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 Las Nieves, 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

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International
Labour
Organization

DEPARTMENT OF
TRADE & INDUSTRY
PHILIPPINES

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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
FLGC	Farm Level Grain Center
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
MPDP	Multi Purpose Drying Pavement
MT	Metric Ton
LGU	Local Government Unit
NGA	National Government Agencies
NGO	Non-Governmental Organization
NIA	National Irrigation Administration
RBO	Rural-Based Organizations
V & A	Vulnerability and Adaptation

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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 Las Nieves.

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 Las Nieves 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

Office Of The Municipal Mayor

In my third term of public service in our municipality, I am very grateful that Las Nieves is among the pilot municipalities in the International Labour Organization-led MDG-F 1656 Climate Change Adaptation Project through its Project Manager Ms. Lurraine Baybay Villacorta.

In today's and future challenges over a changing climate, this Vulnerability and Adaptation [V&A] Assessment of Climate Change Adaptation Project is timely formulated.

This document is vital to our unified efforts in addressing the hazards brought about by climate change to protect the people and to secure the environment of Las Nieves.

With these, I would like to express my sincere thanks and gratitude to the people of Las Nieves, and those who have helped in way this plan.

Mabuhay!

Reinario P. Rosales
Municipal Mayor, Municipality of Las Nieves

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 Las Nieves CCAP Municipal Focal Team:

Led by Engr. Gerardo B. Beluan, Erma A. Balaba and Leonito C. Pasquito, *with additional support from* Josefina A. Almine, Leoncia R. Calang, Dr. Glee D. Valenzona, Jover A. Manliguez *and* Gerson Enhambre.

Technical Working Group (TWG) and Mentors:

*Led b*y Lurraine B. Villacorta, *CCA Project Manager of the International Labour Organization and* Maida Lynn Sanchez, *Municipal Anchor for Las Nieves and also from the Department of Labor and Employment (DOLE)-Caraga; together with other TWG members:* Brenda B. Corvera *and* Gemma L. Clarin o*f the Deparment of Trade and Industry (DTI)- Caraga;* Rofel C. Cabaltera, Lauro G. Hinaloc, 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.*

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LGU Acknowledgments

The Local Government Unit of Las Nieves represented by Honorable Mayor Reinario P. Rosales has entered into a Memorandum of Understanding with the International Labor Organization (ILO), represented by Ms. Lurraine B. Villacorta, the Project Manager of MDG-F 1656 Climate Change Adaptation Project (CCAP), to undertake an applied research that centers on the assessment on the vulnerability and adaptation to climate change of the municipality Las Nieves as one of the pilot municipalities in Agusan del Norte. Hence, this Vulnerability and Adaptation [V&A] Assessment is carefully and tediously worked out to outline actions of the municipality in the faced climate shift and make recommendations for how such actions could become more effective.

The beginning and the completion of this work would have not been possible without the contributions of following group of people and individuals:

- The *Farmer Leaders and Representatives of the Farming Sectors* in the municipality whom supplied first hand information during focus group discussion sessions and in survey questionnaires necessary in substantiating and validating the official technical data generated from concerned government offices;
- The *20 Punong Barangays* in the municipality whose alliance and support on this particular project are unquestionable for the good of all the constituents;
- The Municipal Officials through the administration of *Honorable Mayor Reinario P. Rosales* with the able *Honorable Vice Mayor Alfonso Pal Yong, Sr***.** and to the supportive *Sangguniang Bayan Members* with unified stand to strongly support climate-related initiatives such as this and provide counterpart funds as equity;
- *Mr. Abel Wagas* of DA-RFU XIII who unselfishly provide climate information from the worldwide web and extend valuable assistance during the maps preparation with the Municipal Focal GTeam;
- The mentors of the UP- Los Banos namely: *Dr. Lansigan, Dr. Florece, Dr. Cruz, Dr. Zamora, Dr. Coladilla,* and others; for their presentations on the scenarios of climate globally and locally as well the technical expertise in cracking or formulating procedures for the V&A Assessment;
- The *GOP Partners* particularly from the *Regional and Provincial Offices of DTI and DOLE* who untiringly extend technical support during the mentoring sessions, conduct of the Farming Value Chain Analysis, focus group discussion with key informants and during the finalization of the writeshop;
- The technical people of *SUCCEED, INC.* namely: *Mr. Penpen Libres, Mr. Joey Gloria, Fidelina A. Valle and Mario Castillo,* who adeptly guided the Municipal Focal Team in series of write shop and in the finalization and packaging of the V&A outputs;
- And, to *Ms. Lurraine Baybay Villacorta*, the Project Manager of MDG-F 1656 Climate Change Adaptation Project, who shares vast knowledge and high level development work to transform the farming communities in Agusan del Norte of becoming more resilient to climate 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 Las Nieves 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 the 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.

Towards the end, the study will 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 Las Nieves 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 CCA Project. 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 of Las Nieves is located 42 kilometers south of Butuan City. It lays 9 degrees north latitude and 125 degrees 30 minutes east longitude of the northern part of Agusan del Norte. Its boundaries are: Butuan City to the north; Buenavista to the west; Esperanza, Agusan del Sur to the south; and, Sibagat, Agusan del Sur to the east. It can be reached by all kinds of land transportation through nearly-completed concrete national highway along Butuan City-Las Nieves-Esperanza Road, through a graveled road via Ilihan, Sibagat, Agusan del Sur –Marcos Calo National Secondary Road and can be accessed through a graveled Las Nieves-Maguinda-Butuan City Road.

Las Nieves is the largest municipality in the Province of Agusan del Norte. Composed of 21 barangays, it has a total land area of 58,269 hectares which is about 22.50% of the total area of the Province. The Comprehensive Land Use Plan 1998-2005 (CLUP) accounts forestry with the largest portion of its total land area with 27,944.41 hectares (48%), followed by grassland at 22,361.64 hectares (38%), and agricultural land at 7,833.84 (14%).

Approximately 9.8% of the municipality's total land area is in 0-3% slope category, located mostly in the eastern portion of the town where almost all barangays are situated. The western part of the municipality is made up of 18% up slope covering 60.44 percent of the whole area.

The huge Agusan River traverses the center of its growth area where the 19 barangays are located. It serves as the only all-weather means of transportation and natural drainage system.

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

Observed (2010) average daily rainfall showed heavy downpours (at 13.5 mm) on the period of October to December, daily average mean temperature at its peak in January and February (26°C), daily average of maximum temperature at 34.0°C in June, and daily average relative humidity is as high as 89% also during the month of January.

Las Nieves has a total population of 25,203 or only 8% of the total population of the province. Population density is about 37 persons per square kilometer [NSO, 2007] and most of the populace is situated in the central portion along the Agusan River. Its population growth rate is recorded at 2.26%/annum.

Poverty incidence in Las Nieves is widespread registered at 63.48% of households, 50.87% of the population with income below food threshold, and 15% that experienced food shortage (CBMS, 2008).

Corn is the major crop in the municipality, followed by rice. Corn production in the municipality covered 1,327 hectares involving 1, 288 farmers with an annual average total production of 14.34 MT. The average corn production per hectare is estimated at 3.8 MT to 4.5 MT. Rice is still the major staple food in Las Nieves. Rice farming forms a vital part in every household's income and employment. There are 1,114 hectares of rice areas with an annual average total production of 6,621 MT of palay. Of the total production area, only 300 hectares are irrigated while the remainder (814 hectares) as rain fed.

Inland fishery is another alternative source of livelihood among the fisher folks in the municipality. It is categorized into two which are: the inland culture and the inland capture. The inland culture involve tilapia and carp productions in earthen ponds. There are 138,275 square meters or 13.8 hectares of backyard fishponds in 17 barangays since 2000, with equivalent production of 14.543 MT of tilapia and carp.

There are two [2] communal irrigation project [CIP] and Small Water Impounding Projects (SWIP) servicing five barangays. Other post-harvest facilities established in the 20 barangays of Las Nieves include the multi-purpose drying pavement (MPDPs), mini-warehouses, grain centers and flat-bed dryers.

Trading and marketing, credit and financing are some supported services provided by the LGU.

Current Hazards and Observed Climate Change Impact

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

Flooding usually occurs annually during the months of December to early February. Prolonged rainy period or excessive rainfall in the upper parts of Agusan del Sur and Compostela Valley have greatly contributed immense volume of water in Agusan River. While rainwater and runoffs pour down from water tributaries in some areas of Las Nieves, also caused the river to overflow submerging communities near the banks and other low-lying areas.

There are ten (10) flood-prone barangays in the municipality, namely; Poblacion, Tinucuran, Malicato, Rosario, Katipunan, Pinana-an, Ambacon, E.G. Montilla, Maningalao and Lingayao. Heights of flood waters were registered at 3.2 meters to 6.4 meters.

During the flood in February 2006, 393.0 hectares of rice at its vegetative stage were submerged or 35% of the total rice area. Land preparation for corn production also usually

starts during this month. While all corn areas are very proximate to the huge Agusan River, the damaged of the impact of flooding on that period was still considered low.

During the 1999 flood, 100 of farmhouses were partially damaged in Barangays Tinucuran, Lingayao, Maningalao, Pinanaan, Ambacon, E.G. Montilla, San Isidro and Malicato. Moreover, 20 other houses were totally gone with the strong flood water.

Damage to infrastructure was mainly on the six (6) road networks during the prolonged rains in 2007-2008.

Las Nieves has dry months starting April, May, and August. Maximum temperatures during these months vary from 34.6 degrees Celcius to 35 degrees Celcius. The worst case in 1994 (El Nino Phenomenon) has made impacts for 8 months in the whole municipality. Dry spell was also experienced during the years 2002, 2003 and recently in 2009. The 15 rain fed rice areas and the whole corn areas are affected by long dry spell.

Adaptation Strategies

The most common adaptation strategies of the communities during flooding involved the information drive, setting of EWS, organized volunteer group for rescue, accessing financing from lending institutions. The LGU has constantly resorted to the utilization of calamity fund, early warning to the residents, accessing funds for production from regional agencies, provide counterpart funding for establishment of agricultural facilities, and distribution of certified seeds. On the part of the farmers were; replanting, adjustment of planting calendar, use of early maturing varieties, engage in backyard livestock and poultry production, and practice organic farming.

During drought, the communities were into accessing of credit and engage in paid labor. The LGU has sped up tree plantation drive (e.g. Fruits and other species). And, the farmers engaged in digging ponds as rain catchment, construct SWIP and adapt natural faming technology.

Current adaptation measures pursued are as follows: i) technical – practice of bio-dynamic farming, adjustment of planting schedule, use of early maturing varieties; ii) Physical/ Infrastructural – construction of post-harvest facilities such as multi-purpose drying pavements [MPDP], warehouses and grain centers; iii) Environmental – protection of creeks (e.g. Lingayao), sped up tree plantation project, establishment of dump site; iv) others – engage in paid labor, farm diversification, and accessing of credit.

Identified gaps in the adaptation strategies include adequate financial support, establishment of automatic weather station, monitoring and early warning systems, Integrated and coordinated approaches, widespread climate change information drive, and development of funding policies and schemes suited to the conditions of the poor.

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 Las Nieves for the year 2020 was: Scenario 1 with Low, scenario 2 as Low, and scenario 3 as Moderate. 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: a) Physical/ infrastructural – access to irrigation facilities; b) Economic - access to emergency farm financial funds and insurance, social and financial assistance, expansion and strengthening of rural based organizations, and provision of pre and post harvest facilities and farm inputs (i.e. organic fertilizers and seeds); c) Technological – acquisition of Automatic Weather Station (AWS) and Early Warning Systems (EWS), and campaign to shift to organic agriculture; d) Political/Institutional – closer and constant coordination of different departments, integration of approaches and information drive on climatic alterations.

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 Las Nieves, 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

Las Nieves was formerly named "Pinana-an", meaning a place for hunting, by its early inhabitants. The native or Manonos with their bows and arrows ("Pana") went to Pinana-an to catch wild pigs, birds and other animals, the baseline survey stated.

At night time, the inhabitants shiver from intense coldness of the area. On early mornings, thick fogs and dews blanket the whole place as if ice were constantly and silently falling upon the inhabitants. Because of this, the name "Pinana-an" was changed by the new inhabitants into "Las Nieves" which means ice, the same document added.

1.1. BIOPHYSICAL CHARACTERIZATION

1.1.1. Location and Topography

Location

The municipality of Las Nieves is located 42 kilometers south of Butuan City. It can be reached by all kind of land transportation through nearly-completed concrete Butuan City-Las Nieves-Esperanza Road, through a graveled road via Ilihan, Sibagat, Agusan del Sur –Marcos Calo National Secondary Road and can be accessed through a graveled Las Nieves-Maguinda-Butuan City Road. It lays 9 degrees north latitude and 125 degrees 30 minutes east longitude of the northern part of Agusan del Norte. Its boundaries are Butuan City to the north; Buenavista to the west; Esperanza, Agusan del Sur to the south; Sibagat, Agusan del Sur to the east. *(Please see Annex A1, Location Map,)*

Land Area and Land Use Patterns

Las Nieves is the largest municipality in the Province of Agusan del Norte. It has a total land area of 58,269 hectares which is about 22.50% of the total area of the Province. The urban area covers 0.09% of the total land area while the rural occupies 99.91%. It has some 3,204 hectares in A&D lands constituting 11% of the province's over-all land area while 53,066 are forestlands or 33% of the Province's total size.

The Comprehensive Land Use Plan 1998-2005 (CLUP) accounts forestry with the largest portion of its total land area with 27,944.41 hectares (48%), followed by grassland at 22,361.64 hectares (38%), and agricultural land at 7,833.84 (14%).

It has a topography made up of flat and rolling lands without big mountain ranges.

1.1.2. Geology

Soils

Figure 1: Land Utilization of Las Nieves

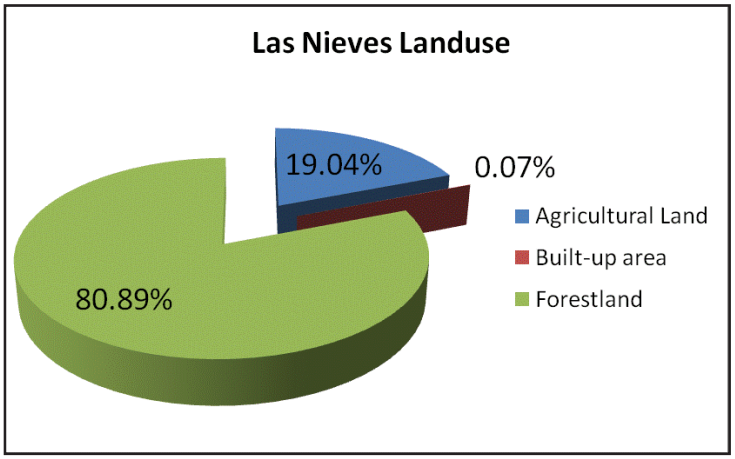


Table 1**: Percentage Distribution of Soil type of Las Nieves and the Province of Agusan del Norte**

Type of Soil	Las Nieves	Agusan del Norte
Clay	-	0.80
Loam	1.96	10.67
Clay Loam	20.16	32.92
Silt Loam	-	19.27
Hydrozol	-	2.13
Others (mountain soils, etc.)	77.88	34.20
TOTAL	100.00	100.00

Source: Municipal Socio-Economic Profile

Soils in Las Nieves are classified generally into Camansa Clay Loam, San Manuel Clay Loam, and Mountain Soils. These types are suitable to banana, forest tree, fruit tree, corn, lowland and upland rice, vegetable, rubber and etc.

The table 1 above shows the distribution of soils in the municipality with 20.16% of Las Nieves area consists of Clay Loam where production areas of corn and rice are found. It has a 1.96% Loam soiled areas. The mountain soils cover 77% of the total land area.

San Manuel clay loam soils are found in Barangays Lingayao, Pinana-an, Ambacon, EG. Montilla, parts of Maningalao, and some areas of Mat-i. Camanza clay loam stretches in Barangays Tinucuran, Malicato, Poblacion, Katipunan, Bonifacio, Marcos Calo, San Isidro, Rosario, San Roque, Casiklan, Durian, Ibuan, Balungagan, Maningalao, Consorcia and Mat-i. Mountain soil spreads in areas of Barangay Lawan-lawan. *(Please see Annex A2: Soil Map)*

Slope

Based on Agusan del Norte Profile 1995 Edition, to data of which were taken from the Agusan River Basin Area Development Study, approximately 9.8% of the municipality's total land area is in 0-3% slope category. This is located mostly in the eastern portion of the town where almost all barangays are situated. The western part of the municipality is made up of 18% up slope covering 60.44 percent of the whole area.

It is also noted that the area percentage in the 18 degrees and above category,

Table 2 **Slope Classification and Size: Las Nieves Municipality, 1995**

Slope	Las Nieves	
	Area [has.]	% of Land Area
0-3%	5,765	9.8%
3-8%	7,408	12.71%
8-18%	9,994	17.15%
18-30%	18,157	31.16%
30-50%	7,156	13.36%
50 and above	9,159	15.72%
Miscellaneous	-	-
Total	58,269	100%

Sources: Agusan River Basin Area Development Study, Agusan del Norte
Comprehensive Land Use Plan of Las Nieves [1998-2005]

has 24.545% [14,295.22 ha.] of its total land area as highly susceptible to erosion; 28.07% [16,353.90 has.] moderately susceptible; and 36.80% [21,441.78 has.] slightly susceptible. Only 10.60% [6,178 has.] is not susceptible to erosion. *(Please see Annex A3: Slope Map)*

Elevation

Elevation levels in Las Nieves are varying. It has 0-3% slope category which covers Barangays Lingayao, Maningalao, Pinana-an, Mat-i, Ambacon, Ambacon, EG. Montilla, Malicato, Katipunan. Except for barangay Katipunan, the other barangays are situated along the huge Agusan River. Other barangays, namely: Rosario, San Roque, Ambacon, parts of Lingayao, portion of Maningalao, Consorcia and some areas of Mat-i falls under 3-8% category. Areas with 8-18% slope category are found in Bonifacio, some parts of Marcos Calo and portions of San Roque, other points of Mat-i and upper places of Consorcia, Casiklan, and Durian as well as in Lawan-lawan. 18-30% slope category is found in areas of Ibuan, Casiklan and numerously at Lawan-lawan. 30-50% slope category covers in Barangays Ibuan and Lawan-lawan. (*Please see Annex A 8: Elevation Map*)

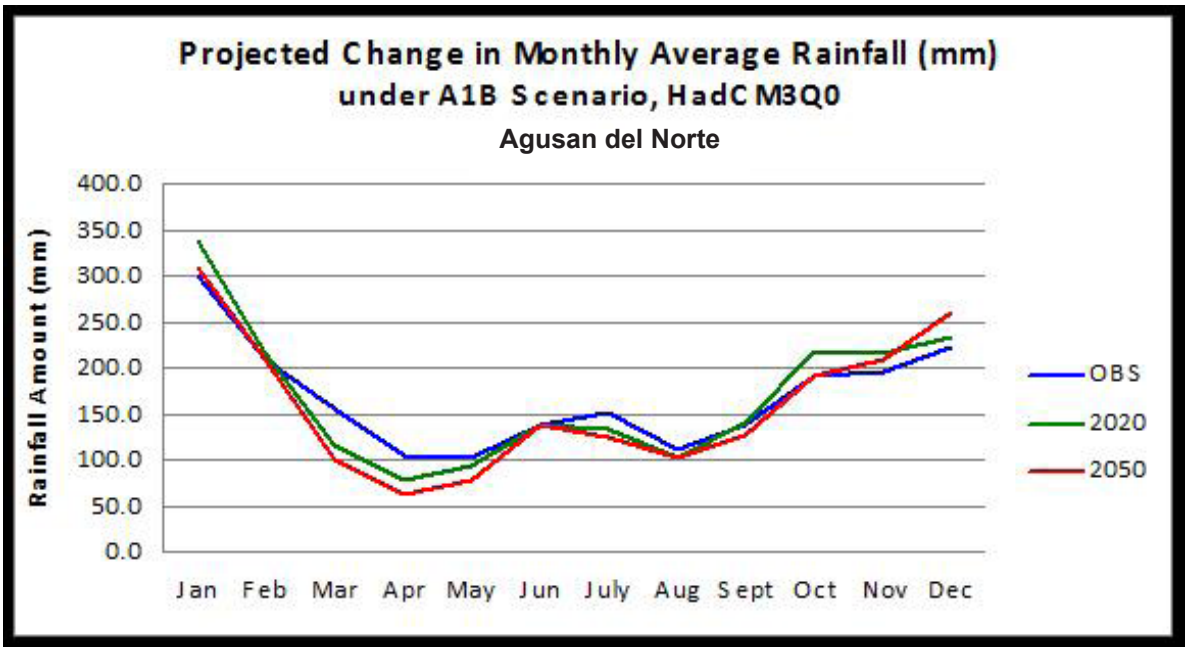
Drainage, River System and Body System

The huge Agusan River traverses the center of its growth area where the 19 barangays are located. It serves as the only all-weather means of transportation and natural drainage system. *(Please see Annex A 4: River Systems).*

Climate and Rainfall Patterns

The prevailing type of climate is typical to all municipalities in Agusan del Norte. This is the Type IV of climate with evenly distributed rainfall (Please see monthly mean rainfall).

Figure 2: Projected Monthly Average Rainfall,



Source: PAGASA, Butuan Office

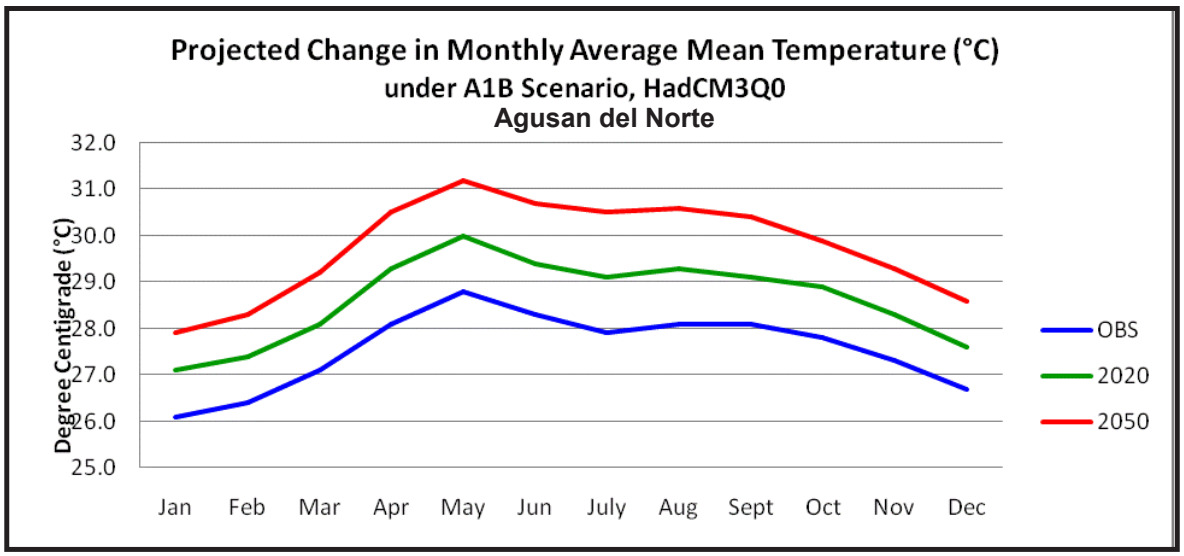
Based on observed data from PAGASA-Butuan Station, rainy months are October, November, December, January and February. The 1971-2000 data from PAGASA revealed that monthly mean on rainfall are higher at 6.3 mm, 6.4 mm, 7.0 mm, 9.9 mm, 7.6, respectively. The trend of this historical data is captured in the graph above. The frequency and excessive amounts of rain has resulted to the rise of water level of Agusan River that causes flooding in Las Nieves.

Moreover, the same agency said that April to September are warm months with 28.1ºC – 28.8 ºC. Both table and graph herein similarly trace the trends of monthly mean temperatures for Agusan del Norte, that is also true to Las Nieves. (Please see Monthly mean temperature).

Cyclones

The figure from PAGASA describes the pathways of cyclones that crossed the province of Agusan del Norte from the year 1948-2009. The pink legend corresponds that Las Nieves is constantly hit by tropical cyclones and typhoons. *(Please see Annex A6: Tracks of Tropical Cyclone)*.

Figure 3: Monthly Average Mean temperature



Source: PAGASA, Butuan Office

1.2. SOCIO-ECONOMIC PROFILE

1.2.1. Demographics: Population Size, Density, Urban-Rural Distribution

Population and Number of Households

The 2007 Census of Population showed that Las Nieves has a total population of 25,203 or 8% of the total population of the province. Of the 21 barangays of Las Nieves, Poblacion is considered as the urban barangay where 1,240 people reside, from 241 households. The remaining 20 barangays populated by 23,963 people constitute the rural barangays. With these characteristic, it can be said that Las Nieves is predominantly rural. The most populated barangay of Las Nieves is brgy. Lingayao with 2,039 residents. The high population of the barangay is attributed to its favorably irrigated rice production areas. The least populated barangay is Lawan-lawan with only 396 residents. The average household size in the municipality was 5.14. *(Please see Annex B6)*.

Population density is about 37 persons per square kilometer [NSO, 2007]. Most of the populace is situated in the central portion along the Agusan River particularly the ten (10) Barangays of Lingayao, Maningalao, Mat-i, Pinana-an, Ambacon, E.G. Montilla, Tinucuran, Poblacion, Malicato and San Isidro. These barangays are major production areas of both corn and rice where most of the people source out their income as farm owners, tenants, leasee, on-call farm workers, and the likes. *(Please see Annex A 5: Population Map)*

Projected Population Changes

The municipality has 2.26% annual growth rate, whereby its population of 25,203 in 2007 is estimated to increase to 30,137 by year 2020 and 50,921 in 2050.

1.2.2. Income and Poverty Incidence

The 2008 Community-Based Management System (CBMS) - Agusan del Norte revealed that there was widespread poverty incidence in Las Nieves, with 63.48% of poverty incidence 50.87% of the population with income below food threshold, and 15% that experienced food shortage. *(Please Annex B 5: Summary of CBMS Core Indicators, p.67).*

Income

In the lone urban barangay- Poblacion, households with income below poverty thresholds are at 37.3% , households below the food threshold are at 26.1%, and 22% of the households are experiencing food shortage.

Out of the total percentage of households in 20 rural barangays, 67% of the households have income below the food threshold. The highest incidence of it is found in Barangay Lawan-lawan at 97.1%, followed by Barangay Ibuan at 90.5%.

There are also 2,047 households with income below the food threshold wherein the highest incidence is recorded in Barangay Lawan-lawan [91.4% of its households], followed by Barangay Ibuan [89.3%].

A total of 567 households experienced food shortage wherein Barangay San Isidro has the highest while Barangay Katipunan follows at 45.8% and 44.3% respectively.

Housing, Water and Sanitation

Only 0.4% of the total households in Poblacion live in makeshift houses and 0.8% of all the households have no access to safe water supply.

Makeshift housing is commonly found in rural barangays such as E.G. Montilla and Tinucuran, 32.6% and 30.8%, respectively, of the total 255. There are 85 households inhabited by informal settlers, and most of them can be found [20.3%] in Barangay Rosario. Some 929 households also in the rural barangays have no access to safe potable water particularly in Lawan-Lawan with 100%, San Roque at 89% and San Isidro at 84%.

Of the 665 households without sanitary facilities, Barangay San Roque has the highest incidence at 65.7%.

Health and Nutrition

There are no recorded cases of malnourished children among 0-5 years old as well as maternal deaths in the Poblacion. However, there was one [1] reported incident of child death among 0-1 year old.

In rural areas, 51 cases of malnourished children among the age group of 0-5 years are distributed in Barangays: San Isidro, Maningalao, and Casiklan. Cases of child deaths aged 0-1 year old had the highest level in Barangay Katipunan at 17.2%. While maternal deaths are only found in Barangays: Malicato and Consorcia, at 2.8% and 2.7, respectively.

Education

In Poblacion, the reported incidence of children not attending elementary school is 24% for children among age group of 6-12 years old; 29.6% for 13-16 years old and 7.9% with 6-16 years old.

In rural barangays, the number of children among age group 6-12 years old who are not attending elementary school is higher at 970. Most of them came from San Roque, 37.2%, and Lawan-lawan followed at 30.9%.

While children among age group of 13-16 years of ages who are not attending high school is very high in Malicato at 88.6% and 82.2% at Lawan-lawan. The number of children within ages 6-16 years old not attending school is 1,064 and most of them can be found in Malicato, Lawan-lawan and Pinana-an.

1.2.3. Agricultural Production System

Farming is the main economic activity among the residents of Las Nieves. Income derived from farms significantly comes from corn and rice farming.

Crop Production

Corn remains a secondary staple food next to rice. It is grown in all barangays in the municipality. The Department of Agriculture-Regional Field Unit XIII identifies Las Nieves as one of the Corn Cluster Areas in Caraga Region considering its potential lands.

Corn production in the municipality covered 1,327 hectares involving 1,288 farmers, with an annual average total production of 14.34 MT. The average corn production per hectare is estimated at 3.8 MT to 4.5 MT. *(Please see Annex B8: Summary of Production of Corn)*.

From the usual way of farming native corn, improve breeds of corn such as hybrid yellow and hybrid white varieties are now introduced either in subsidies or 50-50 schemes. Farmers through associations availed of pre and post-harvest equipments and facilities like farm tractors, corn shellers and village-type corn processing center.

Mono-cropping system and corn-squash rotation are the usual farmer's practice in the area. High-input production is also common using commercial and inorganic inputs. Though, some farmers have shifted to

Figure 4: A farmer drying hybrid yellow corn from Brgy. San Isidro, Las Nieves

Figure 5: Rain-fed Rice Area at Brgy. Malicato, Las Nieves

organic way of producing corn.

Maximum volumes of corns are produced in Barangays E.G. Montilla, Tinucuran and Pinana-an. Barangay Rosario has the least production throughout the 10 year period. *(Please see Annex B8: Summary of Production of Corn)*.

Rice Production

Rice is still the major staple food in Las Nieves. It forms a vital part to rice farming in every household's income and employment. There are 1,114 hectares of rice areas with an anuual averarage total production of 6,621 MT of palay . Of the total production area, only 300 hectares are irrigated while the remainder is rainfall-dependent. Rice is planted twice a year, known to local dialect as "panu-ig"- which on record has more harvest, and "pangulilang"- the make-or-break crop cycle for rain-fed areas. *(Please see Annex B9)*.

Rice farmers have an average palay production of about 2.9 MT per hectare. This translates to an average income of about P 24,840.00 per farmer, depending on the prevailing market price of palay at the time of harvest.

Farmers usually market 75-80% of net palay produced and the remaining is for food reserve [FGD Results]. Over the last two decades, production level of rice has met the attainable volumes per hectare. But with a rising population, it needs to be increased despite the limited options for expanding the irrigated areas.

Barangay Lingayao is the major producer of rice because most of its areas are irrigated. Second on the list is Barangay Rosario because of its wider areas but most rice areas in this is rain-fed. Others on the tables are the rainfall dependent areas very susceptible to increase of rainfall and lowering of rainfall. (*Pls. see Annex B9)*

Hopes for rice sufficiency in Las Nieves will be made possible through investment of agriculture: exploration of surface waters in the uplands for irrigation purposes, construction of new and rehabilitation of old small farm reservoir.

1.2.4. Livestock and Poultry Production

Livestock and poultry production in the municipality come in the backyard or home lot production. This is another source of farm income of farmers and is commonly

found in all barangays.

Population of large animals [e.g. cattle and carabao] has increased overtime due to some government projects such as Community-Based Resource Management Project [CBRMP] and Mindanao Rural Development Project. Goat production is seen as promising and already being integrated in farming systems specifically in coco areas, fruit trees and falcata plantation.

As to swine, one to two sow-level is the most manageable level in the area. Improvement of backyard hogs is brought to shifting of farmers' preference to improved breeds because of production efficiency and better economic return. The native swine are also common to traditional raisers purposely for household consumption.

Backyard native chicken production is still very evident and a good farm income earner. Native chicken is still commonly used for free-range production because of its higher resistance to shifting weather condition.

1.2.5. Production losses, causes and actions

One of the major contributory factors of production losses is unpredictable weather especially during harvest period of either rice or corn. Coupled with inadequate post-harvest facilities, farm produce had resulted to lesser volume and inferior quality. (*Please see Annex B 14).*

Implementation of small support infrastructure projects co-financed by the municipal government, DA-RFU XIII and World Bank are the recent initiatives to address the problem. Other support services from the municipal and provincial government, Department of Agriculture Regional Field Unit-XIII, Agricultural Training Institute-Caraga are likewise provided. Some of these are certified seeds distribution, organic fertilizers production and management, and technology trainings, among others.

Clamors for reforms among farmers still resounds in the country side because of the escalating costs of fertilizers, seeds, transportation costs, financial/ capital difficulties, unstable market and most of all, the changing climatic environment. These are making farmers less self-reliant as net farm income is not constantly achieved, the FGD revealed.

Focus Group Discussion attended by 22 KI responses reported that they have experienced a decrease in production over the past five years. Others, with a frequency of 7 responses, indicated that production trend is fluctuating over the past five years.

Decrease in harvest is attributed to the climatic changes that have caused adverse effects in their farms, with 96% of the KI responses. Other responses, with 79%, attributed the decrease to lack of finances or capital for the provision of farm inputs and/or farm supplies. Others reported that it was due to lack of marketing strategies and assistance and lack of proper knowledge on appropriate technology with each having 3% of the responses.

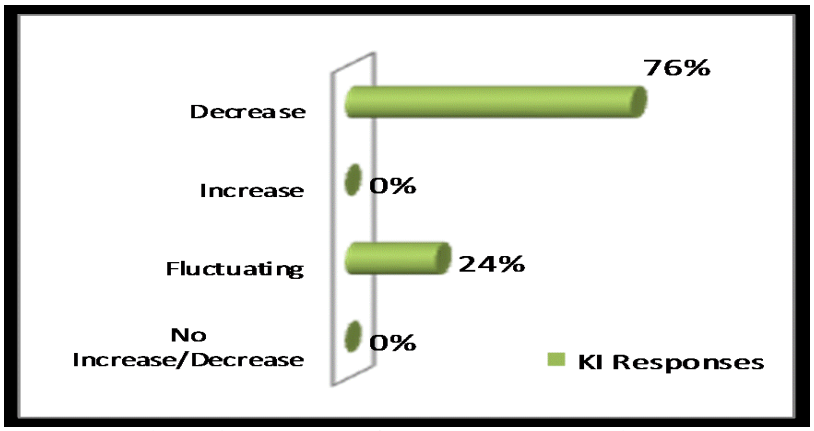


Figure 6: Percentage of Responses on Production Trend

The FGD discussion output also showed that the production trend for rice in the municipality is decreasing for the past five years. This was due to changing weather conditions/climatic changes and farmers' lack of training.

Moreover, the mono-cropping system of corn as well as rice-rice production systems forms part of the day-to-day living of the people. Thus, these farm systems limit the diversification of sources of income in the locality.

1.2.6. Fisheries Production

Inland fishery is another alternative source of livelihood among the fisher folks in the municipality. It is categorized into two, namely: the inland culture and the inland capture. The inland culture involves Tilapia and Carp productions in earthen ponds. There are 138,275 square meters or 13.8 hectares of backyard fishponds in 17 barangays since 2000. This accounts 14.543 MT of tilapia and carp produced which has a monetary value at P 581,720.00. On the other hand, inland capture involves the gathering of fish, freshwater crustaceans and other species in Agusan River using the allowed fishing gears of Bureau of Freshwater Fisheries and Aquatic Resources. Estimates of caught fish and other species in Agusan River are at least 2.5 MT which has a value of P 125,000.00. A fisherman is estimated to have 50 kg caught fish a year.

There are available supports for fisheries development in the municipality. These are in the form of tilapia and carp fingerlings distribution to backyard fish growers, trainings for fish productions either in ponds or cages and regulatory services which centers on activities prohibiting any form of illegal fishing in the area. Planned project to support the inland capture sector is livelihood assistance to procure, construct, operate and manage fishing gears in Agusan River. *(Please see Annex B9: Fish Production, p.76)*

1.2.7. Commerce and Trade

The National Food Authority [NFA], wholesalers and retailers in Butuan City are the major markets of rice and corn surplus of farmers in Las Nieves. Other farmers deliver their agriculture goods in Bayugan City and in Esperanza, Agusan del Sur considering farm-to-market location. With an end in view of cutting post-production costs, some farmers resort to deal newly harvested palay and corn to middlemen operating within the municipality. An inventory of market enablers are cited in the following table based on the Focus Group Discussion (FGD) of Farming Value Chain Analysis (FVCA) spearheaded by the Department of Trade and Industry.

1.2.8. Livelihood

Result of Focus Group Discussion reveals that all of the key informants ascribed

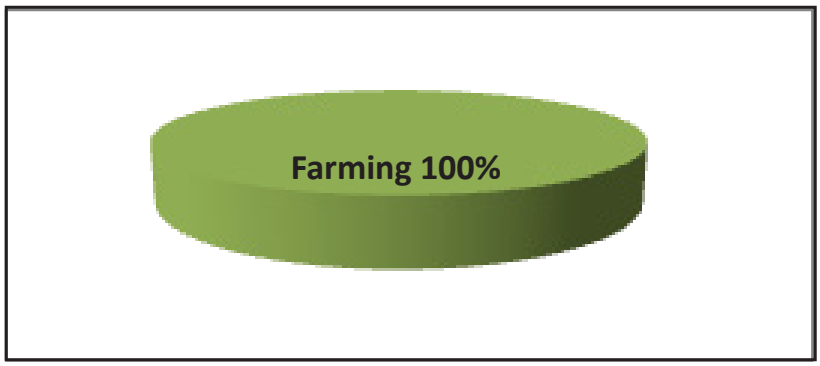


Figure 7: Proportion of Informants' Major Source of Income

farming as main source of income from producing rice, corn, coconut, banana and others.

The main livelihood of Las Nieves is agricultural farming with 100% coverage as emanated from BSG KI consolidated results.

1.3 INSTITUTIONAL PROFILE

1.3.1. Infrastructure

As of 2010, Las Nieves has an improving state of physical infrastructure. The Butuan City- Las Nieves- Esperanza Road Concreting Project is more than 50% complete which will improve efficient movement of goods and people particularly in the western side of Las Nieves. There is also an on-going rehabilitation project via Butuan City- Bilay-Maguindai, Las Nieves Road which speeds up travel time in the eastern side.

Other agriculture facilities

Post-harvest facilities established in the 20 barangays of Las Nieves include the multi-purpose drying pavement (MPDPs), mini-warehouses, grain centers and flat-bed dryers.

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Communication

At present, the municipality has been able to cope with the modern information technology. Smart and Globe relay stations are available in the area, as well as the mobile phones for individual users.

However, hand-held radios and radio phone telecommunication equipment are still connected to the provincial and municipal governments of Agusan del Norte, Agusan del Sur and to other places such Tandag, Surigao del Sur transmitting incoming and outgoing messages.

Power

The municipality is serviced by Agusan del Norte Electric Cooperative [ANECO] as its source of electricity, specifically the western-side barangays are powered by the Libertad Sub-Station while the Ampayon Sub-Station distributes power to the east-bound barangays because the municipality is traversed by the huge Agusan River.

Water Supply/Irrigation System

Seven [7] barangays in Las Nieves have Level 3 Water System, these are located in the following areas: Poblacion, Tinucuran, Lingayao, Casiklan, Durian, Ibuan and Pinana-an. Twelve [12] barangays are serviced by Level 2 Water Systems. And the remaining barangay San Roque uses rain water collector as source of potable water and dug wells along Agusan River for the residents' other domestic uses.

Community-based waterworks/ water systems organizations are functional in the following barangays with their respective organizations, namely:

- Durian-Ibuan-Casiklan Water System Association [DICAWASA];
- Katipunan-Malicato Water System Association;
- Las Nieves Poblacion Rural Water Works Association [LAPRUWASA];
- Tinucuran Water Works Association;
- Marcos Calo Water Works Association;
- Bonifacio Water System Association;
- Ambacon Water Works Association;
- E.G. Montilla Water System Association;
- Pinana-an Water Works Association.
- Lingayao Water Works Association;
- Balungagan Water System Association;
- Consorcia Water Works Association;
- Mat-I Water System Association.

There are three [3] existing irrigation facilities classified as communal irrigation system [CIS] such as the Lingayao CIS, Maningalao CIS and Mat-i-Ambacon-Pinanaan Agrarian Reform Community; however the latter is still an on-going work. Others are classified as Small Water Impounding Projects [SWIP] situated in barangays: Maningalao, Mat-i and Ambacon.

The rest are using Shallow Tube Well [STW] as source of irrigation.

Building/Shelter

The government offices such as the municipal building, municipal police station and NFA municipal grain center are the structures considered within the building category. Moreover, 88.8% of the housing units are made up of mixed materials while the remaining 11.2% are made up of semi-concrete residential houses.

1.3.2. Support Services

Trading and Marketing

For fast moving marketing and trading, the Department of Agrarian Reform-Provincial Office [DARPO] established a business area in Butuan City called AIM-Center where individual farmers and their organizations (or cooperatives) could display their harvested farm produce, value-added or processed products (e.g. rice, corn, handicrafts, processed foods and others). In the same manner, the local government had investments for mini-market construction which today used as trading center during designated days of the week, known as "*Tabu"*. There are also designated places within the barangay site for block tiendas where private operators set up stores, snack goodies, refreshments and even used clothing (*ukay-ukay)*.

Credit and Financing

The result of the Focus Group Discussion (FGD) conducted revealed that 52% of the cumulative responses show that the farmers were adversely affected by the climatic changes and in order to cope with their finances they have resorted to avail loans to support their livelihood (farm lots) and the needs of their respective families.

The municipality at present has no formal financing institution such as banks and other forms. Thereby farmers are forced to avail of the loans with high interest rates from other lending institutions and private individuals, termed as village rotation loan (palanguy).

Other responses, with 13%, show that farmers borrow from friends and/or relatives during times they have no income.

Indicative of the FGD output, farmers coped with the adverse effects of climatic changes to their agricultural production by engaging in other alternative livelihood activities such as planting vegetables, paid labor outside the municipality, livestock raising as well as lending some basic goods from sari-sari stores and borrowing from banks.

The municipal government thru its previous World Bank-assisted project had downloaded surplus funds to the partner-associations to start its micro-financing projects with lower interest rates. Such of these associations were Consorcia Agro-Forestry Farmers Association (CAFA) and Marcos Calo Agro-Forestry Farmers Association (MACAFA) which later became Marcos Calo Farmers Multipurpose Cooperative. Both associations have good financial condition as per audit report of the Municipal Roving Bookkeeper.

2

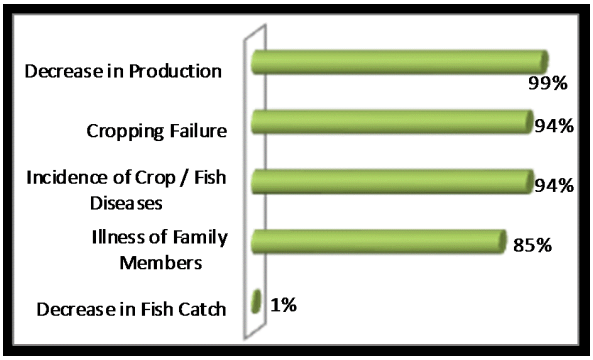
CURRENT HAZARDS AND OBSERVED CLIMATE CHANGE IMPACTS

2. CURRENT HAZARDS AND OBSERVED CLIMATE CHANGE IMPACTS

2.1 SOURCES AND TYPES

For several years, Las Nieves has experienced floodings and droughts that greatly affected agriculture, damaged infrastructure and deteriorated the health condition of the vulnerable sectors.

Figure 8: Percentage of Responses on the Observed Effects of Climatic Changes in the Municipality



Source: KI & General Poll Results

2.1.1. Floods

This event usually occurs annually during the months of December to early February. The prolonged rainy period and excessive rainfall in the upper parts of Agusan del Sur and Compostela Valley have greatly contributed immense volume of water in Agusan River. Moreover, runoffs that pour down from water tributaries in some areas of Las Nieves, also caused the river to overflow submerging communities near the banks and other low-lying areas.

With continuous rains, there is high possibility of flash floods in small upstream water tributaries, such as Pangamangan Creek, Malicato Creek, Marcos Calo Creek, Lingayao River and Magus River.

The flood-prone barangays in the municipality include the Poblacion, Tinucuran, Malicato, Rosario, Katipunan, Pinana-an, Ambacon, E.G. Montilla, Maningalao and Lingayao. *(Please see Annex B 14)*.

Accounts from Key Informants and records from Local Government Unit showed that flood visited Las Nieves in the years 1998, 1999, 2001, 2007 and 2008. Heights of flood waters were registered at 3.2 meters to 6.4 meters.

2.1.2. Droughts

Las Nieves has dry months within April, May, and August. Maximum temperatures during these months vary from 34.6 degrees Celcius to 35 degrees Celcius. The worst case was in 1994, as El Nino Phenomenon made devastating impact in the municipality for 8 months.

Experienced dry periods was also recorded in the years 2002, 2003 and most recently in 2009, which warmed the 21 barangays and caught people unprepared.

2.2. PLACE AND TIME OF OCCURRENCE

The municipality's rainy season starts during December ranging from rains-shower to heavy down-pour. January had the frequent rain as well the month of February. Rains are occasionally localized from one barangay to its two adjacent places. Widespread raining in the entire municipality from the uplands to the low-lying land creates excess volume of rains which further settle down the Agusan River and thus flood occurs. There are 10 flood-prone barangays namely: Poblacion, Tinucuran, Malicato, Rosario, Katipunan, Pinana-an, Ambacon, E.G. Montilla, Maningalao and Lingayao. In contrast, March, April, May, August and September are the dry months in the area. The 15 rice producing barangays are much affected, much more to the rain-fed areas.

2.3. IMPACTS (EXTENT/DEGREE)

Observed effects of climatic changes in the municipality per percentage of the cumulative responses from KI and GP results showed that it generally led to decrease in production with 99%. Others also reported that changes in the climatic patterns have led to cropping failure and increase incidence of crop/fish diseases, with each having 94% of the responses, that further led to decrease in harvest and fish catch. Some 85% of the responses ascribed illness of family members to the changing climatic conditions, while one percent of the responses indicated that it led to decrease in fish catch.

2.3.1. Damage to Crops

Production areas of rice are highly vulnerable as water from Agusan River rises from its normal level while areas near from small water tributaries upstream are also prone to flashfloods.

The municipality has 1,114 hectares of rain-fed and irrigated rice areas. During the flood in February 2006, 393.0 hectares of rice at its vegetative stage were submerged (or 35% of the total rice area. On the other hand). Land preparation for corn production usually starts during this month. While all corn areas which are very proximate to the huge Agusan River were flooded, the impact of damaged was considered low.

2.3.2. Damage to Livestock

There is minimal damage as to population of livestock due to drought and

Figure 9: A stunted growth of rice in one of the farms in Brgy. Katipunan due to prolonged dry period (April 2009)

flooding. But the indirect effects brought about by these environmental disturbances were manifested in animal health condition. Invasive diseases such as SURRA nearly eliminated the bovine, and porcine population of the municipality. It reached at alarming level, such that the Provincial Veterinary Office – Agusan del Norte, Department of Agriculture- Regional Field Unit XIII and the experts of University of Southern Mindanao [USM] came full force to observe and inspect the contaminated areas. Avian-related diseases are also very common during and after every flooding incident.

2.3.3. Damage to Property

Farmlands in riverbanks are inundated by heavy currents causing it to collapse and scoured, slowly decreasing farm production in many areas. New soil compositions from mud and silts are integrated in the corn areas. Destructive currents also wrecked residential and farm houses. During the 1999 flood, a hundred (100) farmhouses were partially damaged in Barangays Tinucuran, Lingayao, Maningalao, Pinanaan, Ambacon, E.G. Montilla, San Isidro and Malicato. Another twenty (20) houses were totally flashed out with strong flood water.

2.3.4. Loss of Life

One [1] casualty was reported in 2009. A corn farmer in Barangay Pinanaan suffered heat stroke and died brought about the warm months.

2.3.5. Damage to Infrastructure

Prolonged rainy season in 2007 to 2008 caused heavy damage to road networks. The graveled municipal and barangay roads became cumbersome:

- Poblacion- Barangay Marcos Calo-Sibagat Road;
- Poblacion- Barangay San Roque Road;
- Barangay Bonifacio – Barangay Marcos Calo Road;
- Barangay Mat-i- Barangay E.G. Montilla Road;
- Barangay Lingayao – Barangay Casiklan Road;

During this period transport of farm produce to Butuan City was delayed and was very difficult. Many farmers specifically in barangays Casiklan, Ibuan, Durian and Balungagan opted to stop momentarily their retailing of marang, rootcrops, lakatan, firewood, bamboo poles and other products. Prices of consumer products in stores in Las Nieves also increased.

A box culvert was also reported damaged in Barangay Ambacon which caused difficulties during travel of commuters and transport of rice and corn produce.

Figure 10: Flood completely submerging one of the corn farm at Barangay Pinanaan (Jan 2008).

3 ADAPTATION STRATEGIES

3. ADAPTATION STRATEGIES

3.1. PAST ADAPATATION STRATEGIES

The most common adaptation strategies of the communities during flooding involved the information drive, setting of EWS, organized volunteer group for rescue, accessing financing from lending institutions. The LGU has constantly resorted to the utilization of calamity fund, ensuring early warning to the residents, accessing funds for production from regional agencies, provide counterpart funding for establishment of agricultural facilities, and distribution of certified seeds. On the part of the farmers were; replanting, adjustment of planting calendar, use of early maturing varieties, engage in backyard livestock and poultry production, and practice organic farming. The LGU has sped up tree plantation drive (e.g. fruits and other species).

BOX 1. DEFINITION: ADAPTATION

Adaptation is the adjustment in natural or human systems in response to actual or expected climatic change or their effects, to reduce harm or exploit beneficial opportunities. Adaptation involves changing processes, practices or structures, either automatic or planned, by individuals, households, governments and stakeholders. The capacity to adapt depends largely on access to assets [including natural resources and human, technological, social, physical and financial capital] and how well these are used.
Source: Oriandi and Zakieldeen, 2006.

During drought, past adaptation strategies of the communities were into accessing of credit and engaged in paid labor. And, the farmers had engaged in digging ponds as rain catchment, construct SWIP and adapt natural faming technology.

Figure 11: Farmers using BIO-N inoculant before planting hybrid corn in Brgy. San Isidro (2008).

3.2. CURRENT ADAPTATION STRATEGIES

3.2.1. Technical Adaptation

There have been observed technical adaptation activities of farmers as they continue to grow corn and rice for their livelihood. These adaptations were acquired practices and were regularly applied. Some of these are:

a) Farmers engaged in bio-dynamic farming methods. One of this is the use of BIO-N seed inoculants to enhance germination. Corn farmers in San Isidro, Malicato and Pinana-an inoculate seeds prior to planting which gave significant results.

b) Planting schedules with reference to the lunar cycle is widely accepted and practiced, which farmers observed it resulted to minimal crop infestations.

c) Farmers calculate seasonality of rain and time of flooding. Corn farmers are very observant to flooding scenario to save money and time. For example, planting of corn is done after water levels of Agusan River is back to its normal state.

d) While farmers adjust planting schedules, some of them already use early maturing varieties of rice in order to minimize pests.

Development intervention and institutional support of Social Action Center-Diocese of Butuan helped capacitate farmers of producing rice through organic methods using the pest-resistant lines of MASIPAG. Farmers also learned from demonstration farms set up in Barangays Lingayao, Ambacon, E.G. Montilla, Bonifacio, Rosario, Katipunan and Malicato.

3.2.2. Physical/ Infrastructural Adaptation

Farmers spend extra money to dig wide pits or ponds which serves as catchments for rainwater and run-offs used as irrigation during dry period of the year. Farmers found it very efficient during the dry months of 2009.

Rice farmers maximized and utilized of small water impounding projects [SWIP] as source of irrigation to rain-fed rice areas during dry period.

The municipal government's investment of post-harvest facilities such as multi-purpose drying pavements [MPDP], warehouses and grain centers partly address the needs of farmers for post-harvest facilities.

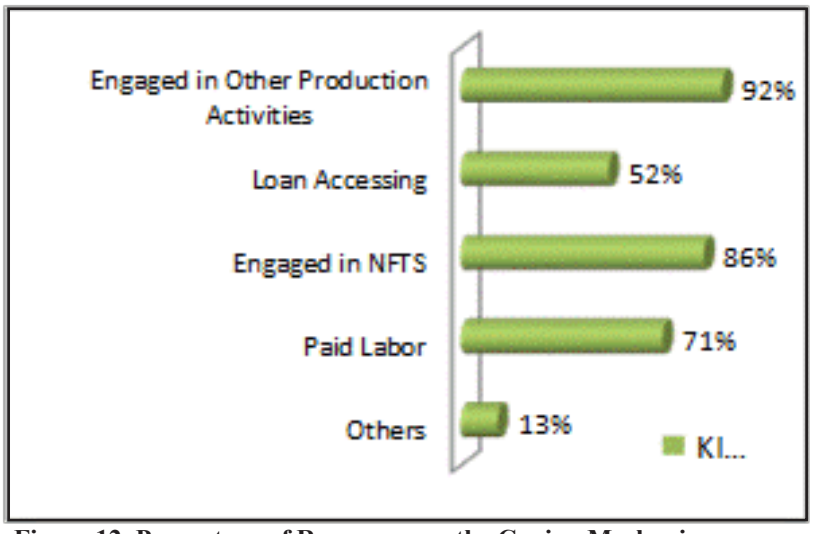


Figure 12 Percentage of Responses on the Coping Mechanisms Employed by Households

3.2.3. Environmental Adaptation

The LGU has identified and established a watershed area in Barangay Casiklan to preserve Lingayao Creek - the major source of Lingayao Irrigation Dam. On-going and continued efforts for planting of fruit trees and others species are undertaken.

The municipal government has also sped-up the tree plantation drive in the barangays through the Municipal Environment Office. LGU workers were deployed to set-up nursery for fruit trees and other tree species for propagation.

A controlled dump site in Barangay Bonifacio was established.

3.2.4. Other Adaptation Strategies

As indicated in the consolidated KI and GP results, most households in the municipality have engaged in other forms of production activities with a cumulative frequency of 127 responses or 92%. Others have engaged in natural farming technology system [86%] while 71% have engaged in doing paid labor. Some other informants reported to have availed of loans with 52% of the informant's responses while other responses not included in the choices has a total percentage of 13% of the informants' responses.

Figure 13: Corn farmer practicing natural farming

Engaged in Other Production Activities

Other farming activities such as diversifying in banana, corn, coconut, vegetable and some root crops production while others have engaged in other crops like coffee, pineapple, and commercial tree plantation like falcata. Other production activities that were employed by the households include venturing into small business with a cumulative frequency of 18 responses who engaged mostly in putting up sari-sari store, vending *tuba* [coconut wine], and engaging in photography.

Engaged in Natural Farming Technology System (NFTS)

A cumulative frequency of 118 responses or 86% indicated to have engaged in natural farming technology systems mostly by composting with a cumulative frequency of 80 responses; animal manure with 40 responses; utilizing organic fertilizer with a frequency of 33 responses; and fermentation with a frequency of 2.

Engaged in Paid Labor

Engaging in paid non-domestic labor was also one of the mechanisms employed by the households in the municipality in order to cope with the effects of climatic changes with a cumulative frequency of 97 or 71%; while two (2) responses reported to have engaged in paid domestic labor to sustain their families.

Loan Accessing

Some 52% of the cumulative responses show that the farmers, in order to cope with the adverse effects of climatic changes reported to have accessed loans to support the needs of their families.

3.3. NEEDS AND REQUIREMENTS OF THE STRATEGIES

The adaptation strategies earlier stated are efficiently enforced only if the following important considerations are addressed:

- *Establishment of Automatic Weather Station, monitoring and early warning systems.* The impacts of climate-related disasters are very high. Thus, the provision of timely early warning to be set-up in a strategic area in Las Nieves could help reduce these impacts.

- *Integrated and coordinated approaches.* Adaptation strategies need to be implemented in an integrated manner and take a long term perspective, rather than involving stand-alone projects. This approach should be included in the Municipal Development Plan and in the agenda both of Executive and Legisalative.

- *Introduce climate change information* in schools, churches, barangay assemblies, conferences, fora, etc.

- *Develop funding policies and schemes which suit the conditions of the poor.* The frequency of flooding and El Nino due to climate change is likely to undermine livelihoods. Vulnerable people will need to adapt their livelihoods, such as by adopting income generating activities as well financial securities of their crops.

Figure 14: Farmers planting rice in a rain-fed rice field.

4 SCENARIO ANALYSIS

4. SCENARIO ANALYSIS

This section will give a picture of different probable scenarios in 2020 and 2050 given some assumptions on some critical variables affecting vulnerability and adaptation 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. SCENARIO COMPONENTS

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. (Please see Annex B 19).

<u>Dry Spell</u>

Reduction in Corn will be set at 18% due to 1.3'C increase in temperature (or 14% x 1.3'C) or an equivalent volume of 1,528 MT (14,344 MT[1] x 18%).

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, 5% reduction will be pegged for the irrigated areas (due to late harvesting) or approximately 86 MT[2]. The non-irrigated areas are expected to be gravely hit equivalent to 850 MT (814 has x 2.9 MT/ha/cropping x 2 cropping x 18%). Total rice reduction will amount to 937 MT.

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 20% or 1,310 MT (6,621 MT x 20%).

Reduction to corn is set at 10% or 660 MT/annum (6,600 MT x 10%).

Potential threat to lives, properties and infrastructure will be minimal.

Scenario 1 (2020)

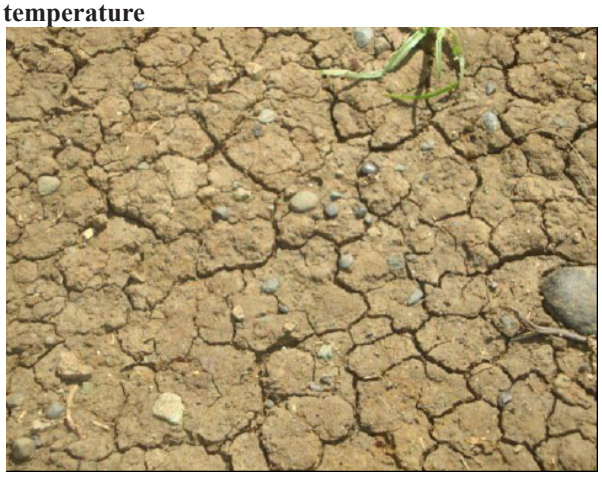
Assumptions for this scenario are:

- advances in Science and Technology are at current level
- population growth rate is 2.26% 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 30,136 at 2.26%/annum growth rate. Rice consumption will be at 3,858 MT at 128 kg/ capita consumption (NFA, 2008).

Net rice production of scenario 1 of 2020 is estimated at 2,787 MT, and with food consumption at 3,858 MT will mean a shortage of rice for food at 1,090 MT (or 30%). In addition, the 28% reduction in corn will consequently translate into lesser income for population increasing further poverty incidence in the municipality. Based on recent

Figure 15: Dried up parcel land caused by increasing temperature



experience to flooding, potential damage to lives is minimal. Hence, overall vulnerability rating in this scenario is considered ***LOW***.

Scenario 2: Year 2020

Assumptions for this scenario are:

- There is marked positive advancement of Science and Technology:
- The population growth rate markedly decreases down to 1.26% (or 1% lower from the current annual 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 27,858 at 1.26%/annum growth rate. Rice consumption will be at 3,566 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 3,566 MT will mean a shortage of rice for food at 793 MT (or 22%). Corn production will be reduced by 28%. Assuming 10-15% increase in production due to advancement of science and technology would still result to insufficiency of rice by 7%-12% and corn production by 13%-18%.

[1]Average annual production

[2] 300 has X 2.9 MT/ha/cropping x 2 cropping x 5%

With minimal impact on lives and properties, and with increased capacity and budget of the LGU, the overall vulnerability rating in this scenario is still 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 3.26% (1% higher from the current level)
- 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 3.26% growth rate is computed at 32,577. At this level, projected demand for rice consumption will be at 4,170 MT.

Aggressive land conversion is set at 10% in rice areas constricting the production area to 1,000 hectares with equivalent output of 3,822 MT. Due to dry spell and increased rainfall with corresponding decrease in production at 15% and 20%, respectively, will mean a total reduction of 1,338 MT making net rice production at 2,484 MT. With increased consumption brought about by growing population, a shortage of 1,685 MT (40%) will be registered.

Corn production reduction is computed at 28% (18% due increase temperature and 10% from increased rainfall). Consequently, this will translate into lesser income for the whole population further raising 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 ***MODERATE*** 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 2.93'C (or 2.97%) 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 (though with lesser rains compared with 2020). *(Please refer to the Annex B 3 & B4)*.

The increase in temperature of 2.93'C during the dry months would translate to forty one percent (41%)[1] 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 un-irrigated.

Dry Spell

Rice production will be cut by 5% from the irrigated areas (300 hectares) or 57 MT due to late harvesting and 41% (1,275 MT) from non-irrigated areas (of 814 hectares) or approximately 1,332 MT (31%) of the total rice production volume.

Reduction in Corn production will be set at 41% due to 2.93'C increase in

[1] 14% x 2.93'C

temperature (or 14% x 2.93'C), or an absolute volume of reduction at 2,706 MT.

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 (426 MT).

Potential threat to lives of population will be minimal.

Scenario 1: (Year 2050)

Assumptions for this scenario are:

- advances in Science and Technology are at current level
- population growth rate is 2.26% 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 in this scenario is estimated at 58,921 at 2.26%/annum growth rate. Rice consumption will be at 7,541 MT at 128 kg/capita consumption (NFA, 2008).

Net rice production of scenario 1 of 2050 is estimated at 2,592 MT, with the estimated consumption at 7,541 MT will mean a shortage of rice for food at 5,030 MT (or 67 %).

Production of Corn will reduced by 41% will mean 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***. *(Please see Annex B 21, p.87)*

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 1.26% (or 1% lower 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 40,560 at 1.26%/annum growth rate. Rice consumption will be at 5,191 MT at 128 kg./ capita consumption (NFA, 2008).

Net rice production of scenario 2 of 2050 is estimated at 2,512 MT, with the estimated consumption at 5,191 MT will mean a shortage of rice for food at 3,523 MT (or 68%). Assuming 15% increase in production due to advancement of science and technology would still result to insufficiency of rice at 43% and 26% (or 41%-15%) for corn production. In spite of the increased rainfall and subsequent flooding potential damage to lives is projected to be at moderate level. Nevertheless, with increased capacity and budget of the LGU, the overall vulnerability rating in this scenario is considered ***MODERATE***. *(Please see Annex B21, p.87)*

Scenario 3: (Year 2050)

Assumptions for this scenario are:

- advancement in Science and Technology are at current level;
- population growth rate increased to 3.26%/annum (or 1% higher of 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 85,285 at 2.68%/annum growth rate. Rice consumption will be at 10,197 MT at 128 kg/capita consumption (NFA, 2008).

Apart from reduction in rice production due to increase temperature and increase rainfall, additional decrease will be set at 20% due to pressure of increasing population pushing land conversion from agricultural (especially rice areas in the lowland) to residential, commercial and industrial uses. Hence, net rice production of scenario 3 of 2050 is estimated at 1,660 MT, with the estimated consumption at 10,197 MT will mean a shortage of rice for food at 9,256 MT (or 85%).

Food shortage and 41% reduction in corn production will mean lesser income for a bigger population further raising poverty incidence in the municipality. Even with low assumption of impact due to rainfall and flooding but because there will be no improvement of LGU's adaptive capacity level and low budget, hence, overall vulnerability rating in this scenario is considered ***HIGH***. *(Please see Annex B 21, p.87)*

Figure 16: **Summary of Vulnerability Rating**

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

(Potential Impact/Damages: Low = 30%; Moderate=31-59%; High= 605 and above)

4.2 VULNERABILITY RATING

The above's scenario building and analysis reveal ratings at 2020 as Low for Scenarios 1 and 2, and Moderate for scenario 3. In 2050, overall impact will be High for Scenario 1, Moderate for Scenario 2 and High for Scenario 3. *(Please see Figure 17)*

4.3. ADAPTATION TO CLIMATE CHANGE AND OTHER SCENARIOS

As changing environment is taking its tool in every residents in Las Nieves, adaptation activities need to be implemented in the coming years at 2020 and onwards to 2050. Planned actions of the municipal government will include: *(Please refer to* Annex B22: *Future adaptation strategies,* p.89*)*

4.3.1. Physical/Infrastructural

- *Increase access to irrigation facilities.* The need for more irrigation facilities to serve the rain-fed rice areas in the municipality will be primarily addressed. With this farmers could plant rice twice a year thereby increasing production of rice in the area. Tapping of creeks in the upland portion, particularly in Barangays Bonifacio and Marcos Calo, and conduct in-depth and comprehensive project planning in order to utilize its potentials.

4.3.2. Economic

- *Access to emergency farm financial funds and insurance.* During crop failures, seeking alternative financial assistance was the logical move of farmers to regain footing of individual lives in the climate-sensitive livelihood. Farm credit from private individuals and unscrupulous operators becomes more wicked due to its high interest rates. To help mitigate

the vulnerability in farming, agricultural production insurance system will be a desired intervention for rice and corn farmers in the municipality. With this mechanism farmers will be encouraged to produce more and to optimize their farms to the fullest despite the threat of climate-related hazards;

- Opportunity and continuity of access to *regular or alternative insurance programs* and other financing schemes for agricultural crops;
- *Expansion and strengthening of rural based organizations*. Every barangay in Las Nieves especially in the rural areas must have an organized groups, associations or organizations to cater to their needs and augment source of daily income through *livelihood program*. Networking with the government and private enterprises and other agencies with existing outreach programs should be done as well as Non Government Organizations (NGO's) and Peoples Organizations (PO's) participation; and,
- *Provision of pre and post harvest facilities and farm inputs* (i.e. organic fertilizers and seeds);

4.3.3.Technological

- *Access to science and technology.* To achieve and successfully implement the prioritized adaptation strategies and all other options to farmers in the municipality, it is indispensable to have an *Automatic Weather Station and Early Warning Systems*. Provisions of these timely technologies could help reduce exposure to environmental hazards; and,
- *The shift to organic agriculture* should be largely incorporated to the municipal and barangay development plans for more emphasis. The municipal government leaders should take the lead roles.

4.3.4. Political/Institutional

- *Closer and constant coordination* different branches of government (e.g. with the health units and engineering departments) for social infrastructures, such as water/ irrigation system installation, waste disposal system and etc.;
- *Integrate and coordinate approaches*. Climate-related initiatives need to be integrated in the Municipal Development Plan and in the agenda of both Executive and Legislative bodies.
- Trainings and *info-dissemination on climatic alterations* addressed to local community.

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. Physical /Infrastructural

- Riverbank stabilization project in Poblacion and Pinana-an
- Construction of Marcos Calo-Bonifacio Communal Irrigation Project and Small Water Impounding Projects

4.4.2. Economic

- Support farmers through crop insurance

4.4.3. Technological

- Establishment of Early Warning System
- Establishment of Automatic Weather Station
- Organic farming and techno farms establishment

4.4.4. Political Institutional

- Local adoption and full implementation of climate change policies and laws

4.4.5. Environmental

- Watershed establishment and management

5 CONCLUSIONS

5. CONCLUSIONS

The municipality is exposed to flooding specifically in February as a result of frequent rainy period starting December. Flooding has caused destruction to agriculture areas, damaged properties and infrastructure, largely in the 10 flood-prone barangays of Las Nieves.

Drought is another climate-related phenomenon in which frequency has increased in the next 20 years and above. This event poses serious threat to local livelihood derived from farming. The observed reduced rainfall directly affected production levels of the 836 hectares rain-fed rice production areas in Las Nieves.

By 2020, average temperatures are expected to rise from 0.9ºC and 1.3ºC above the observed data. The projected rise in temperature level will directly affect food sufficiency of the municipality. Having a ballooning population, which means increased food consumption requirement that will likely result to food shortage.

In 2050, vulnerability of Las Nieves to climate change is even higher. The severity of drought will continue to threaten agricultural production and the local population. Rice and corn production is predicted to decline substantially. By this time seasonal mean rainfall ranges from -34.5% to 4.4% enough to affect water resources through reduced ground water recharge. Waterworks systems in the municipality with deep well facilities are likely be in danger.

The most exposed groups to the changing climate are the 612 corn farmers in the low-lying and upland barangays, and the 706 rice growers both in the irrigated and rain-fed areas of the municipality.

Future adaptation measures are designed based on experiences and responses on climate change of people, communities and the LGU who came as active participants of consultative meetings, focus group discussions and other gatherings. Some of the cited strategies are the following:

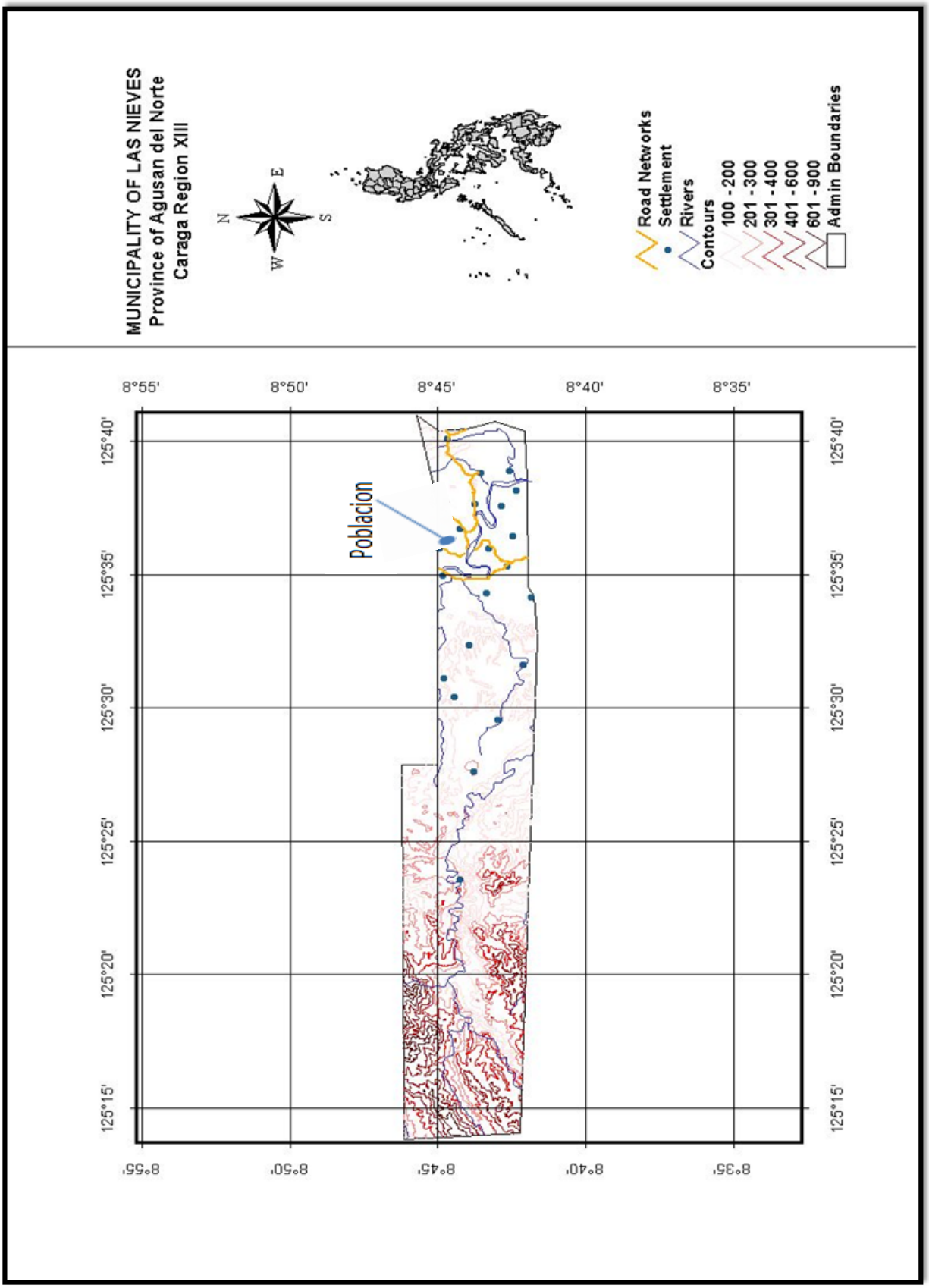
- Construction of Marcos Calo-Bonifacio Communal Irrigation Projects and Small Water Impounding Projects;
- Crop Insurance;
- Organic farming and techno-farms establishment;
- Establishment of Automatic Weather Station and Early Warning System;
- Water-shed establishment and management;
- Local adoption and full implementation of climate change policies and laws;

Moreover, identified barriers to the said adaptation strategies that shall be addressed include, as follows:

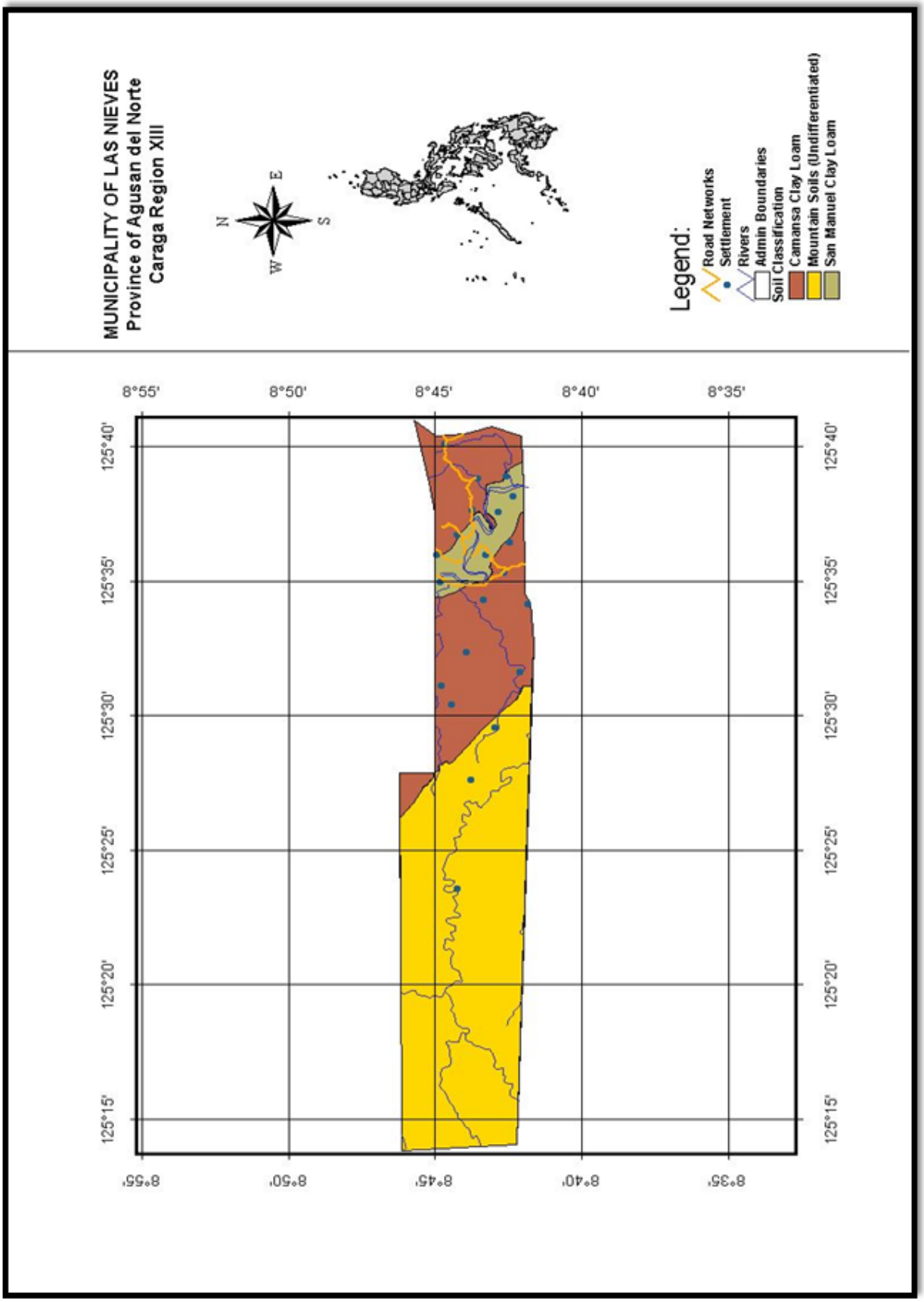
- Adequate financial support;
- Integration of V&A strategies in the Municipal Development Plan, and in both of the Executive and Legislative agenda;
- Identification of financial schemes for the vulnerable areas and residents of Las Nieves affected by climate change.

Annex-A

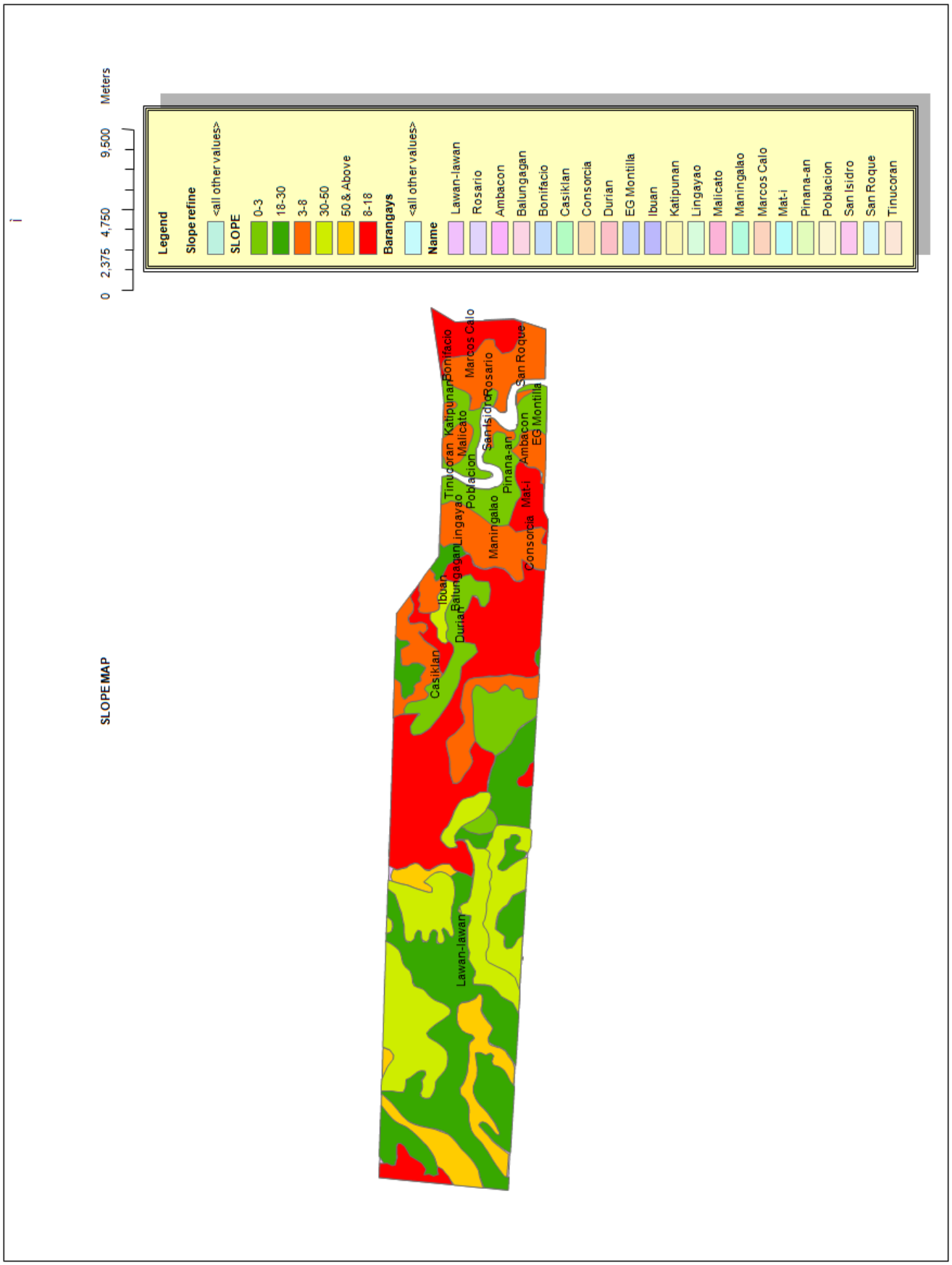
List of Annexes (A)-Figures



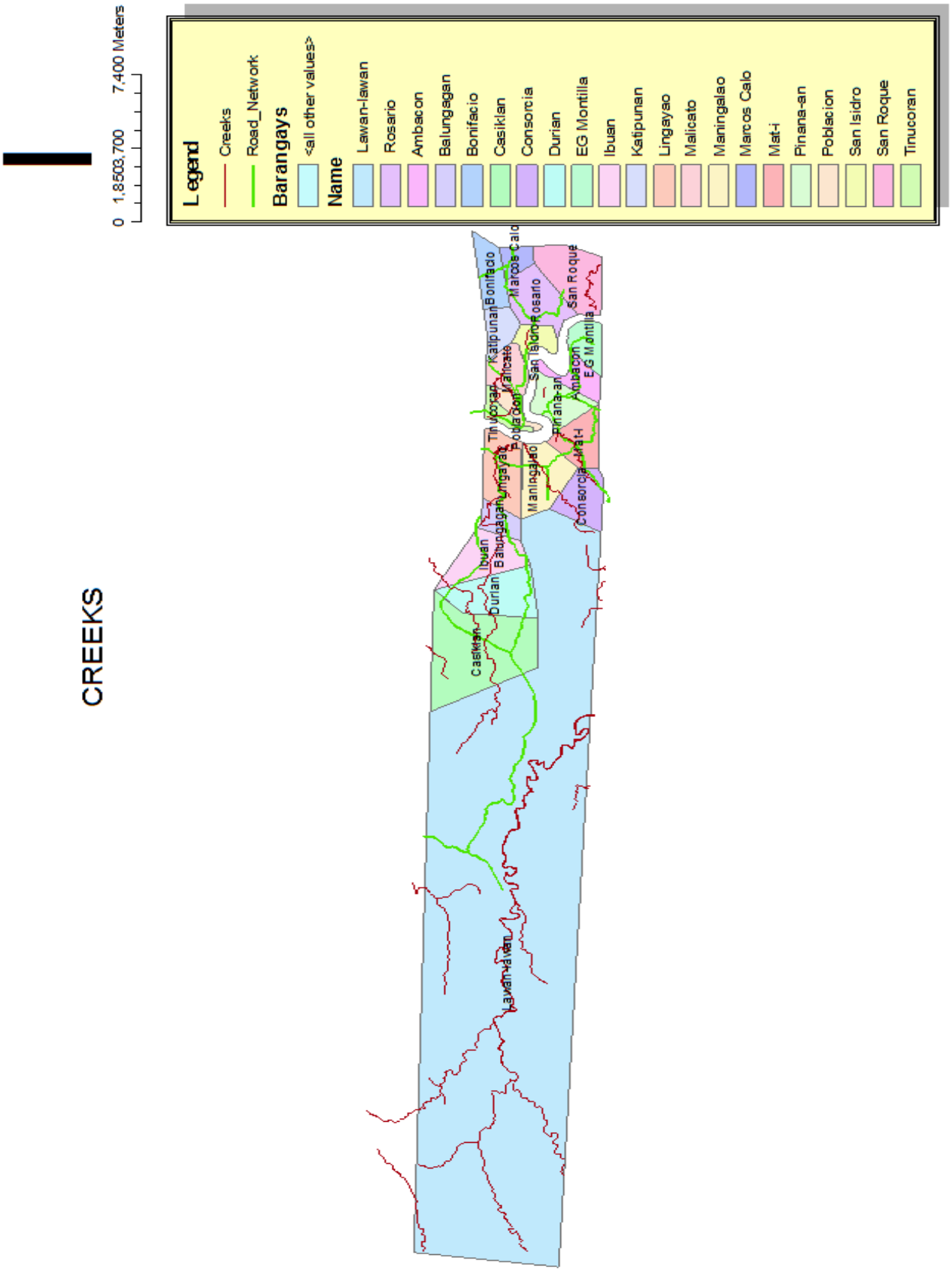
Annex A 1: Location Map



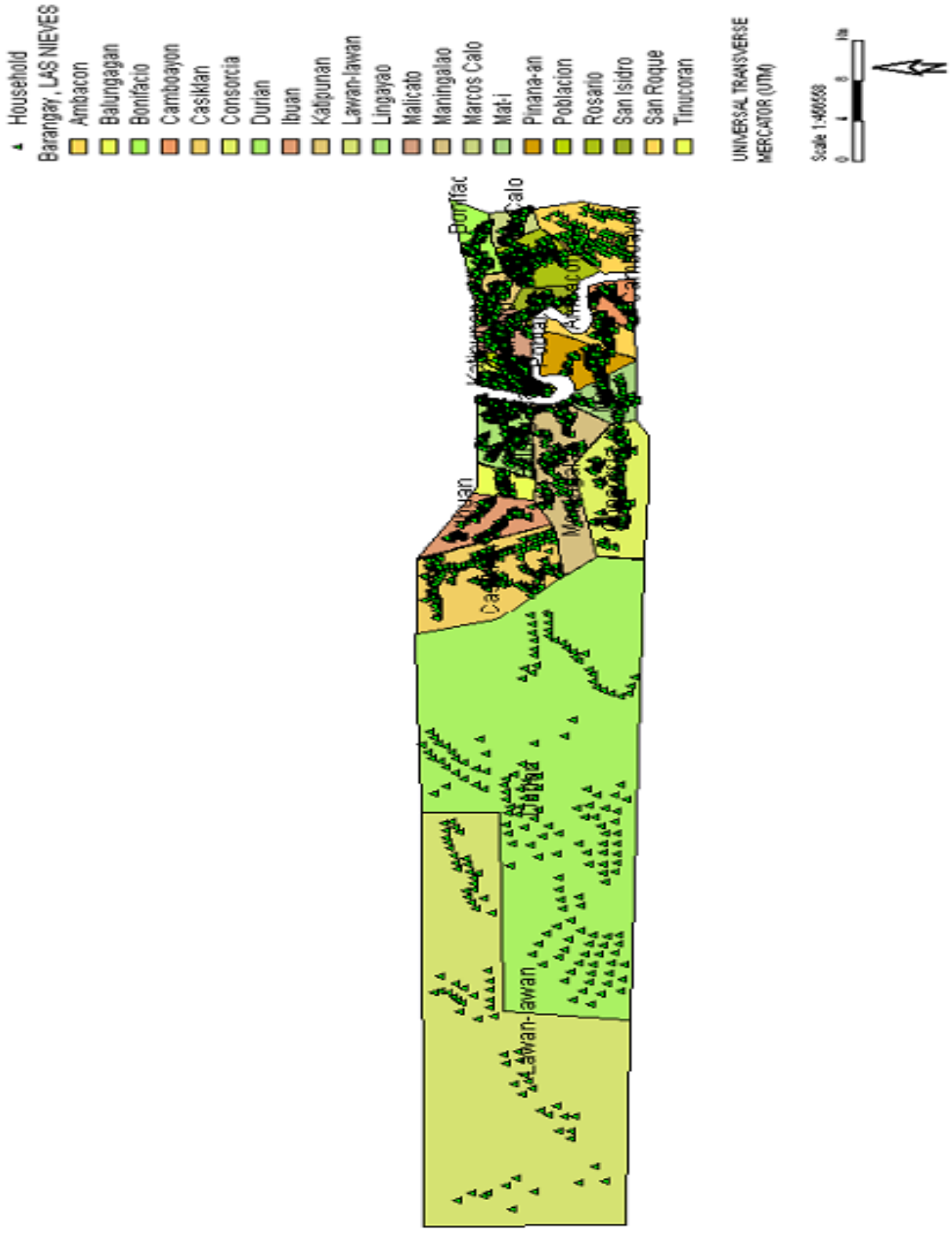
Annex A 2: Soil Map



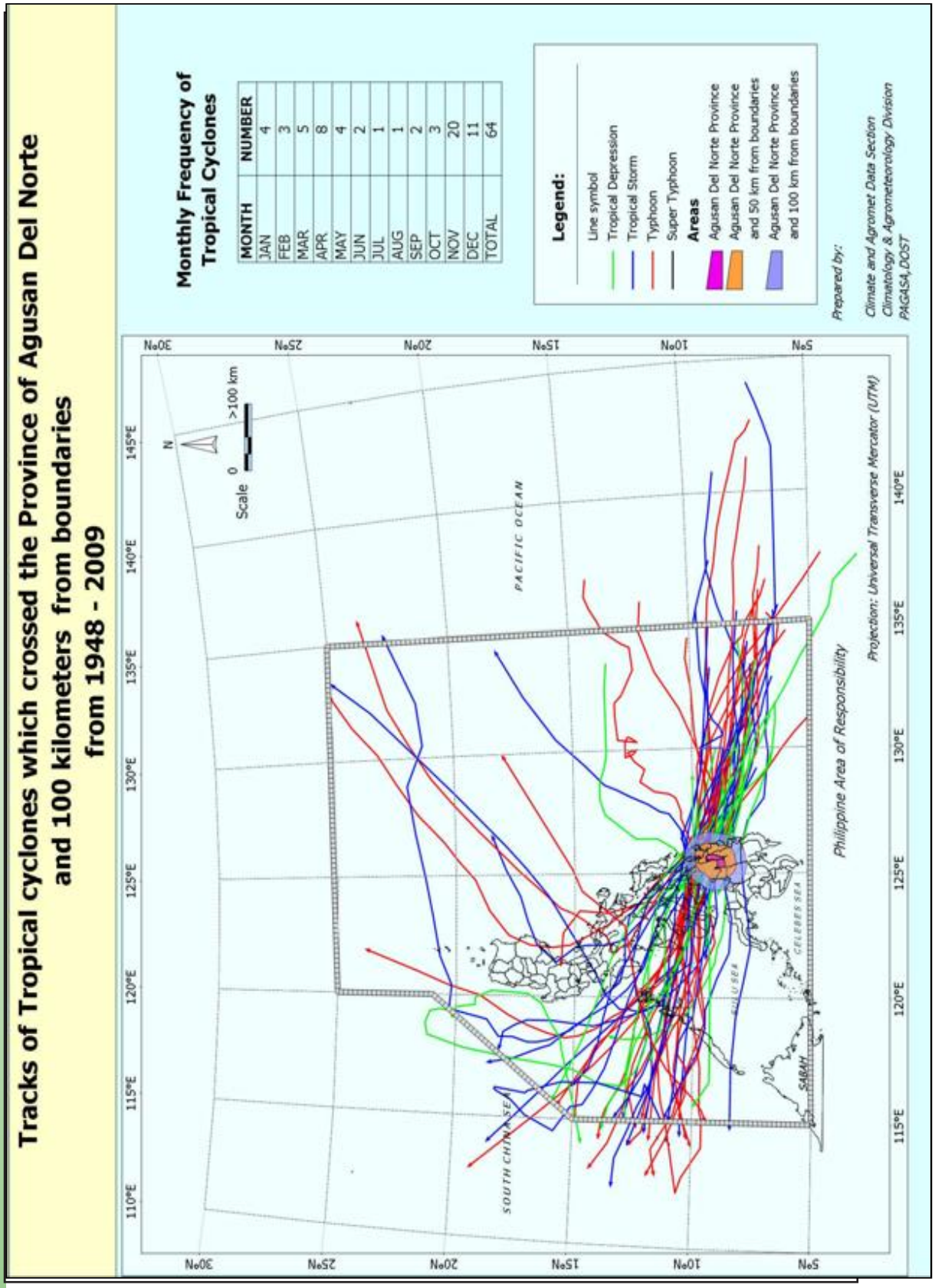
Annex A 3: Slope Map



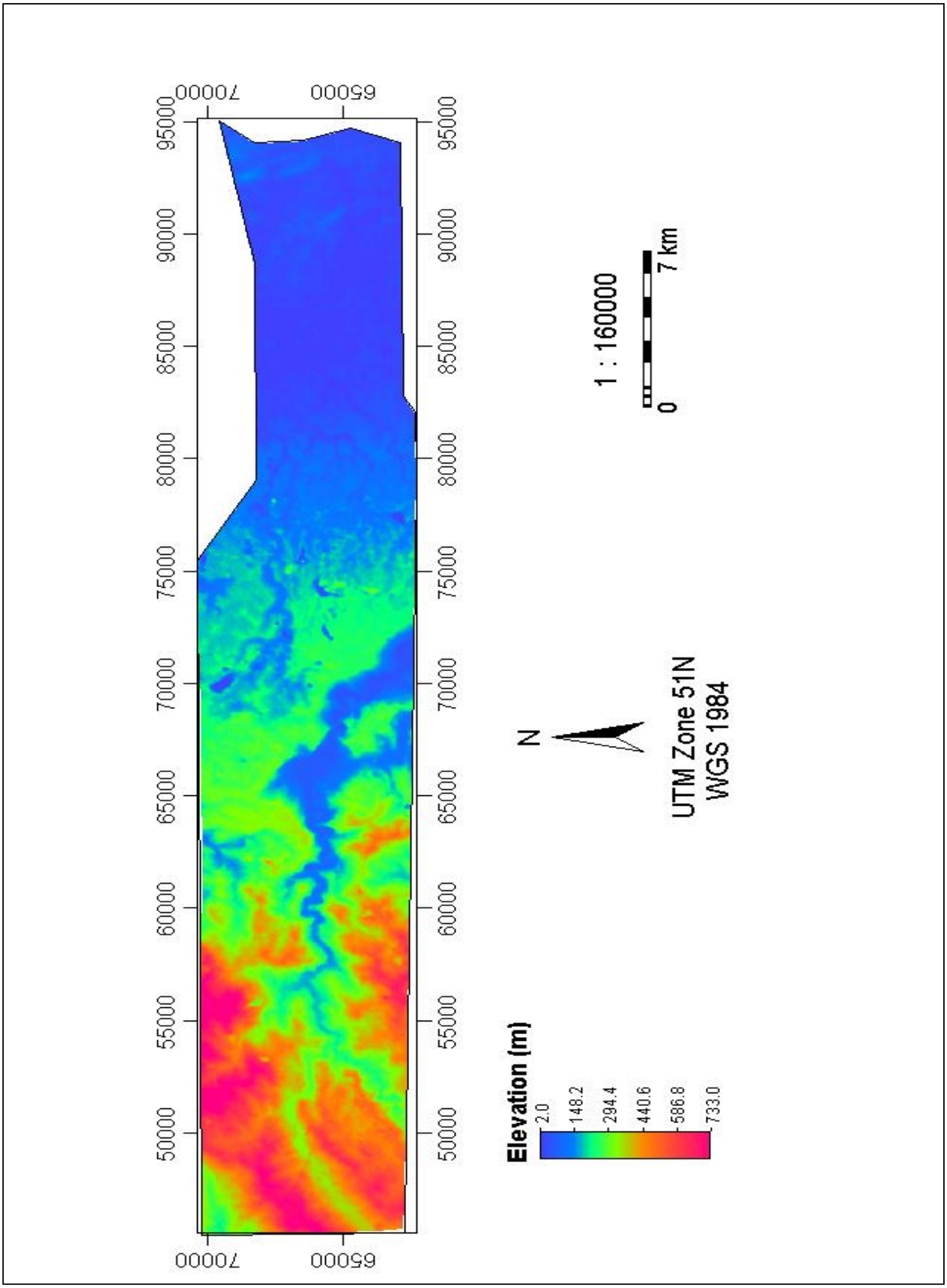
Annex A4: River Systems



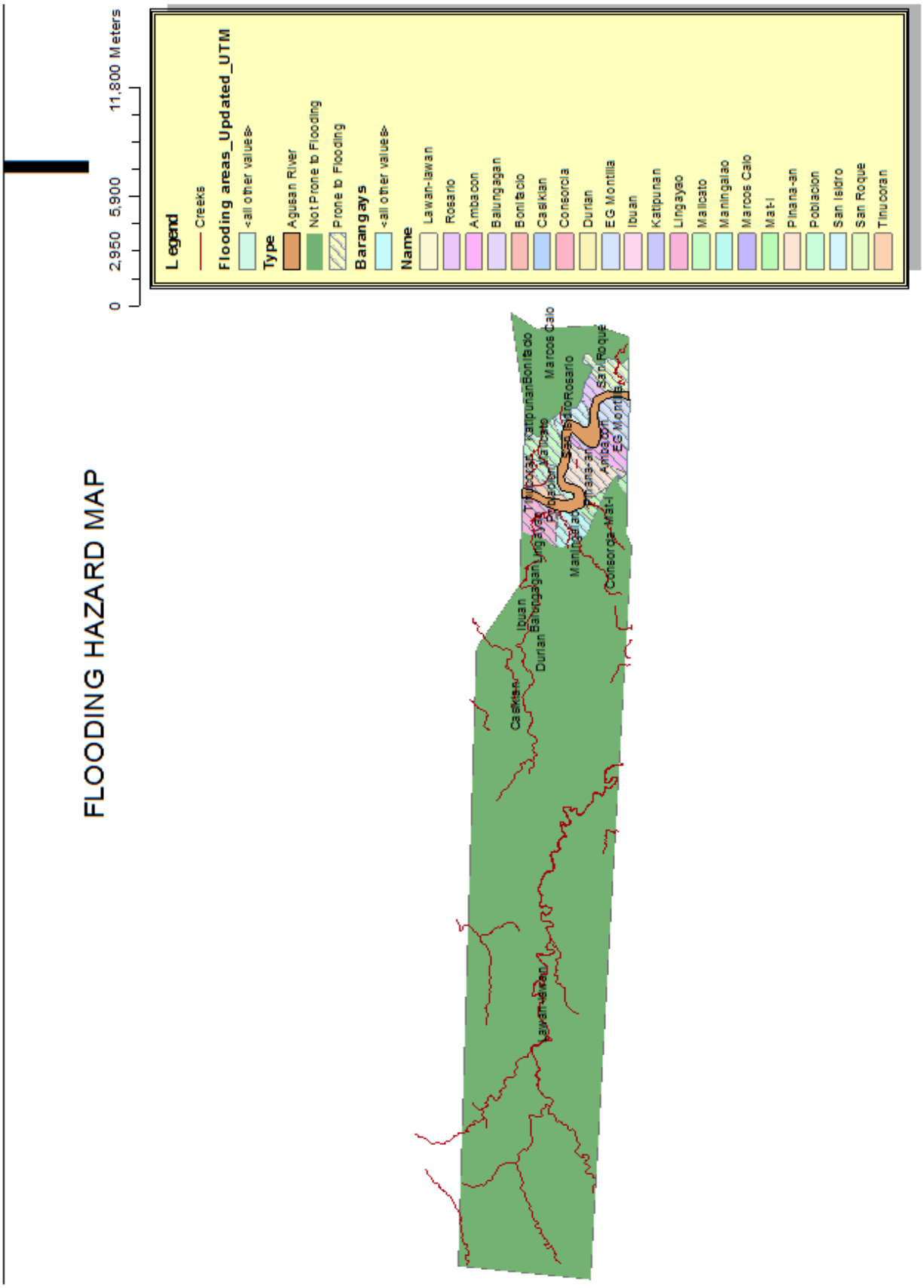
Annex A5: Population Map



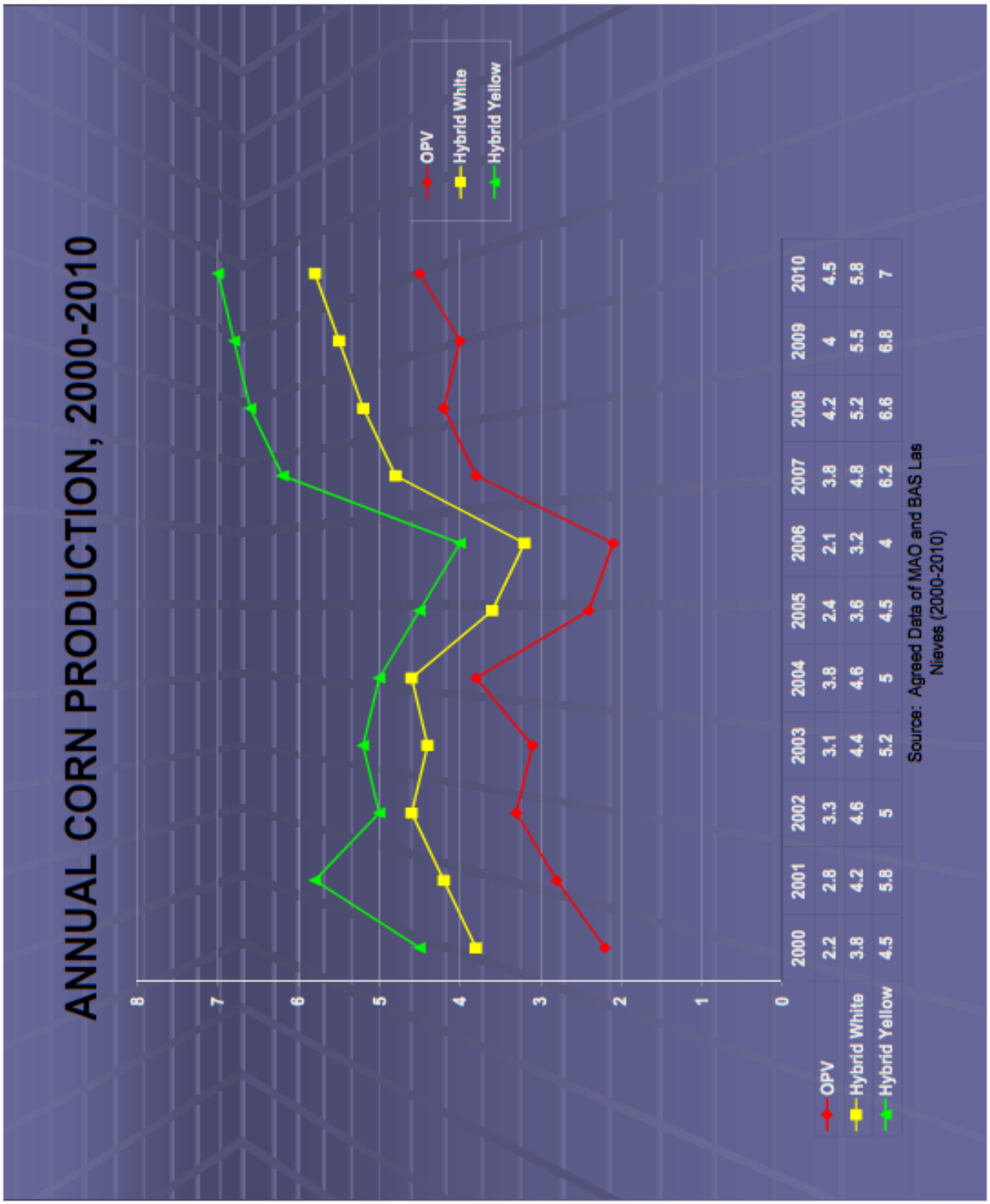
Annex A 6: Tracks of Tropical Cyclone 1948-2000, PAGASA



Annex A 7: Elevation Map



Annex A 8: Flooding Hazard map



Annex A 9: Annual Corn Production 2000-2010

Annex-B

List of Annexes (A)-Tables

Annex B1: Land Use Area by Category, Las Nieves

Use Category	Las Nieves
Agriculture and Open Spaces	7,833.84
Forest	27,944.41
Grassland	22,361.64
Agro-industrial	-
Industrial	-
Built-up	83.93
Tree Plantation	-
Marshland	-
Shrubland	-
Others	-
Total	**58,269.00**

Annex B2: Slope Classification and Size: Agusan del Norte and Las Nieves Municipality, 1995

Slope	Agusan del Norte		Las Nieves	
	Area [has.]	%of Land Area	Area [has.]	% of Land Area
0-3%	32,266	14%	5,765	9.80%
3-8%	14,097	6%	7,408	12.71%
8-18%	56,165	24%	9,994	17.15%
18-30%	53,937	23%	18,157	31.16%
30-50%	68,905	29%	7,156	13.36%
50 and above	3,625	1%	9,159	15.72%
Miscellaneous	8,063	3%		
Total	237,057	100%	58,269	100%

Sources: Agusan River Basin Area Development Study, Agusan del Norte
Comprehensive Land Use Plan of Las Nieves [1998-2005]
Proposed Agro-Forestry Estate in Las Nieves, Agusan del Norte (Volume 1)

Annex B3: Monthly Mean Of Rainfall, Pagasa Butuan City

RAINFALL (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 B4: Monthly Mean Of Temperature, Pagasa, Butuan City

TEMPERATURE [ºc]								
Month	MEAN		BIAS	Projected Change (%)		BIAS CORRECTED PROJ CHANGE		
						TMEAN		
	Observed 1971-2000	Model 1971-2000		2020	2050	1971-2000	2020	2050
Jan	26.1	23.9	-2.2	1.0	1.8	26.1	27.1	27.9
Feb	26.4	24.2	-2.2	1.0	1.9	26.4	27.4	28.3
Mar	27.1	24.7	-2.4	1.0	2.1	27.1	28.1	29.2
Apr	28.1	25.1	-3.0	1.2	2.4	28.1	29.3	30.5
May	28.8	25.3	-3.5	1.2	2.4	28.8	30.0	31.2
Jun	28.3	25.1	-3.2	1.1	2.4	28.3	29.4	30.7
July	27.9	25.1	-2.8	1.2	2.6	27.9	29.1	30.5
Aug	28.1	25.4	-2.7	1.2	2.5	28.1	29.3	30.6
Sept	28.1	25.5	-2.6	1.0	2.3	28.1	29.1	30.4
Oct	27.8	24.6	-3.2	1.1	2.1	27.8	28.9	29.9
Nov	27.3	24.0	-3.3	1.0	2.0	27.3	28.3	29.3
Dec	26.7	23.8	-2.9	0.9	1.9	26.7	27.6	28.6

Annex B5: Summary of CBMS Core Indicators

Basic Needs	Indicators	Number	Proportion	National Average
Health	Proportion of child deaths aged 0-5 years old	54	1.46	0.04
	Proportion of women deaths due to pregnancy-related causes	2	0.35	0.001
Nutrition	Proportion of malnourished children aged 0-5 years old	51	1.40	27.6
Shelter	Proportion of households living in makeshift housing	256	6.17	29.5
	Proportion of households who are squatters	85	2.05	35.6
Water and Sanitation	Proportion of households without access to safe water supply	934	22.52	19.8
	Proportion of households without access to sanitary toilet facilities	665	16.03	13.8
Basic Education	Proportion of children aged 6-12 years old not attending elementary school	1,022	22.59	9.4
	Proportion of children aged 13-16 years old not attending high school	1,106	46.61	25.5
Income	Proportion of household with income below the poverty threshold	2,633	63.48	24.4
	Proportion of households with income below the food threshold	2,110	50.87	10.2
	Proportion of households who experienced food shortage	619	14.92	
Employment	Unemployment rate	42	0.65	7.8
Peace and Order	Proportion of persons who are victims of crime	37	0.17	

Annex B6: **2007 Census of Population of Las Nieves**

Barangay	Household		Population		Average HH Size	Area [sq. km.]	Density [person/ sq. km]
	Number	Percent	Number	Percent			
Urban							
Poblacion	241	5.8	1,240	5.6	5	56.25	22
Rural							
Ambacon	205	4.9	1,062	4.8	5	805.54	1
Bonifacio	194	4.7	1,090	5.0	6	903.95	2
Consorcia	242	5.8	1,199	5.4	5	2,192.91	1
Katipunan	158	3.8	924	4.2	6	326.71	3
Lingayao	378	9.1	2,039	9.3	5	1,091.31	2
Malicato	186	4.5	867	3.9	5	480.12	2
Maningalao	256	6.2	1,418	6.4	6	15,704.80	1
Marcos Calo	146	3.5	792	3.6	5	755.92	1
Mat-i	318	7.7	1,746	7.9	5	353.03	5
Pinana-an	183	4.4	933	4.2	5	202.71	5
San Isidro	212	5.1	1,161	5.3	5	333.98	3
Tinucuran	169	4.1	840	3.8	5	355.60	3
Balungagan	104	2.5	551	2.5	5	866.53	1
E.G. Montilla	178	4.3	987	4.5	5	400.90	1
Durian	155	3.7	811	3.7	5	31,225.69	1
Ibuan	169	4.1	886	4.0	5	801.62	1
Rosario	231	5.6	1,249	5.7	5	1,065.43	1
San Roque	102	2.4	498	2.2	5	346.00	1
Casiklan	251	6.0	1,304	4.7	4		1
Lawan-lawan	70	1.7	396	1.8	6		1
Total	**4,148**	**4.76**	**25,203**	**4.69**	**5.14**		

Annex B7: Agriculture Crop Data

Barangay	Major Crops	Area Planted	Farming Practices		Farming System		No. of HH engaged in Production of Major Crops and Its Size by tenure							
			Low Input	High Input	Mono-crop	Inter crop	Owned		Tenant		Lease			
							# of HH	Ave. Farm	# of HH	Ave. Farm	# of HH	Ave. Farm		
1. Poblacion														
2. Tinucuran	Rice Corn Coconut	93.75 140.0 28.83	 /	/ /	/ /	 /	28	100 has.	24	20 has.	15	20 has.	7	10 ha.
3. Katipunan	Rice Corn Coconut	76.00 30.00 21.29	 /	/ /	/ /	 /								
4. Malicato	Rice Corn Coconut	91.75 70.00 42.13	 /	/ /	/ /	 /	31 12		46 31				12 11	
5. Bonifacio	Rice Corn Coconut	39.75 55.00 12.15	 / /	/	/	 / /	30 32		6 23					
6.Marcos Calo	Rice Corn Durian	49.5 26.0 71.14	 /	/ /	/	 / /	17		9				10	
7. Rosario	Rice Corn Coconut	150.5 25.00 14.75	 /	/ /	/	 / /	9 45 25							
8. San Roque	Rice Corn Coconut	50.00 80.00 8.85	 / /	/	/	 / /	23 25 12		1 35				7 19	

9. San Isidro	Rice	29.00		/	/		1		20					
	Corn	75.00		/	/		10							
	Coconut	16.98	/			/	49							
10. Ambacon	Rice	160.0		/	/		28		8					
	Corn	64.0		/	/		62		36					
	Coconut	256.0	/			/	41							
11. EG Montilla	Rice	35.00		/	/		7		29					
	Corn	132.0		/	/		12		109					
	Coconut	14.14	/			/			14					
12. Pinanaan	Rice	51.5		/	/		20		24					
	Corn	126.0		/	/		26		63					
	Coconut	55.75	/											
13. Mat-I	Rice	87.5		/	/		7							
	Corn	13.0		/	/		21		76					
	Coconut	10.63	/			/	5							
14. Consorcia	Rice	22.5		/	/		36		20					
	Corn	20.0		/	/		30		19					
	Coconut	25.71	/			/	14		4					
15. Maningalao	Rice	73.5		/	/		49		20					
	Corn	30.0		/	/		40		9					
	Coconut	63.25	/			/	54		4					
16. Lingayao	Rice	127.5		/	/		86		16					
	Corn	15.0		/	/		17		6					
	Coconut	12.29	/			/								
17. Balungagan	Coffee	103.0	/			/	103							
	Durian	52.4	/			/	103							
	Coconut	18.65	/			/	18							
18. Ibuan	Coffee	123.0	/			/	135							
	Durian	36.6	/			/	110							
	Coconut	21.45	/			/								
19. Durian	Coffee	560.0	/			/	140							
	Durian	18.00	/			/	30							
	Coconut	15.65	/			/								
20. Casiklan	Coffee	375.0	/			/	220							
	Durian	10.0	/			/	32							
	Coconut	20.0	/			/	41							

Sources: Municipal Agriculture Office File, Philippine Coconut Authority Inventory

Annex B 8: **Summary of Production of Corn in Las Nieves, 2000-2009**

Barangay	No. of Farmers	Area [has.]	Ave. Production [MT/ha/yr]	Minimum Production [MT]	Maximum Production [MT]
1. Maningalao	33	45	486	288	558
2. Consorcia	49	33	356	211	409
3. Pinanaan	89	126	1,360	806	1,562
4. E.G. Motilla	121	196	2,116	1,254	2,430
5. Tinucuran	100	150	1,620	960	1,860
6. Katipunan	30	30	324	192	372
7. Bonifacio	55	55	594	352	682
8. Malicato	54	60	648	384	744
9. Marcos Calo	26	26	280	166	322
10. San Isidro	49	75	810	480	930
11. Rosario	25	25	270	160	310
12. San Roque	84	80	864	512	992
13. Balungagan	63	48	517	307	592
14. Durian	96	45	496	288	595
15. Casiklan	129	80	864	512	992
16. Lawan-lawan	103	52	561	332	644
17. Ibuan	95	64	690	409	793
18. Lingayao	21	35	378	224	434
19. Mat-i	25	28	311	179	437
20. Ambacon	41	74	799	473	917
	1,288	**1,327**	**14,344**	**8,489**	**16,575**

[Source: Municipal Agriculture Office, Las Nieves, ADN]

Annex B 9: **Production of Rice in Las Nieves, 2000-2009**

Barangay	No. of Farmers	Area [has.]	Ave. Production [MT/ha/yr]	Minimum Production [MT]	Maximum Production [MT]
1. Ambacon	134	160.0	640	382	960
2. Bonifacio	36	39.8	240	218	264
3. Consorcia	56	22.5	184	145	217
4. Katipunan	54	76.0	372	290	488
5. Lingayao	102	127.5	917	777	1,090
6. Malicato	13	91.8	662	627	697
7. Maningalao	69	73.5	462	308	569
8. Pinanaan	44	51.5	338	308	385
9. Rosario	54	150.5	726	550	1,141
10. San Isidro	31	29.0	143	130	165
11.San Roque	28	50.0	210	125	360
12. E.G. Montilla	36	35.0	298	226	344
13. Marcos Calo	48	49.5	298	155	372
14. Mat-i	104	87.5	540	469	588
15. Tinucuran	74	93.8	591	542	655
	883	1,138	6,621	5,252	8,295

Source: Municipal Agriculture Office Accomplishment Report

Annex B10: **Livestock and Poultry Production**

Name of Barangay	Major Livestock	No. of Heads	Livestock Practices		No. of HH engaged in Livestock Production by Tenure			
			Comm'l.	Backyard	Owned	Tenant	Lease	Others
1. Poblacion	Swine Carabao Cattle Goat Native Chicken	438 98 6 42 1,450		/ / / / /	89			
2. Tinucuran	Swine Carabao Cattle Goat Native Chicken	142 58 15 45 4,235		/ / / / /	89 89 22 21 61	24	15	7
3. Katipunan	Swine Carabao Cattle Goat Native Chicken	68 65 14 28 3,050		/ / / / /	65			70
4. Malicato	Swine Carabao Cattle Goat Native Chicken	315 87 35 70 4,035		/ / / / /	40	110		15
5. Bonifacio	Swine Carabao Cattle Goat Native Chicken	150 50 30 75 3,500		/ / / / /		65		80
6. Marcos Calo	Swine Carabao Cattle Goat Native Chicken	300 60 20 40 5,238		/ / / / /		51		74
7. Rosario	Swine Carabao Cattle Goat Native Chicken	315 115 5 25 3,483		/ / / / /		82		100
8. San Roque	Swine Carabao Cattle Goat Native Chicken	218						

Annex B 11: **Agricultural Facilities and Other Related Services**

Agricultural Facilities and Other Related Services	Location	Agency	Total Funding Cost [P]
1. Breeding stations/ services	-	-	-
2. Agricultural School	-	-	-
3. Technical institution	-	-	-
4. Extension services	All barangays	MAO	P 3 0 0 , 0 0 0 . 0 0 [includes Municipal Demo Farm]
			P 10,000.00
a. Small Farm Reservoir [SFR]	1- Marcos Calo	DA/ LGU	P 30,000.00
	2- Mat-i		P 10,000.00
	1- Malicato		P 10,000.00
	1- Katipunan		
b. Corn Sheller with engine		DA/ LGU	P 75,000.00
	1- MAP ARC MPC Pinana-an	DA/ LGU	P 75,000.00
	1- LMPC Lingayao	DA/ LGU	P 75,000.00
	1- MARBA Malicato	DA/ LGU	P 75,000.00
	1- FA Tinucuran	DA/ LGU	
	1- FA Ambacon		P 75,000.00
	1-FA Cambuayon	DA/ LGU	
			P 75,000.00
		NIA	
	1- FA Lingayao		
	FA Mat-i	NIA	
c. Rice thresher			P 75,000.00
	1- CIP Lingayao		
	2- C I P Maningalao		
d. Irrigation System		NIA/ LGU	
	Malicato		
	Ambacon		
	Maningalao	DA/ LGU	
e. SWIP		DA/ LGU	
1-P4		DA/ LGU	
1-PALMAVERA	Poblacion	DA/ LGU	
1-DAMULUG	Tinucuran	DA/ LGU	
	Malicato	DA/ LGU	
f. Pump- Open Source	San Isidro	DA/ LGU	
-3 STW	Rosario		P 151,780.00
-4 STW	Marcos Calo		P 197,920.00
-7 STW	San Roque	LGU	P 284,220.00
-2 STW	Mat-i		P 82,096.00
-2STW	Consorcia	DA/ LGU	P 142,610.00
-3 STW	Ambacon		P 154,440.00
-1 STW	Cambuayon	DA/ LGU	P 57,000.00
-2 STW	Pinanaan	DA/LGU	P 100,960.00
-1 STW	Lingayao		P 48,200.00
-1 STW	Maningalao		P 49,000.00
-2 STW			P 103,250.00
-1 STW			
-5 STW			
-2 STW	MAO		

a. Post-harvest Facilities	FA Mat-i		P 1,800,000.00
a. -Farm Tractor 4Wheel		DA/ LGU	P 479,000.00
		DA/ LGU	
b. - Mechanical Dryer	FA- Lingayao		P 479,000.00
c. -1 Motor and Transformer [on –nstallation]	FA- Poblacion	DA/ LGU	P 479,000.00
		DA/ LGU	
d. -1 Service drop Wire [lacking on installation]	Poblacion		
	Parish Council		
	Malicato		P 250,000.00
e. -1 motor, etc. [on installation]	FA-Maningalao		
	FA-Lingayao	NFA/LGU	
	FA-Mat-i	DA/LGU	P 79,800.00
b. MLGC			P 79,000.00
c. Mini-warehouse	1 – Maningalao	DA/LGU	P 79,000.00
	2 – Lingayao	DA/LGU	
d. Rice Thresher with Engine	2 – Mat-i	DA/LGU	P 200,000.00
	1 – Pinanaan MAP ARC		
e. Mill	1 – Ambacon	CIDSS/LGU	
a. Rice and corn mill	1 – E.G. Montilla	Private	250,000.00
b. Rice and corn mill	1 – Tinucoran	Private	250,000.00
c. Rice mill	1 – Poblacion	ARSP	
d. Rice and corn mill	1 – Malicato SN MPC	Private	
e. Corn mill	1 – Katipunan	Private	
f. Rice and corn mill	1 – Bonifacio	Private	120,000.00
g. Rice and corn mill	1 – Marcos Calo	Private	
h. Rice and corn mill	Rosario	LBP	
i. Rice mill	Rosario	Private	
j. Rice mill	Rosario	LGU Brgy.	
k. Rice mill	Ibuan	Private	200,000.00
l. Rice mill	Durian	Private	
	Casiklan	LGU/National	
	Casiklan	DTI	
	Casiklan	Private	
	1 – San Roque	Private	
	1 – San Isidro	Private	
	1 – Malicato	Private	P 60,000.00
	1 – Mat-i	Private	P 60,000.00
	1 – Consorcia	DA/LGU	P 54,000.00
	2 – Maningalao	DA/LGU	P 66,000.00
	2 – Maningalao	DA/LGU	P 59,000.00

	Lingayao	DA/LGU	P 40,000.00
	Malicato	DA/LGU	
	Consorcia	DA/LGU	P 49,000.00
	Mat-i		P 49,000.00
a. Floating Tiller	Maningalao	DA/LGU	P 49,000.00
	Ambacon/Pinanaan	DA/LGU	P 49,000.00
	San Roque	DA/LGU	P 49,000.00
	Maningalao	DA/LGU	P 149,850.00
		DA/LGU	
		LGU	
		LGU	
b. Hand Tractor with Trailer		LGU	
5.Loan/Credit Facility			

Annex B 12: Present and Projected Agricultural Production (In Metric Tons)

Year	Rice						Corn	
	Irrigated		Rainfed		Total			
	Area (Has.)	Prod'n. (M.T.)	Area (Has.)	Prod'n. (M.T.)	Area (Has.)	Prod'n. (M.T.)	Area (Has.)	Prod'n. (M.T.)
2000	303	3,328	595	4165	898	7493	513	1539
2001	305	3355	600	4200	905	7555	628	2198
2001	308	3385	673	4708	980	8093	715	2503
2003	311	3418	676	4732	987	8150	738	2952
2004	458	5038	680	4757	1138	9795	804	3216
2005	520	5720	683	4781	1203	10501	958	3832
2006	625	6875	687	4806	1312	11681	976	3904
2007	749	8239	693	4830	1439	13069	992	3968
2008	858	9438	694	4855	1552	14293	1052	4208
2009	988	10868	697	4879	1685	15747	1512	6048
2010	1,335	14685	701	4904	2036	19589	1611	6444
2011	1,381	15191	706	4939	2087	20130	1628	6512
2012	1,545	16995	709	4963	2254	21958	3414	15363
Total				**61,516**				**62,687**

Annex B13: **Fish Production**

Fishponds/Fishing Grounds/Fishcages	**Location**	**Area (sq.m.)**	**Volume of Catch**		
			Average	**Total (kg)**	**Value(40/kg)**
Fishpond					
1.Inland culture	Ibuan	21,600	(70% survival	2,592	103,680
	Durian	10,950	Rate at 150g	1,149	45,960
	Casiklan	22,100	ABW)	2,320	92,800
	San Isidro	2,300		241	9,640
	Katipunan	1,400		147	5,880
	Lingayao	9,600		1,008	40,320
	Maningalao	18,500		1,942.5	77,680
	Marcos Calo	16,200		1,701	68,040
	Poblacion	1,850		194	7,760
	Malicato	3,725		95	3,800
	Bonifacio	700		73	2,920
	Rosario	13,000		1,365	54,600
	Mat-i	4,000		420	16,800
	Consorcia	11,650		1,223	48,920
	Cambuayon	500		52	2,060
	Balungagan	200		21	840
Total		**138,275**		**14,543 MT**	**581,720**
2.Inland Capture (Agusan river. Lingayao creek and Magus creek	Poblacion Pinanaan Malicato Ambacon E.G. Montilla San Isidro Tinucoran Lingayao Mat-i			1.5 MT Tilapia carp	75,000

Source: MAO

Annex B 14: History and Effects of Past Hazards

Hazard	Period	Impacts	Exposed Group/ commodity	Vulnerable areas	Baseline data per barangay	Extent of damage/ yield loss per barangay	Analysis/ evaluation of impacts
1. Flood	December 2005 to February 2006	Damage to Crops					
		Rice	Rice farmers	San Roque	50.0	20.0	40% [medium]
				Rosario	150.0	50.0	33% [medium]
				Malicato	91.75	40.0	42% [medium]
				Tinucuran	93.75	61.0	65% [high]
				Ambacon	160.0	62.5	39% [medium]
				Mat-i	87.5	20.0	22% [low]
				M. Calo	48.0	25.0	52% [medium]
				Pinanaan	51.5	10.0	19% [low]
				Maningalao	73.5	15.0	20% [low]
				EG Montilla	35.0	35.0	100% [high]
				Bonifacio	39.75	9.0	23% [low]
				Consorcia	22.5	11.0	49% [medium]
				Lingayao	127.5	27.0	21% [low]
				Katipunan	76.0	7.0	9% [low]
				San Isidro	29.0	10.0	33% [low]
		Corn	Corn farmers	Lingayao	35.0	1.0	3% [low]
				Mat-i	28.0	2.0	7% [low]
				Pinana-an	126.0	20.0	16% [low]
				Ambacon	74.0	18.0	24% [low]
				San Isidro	75.0	15.0	20% [low]
				San Roque	80.0	12.0	15% [low]
				Marcos Calo	26.0	8.0	31% [medium]
				Bonifacio	55.0	10.0	18% [low]
				Katipunan	30.0	10.0	33% [medium]
				Balungagan	48.0	4.0	8% [low]
				Casiklan	80.0	2.0	2.5% [low]
		Damage to Livestock					
		*Goat	Backyard Livestock growers	Puroks 1-7 of Tinucuran	42	30	71% [high]
		Chicken			4,235	150	3.5% [low]
		Pig			142	100	70 [high]
		Carabao			58	10	17% [low]
		Cow			15	5	33% [low]
		*cattle		Marcos Calo [Puroks: 1,3,4 and 5]	20	7	35% [medium]
		Swine			300	105	35% [medium]
				Ambacon	25	3	12% [low]

				[Purok 1,4	70	7	34%
		*cattle		and 5]	205	24	[medium]
		carabao					11% [low]
		Swine		San Roque	54	15	
							29%[low]
		*carabao		Malicato	315	50	
					35	12	15% [low]
		*swine					34%
		Cattle		Balungagan	30	27	[medium]
					244	231	
		*goat			23	1	70% [high]
		Swine			2,500	1,750	90% [high]
		Carabao					4% [low]
		Chicken					70% [high]
				Ambacon			
				[1 box			
		Damage		culvert]			low
2.	June –	to Prop-					
Drought	December	erty					
	2009						
		Damage			50.0	45.0	
		to crops		San Roque	150.0	132.5	
				Rosario	91.75	71.75	90% [high]
		*rice		Malicato	93.75	82.75	88% [high]
				Tinucuran	160.0	125.0	78% [high]
				Ambacon	87.5	76.5	88% [high]
				Mat-i	48.0	38.0	78% [high]
				M. Calo	51.5	51.5	87% [high]
				Pinanaan	73.5	19.5	79% [high]
				Maningalao	35.0	35.0	100% [high]
				EG Montilla			26% [low]
				Bonifacio	39.75	13.5	100% [high]
				Consorcia	22.5	18.0	
				Katipunan	76.0	58.0	33%
				San Isidro	29.0	10.0	[medium]
							80% [high]
					89	1	76% [high]
				Pinanaan			34%
			Corn				[medium]
		Loss of	farmer				
		life					Low

Annex B15: **Past Adaptations by Affected People and Places**

Past Adaptation by Affected People and Places	1999 **Flood**	2002 **Flood [Prolonged rainy season]**	2008 **Flood [Prolonged rainy season]**	2009 **Drought**
Communities	· Deployed community volunteers to rescue and provide assistance in immediate evacuation of affected families; • Used church bell as warn system especially during rise of river water levels	• Information campaign on disaster preparedness and utilized church bell as early warning system;	• Information campaign on disaster preparedness and utilized church bell as early warning system; • Construction of houses with the use of concrete instead of wood posts; • Accessed loans to rural banks and individual lenders in the municipality	• Accessed loans to rural banks and individual lenders in the municipality; • Engaged on paid labor;
Municipal Government	• Maximized calamity funds to distribute relief goods to affected households and individuals • Acquired one [1] unit motorized boat and 2 units banca used as additional transport, rescue and relief operations • Networked communication from LGU radio-phone station to individuals with hand-held radios in the municipality to provide daytime updates and uplate happenings in the barangays	• Provided support funds to DA-RFU XIII to acquire shallow tube wells and water pumps to supply irrigation for rice;	• Provided counterpart funds to establish post-harvest facilities such as warehouses, multi-purpose drying pavements; • Provided certified rice seeds for rehabilitation of flood prone areas;	• Sped-up tree plantation drive in the barangays, deployed LGU workers to set-up nursery for fruit trees and other tree species propagation; • Provide legislative and financial support for watershed area development in Barangay Lingayao

Farmers	• Replanting of corn after flood water subsided;	• Engaged on backyard or home lot livestock production system; • Adjust planting schedules;	• Planting of corn in the first crop cycle after rainy months and flood; • Use of BIO-N seed inoculants before planting; • Use of early maturing varieties of rice; • Observed lunar cycle to start rice and corn production cycle;	• Construct or dug ponds to catch rain water to support rice field during dry months as an alternative irrigation; • Use of Small Water Impounding Projects [SWIP] to supply rain-fed areas • Engaged on Natural Farming Technology System;

Annex B 16**: Assessment of Past Adaptation Strategies**

Past Adaptation by Affected People and Places	Sufficiency	Constraints
Flood		
Strategy 1- Distribution of relief goods by the municipal government	With the coordinated response of the MSWDO, Local Disaster Coordinating Council and the B-LGUs, total reported affected individuals and household were served;	Goods with less nutritional values [e.g. noodles] were usually an alternative for aide;
Strategy 2-Provision of vehicles [i.e. motorized boat, banca] for immediate response, and other transport	Some of the activities of the LGU such as relief operations, transport, monitoring and surveillance during flood are met;	Short service life of the transport vehicles; additional funds for maintenance
Strategy 3- Access of loans from rural banks, private institutions and individual lenders to rehabilitate corn and rice farms after the hazards	Not all affected farmers could access loans to rehabilitate rice and corn farms after floods;	High interest rates, no centralized program of the LGU catering financial support to farmers
Strategy 4-Adjustments of cropping calendar	Some farmers observed traditional way of farming which for them have direct relation to pest population and infestation	Need of climate instruments such as Automatic Weather Station and EWS

Strategy 5-Use of BIO-N during corn planting and other sustainable farming methods;	Not all farmers are informed on the inoculation technique; few farmers practiced on this technology. The Provincial Agriculturist of Agusan del Norte have put up a BIO-N processing plant to be functional sooner,	Training and more techno-farms should be made
Strategy 6- Provision of post-harvest facilities such as warehouses and flat-bed dryers	Farmers benefit much of these facilities during drying of palay and corn produce	More units should be established which needs more LGU investments
Strategy 7- Riverbank stabilization project and Construction of Warf at Poblacion, Las Nieves	Less investment were made and very minimal physical accomplishment were reached	Not prioritized in development planning of the LGU
Drought		
Strategy 1-Construct or dug ponds to catch rain water to support rice field during dry months as an alternative irrigation especially to rain-fed areas;	Not all farmers initiate such activity; rainwater catchments could only served small fields;	Limitation of service area and unsustainable supply; irrigation facilities will be in need

Annex B 17: Details Of The 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 early onset of rainy season or prolonged rains) F. Others (Please Specify)	Impacts A. Increased income B. Generated employ-ment C. Reduced poverty D. Environmen-tal 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			
1. Promotion of early maturing of Upland Varieties and Lines of Rice & Corn	C (15 Brgy's)	Source out seeds stocks from PhilRice-RTR, Sus-Ag		A	E	A	B
2. Invest on community irrigation project, utilizing available surface water .	B [9 brgys.]	Source out funds from concerned agencies		A	B	A,B,C D	A
3. Shift on farming system: Rubber base farming system	B (10 Brgys)	Planting of Budded & Non-Budded Seedlings		A	A,B,&C	A,B,C,&D	A
4. Orchard/Coconut + Small Ruminants production	A	Raise Goat under Coco Farms with Housing		A	A	A,C,&D	A
5.Use of Hybrid & improved Open Pollinated Variety of corn	C (20 Brgys)	Source out seeds stocks from DA-RFU 13		A	A	A,B,&C	C
6. Corn-melon, & vegetables Production	A	Mixed Planting of corn & Vegetables		B	A,B,&E	A,B,C,&D	A

7. Crop Rotation-Rice then legumes	A	Planting of Legumes after Rice harvest		B	A,B,&E	A,B,C,&D	A
8. Rice - Ducks Production	A	Raising of 1 month old Ducks after 30 DAT		A	A,B,&E	A, D, &E	A
9. Organic Fertilizer Production	A	Used IMO, Vermi Composting, & EMAS in Organic Fertilizer Production		A	B & F	A, B, C, &D	A
10. SALT Farming	A	Establishment of Hedge Rows in Hilly Farm Areas		A	A, C, & D	D	A
11. Crop Insurance							

Annex B18: **Assessment of Past Adaptation Strategies**

Past Adaptation by Affected People and Places	Sufficiency	Constraints
Flood		
Strategy 1- Distribution of relief goods by the municipal government	With the coordinated response of the MSWDO, Local Disaster Coordinating Council and the B-LGUs, total reported affected individuals and household were served;	Goods with less nutritional values [e.g. noodles] were usually an alternative for aide;
Strategy 2-Provision of vehicles [i.e. motorized boat, banca] for immediate response, and other transport	Some of the activities of the LGU such as relief operations, transport, monitoring and surveillance during flood are met;	Short service life of the transport vehicles; additional funds for maintenance

Strategy 3- Access of loans from rural banks, private institutions and individual lenders to rehabilitate corn and rice farms after the hazards	Not all affected farmers could access loans to rehabilitate rice and corn farms after floods;	High interest rates, no centralized program of the LGU catering financial support to farmers
Strategy 4-Adjustments of cropping calendar	Some farmers observed traditional way of farming which for them have direct relation to pest population and infestation	Need of climate instruments such as Automatic Weather Station and EWS
Strategy 5-Use of BIO-N during corn planting and other sustainable farming methods;	Not all farmers are informed on the inoculation technique; few farmers practiced on this technology. The Provincial Agriculturist of Agusan del Norte have put up a BIO-N processing plant to be functional sooner,	Training and more techno-farms should be made
Strategy 6- Provision of post-harvest facilities such as warehouses and flat-bed dryers	Farmers benefit much of these facilities during drying of palay and corn produce	More units should be established which needs more LGU investments
Strategy 7- Riverbank stabilization project and Construction of Warf at Poblacion, Las Nieves	Less investment were made and very minimal physical accomplishment were reached	Not prioritized in development planning of the LGU
Drought		
Strategy 1-Construct or dug ponds to catch rain water to support rice field during dry months as an alternative irrigation especially to rain-fed areas;	Not all farmers initiate such activity; rainwater catchments could only served small fields;	Limitation of service area and unsustainable supply; irrigation facilities will be in need

ANNEX -B

Annex B19: **Climatological Changes by Month**

Province Agusan del Norte	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave.
Rainfall [mm]	173.4	272.9	217.5	78.5	78.8	192.5	140.5	178.9	407.0	270.4	73.7	231.4	192.97
Number of rainy days	23	22	18	12	15	24	20	20	17	19	22	25	19.75
Maximum Temp. [C]	32.3	32.6	33.6	34.6	35.4	34.8	34.6	35	34	34.3	35	34	34.18
Minimum Temp [C]	18.6	20.8	21.0	21.0	22.3	23.4	21.6	22.8	22.5	22.6	22	22	21.72

Source: Caraga SEP; Philippine Geophysical and Astronomical Services Administration [PAGASA], Proposed Agro-Forestry Estate in Las Nieves, Agusan del Norte [Vol. 1]

Annex B20: Scenario Analysis Matrix[1] (Year 2020)

Scenario	Climate Scenario: Increasing temperature and decreasing rainfall	Extent of areas to be affected	No. of people to be affected	Damage to lives	Damage to properties	Livelihood impacts	Others e.g. human health, etc.
Scenario 1: Status Quo	Current S&T dev't	Rice: 1,114 ha Corn:1,167 ha	Rice: 706 Corn: 612	Moderate	Moderate	Low	Increase morbidity
	Current population growth	high	35,386	Moderate	Moderate	Low	High impact
	Current adaptive capacity	High	High	Low	Moderate	Low	High
	Current LGU budget levels	High	High	Moderate	High	Less oppurtunities	Limited support for health service
	W/out land conversion	Rice: 1,114 ha Corn:1,167 ha	Rice: 706 Corn: 612	Low	Low	Low	High
	Summation or scenario narrative	All production areas of corn and rice are affected.	706 rice farmers and 612 corn farmers	Displacement of communities [moderate]	Moderate impacts	Low opportunities of livelihood	High negative impacts

Scenario 2: Positive	Increasing S&T dev't	Moderate	Low	Low	Low	High	Low
	Decreasing population growth	Low	Moderate	Low	Low	Moderate	Low
	Increasing adaptive capacity	Low	Low	Low	Low	Additional investments	Low
	Increasing LGU budget levels	Low	Low	Low	Low	Increased opportunities	Low
	W/out land conversion	Low	Low	Low	Low	High	Low
	Summation or scenario narrative	Food base is stabilized	Affected population is lesser	Minimal effect	Low impact	High opportunities	Low
Scenario 3: Negative	Current S&T dev't	Rice: 1,114 ha Corn:1,167 ha	Rice: 706 Corn: 612	High	High	Low	Increase morbidity
	Increasing population growth	High	High	High	High	Low	High negative impacts
	Current adaptive capacity	High	High	High	High	Low	High
	Decreasing LGU budget level	High	High	High	High	Low	High negative impacts
	With land conversion	High	High	Moderate	Moderate	Low	High
	Summation or scenario narrative	Less food production level and high food demand	706 rice farmers and 612 corn growers	Displace-ment of community is high	High impacts to water utilities	Low livelihood opportunity	Increased problems on health

___[1]Prepared by SUCCEED, Inc. for CCAP-ILO based on project's guidelines on scenario analysis.

Annex B 21: Scenario Analysis Matrix[1] (Year 2050)

Scenarios	Climate Scenario: Increasing temperature and decreasing rainfall	Extent of areas to be affected	No. of people to be affected	Damage to lives	Damage to properties	Livelihood impacts	Others e.g. human health, etc.
Scenario 1: Status Quo	Current S&T dev't	Rice: 1,114 ha Corn:1,167 ha	Rice: 706 Corn: 612	High	High	Low	Increase morbidity
	Current population growth	high	50,657	High	High	Low	High impact
	Current adaptive capacity	High	High	Moderate	Moderate	Low	High
	Current LGU budget levels	High	High	High	High	Less opportunities	Limited support for health service
	W/out land conversion	Rice: 1,114 ha Corn:1,167 ha	Rice: 706 Corn: 612	Moderate	Low	High	
	Summation or scenario narrative	All production areas of corn and rice are affected.	706 rice farmers and 612 corn farmers	Displacement of communities [High]	High impacts	Low opportunities of livelihood	High negative impacts
Scenario 2: Positive	Increasing S&T dev't	Moderate	Low	Low	Low	High	Low
	Decreasing population growth	Low	41,080 [moderate]	Low	Low	High	Low
	Increasing adaptive capacity	Low	Low	Low	Low	Additional investments	Low
	Increasing LGU budget levels	Low	Low	Low	Low	Increased opportunities	Low
	W/out land conversion	Low	Low	Low	Low	High	Low
	Summation or scenario narrative	Food base is stabilized	Affected population is lesser	Minimal effect	Low impact	High opportunities	Low

Scenario 3: Negative	Current S&T dev't	Rice: 1,114 ha Corn:1,167 ha	Rice: 706 Corn: 612	High	High	Low	Increase morbidity
	Increasing population growth	High	High	High	High	Low	High negative impacts
	Current adaptive capacity	High	High	High	High	Low	High
	Decreasing LGU budget level	High	High	High	High	Low	High negative impacts
	With land conversion	High	High	Moderate	Moderate	Low	High
	Summation or scenario narrative	Less food production level and high food demand	706 rice farmers and 612 corn growers	Displace-ment of community is high	High impacts to water utilities	Low livelihood opportunity	Increased problems on health

[1]Prepared by SUCCEED, Inc. for CCAP-ILO based on project's guidelines on scenario analysis

Annex B 22: **Future Adaptation Strategies Category**

Future Adaptation Category	Strategy		Critical Factor	
	Flood	Drought	Flood	Drought
Physical/ Infrastructure	Riverbank stabilization project in Poblacion and Pinana-an	Construction of Marcos Calo-Bonifacio Communal Irrigation Project and Small Water Impounding Projects	Conduct feasibility study and prepare all relevant documents for submission to funding donors	Conduct feasibility study and prepare all relevant documents for submission to funding donors
Technological	Establishment of Automatic Weather Station and Early Warning System	Establishment of Automatic Weather Station and Early Warning System Organic farming and technofarms establishment	Support of the Local Chief Executive and other municipal officials	Support of the Local Chief Executive and other municipal officials Integrate in the Municipal Development Plans ; tap concerned offices to source out necessary funds for long-term implementation
Economic	Support farmers through crop insurance;	Support farmers through crop insurance;	Tap line agencies which caters insurance services to crops as well as livestock	Tap line agencies which caters insurance services to crops and livestock
Political/ Institutional	Local adoption and full implementation of climate change policies and laws	Local adoption and full implementation of climate change policies and laws	Political will	Local adoption and full implementation of climate change policies and laws
Environment		Water-shed establishment and management		Support of the Local Chief Executive and other municipal officials; Tap all concerned agencies and stakeholders for smooth implementation

Annex B 23: Criteria/Indicators and the Corresponding Weights in Percentage

Criteria/Indicators of Effectiveness	Assigned Weights (%)
1. ***Cost Effectiveness*** (the higher the positive return from the given inputs/costs, the more cost-effective)	5%
2. ***Contribution to Poverty Reduction*** (potential of the adaptation practice to reduce poverty)	10%
3. ***Increase Income*** (potential of the adaptation practice to increase income)	10%
4. ***Contribution to Employment*** (potential of the adaptation practice to provide employment)	10%
5. ***Size of beneficiary group*** (more positive impacts to greater number of people, the more efficient the adaptation strategies)	10%
6. ***Absence of adverse impacts on other sectors/group*** (less negative impacts to other group/sectors, the more effective the CCA strategy)	10%
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)	10%
9. ***Socio-cultural Acceptability*** (the more acceptable the CCA practice to greater number of stakeholders, the more effective)	5%
10. ***Immediate impact/response to urgent needs*** (the more immediate positive impacts of adaptation practice the more effective)	10%
11. ***Potential for Up-scaling*** (the greater the potential for wider application, the more effective)	10%
TOTAL	**100**

Annex B 24: Scoring of the Adaptation Practice based on the Weighted Percentage Given for Each Criterion/ Indicator

Climate Change Adaptation Practice	Criteria/Indicators of Effectiveness											
	Cost Effectiveness 5	Contribution to Poverty Reduction 10	Increase Income 10	Contribution to Employment 10	Size of beneficiary group 10	Absence of adverse impacts on other sectors/ groups 10	Environmental Soundness 10	Ease of Implementation 10	Socio-Cultural Acceptability 5	Immediate Impact 10	Potential for Upscaling 10	Total Score 100
1. Promotion of early maturing of Upland Varieties and Lines of Rice & Corn	3	10	7	7	7	7	10	10	5	7	10	83
2. Invest on community irrigation project, utilizing available surface water .	5	7	10	5	7	10	10	5	5	10	10	84
3. Shift on farming system: Rubber base farming system	5	10	10	7	7	10	10	5	5	5	10	84
4. Orchard/Coconut + Small Ruminants production	5	10	10	7	5	7	10	7	3	7	10	81
5.Use of Hybrid & improved Open Pollinated Variety of corn	5	10	10	7	7	10	7	7	3	10	7	92
6. Corn-melon, & vegetables Production	5	10	10	7	7	10	10	10	3	10	10	86

7. Crop Rotation-Rice then legumes	5	7	10	7	7	10	10	10	3	10	10	89
8. Rice - Ducks Production	5	10	10	7	5	7	7	10	1	7	10	79
9. Organic Fertilizer Production	5	7	10	7	10	10	10	10	3	10	10	92
10. SALT Farming	3	5	5	5	7	10	10	5	3	7	10	70
11. Crop Insurance	5	10	10	7	10	10	10	7	10	10	10	99

Annex B 25: Ranking of Adaptation PracticesBased on their Weighted Score

Ranking
1. Crop Insurance
2. Organic Fertilizer Production
3. Use of Hybrid & improved Open Pollinated Variety of corn
4. Crop Rotation-Rice then legumes
5. Corn-melon, & vegetables Production
6. Invest on community irrigation project, utilizing available surface water .
7. Shift on farming system: Rubber base farming system
8. Promotion of early maturing of Upland Varieties and Lines of Rice & Corn
9. Orchard/Coconut + Small Ruminants production
10. Rice - Ducks Production
11. SALT Farming

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