year 10)	
	Ha.	Yield	Ha.	Yield	Ha.	Yield	Ha.	Yield	Ha.	Yield	Ha.	Yield	Ha.	Yield
Abilan	92	322	4.25	9.31	23.5	35.25	59.5	83.3			19.0	37.45	6.2	20.46
Alubihid	193	535.73	3.5	91.68	17.5	47.25	20.25	31.9	23.0	11.5	23.0	46.01	3.0	5.5
Agong-ong	97.75	395.9	10.25	28.75	17.5	49.0	16.0	28.8			3.0	6.75	1.5	6.75
Laoag, Barangay 1	74.5	254.61	4.5	9.9	34.0	78.2	11.0	17.16	5.5	2.2	3.0	6.15		
Macalang	78	244.16	10.25	22.92	3.0	6.9	4.3	13.41	4.0	1.6	2.25	4.5		
Manapa	40	144	4.5	10.1										
Matabao	50	190	7.8	15.45	14.25	27.1	15.0	45.0			28.0	63.0		
Malapong	2.75	10.75												
Talo-ao	5	19	9.6	24.18			4.0	6.16			3.15	6.6		
Malpoc	15.2	43.9					0.75	1.17						
Rizal	113.25	392.5	13.0	31.88	9.5	23.27	1.0	1.6	2.0	0.8	0.25	0.53		
Guinabsan	-	-												
Sangay	3.75	11.75	2.0	4.6	6.15	14.95	7.0	9.8						
Olave														
Simbalan														
TOTAL	**765.2**	**2,564.3**	**69.65**	**248.77**	**125.4**	**281.92**	**138.8**	**238.3**	**34.5**	**16.1**	**81.65**	**170.99**	**10.7**	**32.71**

Annex B 19: **Production Losses, Causes, Action**
(Crop: Rice)

Brgy Name (1)	Production trend per year (2)		Causes (3)	Action (4)		
	Year (2.1)	Prod. Yield Analysis (positive, ,static, negative) (2.2)		Household (4.1)	Community (4.2)	LGU (4.3)
Abilan	2000-01					
	2001-02					
	2002-03		Dry Spell	Shift to other means of livelihood like construction/ labor work		Provision of free seeds and other inputs
	2003-04		Flash Flood	-do-		
	2004-05		Dry Spell			
	2005-06		Flash Flood			
	2006-07					
	2007-08		Flash Flood			
	2008-09		Flash Flood			
	2009-10		Dry Spell			

Alubihid	2000-01																	
	2001-02																	
	2002-03		Dry Spell	Crop rotation instead of rice	Pahina,provision of relief goods,													
	2003-04		Flash Flood	Labor work, peddling ornamental propagation														
	2004-05		Dry Spell															
	2005-06		Flash Flood															
	2006-07		Flash Flood															
	2007-08		Flash Flood															
	2008-09		Flash Flood															
	2009-10																	
Agong-ong	2000-01																	
	2001-02																	
	2002-03		Dry Spell	Labor works,														Rice and vegetable subsidy, animal health outreach
	2003-04		Flash Flood															
	2004-05		Dry Spell															
	2005-06																	
	2006-07																	
	2007-08		Flash Flood															
	2008-09		Flash Flood															
	2009-10																	

Laoag, Barangay 1	2000-01					
	2001-02					
	2002-03		Dry Spell	Crop rotation, depend on coco products as alternate source of livelihood		Provisions of relief goods from DSWD, financial assistance for livelihood
	2003-04		Flash Flood	Shift to labor works, peddling of kakanins, panulo, pananggot		
	2004-05		Dry Spell			
	2005-06		Flash Flood			
	2006-07		Flash Flood			
	2007-08		Flash Flood			
	2008-09		Flashflood			
	2009-10					

Macalang	2000-01					
	2001-02					
	2002-03		Dry Spell			
	2003-04		Flash Flood			
	2004-05		Dry Spell	Shifting to vegetable farming, womens were peddling vegetables and other farm products to the target market	The Brgy. LGU adopt and implement the planting of trees of the community	MAO provide seeds for the farmers and conducted animal health outreach DENR provide assistance through UDP, DSWD provide assistance to the affected people
	2005-06		Flash Flood			
	2006-07		Flash Flood			

	2007-08		Flash Flood			
	2008-09		Flash flood	Mga troso na nangaanod sa baha gipangsagop sa mga tao ug gipalukat sa tag –iya, planting of root crops in upland areas,carpentry,labor works		
	2009-10					
Manapa	2000-01					
	2001-02					
	2002-03					
	2003-04		Flash Flood			
	2004-05		Dry Spell			
	2005-06					
	2006-07					
	2007-08					
	2008-09		Flash Flood	Labor employment(APC), fish and shell vending,coco product dependent,		Assistance from the LGU, free rice seeds from MAO
	2009-10					

Matabao	2000-01					
	2001-02		Dry Spell			
	2002-03					
	2003-04		Flash Flood		Mass Pahina	Provision of food for work
	2004-05		Dry Spell			

	2005-06					
	2006-07		Flash Flood			
	2007-08		Flash Flood			
	2008-09		Flash Flood	Mamagus og silhig, Nipa Shingles making, labor works and pananggot,PO's have a buy and sell business and money lending	Allocation of 5% calamity fund, organization of PO	Provisions of relief goods (DSWD),Livelihood loans (SKA), financial assistance to RIC (DOLE), provide rice seeds subsidy (MAO)
	2009-10					

Malapong	2000-01					
	2001-02		Flash Flood	Laborer, livestock raising, fish(tilapia) catching during the flood,		MAO provide seed subsidy, tilapia dispersal (BFAR)
	2002-03					
	2003-04		Flash Flood			
	2004-05		Flash Flood			
	2005-06					
	2006-07					
	2007-08		Dry Spell	Fire wood gathering, mamagus og barbecue sticks		
	2008-09		Flash Flood			
	2009-10		Dry Spell			

Talao-ao	2000-01								
	2001-02								
	2002-03								
	2003-04			Flash Flood					
	2004-05								
	2005-06			Flash Flood					
	2006-07								
	2007-08			Flash Flood	Coconut trees as other income source, job employment, barbecue stick making, firewood gathering		Monitoring of affected people of the community, allocation of 5% calamity fund,	LGU assistance in clearing of the river basin by providing Back hoe	
	2008-09								
	2009-10								
Malpoc	2000-01								
	2001-02								
	2002-03			Dry Spell					
	2003-04			Flash Flood					
	2004-05								
	2005-06			Flash Flood					
	2006-07			Dry Spell	Crop rotation				
	2007-08			Dry Spell	Crop rotation, construction works				
	2008-09								
	2009-10			Flash Flood	Livestock raising, labor works (APC), trisicad driving, peddling			Seed subsidy, provisions of vegetable seeds animal health outreach (MAO), LGU financial assistance for the affected residents	

Rizal	2000-01					
	2001-02					
	2002-03		Dry Spell	Scheduling the use of irrigation, use of crops suited for lack of water and highly elevated rice areas and resistance to pest		
	2003-04		Flash Flood			
	2004-05		Dry Spell			
	2005-06		Flash Flood			
	2006-07		Flash Flood			
	2007-08		Flash Flood			
	2008-09					
	2009-10		Flash Flood	Loan from the private financiers, coconut as alternate source of income	5% allocation as calamity fund from Barangay	Food assistance from LGU, seed subsidy from MAO, animal health outreach conducted by MAO
Sangay	2000-01					
	2001-02					
	2002-03		Dry Spell			
	2003-04					
	2004-05		Dry Spell			
	2005-06		Flash Flood			
	2006-07					
	2007-08					
	2008-09		Flash Flood			

	2009-10		Flash Flood, landslide	Choice of crops to plant in preparation of particular season, logging as alternate source of income, minimize illegal cutting of trees, contour farming, diversified farming practice	Financial assistance, food assistance from the barangay for the affected residence	UDP (DENR), Financial assistance from LGU, seed subsidy (MAO) and IEC regaring environmental protection from LGU-MENRO
Guinabsan	2000-01					
	2001-02					
	2002-03		Dry Spell			
	2003-04					
	2004-05		Dry Spell			
	2005-06		Flash Flood			
	2006-07					
	2007-08		Flash Flood			
	2008-09					
	2009-10		Flash Flood	Logging as alternate source of income, developing upland area for upland crops, labor, driving of trisicad, firewood gathering		Falcata and fruit tree provision (MENRO), assistance from NGO and LGU, seed subsidy from MAO
Olave	2000-01					
	2001-02					
	2002-03		Dry spell			
	2003-04					
	2004-05					
	2005-06					
	2006-07					

	2007-08					
	2008-09					
	2009-10		Landslide, flash flood	Labor, logging as alternate source of income, peddling of farm products, livestock raising	5% calamity fund	DSWD provide food assistance, LGU livestock dispersal,
Simbalan	2000-01					
	2001-02					
	2002-03		Dry spell, crop infestation (banana)	Logging activities by IP's as source of their income, alternate planting of diversified crops,peddling		
	2003-04					
	2004-05					
	2005-06					
	2006-07					
	2007-08					
	2008-09					
	2009-10		Landslide		Food assistance by the barangay	Cash assistance by DSWD, livestock program by NGO

Annex B 20: **Production Losses, Causes, Action (Crop: Banana)**

Brgy Name (1)	Production trend per year (2)		Causes (3)
	Year (2.1)	Prod. Yield Analysis (positive,,static,negative) (2.2)	
Abilan	2009		Flash Flood
Manapa	2003		Flash Flood
Malapong	2009		Flash Flood
Malpoc	2009		Flash Flood
Rizal	2006		Flash Flood
	2009		Flash Flood
Guinabsan	2003		Flash Flood
	2006		Flash Flood
	2009		Flash Flood
Sangay	2009		Flash Flood
Simbalan	2009		Flash Flood

Annex B 21**: History and Effect of Past Hazards**

Hazard	Occur-rence (year)	Impacts	Exposed group/ commo-dity	Where are these?	Baseline data per Bara-ngay	Extent of Damage / Yield loss per Barangay	Analysis / Evaluation of impacts
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1. Increasing rainfall (occurrence or extent or volume)	2003	Damage to crops	Rice	Abilan	134.25	92	Highly affected
				Alubihid	141.5	132	Highly affected
				Agong-ong	144.75	90	Highly affected
				Laoag	105.75	60	Moderately affected
				Macalang	90	55	Highly affected
				Manapa	60.5	40	Highly affected
				Matabao	103	50	Moderately affected
				Malapong	60	2.75	Low affected
				Talo-ao	112	5	Low affected
				Malpoc	71	5.2	Low affected
				Rizal	152.5	88.25	Moderately affected

	2005		Rice	Abilan	134.25	5	Low affected
				Alubihid	141.5	1.5	Low affected
				Laoag	105.75	6	Low affected
				Macalang	90	0.5	Low affected
				Malpoc	71	0.25	Low affected
				Rizal	152.5	1	Low affected
				Sangay	28	1.15	Low affected
	2006		Rice	Abilan	134.25	59.5	Moderately affected
				Alubihid	141.5	20.25	Low affected
				Agong-ong	144.75	16	Low affected
				Laoag	105.75	11	Low affected
				Macalang	90	4.3	Low affected
				Matabao	103	15	Low affected
				Talo-ao	112	4	Low affected
				Malpoc	71	0.75	Low affected
				Rizal	152.5	1	Low affected
				Sangay	28	7	Low affected
	2007		Rice	Alubihid	141.5	23	Low affected
				Laoag	105.75	5.5	Low affected
				Macalang	90	4	Low affected
				Rizal	152.5	2	Low affected
	2008		Rice	Abilan	134.25	19	Low affected
				Alubihid	141.5	23	Low affected
				Agong-ong	144.75	3	Low affected
				Laoag	105.75	3	Low affected
				Macalang	90	2.25	Low affected
				Matabao	103	28	Low affected
				Talo-ao	112	3.15	Low affected
				Rizal	152.5	0.25	Low affected
	2009		Rice	Abilan	134.25	6.2	Low affected
				Alubihid	141.5	3	Low affected
				Agong-ong	144.75	1.5	Low affected
	2003		Vegetable	Agong-ong	4	3.5	Highly affected
				Malapong	25	1	Moderately affected
				Malpoc	3	1	Moderately affected

	2009		Vegetable	Abilan	5	2.5	Moderately affected
				Alubihid	37	16.5	Moderately affected
				Agong-ong	4	2.5	Highly affected
				Macalang	10	4.75	Moderately affected
				Manapa	5	8.375	Highly affected
				Matabao	5	4.25	
				Malapong	25	18.5	Highly affected
				Talo-ao	5	4	
				Malpoc	3	3.5	Highly affected
				Rizal	15	13	
				Guinabsan	19	10.25	Moderately affected
				Sangay	16.5	22.13	
	2003		Corn	Agong-ong	5	3.5	Highly affected
				Malpoc	5	1	Low affected
				Guinabsan	54	2	Low affected
	2009		Corn	Abilan	2	0.7	Moderately affected
				Laoag	5	4.27	Highly affected
				Macalang	15.5	4.25	Low affected
				Malpoc	5	3.5	Highly affected
				Rizal	40	16	Moderately affected
				Guinabsan	54	15.5	Low affected
				Sangay	80	70.75	
				Simbalan	150	13.75	Low affected
	2003		Banana	Manapa	7.5	0.25	Low affected
				Guinabsan	425	1	Low affected
	2006			Rizal	50.636	5	Low affected
				Guinabsan	425	0.25	Low affected
	2009			Abilan	6	6	Low affected
				Malapong	110	3	Low affected
				Malpoc	15	3	Low affected
				Rizal	50.636	4	Low affected
				Guinabsan	425	4.5	Low affected
				Sangay	15	10.13	Highly affected
				Simbalan	95	7.55	Low affected
	2009		Root Crops	Sangay	10	5.4	Moderately affected

	2009	Damage to Livestock		Rizal		61	
				Malpoc		6	
				Olave		10	
				Sangay		11	
				Simbalan		5	
				Guinabsan		8	
				Macalang		8	
		Damage to property					
		Loss of lives					
		Damage to infrastructure					
2. Flooding							
3. Increase in temperature (drought)	2003	Damage to crops	Rice	Alubihid	141.5	61	Moderately affected
				Agong-ong	144.75	7.75	Low affected
				Laoag	105.75	14.5	Low affected
				Macalang	90	23	Low affected
				Malpoc	60	10	Low affected
				Rizal	152.5	25	Low affected
				Sangay	28	3.75	Low affected
	2004			Abilan	150	4.25	Low affected
				Alubihid	141.5	3.5	Low affected
				Agong-ong	144.75	10.25	Low affected
				Laoag	105.75	4.5	Low affected
				Macalang	90	10.25	Low affected
				Manapa	60.5	45	Highly affected
				Matabao	103	7.8	Low affected
				Talo-ao	112	9.6	Low affected
				Rizal	152.5	13	Low affected
				Sangay	28	2	Low affected

	2005			Abilan	150	18.5	Low affected
				Alubihid	141.5	16	Low affected
				Agong-ong	144.75	17.5	Low affected
				Laoag	105.75	28	Low affected
				Macalang	90	22.5	Low affected
				Matabao	103	14.25	Low affected
				Rizal	152.5	8.5	Low affected
				Sangay	28	5	Low affected
	2003		Vegetable	Agong-ong	5	4.35	Low affected
				Malpoc	3	0.25	Low affected
	2003		Corn	Agong-ong	5	0.5	Low affected
				Malpoc	5	1	Low affected

Annex B 22: **Climate Change Adaptation Practice**

Climate Change Adaptation Practice	**Location** A. Household Level B. Barangay/ Community Level C. Municipal level D. Provincial level (Indicate the specific name of Barangay or municipality where practiced)	**Description** (Answer the ff: 1. What is being done? 2. Materials Used? 3. How is it being done? 4. Why is it being done?)	**Origin of Practice**		**Climate Drivers** A. Floods B. Drought C. Typhoon D. Landslide E. Seasonality (e.g. Late or e arly onset of rainy season or prolonged rains) F. Others (Please Specify)	**Impacts** A. Increased income B. Generated employment C. Reduced poverty D. Environmental E. Others (Please Specify)	**Extent of Use** (percentage of use in a certain area) A. Low – 1-33% B. Moderate – 34-66% C. High – 67-100%
			Locally Initiated A. Adopted B. Modified	**Externally Introduced** A. Adopted B. Modified			
Construction of Additional rain harvesting facilities (SWIP, mini-dams)	B and C	1. On-going 2. Concrete Materials 3. Counterparting with Brgy. & PO's 4. To promote equity sharing and sense of ownership among beneficiaries	A	A	B and E	A, B and C	C
Maintenance/ Repair of existing rain harvesting facilities and Irrigation Canal	B	1. On-going 2. Concrete Materials 3. Through PO's 4. To prolong the lifespan of the project and sustain increased production	A	A	A and E	A, B and C	C

Planting of trees in head water, landslide and soil erosion prone areas	B	1. Establishment of Barangay Nurseries 2. Provision of Quality Seeds 3. Through PO's and Academe 4. For environmental protection and to maintain adequate supply for irrigation	A	A	A, B, C and E	A and D	B
Promotion of Crop Diversification and Organic Farming	A	1. Training of Farmers and Provision of subsidies 2. High Quality Seeds and VERMI 3. Through PO's and Academe 4. For sustainable Livelihood	A	A	A and B	A, B, and D	C
Riverbank/ Coastal Areas protection through bio-engineering technology	B	1. Planting of Bamboo, Vetiber grass and Mangroves 2. Indigenous Materials 3. Through PO's and Barangay Officials 4. For River protection	A	A	A, C, D, and F (Siltation and Sedimentation)	D and E (Protection of Properties)	B
Construction of Sea Wall, Causeways and River Dikes	C	1. Prioritize flooding and erosion prone coastal areas 2. Construction Materials 3. Through Admin 4. For Shoreline and River Protection	A	A	A, C, D and F (Sea Level Rise)	D and E (Protection of Properties)	C

Annex B 23: **Assessment of Past Adaptation Strategies – Sufficiency and Constraints**

Past Adaptation by Affected People and Places	Sufficient	Constraints
Flooding Strategy 1	The adapted strategy of the affected people is not suffecient to met their needs under the misery of poverty and hunger. People have to allocate so much of their time to look for other sources of income in order to survive. Fish vending, masonry & carpentry works are sources of additional income.	1. Funding source 2. Vacancies in construction 3. Lack of skills and expertise for employment needs 4. Inadequate LGU funds 5. Promotion of economic enterprise development 6. Relocation of the Informal settlers and urban slum dwellers
Flooding Strategy 2	Farmers on the other hand have adopted planting of hybrid rice that will survuve in hihg level water. Utilization of upland farming during flooding and peddling, driving of trisikads and labor for hire in construction and carpentry works to make extra income.	
Drought Strategy 1	The adapted strategies of the people affected by drought are the same to flooding situation. People have to look for other sources of income aside from agricultural activities in order to survive.	
Drought Strategy 2	Fish vending, masonry, carpentry works, labor for hire and driving of trisikads are sort of additional income. Likewise government assistance is not enough to cater the needs of affected people and the places to be rehabilitated	

Annex B 24: **Maximum Temperature, PAGASA Butuan Office**

Month	MEAN		BIAS	Projected Change (%)		BIAS CORRECTED PROJ CHANGE		
						TMAX		
	Observed 1971-2000	Model 1971-2000		2020	2050	1971-2000	2020	2050
Jan	30.1	27.5	-2.6	1.1	2.3	30.1	31.2	32.4
Feb	30.8	28.5	-2.3	1.1	2.3	30.7	31.9	33.1
Mar	31.8	29.2	-2.6	1.2	2.8	31.8	33.0	34.6
Apr	33.1	29.8	-3.3	1.5	3.1	33.1	34.6	36.1
May	33.8	29.6	-4.2	1.3	2.9	33.8	35.1	36.7
Jun	33.0	28.9	-4.1	1.2	2.9	33.0	34.2	35.9
July	32.5	29.3	-3.2	1.3	3.0	32.5	33.8	35.5
Aug	32.8	30.0	-2.8	1.3	3.1	32.8	34.1	35.9
Sept	32.9	30.3	-2.6	0.9	2.6	32.9	33.8	35.5
Oct	32.3	28.6	-3.7	1.2	2.4	32.3	33.5	34.7
Nov	31.6	27.8	-3.8	1.0	2.3	31.6	32.6	33.9
Dec	30.8	27.2	-3.6	0.9	2.2	30.8	31.7	33.0

Annex B 25: **Rainfall, PAGASA Butuan Office (mm)**

Month	MEAN		BIAS	Projected Change (%)		BIAS CORRECTED PROJECTED CHANGE (mm)					
						RR (mm/day)			RR Total (mm)		
	Observed 1971-2000	Model 1971-2000		2020	2050	1971-2000	2020	2050	Obs 1971-2000	2020	2050
Jan	9.9	3.9	2.5	12.8	2.6	9.7	10.9	10.0	300.7	337.9	310.0
Feb	7.6	2.7	2.8	0.0	3.7	7.5	7.7	7.5	210.0	215.6	210.0
Mar	4.8	4.5	1.1	-26.7	-35.6	5.0	3.7	3.2	155.0	114.7	99.2
Apr	3.6	5.0	0.7	-26.0	-40.0	3.5	2.6	2.1	105.0	78.0	63.0
May	3.4	6.6	0.5	-9.1	-24.2	3.3	3.0	2.5	102.3	93.0	77.5
Jun	4.5	7.6	0.6	0.0	0.0	4.6	4.6	4.6	138.0	138.0	138.0
July	5.1	7.0	0.7	-12.9	-18.6	4.9	4.3	4.0	151.9	133.3	124.0
Aug	3.4	6.0	0.6	-8.3	-8.3	3.6	3.3	3.3	111.6	102.3	102.3
Sept	4.7	5.1	0.9	2.0	-7.8	4.6	4.7	4.2	138.0	141.0	126.0
Oct	6.3	4.8	1.3	12.5	0.0	6.2	7.0	6.2	192.2	217.0	192.2
Nov	6.4	4.7	1.4	8.5	6.4	6.5	7.2	7.0	195.0	216.0	210.0
Dec	7.0	5.5	1.3	5.5	18.2	7.2	7.5	8.4	223.2	232.5	260.4

Annex B 26: **Future Adaptation Strategies Category**

Future Adaptation Category	Strategy		Critical Factor	
	Hazard 1 (Flooding)	Hazard 2 (Drought)	Hazard 1 (Flooding)	Hazard 2 (Drought)
Physical/Infra	Construction of Additional rain harvesting facilities (SWIP, mini-dams)		Land acquisition for RROW, soil eroision and oversiltation of riverbeds. Fund sourcing for the implementation of the needed infrrastructure projects and other development.	
	Construction of all weather roads			
	Construction of river banks revetment and flood walls			
	Construction of Sea Wall, Causeways and River Dikes			
	To establish warehouses, storage and transport facilities to preserve or extend the shelf life of agricultural and fishery products and improve its distribution.			
	Upgrading the existing fishports, harbours and terminals of fishing boats			

Biological	Riverbank/Coastal Areas protection through bio-engineering technology		Funding source and resources allocation
Technological	Maintenance/Repair of existing rain harvesting facilities and Irrigation Canal		Funding source and resources allocation
Economic	Planting of trees in head water, landslide and soil erosion prone areas	Promotion of Crop Diversification and Organic Farming	Application of Slope Agricultural Land Tilling (SALT) Program & Funding source.
	Intensification of livestock and poultry breeding program for high quality breed for livestock and poultry dispersal program to uplift the living condition of the rural folks and indigent families		Relocation of informal settlers located in some critical areas. Allocation of adequate funding
	Expansion of crop insurance coverage		Funding source and farmer beneficiaries
Political/ Institutional	Formulation of an ordinance strictly prohibiting the construction of settlements in areas identified as prone to flooding, storm surges and sea level rise especially along riverbanks and coastal areas		Implementation and enforcement of the ordinance. Funding for the procurement of resettlement sites ad socialized housing project.

Annex B 27: **Criteria/Indicators of Effectiveness**

Criteria/Indicators of Effectiveness	Assigned Weights (%)
1. ***Cost Effectiveness*** (the higher the positive return from the given inputs/costs, the more cost-effective)	6
2. ***Contribution to Poverty Reduction*** (potential of the adaptation practice to reduce poverty)	20
3. ***Increase Income*** (potential of the adaptation practice to increase income)	15
4. ***Contribution to Employment*** (potential of the adaptation practice to provide employment)	18
5. ***Size of beneficiary group*** (more positive impacts to greater number of people, the more efficient the adaptation strategies)	12
6***. Absence of adverse impacts on other sectors/group*** (less negative impacts to other group/sectors, the more effective the CCA strategy)	2
7. ***Environmental Soundness*** (the more environmental friendly the practice, the more effective)	10
8. ***Ease of Implementation*** (the strategy is easily employed, absence of barriers for implantation)	5
9. ***Socio-cultural Acceptability*** (the more acceptable the CCA practice to greater number of stakeholders, the more effective)	1

10. ***Immediate impact/response to urgent needs*** (the more immediate positive impacts of adaptation practice the more effective)	8
11. ***Potential for Up-scaling*** (the greater the potential for wider application, the more effective)	3
TOTAL	**100**

Annex B 28: Criteria/Indicators of Effectiveness

Climate Change Adaptation Practice	Criteria/Indicators of Effectiveness											
	Cost Effectiveness	Contribution to Poverty Reduction	Increase Income	Contribution to Employment	Size of beneficiary group	Absence of adverse impacts on other sectors/ groups	Environmental Soundness	Ease of Implementation	Socio-Cultural Acceptability	Immediate Impact	Potential for Up-scaling	Total Score
	-6%	-20%	-15%	-18%	-12%	(2%)	-10%	-5%	(1%)	-8%	-3%	-100
Construction of Additional rain harvesting facilities (SWIP, mini-dams)	6	18	13	15	12	2	5	4	0.5	6	2	83.5
Maintenance/Repair of existing rain harvesting facilities and Irrigation Canal	5	20	15	15	12	2	5	5	0.8	8	2	89.8
Planting of trees in head water, landslide and soil erosion prone areas	6	18	14	16	12	2	10	5	1	8	3	95
Promotion of Crop Diversification and Organic Farming	6	20	15	18	12	2	10	5	1	8	3	100
Riverbank/Coastal Areas protection through bio-engineering technology	6	18	12	15	12	2	10	5	1	8	1	90
Construction of Sea Wall, Causeways and River Dikes	5	15	10	12	8	1	10	2	1	8	3	75

Annex B 29: **Ranking**

Ranking
1. Promotion of Crop Diversification and Organic Farming
2. Planting of trees in head water, landslide and soil erosion prone areas
3. Riverbank/Coastal Areas protection through bio-engineering technology
4. Maintenance/Repair of existing rain harvesting facilities and Irrigation Canal
5. Construction of Additional rain harvesting facilities (SWIP, mini-dams)
6. Construction of Sea Wall, Causeways and River Dikes

References

- ANECO, Buenavista Sub-office
- ArcGIS 9 ® - ArcMap Version 9.3(PPDO)
- Community-Based Monitoring System (CBMS) of the Municipality of Buenavista, 2007
- Comprehensive Land Use Plan (CLUP), Municipal Profile of the Municipality of Buenavista (2003-2012)
- Municipal Agriculture Office (MAO), Mun. of Buenavista
- Municipal Socio-Economic and Ecological Profile
- National Statistics Office (NSO)
- Philippine Atmospheric, Geophysical, Astronomical Services Administration (PAGASA), Butuan City
- Philippine Rice Research institute (PhilRice), RTR, (2003-2009)
- Synchronized Data of BAS,DA, and LGU (2002-2009)

For further information contact;

International Labour Organization (ILO) Country Office for the Philippines, Manila
19th Floor, Yuchengco Tower, RCBC Plaza
6819 Ayala Avenue, Makati City
1200 Philippines
Telephone +63 2 5809900
Fax +63 2 856 7597
www.ilo.org/manila

ILO Climate Change Adaptation Project (ILO-CCAP) Office, Butuan City
3rd Floor, D & V Plaza Bldg.
J.C. Aquino Ave., Butuan City
8600 Philippines
Telefax +63 85 3424378
Mobile +63 917 724 7381
email: villacortal@ilo.org