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 Remedios T. Rumaldez, 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

Table of Content

Acronyms

A&D	Alienable and Disposable
CLUP	Comprehensive Land Use Plan
CBMS	Community Based Monitoring System
CCAP	Climate Change Adaptation Project
DA	Department of Agriculture
DOLE	Department of Labor and Employment
DTI	Department of Trade and Industry
EWS	Early Warning System
FFS	Farmers Field School
FGD	Focus Group Discussion
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
MT	Metric Ton
LGU	Local Government Unit
NGA	National Government Agencies
NGO	Non-Governmental Organization
NIA	National Irrigation Administration
RBO	Rural-Based Organizations
RTR	Remedios Trinidad Romualdez
V & A	Vulnerability and Adaptation

List of Figures

List of Tables

Message

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

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 R.T.Romualdez 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

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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 R.T.Romualdez CCAP Municipal Focal Team:

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*Led b*y Lurraine B. Villacorta, *CCA Project Manager of the International Labour Organization and* Gemma Clarin, *Municipal Anchor for R.T.Romualdez and also from the Department of Trade and Industry (DTI)-Caraga; together with other TWG members:* Brenda B. Corvera o*f the Deparment of Trade and Industry (DTI)- Caraga*; Maida Lynn Sanchez *of the Department of Labor and Employment(DOLE)-Caraga;* Rofel C. Cabaltera, 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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Nothing could simply be done without the involvement of the Municipal Offices comprising the Municipal Focal Team in the data generation, participation in workshop and extra time spent in the writing of this reports.

The LGU of RT Romualdez also acknowledges the support extended by the farmers' organization represented by the members from different barangays who have spent time and effort participating in focus group discussions (FGD), Key Informant Interview (KIIs), and pool survey responding to the information needed in the process of data generation and seeing to it that their respected areas of concern are included.

For every one, for or against anything adopted as thrust of the municipality in the next coming year 2020 and forward to year 2050, your contribution is invaluable and may that be always be available as we buckle down to work.

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 Remedios T. Romualdez 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.

Towards the end, the study will present prioritized options for climate change adaptations

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. This is enhanced and finalized through cliniquing sessions with the TWG anchors, V&A mentors and, finalization and packaging support by SUCCEED, Inc..

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

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

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 Remedios T. Romualdez 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 Remedios Trinidad Romualdez (RTR), Agusan del Norte, is 18.80 kilometers from Butuan City. Founded on January 1, 1984, it has eight barangays, namely: Poblacion 1, Poblacion 2, Tagbongabong, Humilog, Basilisa, Panaytayon, Balangbalang, and San Antonio.

As of the recent survey, RTR has a total population of 13,077.

Ranging from level land up to very steep hills and mountains, the town has a total of 8,147 hectares where 4,945 hectares (or 60.70%) is devoted to agricultural activities and 3,033.255 hectares (or 37.23%) for forest use.

RTR has type IV climate which is characterized with evenly distributed rainfall all year round.

Around 1,889 households in the municipality or 70.20% lives within income below poverty threshold level of Php 10,978.92, which is much higher than the 35.20% poverty incidence of the province. San Antonio has 87.7% or the largest number of its households who are below the poverty level income The average monthly income ranges between Php 12,000.00 to 45,000.00 or an average of Php 14,626.58 (*CBMS 2007*)

Each barangay is doing its part in tracking the odds of housing, water, & sanitation, health & nutrition and education. Aside from rice farming, residents find as alternative sources of livelihood: poultry/swine/large ruminant raising, vegetable production, abaca/banana production & trading, etc. Losses in rice production are due to steam borer, floods, strong winds & other diseases.

RTR has a 113.55-kilometer road system, exceeding the road lengths required by standards.

The National Irrigation Administration (NIA) is the main source of irrigation & the town has abundant water sources. For rice trading & marketing, the national food authority

buys dried palay & the local government also tapped the Department of Trade and Industry for the promotion of products.

Aside from the LGU initiatives, privates' entities also provide financial loans to farmer at interest rate of 10% per month.

The priority crops given focus in this study are rice and banana. All barangays except San Antonio are engaged in rice production with 1,742 hectares of land devoted to it, involving almost 800 farmers. Banana is the second widely produced agricultural crop in the municipality next to rice. The average yield of banana was recorded at 12 tons per hectare from year 2002 to 2006. All barangays except Poblacion I and II are likewise engaged in Banana production.

Causes of production losses ranging from 10% to 40% were due to infestation (i.e. stem borer and other diseases), flooding and strong winds.

Current Hazards and Observed Climate change Impacts

Flooding, drought, crops infestation, typhoon are the sources of hazards of the municipality. Though, flooding, due to torrential rains, is the most frequent occurrence,

Flooding usually occurs in the eastern part of the municipality where it is also prone to erosion covering 224.65 to 2,231.39 hectares (or 3 to 27%) of the total land area of the municipality. Barangays Basilisa, Humilog, Panaytayon, Poblacion I and Poblacion II, with slope level ranges from 0-3 % were the most affected areas.

Adaptation Strategies

A number of common past adaptation strategies were done to mitigate the ill effects of climate hazards. The farmers and communities coping up mechanisms mainly include adjustments in their farming practices (i.e. adjustment of planting calendar, synchronous planting, cleaning of canal and drainage system, re-planting of affected areas, early harvesting, Pest management, crop and life insurance). On its part, the LGU employed the declaration of state of calamity to raise fund, dredging of creeks, seed subsidy, tree-planting program, rehabilitation of road networks, financing assistance e.g. rice production loan, mass production of organic fertilizers (i.e. vermie composting), promotion of organic farming technology, promotion of crop insurance scheme, etc.

Current adaptation strategies are set in place in the municipality, categorized as; physical/infrastructural, economic, technological, and political/institutional. However, limited funding posed as the major hurdle to fill in the gaps (insufficiency) in the stated strategies, followed by lack of full cooperation of farmers in adaption of organic farming technologies, manually operated early warning system (EWS), among others.

Scenario Analysis & 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 RTR for the year 2020 was: Scenario 1 with Low, scenario 2 as Low, and scenario 3 as high. In the year 2050, scenario 1 is rated as moderate, scenario 2 as low and scenario 3 as high.

To respond to the predictions of impacts, strategies are pushed thereby enhancing all- sided adaptation capacity of various stakeholders headed by the LGU. From the long list, priorities were identified including, but not limited to: a) Economic - Promotion of organic and sustainable farming technology; Financial and technical assistance; Strengthening of RBO's and Expanded crop insurance program; b) Technological - Upgrading of Early Warning System (EWS) of PAGASA; c) Physical/infrastructural - Construction of alternative irrigation facilities in Agay river; d) $Political/ institutional - Strict enforcement of municipal ordinance on agriculture and forestry related to environmental protection; Increase capacity to generate funds for climate change, and Negotiate with the LGU of Magallanes on the egress of the drainage system passing through their area.

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 Remedios T. Romualdez, 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 the 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

1.1. BIOPHYSICAL CHARACTERIZATION

The new-born town Remedios T. Romualdez has its roots from the seven barangays that were part of the adjacent municipality of Cabadbaran (i.e. Barangays Agay, Tagbongabong, Humilog, Basilisa, Panaytayon, Balang-balang and San Antonio), dubbed as the rice granary of Cabadbaran. In 1978, Atty. Antonio R. Tupaz the elected assemblyman of Agusan del Norte, sponsored Parliamentary Bill No. 1291, or An Act Creating the Municipality of Remedios T. Romualdez.

Having qualified with the requirements provided for under the law. Batas Pambansa Bilang 336 was passed making the municipality of Remedios T. Romualdez the eleventh town of Agusan del Norte. It officially became a local government unit on January 1, 1984 with Mr. Euquerio A. Dominise, a former Sangguniang Panlalawigan member, serving as its first Municipal Mayor.

1.1.1. Location/Topography

Location

The municipality of Remedios T. Romualdez (RTR) is 18.80 kilometers from Butuan City. The municipality lies within grid coordinates of 9^0 02' to 9^0 05' North latitude and 125^0 33' to 125^0 44' East longitude. From the North it is bounded by the municipality of Cabadbaran, Agusan del Norte; on the South by the city of Butuan, on the west by the municipality of Magallanes and on the East by the Municipality of Sibagat.

The municipality is characterized by 25% flat areas on its western most part which suddenly rises to rolling and steep hills, and mountainous areas along the eastern side. A visible landmark to the west is Mt. Malinhawod, which has an elevation of 1,608 meters above sea level.

Figure 1: The Municipal Hall of RTR

1.1.2. Land Area And Land Use Patterns

By classification, the municipality only has 2,650 hectares or 32.52% of the total area as alienable and disposable. The other 5,497 or 76.47% hectares are classified as forestland.

In actual use, however, up to 5,113.75 hectares or 62.77% of its land area is now already being treated as Alienable and Disposable (A & D) lands. Only 3,033.26 hectares or 37.23 are now being considered as forestland.

Currently, the place is devoting 168.745 hectares or 2.07% of its land for built-up and 4,945 hectares or 60.70% for agricultural activities. The other 3,033.255 hectares or 37.23% are for forest use.

The 547.23 hectares land at the urban area is utilized as follows: Residential, 15.20

hectares or 2.78%; Commercial, 0.7755 hectare or 0.14%; Institutional, 7.10 or 1.30%; Agro-Industrial, 3.67 hectares or 0.67%; Open Spaces, 1.68 or 0.31%.

Those utilized for infrastructure and utilities comprise 10.78 hectares or 1.97%, and agriculture 505.02 hectares (or 92.29%).

Some 3.0 hectares (or 0.55%) are utilized for cemetery and buffer.

Table 1: **Existing General Land Use, RTR**

1. Built-Up	**168.745**	**2.07%**
2. Agriculture	**4,945.000**	**60.70%**
a. Crops/Mixed	4,678.43	57.429%
b. Livestock	-	-
b. Fish Pond	-	-
c. Uncultivated/Mixed Crops	591.670	7.26%
3. Forest	**3,033.255**	**37.23%**
a. Production	1,546.446	18.98%
b. Protection	1,486.809	18.25%
b.1. Watershed	*1,369.460*	*16.81%*
b.2. Virgin Forest	*117.349*	*1.44%*
4. Special Use		
a. Mining	800.00	9.82%
b. Agro-Industrial	3.670	0.05%
b. Tourism	2.000	0.02%
c. CARP	500.960	6.15%
d. CBFM	2,562.00	31.45%
TOTAL	**8,147.00**	**100%**

SOURCE: CLUP 2003-2012

Table 2: The Existing Urban Land Use Pan

1. Residential	**15.2000**	**2.78%**
2. Commercial	**0.7755**	**0.14%**
3. Institutional	**7.1000**	**1.30%**
4. Industrial	**-**	**-**
5. Agro-Industrial	**3.6700**	**0.67%**
5. Park/Playground & Other Recreational Spaces	**1.6820**	**0.31%**
6. Infrastructure/Utilities	**10.7800**	**1.97%**
7. Others Uses	**3.0000**	**0.55%**
a. Cemeteries	0.5000	0.09%
b. Others(Buffer)	2.5000	0.46%
8. Agriculture	**505.0255**	**92.29%**
TOTAL	**547.2330**	**100%**

SOURCE: CLUP

1.1.3. Geology

Rock Formation

Geologically, the lands here are made of sedimentary intrusive materials, whose formations (like the other parts of Agusan del Norte) can be traced to the earth's movement in the Jurassic Era some 365 million years ago.

Soil

There are five (5) soil types present in the municipality where 47% of the total land area is covered by Malalag Silt Loam, San Miguel Loam/Butuan Loam consist 23%, and Mountain soil (rubble land) at 30%. *(Please see table 3 below)*

Table 3: **Soil Type**

Type of Soil	# of Hectares
Butuan/San Miguel Loam	1,874
Malalag Silt Loam	3,829
Mountain Soil(Rubble Land)	2,444
Total	8,147

Slope

The terrain of the municipality ranges from level land up to very steep hills and mountainous areas. Above 50% slope occupies 44% of the total land area corresponding to 3,625.29 hectares located at the eastern part of the municipality. Rice areas largely occupy the second biggest area of the level land covering 1,742 hectares.

Barangays Panaytayon and Humilog are located in the lower portion of the municipality. *(Please refer to Annex 3: Slope Map, p.56)*

Elevation

A visible landmark to the west with the highest elevation level is Mt. Malinhawod at 1,608 meters above sea level. Tagnote Falls (a tourist spot) can also be found in the area. *(Please refer to Annex 4: Elevation Map, p.57)*

1.1.4. Drainage And River System

Agay River is the only river in town. This is the main source of the National irrigation System (NIA) lateral canal that provides water to the rice fields and other vegetation.

There could have been no problem with the drainage had it not for the fishponds in Magallanes, an adjacent town. These ponds cause or impede natural flow of excess water which cannot be freely drained to the sea so that it flows back. This causes flooding especially during heavy rains *(Please refer to Annex A5: Topographic Map, p.58)*

1.1.5. Climate And Rainfall Patterns

Baseline Climate Situation

The municipality has Type IV climate characterized with evenly distributed rainfall. This type of climate is common to almost all municipalities in the Province of Agusan del Norte.

Average Daily Rainfall

As observed, the daily average of rainfall values reflects that the highest amount occurs in February at 13.5 millimeters while the lowest usually occur in September at 2.3 millimeters.

In 2020, the highest amount of rainfall would occur in February at 12 millimeters and the lowest would be in April at 2 millimeters.

In 2050, the highest amount of rainfall would be 15 millimeters in January and the lowest would be 1.8 millimeters in April. *(Please refer to Figure 2 below)*

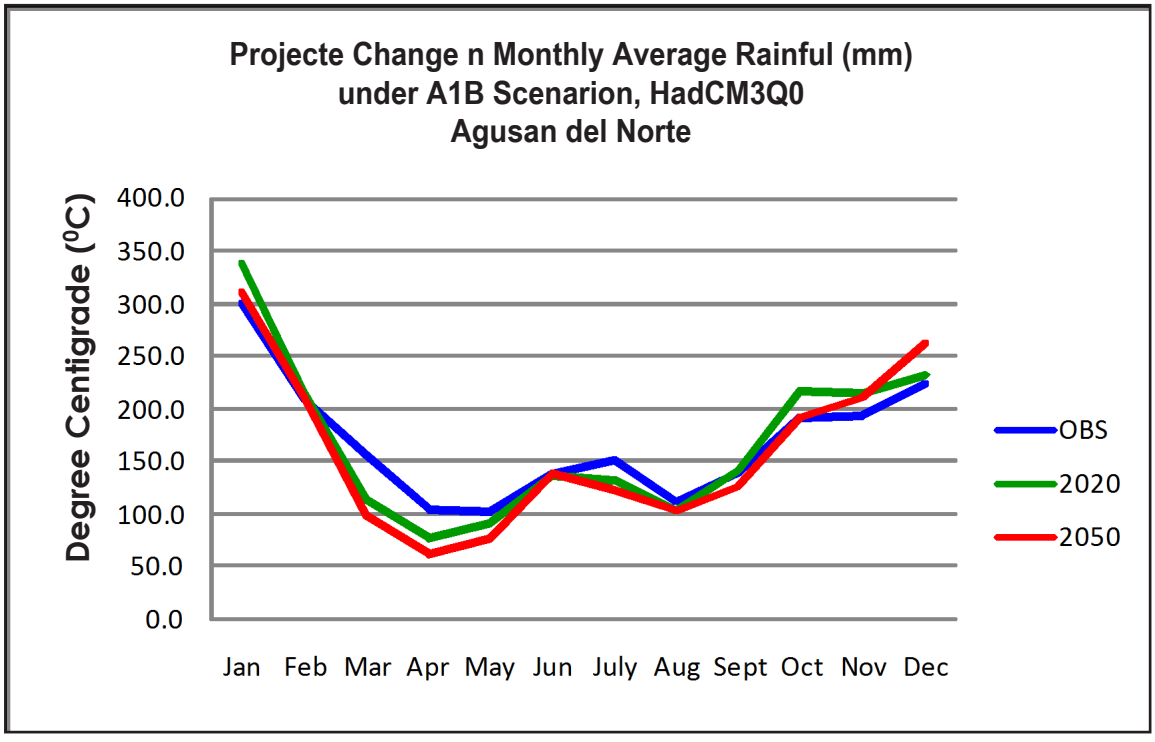
Daily Mean, Maximum and Minimum Temperature and

The observed scenario, records the highest temperature at 29 degrees centigrade in June and the lowest at 26 degrees centigrade in January and February.

The highest temperature would be at 30 degrees centigrade in June while January would have the lowest at 27 degrees centigrade in the year 2020.

A forecast of the daily average of mean temperature in 2050 reflects that the highest would be at 29 degrees centigrade in June and the lowest at 26 degrees centigrade in the months of January and February.

Figure 2: Average Daily Rainfall, PAGASA-Butuan City



Daily Average of Maximum Temperature

The highest Daily Average of Maximum Temperature in 2050 is within the month of May while the lowest is in the month of January.

The highest Daily Average of Maximum Temperature in 2020 in the month of June while the lowest is in the month of January.

Average Minimum daily Temperature

The highest Daily Average of Minimum Temperature in 2050 is in between June and July while the lowest is in the month of February.

The highest Daily average of Minimum Temperature in 2020 is between May and June while the lowest occur in the first quarter, month of January, February and March.

The highest Daily Average of Minimum Temperature in observed situation is in the month of June while the lowest is in the month of January. *(Please refer to figure 3 below)*

Maximum Daily Relative Humidity

As observed, the daily average of relative humidity records the highest in January at 89% and the lowest in April at 81%.

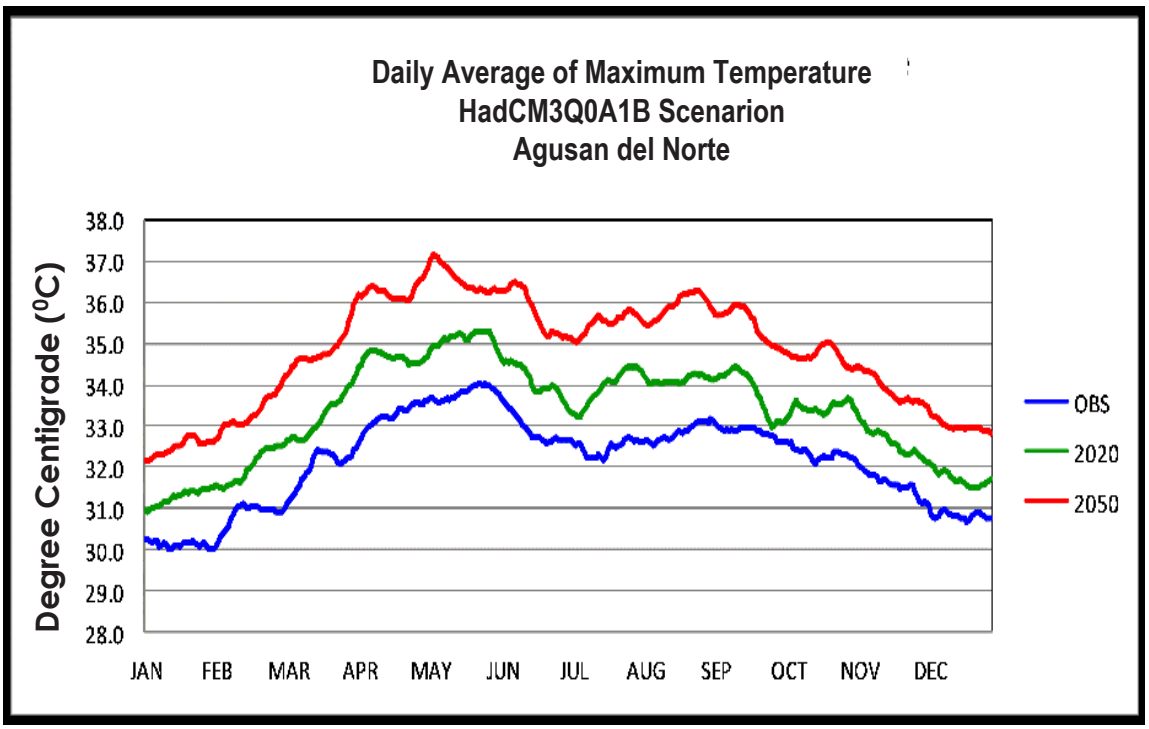
Forecast for 2020 shows that the highest daily average of relative humidity would be 88% in January and the lowest would be in April at 79%.

In 2050, it would be very humid in January at 87% and lowest in May at 76%.

Typhoons Observed

The municipality is not within the typhoon-belt area. However, during almost the last two decades it experienced a typhoon (named Urduja) on November 2009 which brought strong winds badly damaging rice production in the lowlands, banana and abaca production in the uplands.

Figure 3: Daily Average Maximum Temperature, PAGASA, Butuan City



1.2. SOCIO-ECONOMIC PROFILE

1.2.1. Demographics

Population and Number of household

The municipality of Remedios T. Romualdez has a total population of 13,077, equivalent to 4.19% of the total population of the entire province of Agusan del Norte. The rural barangays (with 6) have a total population of 9,254 (or 70.77%) while the urban (with 2 barangays) population has 3,823 (or 29.23%) of the total municipal population.

The population density of the municipality is **1.6** persons per hectare.

The municipality is pre-dominantly rural. Only 29.23% of the populace are settled at the urban barangays. The gross urban density is 6.99 and the gross rural density is 1.21. Barangay Poblacion I has the highest density at 28.45 per hectare and the rural barangay of San Antonio has the lowest at 0.44.

Settlements in the place are highly dispersed. Not much difference distinguishes the urban and the rural, except that the urban district is the seat of municipal government and the central commercial district. In terms of population, however, the number of residents is almost even. The population of rural barangay Balangbalang matches that of Poblacion 1 and that of rural Barangay Tagbongabong, with that of Poblacion 2.

The population is usually drawn from the location of economic activity centers. In RTR's case, however, not much economic activities draw people to reside at the urban center. Most of the residents live in the farm.

Projected Population Changes

Based on the population history (1995 to 2000), RTR has a growth rate of 2.45%. Population reaches to 15,870 in 2020 and 32,806 in 2050. This means the increases of the present requirements for land as well as subsequent economic, social and other services in a span of 40 years.

Table 4: Social Composition, NSO (2007)

Barangay	Urban		Rural		Population Density
	Population	# of HH	Population	# of HH	
Pob. 1	2,235	450			28.45
Pob. 2	1,588	330			3.29
Basilisa			1,647	343	3.33
Humilog			1,056	218	2.54
Panaytayon			858	175	2.65
San Antonio			1,928	375	.44
Tagbongabong			1,782	390	3.99
Balanglang			1,983	409	1.26
	3,823	780	9,254	1910	1.60

1.2.2. Income and Poverty Incidence

Income Level

Around 1,889 households in the municipality or 70.20% lives within income below poverty threshold level of Php 10,978.92, which is much higher than the 35.20% poverty incidence of the province.

Of those mired in poverty, 303 are surviving on incomes below Php 1,500.00 per month. The other 1,558 are subsisting on sums beyond the food threshold level below the poverty line.

Only 801 households of 29.80% are earning enough or more than what is required to meet the basic necessities of living. Their average monthly income ranges between Php 12,000.00 to 45,000.00 or an average of Php 14,626.58 (*CBMS 2007*)

Housing, Water and Sanitation

Urban Barangays

There are 11 households living in makeshift houses in the urban barangays while 51 households are informal settlers. There are 24 households without access to safe water supply and 42 households without access to sanitary toilet facilities.

Rural Barangays

The largest percentage of households living in makeshift houses in the rural barangays in the municipality, is found in Barangay Basilisa (5.8%), followed by Barangay Tagbongabong (5.4%), while the largest percentage of households who are informal settlers are found in Barangay Tagbongabong (5.6%) followed by Barangay Balangbalang (5.4%).

The largest percentage of households without access to safe water supply and sanitary toilet facilities is found in Barangay San Antonio with 79.5% and 58.4%, respectively.

Health and Nutrition

Urban Barangays

Cases of children's malnutrition aged 0-5 years old in the two Poblacion barangays have a total of 26 children, 7.4% in Poblacion 1 and 1.5% in Poblacion 2, while there were no recorded child deaths 0-1 year and also no maternal deaths.

Rural Barangays

The largest proportion of malnourished children aged 0-5 years old out of the six rural barangays in the municipality was found in Barangay Humilog with a percentage of 11.2, while child deaths aged 0-1 year old happened only in barangays Balangbalang, Humilog, San Antonio and Tagbongabong. There was only one incident of maternal death recorded, located in Barangay San Antonio.

Education

Urban Barangays

The largest percentage of children aged 6-12 years old in the urban barangay is found in Barangay Poblacion 2 with 29.3%. Children aged 13-16 years old who are not attending high school have a total of 107 while a total of 142 children aged 6-16 years old are not attending any school with a percentage of 20.5.

Rural Barangays

The largest percentage of children in rural barangays aged 6-12 years not attending

Humilog with 25.9% and followed by Barangay Panaytayon with 23.7%.

The largest percentage of children aged 13-16 years old, not attending high school education is found in Barangay San Antonio with 60.7%, while the largest percentage of children aged 6-16 years old not attending school in the rural barangays is found in Barangay Balangbalang with 18.2%.

1.2.3 Agricultural Production System

Crop Production System

Mono-cropping, multi-storey cropping and intercropping characterized the agricultural production system of the municipality. Ninety two percent (92.29%) of the population is engaged in farming.

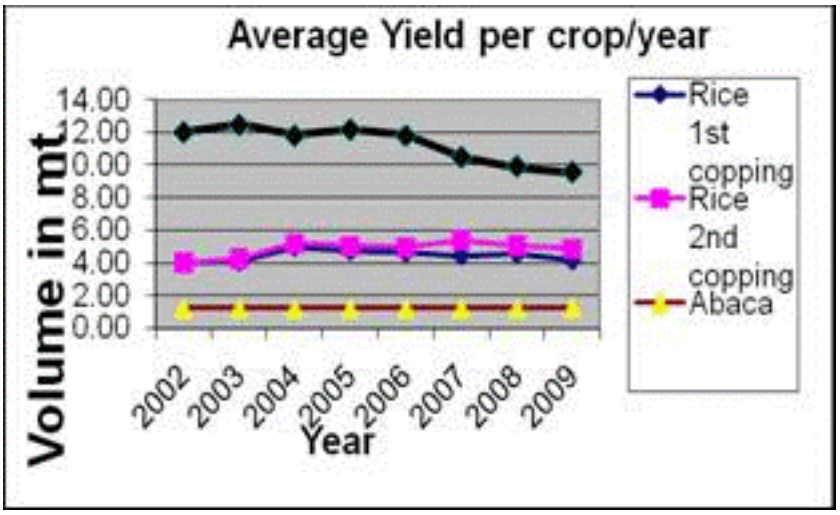
All barangays except San Antonio is engaged in rice production with 1,742 hectares of land devoted to it, involving almost 800 farmers. There are two cropping seasons in a year with the second cropping having the higher yield with a difference ranging from .02 to .73 tons covering the year 2002 to 2009. *(Please refer to Table 5 on the next page)*

Banana is the second widely produced agricultural crop in the municipality next to rice. The average yield of banana was recorded at 12 tons per hectare from year 2002 to 2006. Though, it went down to an average of ten (10) tons in the following years (2007 to 2009) due to pest and diseases and natural calamities. All barangays except Poblacion I and II are engaged in Banana production.

Figure 4: Rice, the Primary Crop of the municipality

Abaca production is largely concentrated in barangays Tagbongabong, Balangbalang and San Antonio. Average yield in the municipality was recorded at approximately 1.25 tons/has./year with an slight increase towards the later period (2007-2009). *(Please refer to figure 5 below on average yield per crop/annum*)

Figure 5: Average Yield/crop/annum



Livestock and Poultry Production

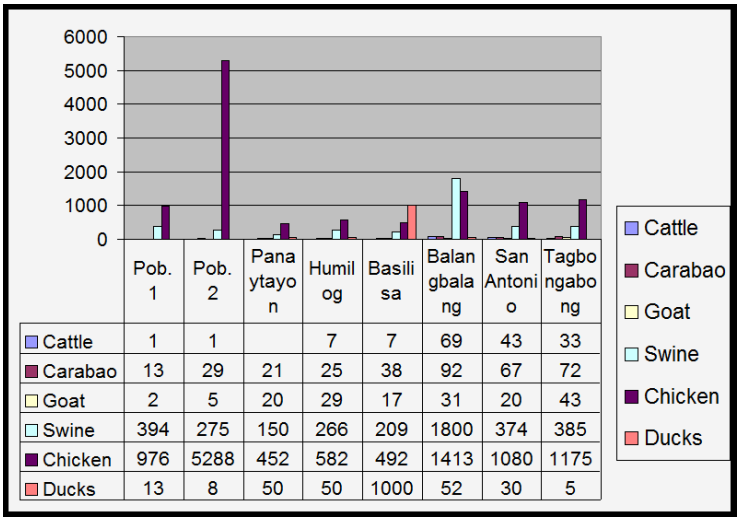
All barangays are engage in livestock and poultry production at varying levels. Brgy. Balangbalang was on top in the production of cattle, carabao and swine cornering 69 (43%), 92 (26%), and 1800 (47%), respectively, of the total municipal outputs. Moreover, other top producers are: Brgy. Tagbongabong for goat at 43 (26%); Brgy. Poblacion 2 for chicken at 5,288 (47%); and, Brgy. Basilisa for Ducks at 1,000 (81%).

Production loses, causes and actions

Based on the data collected, the cause of production losses were due to the stem borer damage, flood, strong winds, and diseases. And the extent of damage ranges from 10% to 40%.

Several actions were being taken such as: following lunar cycle, synchronous planting, light trapping, conduction of Farmers Field School (Season-Long Training on IPM-KASAKALIKASAN), provision of rehabilitation palay seed, and sourcing put of financial assistance as mitigating measures.

Figure 6: Livestock Data, MAO-LGU



	Pob. 1	Pob. 2	Panaytayon	Humilog	Basilisa	Balangbalang	San Antonio	Tagbongabong
Cattle	1	1		7	7	69	43	33
Carabao	13	29	21	25	38	92	67	72
Goat	2	5	20	29	17	31	20	43
Swine	394	275	150	266	209	1800	374	385
Chicken	976	5288	452	582	492	1413	1080	1175
Ducks	13	8	50	50	1000	52	30	5

1.2.4. Commerce and Trade

As an agricultural town, agricultural products are at the core of the commerce and trade involving rice, banana, abaca, vegetables and livestock/poultry.

Farmers, traders, millers, retailers and financiers are involved as the key players in each value chain at varying levels of participation.

After harvesting, rice farmers just left few cavans of palay from their produce for household consumption and sell the rest of their produce to the traders (within or outside the municipality) for the needed cash for other basic household necessities. For banana and Abaca, though, the harvests are mainly intended for market requirement.

1.2.5. Livelihood

For livelihood, aside from rice farming, the residents are also engaged in poultry/ swine/large ruminant raising, vegetable production, banana/abaca production and trading, backyard fishponds and agri-business and support services.

Aside from providing food for their families, these other means of livelihood provide a good source of income as their produce are sold at reasonable prices.

Other sources of income are generated mostly from wages of doing non-domestic works such as: carpentry, masonry, vending, tricycle driving, etc. within and outside of the municipality. Others derived additional income from farm labor contracting; while some are engaging in small business such as sari-sari store and others.

Figure 7: Stripping of Abaca

1.3. INSTITUTIONAL PROFILE

1.3.1. Infrastructure

Other Agriculture Facilities

Most of the agricultural production facilities such as hand tractors, drum seeders, and others are owned by individual farmers.

Post harvests facilities present include: threshers, 24 solar dryers, 10 mechanical dryers, one warehouse which were provided by the local and national government. The town has a manually-operated weather station located at PhilRice-Basilisa. Aside from government facilities provided, there are eight (8) rice mills, 10 warehouses, 6 mechanical dryers owned and operated by an NGO.

Transportation

RTR has a 113.55-kilometer road system, 12.90 kilometers or 11% of which forms the urban network and 46.60 kilometers on the rural areas, the length that traverse its 4,945-hectare farmlands.

The other 19.10 kilometers or 17% comprise its provincial and national links.

Given its extensive network, RTR stands as the only municipality in the province with road lengths that exceeds those required by standard. Its urban network is 3.96 kilometers more than what is required by its 3,725 population. At 2.4 kilometers per 1,000 urban dwellers, it is supposed to be only having 8.94 kilometers at its urban barangays by now.

Its rural road network is 7.38 kilometers more than what is required for an efficient farm road system, thanks to the National Irrigation Administration (NIA) whose canal system is developed to also serve as all-weather roads. The 34.95 kilometers NIA system crisscrosses the rice lands and without them the municipality would have been deficient of this facility by more than 20 kilometers by now.

The interiors, including the agro-forestry area, are linked to the municipal center by a total of 16.1-kilometer all-weather road.

Traversed by the national highway, the place is also conveniently linked to its neighboring municipalities, the provincial government and market centers.

It also has adequate bridges.

In terms of road condition, around 60% of the system are graveled, the other 35% made of earth. All these need regular maintenance and could be the network's downside. Only 15% of the roads are cemented.

Passenger transport utilities also ply the route, including the interiors, in convenient

Figure 8: One of the 8 Rice Mills in the Municipality

frequencies. Ten privately owned trailers serve the farms. The urban core is served by *tri-sikads*.

There is no bus or jeepney terminal here. But the volume of commuters does not call for it yet. What could be lacking is a convenient waiting shed for a number of passengers' at both side of the road along public transport routes.

Communication

Telephone

Only one private telephone company or Bayantel is currently serving the municipality. Some 35 subscribers are so far served by the facility as of 2007.

Signal for mobile cellular phone service is also generally available in the place, serving around 100% of the municipal area.

Postal Service

The government-run Philippine Postal Corporation (PPC) is the lone entity that offers this service to the residents. Absence of Telecom/Post office building and lack of manpower affect the speedy delivery of communication to all barangays.

Broadcast and Print Media

There are no mass media facilities here but signals of television or radio from the regional city of Butuan and other parts of the country can be picked up here. Newspapers from the regional and national capital are also distributed in the place.

Power

Power is generally available in all eight (8) barangays. The two (2) urban barangays are fully energized. Though, 131 (5%) households in the rural barangays have no electric connection.

Power here is sourced from a grid in far away Iligan City in Northwestern Mindanao. It is transmitted to the place through the lines of the National Power Corporation (NPC) and distributed by a provincial electric cooperative. The supply is so far adequate. The municipality has utilized around 1.045 megawatts (MW) of power in 2007.

Water Supply/Irrigation System

Water is abundant both in the homes and in the farms. What it lacks is a tap water distribution system that could have minimized and controlled the excessive use of the supply of the municipal ground water.

Figure 9: One of the major source of irrigation in the Municipality

Water is drawn here from three shallow wells, 43 deep wells and seven (7) developed springs.

There are 3,119 households provided access with the different types of water sources, with measly 658 (or 21%) households having access to more than one of the facilities. In addition, only around 241 or 9.79% of the households enjoy connection with tap water.

The main source of water for irrigation of agricultural crops especially rice, come from the National Irrigation Administration (NIA), small water impounding project (SWIP), and communal irrigation systems (CIS).

Aside from existing irrigation systems, RTR is blessed with abundance of water and with rainfall evenly distributed the whole year round (type IV Climate), excess of water sometimes create problem to the farmers due to poor drainage system.

Building/Shelter

There are 71 existing government-owned buildings in the municipality which includes the following; Municipal building, Municipal Gymnasium, Multi – Purpose Halls, Day Care Centers, Barangay Health Stations, Elementary and Secondary School Buildings, among others. These structures sometimes serve as evacuation centers for calamity victims in times of natural and man-made calamities.

Records also showed that there are 19 privately owned buildings including churches (or house of worship) in the Municipality.

1.3.2. Support Services

Trading and Marketing

Most of the farmers directly sell their produce to the traders that provide them with financing.

The National Food Authority (NFA) also buys dried palay from organized farmers (through their cooperatives and organizations) with premium price.

The Local Government Unit in coordination with the Department of Trade and Industry occasionally facilitated the promotion of the farmers' produce through trade and agro fairs.

Other forms of technical and marketing services are; SEA-Kaunlaran, Seed Subsidy Program, One-Town-One Product[1], promotion of Organic Farming, and, Farmers Field School (FFS) are also provided to farmers.

Philippine Crop Insurance Corporation (PCIC), a quasi government entity also operates in the municipality that provides crop insurance to farmers.

Credit and Financing

The private entities (traders cum financiers) is the major source of credit for production to farmers with interest rates as high as 10% per month.

The Local Government Unit of RTRomualdez, on the other hand, provided credit financing support services such as rice production loan package with crop/life insurance, and hog fattening and vegetable production loan (with a lower interest rate at 5%/6 months).

The municipal LGU through the Municipal Agriculture Office (MAO) also distributed organic and inorganic inputs such as organic fertilizers and seeds supplied by farmers' cooperatives (e.g. Tagbongabong Organic Cooperative) and private suppliers (i.e. Daquipel Agrivet Store, Jeels Masagana Farm Supply).

[1] *A program of DTI that provides technical, financial and marketing assistance to LGUs with certain product given focus.*

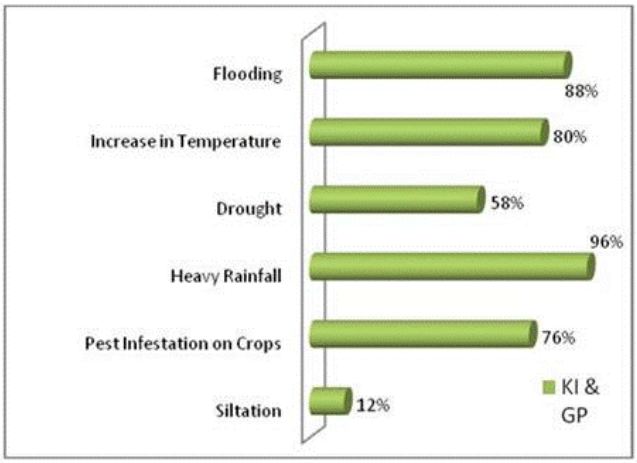
2

CURRENT HAZARDS AND OBSERVED CLIMATE CHANGE IMPACTS

2. CURRENT HAZARDS AND OBSERVED CLIMATE CHANGE IMPACTS

Based cumulative result of the FGDs, the KI interview and poll survey show that heavy rainfall, with 96% of the responses, has the highest percentage of observed climatic changes in the municipality. It is followed by flooding with 88% and increase in temperature with 80%; pest infestation on crops with 76%; drought with 58%, and; siltation with 12%. *(Please refer to Figure 10)*

Figure 10: Percentage of responses on Observed Climatic Changes in the Municipality of RTR



2.1. SOURCES AND TYPES

2.1.1. Flood hazards

During continuous rain, flood usually occurs at the western part of the municipality covering 224.65 to 2,231.39 hectares (or 3 to 27%) of the total land area of the municipality. Barangays Basilisa, Humilog, Panaytayon, Poblacion I and Poblacion II, with slope level ranges from 0-3 % were the most affected areas. Apparently, no flooding occurs in the eastern part of the municipality which is in a higher elevation. *(Please refer to Annex A7: Hazard Map, p.60))*

2.1.2. Erosion Hazards

The eastern part of the municipality is prone to moderate and severe erosion covering approximately 45% of the total land area. Severe soil erosion mostly affects Barangay San Antonio and Tagbongabong, while barangays Humilog, Panaytayon and Basilisa have slight and no apparent erosion. The western part of the municipality has no threat of soil erosion.

Table 5: **Historical Hazard Data (Place and Time of Occurrence)**

Hazards	Date of Occurrence	Barangays Affected
Torrential Rain/Flood	January 2009	Balangbalang, Pob. 1 & 2, Panaytayon, Humilog, Basilisa, Tagbongabong
Typhoon Urduja	November 2009	Panaytayon, Balangbalang, San Antonio, Poblacion 2
Torrential Rain/Flood	January 2007	Balangbalang, Pob. 1 & 2, Panaytayon, Humilog, Basilisa, Tagbongabong
Torrential Rain/Flood	February 2006	Balangbalang, Pob. 1 & 2, Panaytayon, Humilog, Basilisa, Tagbongabong
Torrential Rain/Flood	December 2005	Pob. 1 & 2, Panaytayon, Humilog, Basilisa
Torrential Rain/Flood	December 2003	Balangbalang, Pob. 1 & 2, Panaytayon, Humilog, Basilisa, Tagbongabong

2.2. PLACE AND TIME OF OCCURRENCE

In December 2003, torrential rains came and adversely affected barangays Balangbalang, Poblacion 1 & 2, Panaytayon, Humilog, Basilisa, and Tagbongabong.

Heavy rains fell and flooding occurred again in December 2005. Barangays Poblacion 1 & 2, Panaytayon, Humilog, and Basilisa were heavily affected. Two months after (February 2006) barangays Balangbalang, Poblacion 1 & 2, Panaytayon, Humilog, Basilisa and Tagbongabong experienced again heavy rains and flooding.

In January 2007, torrential rains and flooding badly affected all the seven (7) barangays except barangay San Antonio.

In January 2009, heavy rains and floods destroyed the crops of all barangays except barangay San Antonio. Typhoon Urduja that visited on the same year caused barangays Panaytayon, Balangbalang, San Antonio and Poblacion 2 to suffer in their farming endeavors. *(Please refer to Table 5 above on Historical Hazards)*

Table 6: Historical Hazard Data (Impacts)		
Hazards	**Date of Occurrence**	**Extend of Damage**
Torrential Rain/ Flood	January 2009	Rice- 1,742 has Livestock: Swine-4 heads, poultry-20 heads, cattle-1 head Loss of Life: 1 person (elderly) Families affected: 717
Typhoon Urduja	November 2009	Rice: 2 has Root crops: 3 has Coconut- 218 has Banana: 1,215 has Mango: 0.50 has Abaca: 525 has Falcata: 936 has. Corn: 2.8 has Fruits trees: 1 ha Livestock: Swine-6 heads, poultry-276 heads, cattle-1 head Houses: 48 houses Families affected: 2,653
Torrential Rain/ Flood	January 2007	Rice: 1,742 has
Torrential Rain/ Flood	February 2006	Rice: 1,742 has Backyard fishpond: 0.50 has Families affected: 2,079
Torrential Rain/ Flood	December 2005	Rice: 871 has Families affected: 2,132
Torrential Rain/ Flood	December 2003	Rice: 871 has Families affected: 2,859

2.3. IMPACTS

Flooding is the most common hazard occurred during the decade. Affected rice areas increased from 871 hectares in 2003 to 1,742 hectares (practically the total rice land of the municipality) in 2009. Fortunately, due to synchronous planting schedule which timely set the rainy period from November to January as land preparation and start of planting, impact to cumulative production output has been insignificant besides those some households that already started planting that suffer losses on inputs.

Number of affected families reduced from 2,859 in 2003 to 171 in 2009. The most recent flooding in 2009 recorded minimal damage on livestock and poultry, and a lone mortality (a seventy-two year old) was registered.

The typhoon that happened last November 2009 (Urduja), was the only typhoon experienced by the municipality during the decade. The extent of damage was far reaching affecting all standing crops both in the lowland and uplands including banana (1,215 has.), abaca (525 has.), and falcata (936 has.). Damage to rice and corn was low because it happened at the start of the planting period. The said hazard also inflicted loses to livestock and poultry, and the number of families affected was evidently high at 2,653. *(Please refer to table 6 above)*

3 ADAPTATION STRATEGIES

3. ADAPTATION STRATEGIES

3.1. PAST ADAPATATION STRATEGIES

The most common adaptation strategies done before involving major stakeholders such as the communities, LGU, and the farmers, were as follows:

Communities

- Adjustment of planting calendar;
- Synchronous planting, and
- Cleaning of canal and drainage system.

LGU

- Declaring state of calamity to raise fund;
- Dredging of creeks;
- Seed subsidy;
- Tree-planting program;
- Rehabilitation of road networks;
- Financing assistance e.g. rice production loan;
- Mass production of organic fertilizers (i.e. vermie composting)
- Promotion of organic farming technology;
- Crop insurance scheme;
- Conducted FFS

Farmers

- Re-planting of affected areas;
- Early harvesting;
- Pest management
- Production of own supply of organic fertilizers.

(Please refer to Annex B1: Past Adaptation Strategies, p. 64)

3.2 CURRENT ADAPTATION STRATEGIES

To adapt to the extreme climate and effectual hazards, and to mitigate their ill effects which usually come in the form of heavy rains, floods, and the increasing temperature, below are some measures in place (though, needed to be up scaled and improved), and others still to be established;

3.2.1 Physical/ Infrastructural Adaptations

The existence of the Philrice Manual Weather Station is expected to help the farmers by issuing early warning on weather and climate situation.

The provision of flatbed dryers helps the farmers dry their palay even during rainy days. The maintenance of farm-to-market roads facilitates the easy delivery of their produce to the market and provides them the access of transportation for other farm needs.

The farmers have engaged in tree planting in watershed preservation and alongside the road. This effort helps to prevent soil erosion especially during heavy rains.

The dredging of Agay River which forms part of the construction of flood control system and the improvement and maintenance of municipal drainage are programmed to minimize flooding.

3.2.2 Technological/ Biological Adaptations

Promotion of sustainable organic farming technology system has been of great help to reduce production cost of farmers and produce safer and healthier food to consume i.e. mass production of organic fertilizer and vermin culture project

Persevere in the adaption of synchronous planting and timely planting schedule to skip extreme weather condition both during dry and wet months.

Distribution of submersible and drought-tolerant rice varieties, for rainy days and dry season, respectively, to mitigate the negative effects of hazards is another option.

3.2.3 Economic

Allocation of loan portfolio (i.e. Rice Production Loan, Hog Fattening Loan, and Vegetable Production Loan) provides the farmers opportunities to access cheaper financing thereby raising their income.

The crops and life insurance to cushion impact of climate, and seed subsidy programs for farmers to recover loses and replanting is inevitable.

In the upland area, the community is encouraged in continuous expansion of abaca areas to meet increasing demand of the market.

The strengthening of the Rural Based-Organization is also effective tool to motivate and update farmers on the necessity to cooperate, do their share in rural development and contingent awareness.

The Farmers-Field-School (FFS) meetings will be regularly conducted to provide technical assistance to farmers. Their knowledge regarding farming technology is enhanced.

3.2.4. Political/ Institutional

Strategies include the passing and approval of a Municipal Ordinance prohibiting the burning of rice straw. Thus, compelling farmers to do their share in climate change adaptation. *(Please refer to Annex B1, p.64)*

3.3. GAPS OF ADAPTATION STRATEGIES

The delivery of services to reduce vulnerabilities and minimize impact of hazards was in many cases insufficient due to encountered constraints and limitations. (Please refer to Annex B3)

- On the part of the LGU, which is the lead implementer on many adaptation strategies (i.e. physical and infrastructure, financing packages, etc.), the limited funding[2] posed as the major hurdle in the insufficiency of services;
- On the promotion of farming technologies (i.e. synchronous farming, organic farming, pest control, etc.) some farmers do not fully cooperate;
- Delayed processing (of seeds and services) from suppliers was also identified as a problem;
- Existing EWS is manually operated which has limited features of forecasting weather and climate compared with the automatically operated model.

[2] *Dependent only to the allocated 20% development fund of the annual budget of a 5th class municipality.*

4

SCENARIO ANALYSIS

4. SCENARIO ANALYSIS

4.1. SCENARIO COMPONENTS

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

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

Projected hazards for the two periods include flooding, dry spell, pest infestation (during dry months), and soil erosion.

In the projection of impacts, 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, banana and abaca), 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 cumulative potential damages (i.e. food production and security, lives and properties, and livelihood and income) as follows; low with 30% and below, moderate at 31% up to 59% and high at 60% and above.

4.1.1. Year 2020

PAGASA Butuan office forecasted in the year 2020 for the whole province of Agusan del Norte a maximum increase of approximately 1.3% (1.33'C) on the average maximum temperature during the months of April-June (with the month of May as the hottest at 33.8'C), and on the average rainfall, an increase of an average of 9.83% (13.8 mm/mo) between the months of October to January. Hence, in the province of Agusan del Norte, during the targeted period it will be hotter during the dry months while also having more rains during wet months. *(Please see Annex B4 & B5).*

Potential Impact:

Dry Spell

Rice production during dry months will not be adversely affected, it will be harvest season during the months of April to June. Hence, the formula of 8-14% reduction for every 1% increase in temperature will not be applicable. However, it is estimated that those harvested late will still be damaged, computed at approximately 5% (or 526 MT/ annum) of the total production.

Pest infestation usually occurs during dry months, also in time of harvest season. Thus, there will be no significant destruction in the rice areas.

Banana production will be significantly reduced during dry months equivalent to 2,853 MT due to 1.3'C (or 18%, 14% x 1.3'C) increase in temperature, plus the damage caused by pest infestation estimated at 30%[3] (3156 MT), giving a total decrease of 6,009 MT/annum.

Abaca production will not be as damaging compared with banana because these are planted under crop with other perennial crops that provide natural shading e.g. Falcata, coconut. Damaged to Abaca is approximated at measly 10% (65.6 MT/annum) of the total production of the municipality.

Increase rainfall

Rice areas to be affected by flooding remain seven (7) barangays, namely: Poblacion 1, Poblacion 2, Basilisa, Panaytayon, Humilog, Tagbongabong, and portion of Barangay Balangbalang.

During rainy period (Oct-Jan), rice farmers are in the land preparation phase though there will be some farmers (estimated at around 30% of the total 800 HH in rice farming community) that will attempt to plant earlier despite the warnings of the LGU. The farmers' ill practice, however, has no direct effect on output of production but will incur losses for them on the applied inputs and other costs.

Looking at the hazard map, the erosion prone barangays are Balangbalang[4] (at 20% severely affected) and San Antonio[5] (at 50% severe and 10% slightly affected). The said barangays are pre-dominatly planted to Banana (1215 has.) and Abaca (525 has.). Corresponding reduction to volume production of the banana due to erosion is computed at 500 has for banana (or 6,450 MT) and Abaca at 260 has. (or equivalent to 325 MT).

Figure 11: Newly developed Banana farm

[3] *Based on experience on past hazard of pest infestation*
[4] *With 550 has. Banana and 100 has. Abaca*
[5] *With 650 has. Banana and 400 has. Abaca*

Potential threat to lives of population will be minimal. Based on past experiences on flooding number of people affected were going down from 2600 on Dec. 2003 to 717 on Jan. 2009 attributed to the pre-empted measures of the LGU that provided timely warning and temporary shelter.

Scenario 1 (2020)

Assumptions for this scenario are:

- advances in Science and Technology are at current level
- population growth rate is 2.45% 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 15,870 @ 2.45%/annum growth rate. Rice consumption will be at 3,459 tons at 128 kg/capita consumption (NFA, 2008).

Net rice production of scenario 1 of 2020 is estimated at 9,990 MT less the consumption at 3,459 MT will yield a net surplus of rice for food at 6,532MT. Banana and Abaca will be hardly hit equivalent to 42% and 50%, respectively, of the total area covered (i.e. barangays Balangbalang and San Antonio) due to increased temperature, pest infestation and soil erosion. Further, livelihood and income of the people residing in the said two upland barangays will be significantly reduced. Potential damage to lives is at low level. Hence, overall vulnerability rating in this scenario is considered ***LOW***.

Scenario 2 (2020)

Assumptions for this scenario are:

- there is marked positive advancement of Science and Technology:
- The population growth rate markedly decreases (down to 1% per annum from 2.45%);
- there is an increasing adaptation capacity with increasing budget; and,
- Without land conversion (meaning no change in land use).

Projected population is computed at 14,673 assuming a minimal growth rate of 1.45%/annum. With the figure on population, demand for rice consumption will only be at 3,199 MT.

The planned automatically operated Early Warning Device (EWS) is expected to be installed that could enhance adaptive capacity of LGUs and minimize impact of hazards to the population and livelihood. Another possible S&T application will be on farming and post harvest technologies that would increase productivity by at least 10 percent.

Due to lesser growth for population, surplus for rice will be higher at 7,794 MT. The additional 10% increased output for banana and abaca can partly offset the reduction caused by increased temperature and pest infestation, thus mitigating the negative effect on the people's livelihood and income. Considering increasing adaptive capacity of LGU, vulnerability rating for scenario 2 of 2020 will be rated as ***LOW***.

Scenario 3 (2020)

Assumptions for this scenario are:

- advancement in Science and Technology are at current level;
- population growth rate increased to 3.5% from the current level of 2.45% per annum (current growth rate);
- no improvement in the LGU's adaptation capacity coupled with decreasing budget; and
- there will be aggressive conversion of land from agricultural to commercial and residential use (meaning production areas markedly decrease to give way to other development initiatives), at 10% of total rice area (Poblacion).

Projected population is at 3.5% growth rate is computed at 17,153. At this level, projected demand for rice consumption will be at 3,740 MT.

Aggressive land conversion is set at 20% in rice areas constricting the production area at 1,568 hectares with equivalent output of 8,414 MT. Due to dry spell, additional reduction of 5% (473.2943 MT) will be included making net rice production at 7,993 MT. Even with increased consumption brought about by growing population, a surplus for rice production equivalent to 4,254 MT will still be registered.

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. The reduction of production of banana and abaca in the upland areas due to erosion and increasing temperature would likewise pull down income level of the population. These factors further aggravate the situation raising the vulnerability rating of the municipality into ***HIGH*** level.

4.1.2. Year 2050

By the year 2050, PAGASA Butuan office forecasted for the whole province of Agusan del Norte an increase of approximately 2.97% (2.93'C) on the average maximum temperature during the months of May-June (with the month of May as the hottest at 35.1'C). 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, while with lesser rains during wet months compared with 2020. *(Please refer to the Annex B4& B5).*

The increase in temperature of 2.93'C during the dry months would translate to forty one percent (41%) decrease in crop production (at a maximum of 14% per 1'C increase in temp). This phenomenon will brought damage to both Banana and Abaca which are grown the whole year round.

Dry Spell

The same with year 2020 rice production during dry months (even with pest infestation) will not be adversely affected because it will be harvest season during the months of April to June. However, it is estimated that those harvested late will be partly damaged, computed at approximately 10% of the total production.

Reduction in banana production will be higher during dry months equivalent to 6,429 MT (or 18%, computed at 14% x 1.3'C) due to 2.9'C increase in temperature, plus the damage caused by pest infestation estimated at 20%[6] (3,134 MT), giving a total decrease of 61% (9,563 MT/annum).

Damaged to Abaca is approximated at 10% of the total production of the municipality, and another 20% (130 MT) due pest infestation giving a total of 30% reduction (195.6 MT).

Increase rainfall

Rice areas to be affected by flooding remain seven (7) barangays, namely: Poblacion 1, Poblacion 2, Basilisa, Panaytayon, Humilog, Tagbongabong, and portion of Barangay Balangbalang**.**

During rainy period (Oct-Jan), rice farmers are in the land preparation phase though there will be some farmers (estimated at around 30% of the total 800 HH in rice farming) that will attempt to plant earlier despite the warnings of the LGU. The farmers' ill practice, however, has no direct effect on output of production but will suffer losses on the applied inputs and other costs.

The hazard map reveals that the erosion prone barangays are Balangbalang[7](at 20% severely affected) and San Antonio[8] (at 50% severe and 10% slightly affected). The said barangays are pre-dominatly planted to Banana (1215 has.) and Abaca (525 has.). Corresponding reduction to volume production of the banana due to erosion is computed at 500 has for banana (or 6,450 MT) and Abaca at 260 has. (or 325 MT).

Scenario 1 (2050)

Assumptions for this scenario are:

- Advances in Science and Technology are at current level;
- population growth rate of 2.45% per annum;
- low level of adaptive capacity and there is no corresponding in the budget of the LGU, and intervention investment is moderate;
- no land conversion where made (meaning no change in land use),

Projected population on 2050 will be at 32,806 with corresponding rice consumption is at 7,152 tons/annum.

Net rice production on scenario 1 of 2050 is estimated at 9,990 MT and consumption at 7,152 MT (for scenario 1) will yield a net surplus of rice for food at 1,051MT. Banana and Abaca will be hardly hit estimated at more than 60% of the total production, covering Barangays Balangbalang and San Antonio due to pest infestation and soil erosions, which subsequently will reduce livelihood and income of the people in the said two upland barangays. The increased

Figure 12: A river in Brgy. San Antonio that overflows during rainy days

[6]*Based on experience on past hazard of pest infestation*
[7]*With 550 has. Banana and 100 has. Abaca*
[8]*With 650 has. Banana and 400 has. Abaca*

population that will be expected to concentrate in the urban area, that is likewise prone to flooding, would constitute added risks to lives. Assuming low adaptive capacity of LGU, the vulnerability rating in this scenario is considered at ***MODERATE*** level.

Scenario 2 (2050)

Assumptions for this scenario are:

- there is marked positive advancement of Science and Technology:
- The population growth rate markedly decreases (down to 1% per annum from 2.45%);
- there is an increasing adaptation capacity with increasing budget; and,
- Without land conversion (meaning no change in land use).

Projected population is at 22,598 with equivalent rice consumption of 4,926 MT/ annum.

The planned automatically operated Early Warning Device (EWS) is expected to be installed that could enhance adaptive capacity of LGUs and minimize impact of hazards to the population and livelihood. Another possible S&T application will be on farming and post harvest technologies that would increase productivity estimated by at least 10 percent.

Due to lesser growth for population, surplus of rice for food will be higher at 4,539 MT. With additional 10% output, banana and abaca production due to advancement in S&T reduction caused by increased temperature and pest infestation will be mitigated pulled down to approximately 50% (from more than 60%). Considering increasing adaptive capacity of the LGU, overall vulnerability rating for scenario 2 of 2020 will be rated as ***LOW***.

Scenario 3 (2050)

Assumptions for this scenario are:

- advancement in Science and Technology are at current level;
- Population growth rate increased to 3.5% from the current level of 2.45% per annum;
- 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),

In this scenario projected population will be at 47,453 with equivalent demand for rice consumption at 10,345 MT/annum.

Aggressive land conversion is set at 40% of the rice areas constricting the production area at 1,045 hectares with equivalent output of 6,310 MT. Due to dry spell, additional reduction of 10% (631MT) will be added making net rice production at 5,258 MT. With increased consumption brought about by growing population, the municipality will face a food shortage of 5,085 MT/annum.

The increased population, largely in the urban center, that is also within the flood prone areas can be one critical factor of vulnerability, considering that in this scenario budget of LGUs will be decreased. The reduction of production of banana and abaca in the upland areas due to erosion and increasing temperature would likewise pull down income level of the population. The cumulative effect of these factors further aggravates the situation raising the vulnerability rating of the municipality into ***HIGH*** level.

4.2 SUMMARY OF VULNERABILITY RATING

The above's scenario building and analysis reveal ratings at 2020 as low for scenarios 1 and 2, while a high rating for scenario 3. At 2050, it will be moderate for scenario 1, low for scenario 2 and high for scenario 3. *(Please refer to table 7 below).*

Table 7**: Summary of Vulnerability Rating**

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

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

4.3 ADAPTATION TO CLIMATE CHANGE SCENARIOS

To minimize the impact of climate and enhance the adaptive capacity of different stakeholders, the following adaptations options are highly recommended:

4.3.1 Physical/ Infrastructural Adaptations

- Upgrading of Early Warning System (EWS) of PAGASA, from manual to automatically operated;
- Rehabilitation of existing farm to market roads and other support infrastructures;
- Construction of alternative irrigation facilities in Agay river;
- Establishment of measures against land denudation, river and creek siltation and soil erosion;
- Rechanneling and dredging of creeks and canals, and negotiation with the LGU of the municipality of Magallanes on the egress of the drainage system to the sea passing by their area.

4.3.2 Technological/Biological Adaptations

- Promotion of flood and drought-tolerant varieties of rice and other major crops such as banana, abaca, cassava, etc.
- Institute measures for the prevention and control of pest and diseases on rice, banana, abaca, and other major crops,
- Increase production of high breed animals such as goat, swine, cattle, carabao, and horse;
- Provide veterinary assistance for livestock to act for the prevention of diseases.

4.3.3. Economic

- Encourage establishment of agro-industrial businesses utilizing raw materials abundant in the area;
- Intensify the implementation of organic and sustainable farming program to reduce cost, increase agricultural output and income;
- Provide additional funding for credit financing for rice, banana, abaca and other crops;
- Create more livelihood and economic opportunities to farmers, women and youth;
- Establish marketing support program;
- Provision of assistance for crop and livestock insurance.

4.3.4 Political/ Institutional

- Improve LGU capacity (i.e. MFTs) through intensive capacity building activities, such as, but not limited to training, seminars, and cross-visits in areas with best practices in the implementation of climate change adaptation projects;
- Adoption by the Sangguniang Bayan of RA 10068 otherwise known as "Organic Agriculture Act of 2010" and other National Laws related to organic agriculture;
- Strict enforcement of national laws And municipal ordinances on agriculture and forestry (for environmental protection), and zoning (to avert unnecessary conversion of rice lands to residential and commercial purposes);
- Improve LGU's capability to generate resources either internal or external i.e. local revenue ordinance, NGAs, NGOs, etc.;
- Increase subsidy for rice as One Town One Product (OTOP) program;
- Strongly support the National Irrigation Administration (NIA) in its desire to turn-over the operation and management to the irrigators association;
- Pursue the implementation of level 3 water system;
- Protect water aquifer through strict regulation or banning of ground water extraction;
- Enhance health facilities having a regular ample supply of medicine and supplements as well as the regular upgrading of the personnel;
- Intensive education on human rights and the linking of peace and order disturbances of the place. Establishment of sanitary landfill/ solid waste disposal;
- Pursue implementation of Reproductive health Program to include natural family planning and responsible parenting.

4.4 PRIORITY ADAPTATION STRATEGIES

From the long list of adaptability options some were culled as priority based on several criteria such as effectiveness in mitigating climate impact, efficiency and urgency.

4.4.1 Economic

- Promotion of organic and sustainable farming technology
- Financial and technical assistance
- Strengthening of RBO's
- Expanded crop insurance program

4.4.2 Technological

- Upgrading of Early Warning System (EWS) of PAGASA

4.4.3 Physical

- Construction of alternative irrigation facilities in Agay river

4.4.4 Political/ institutional

- Strict enforcement of municipal ordinance on agriculture and forestry related to environmental protection.
- Increase capacity to generate funds for climate change.
- Negotiate with the LGU of Magallanes on the egress of the drainage system passing through their area.

5 CONCLUSIONS

5. CONCLUSIONS

Current hazards in the forms of torrential rains and flooding, and the forecast on increasing temperature will continue to challenge the residents.

Rice fields, banana and abaca farms will always be at risk by these climate hazards. Farmers bear the brunt of replanting due to damage of crops or even failure to have abundant harvests. There are times that their efforts only result to break-even returns or even heavy losses. Lives, properties and livelihood will likewise be threatened pulling down further the existing low level of the quality of lives of the majority of the population (with 70% poverty incidence).

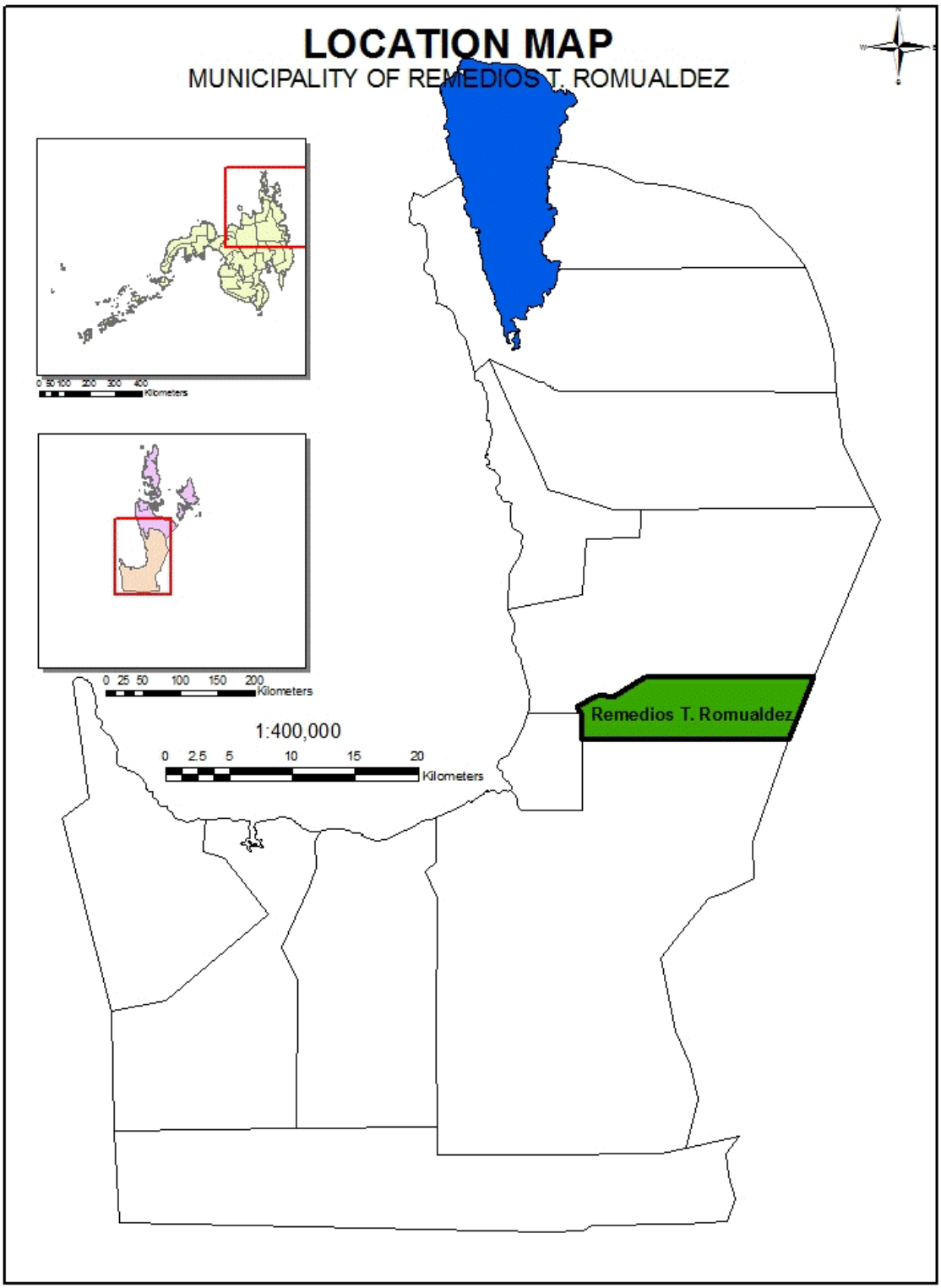
Adaptation strategies enumerated earlier have time and again proven very helpful to respond to every crisis. There is an urgent need to reinforce these strategies and enhance overall adaptation capacity of the municipality and subsequently reduce vulnerabilities.

With inherent limitations it is imperative to seek external support to meet some immediate and effective strategies such as crop and life insurance and other financial aid, among others, to ease the difficulties of the already impoverished small farmers.

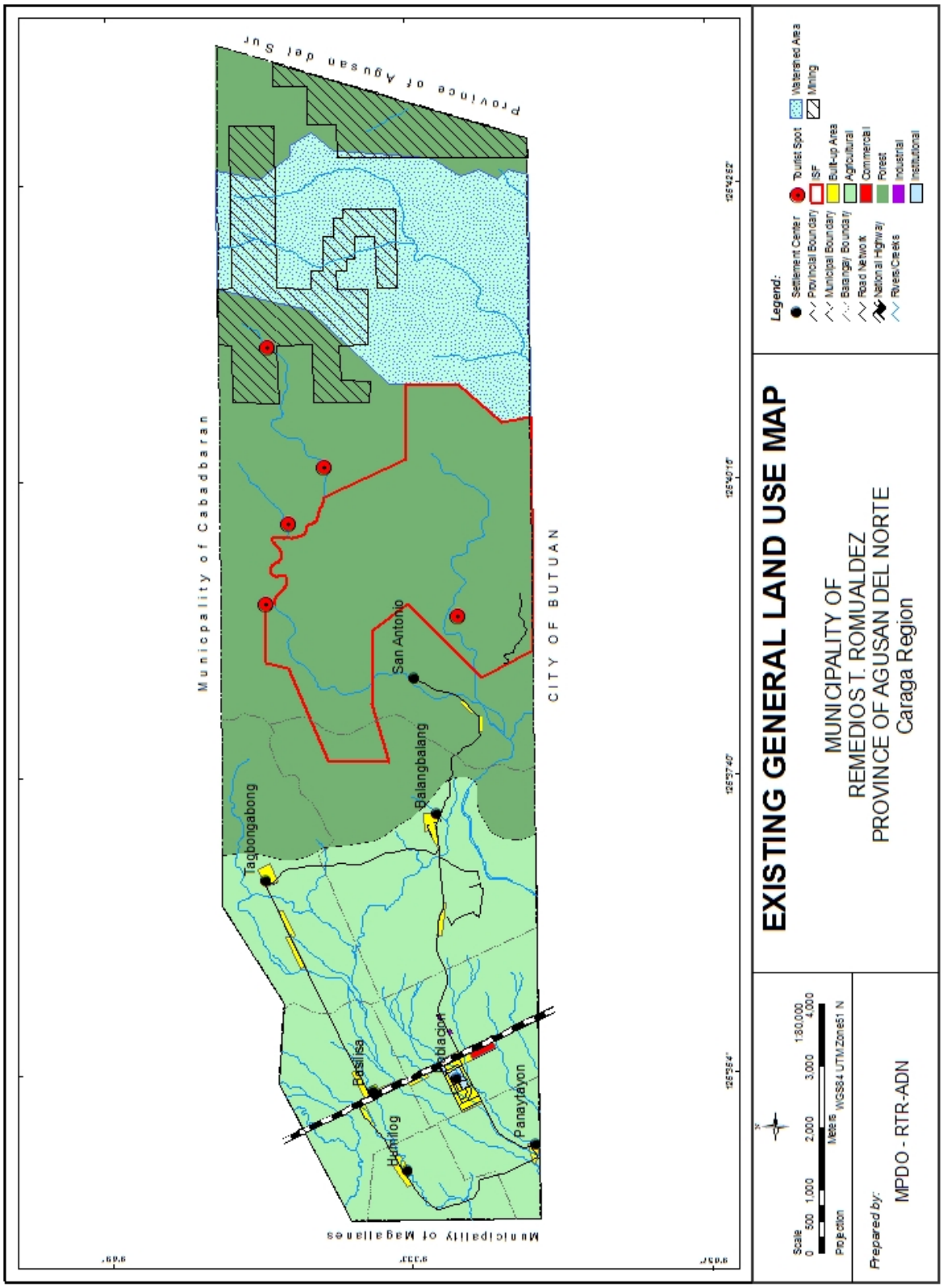
Figure 13: Rice farm in Barangay Poblacion, RTR

ANNEX A

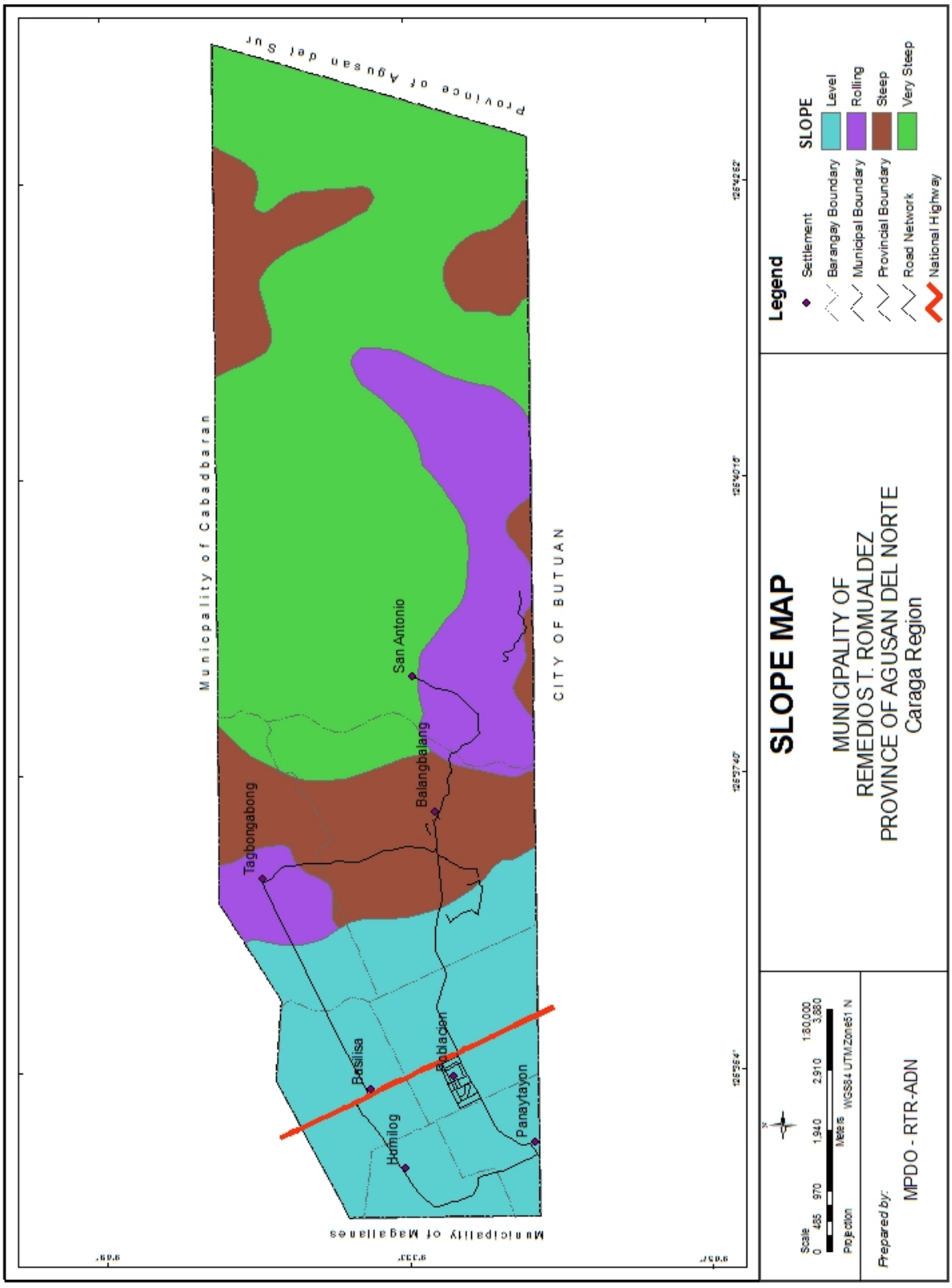
List of Annexes (A) - Figures



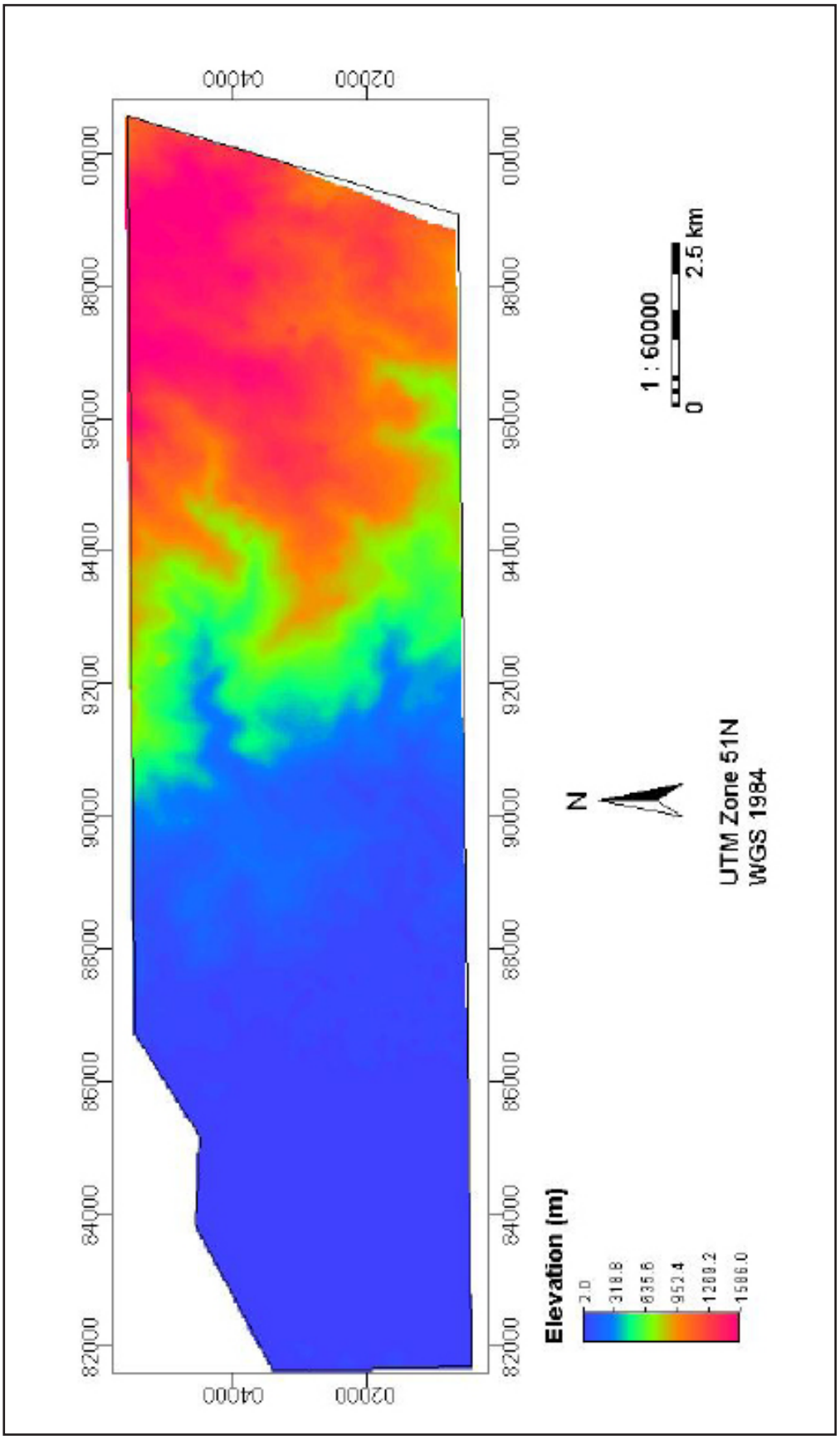
Annex A 1: Location Map, Municipality of RTR



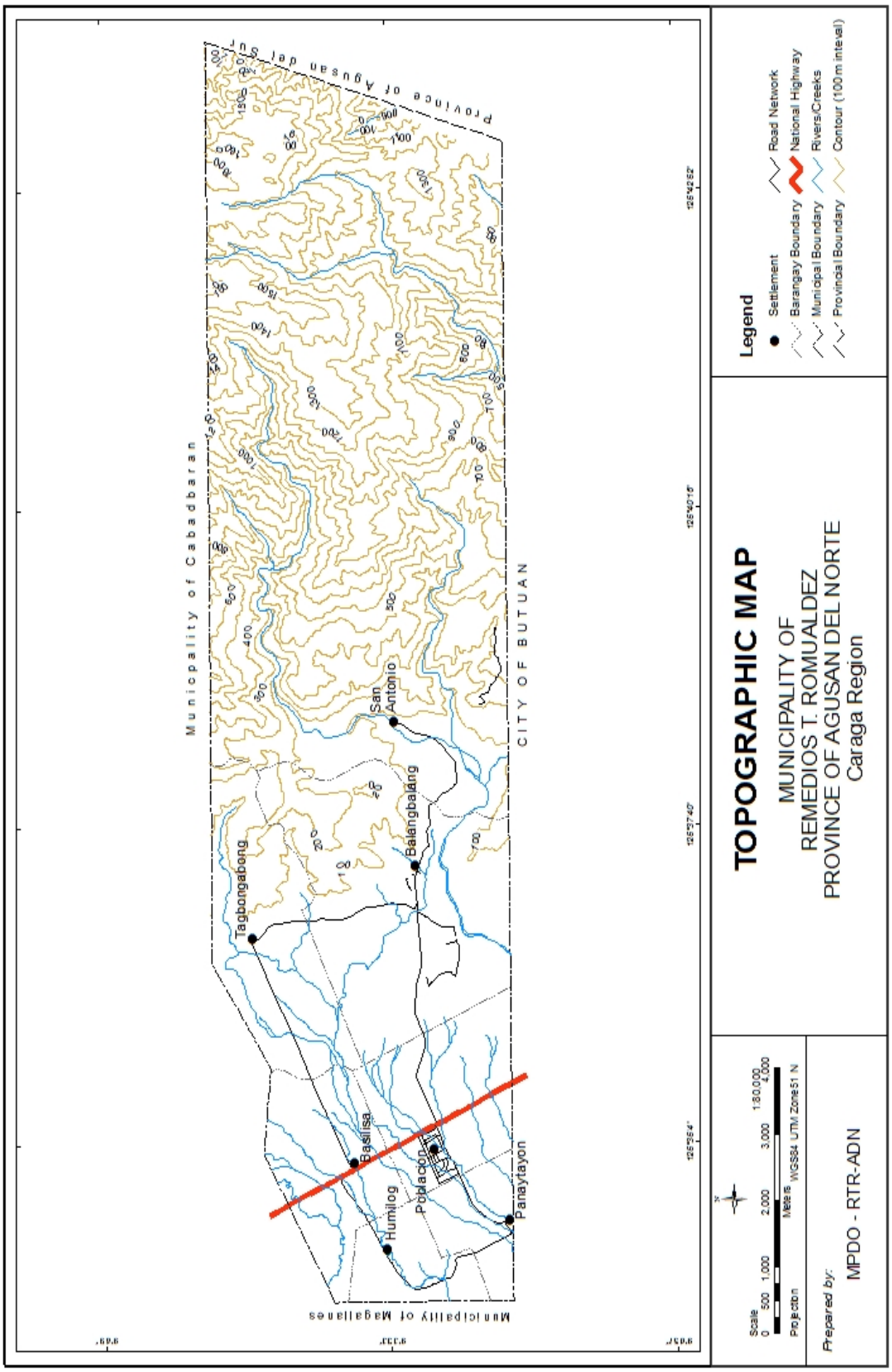
Annex A 2: The Existing General Land Use Map, RTR



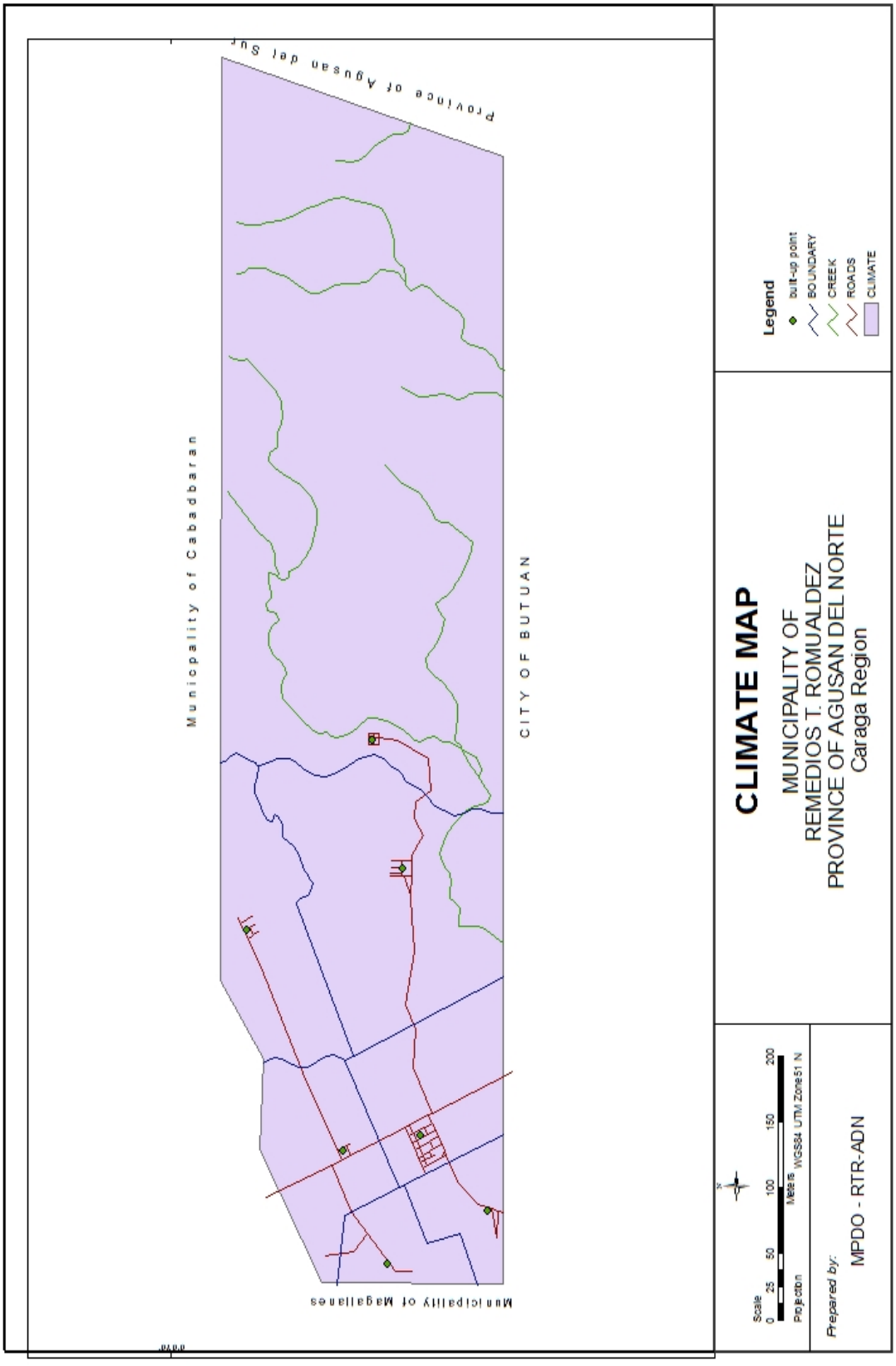
Annex A 3: Slope Map



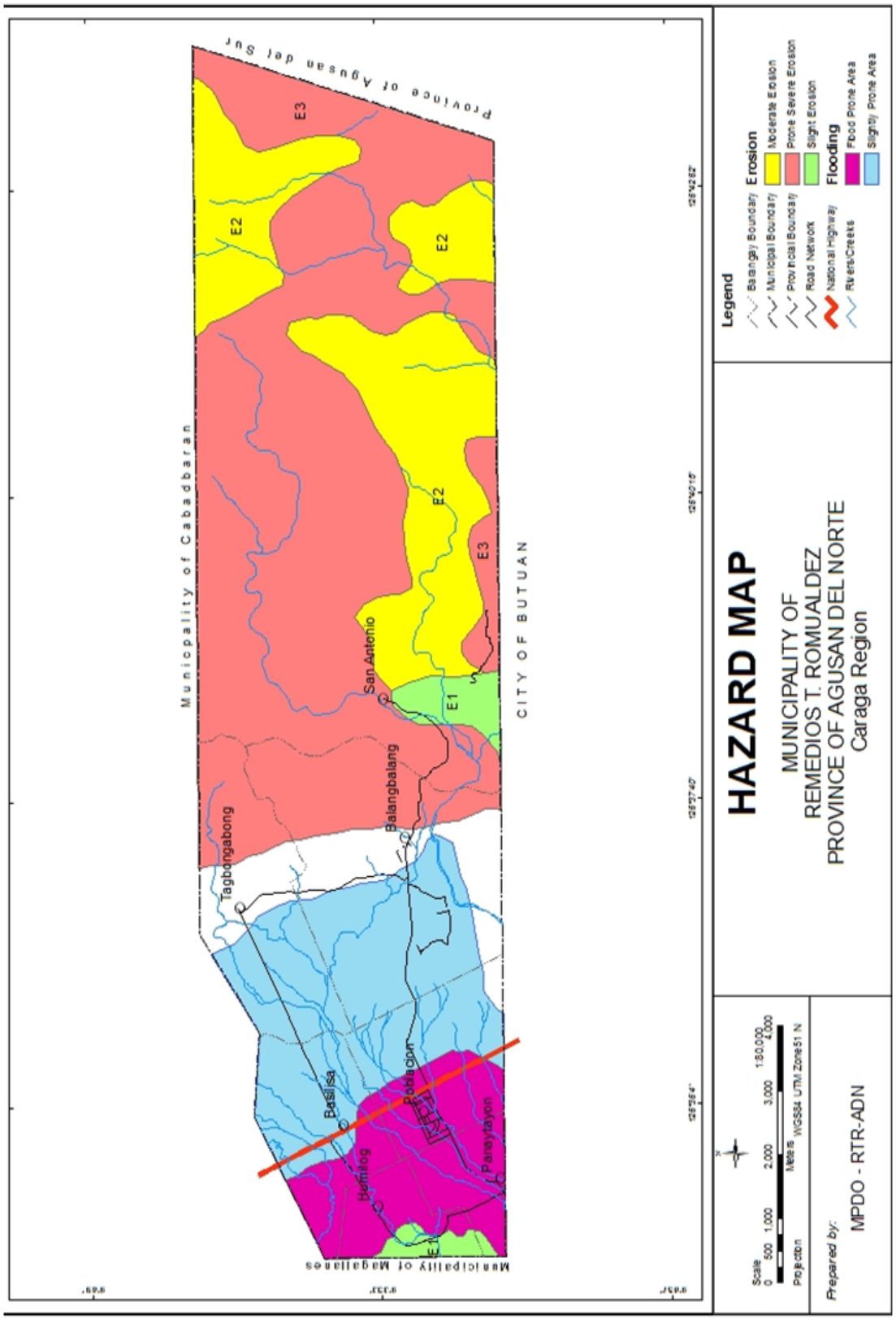
Annex A 4: Elevation Map, RTR



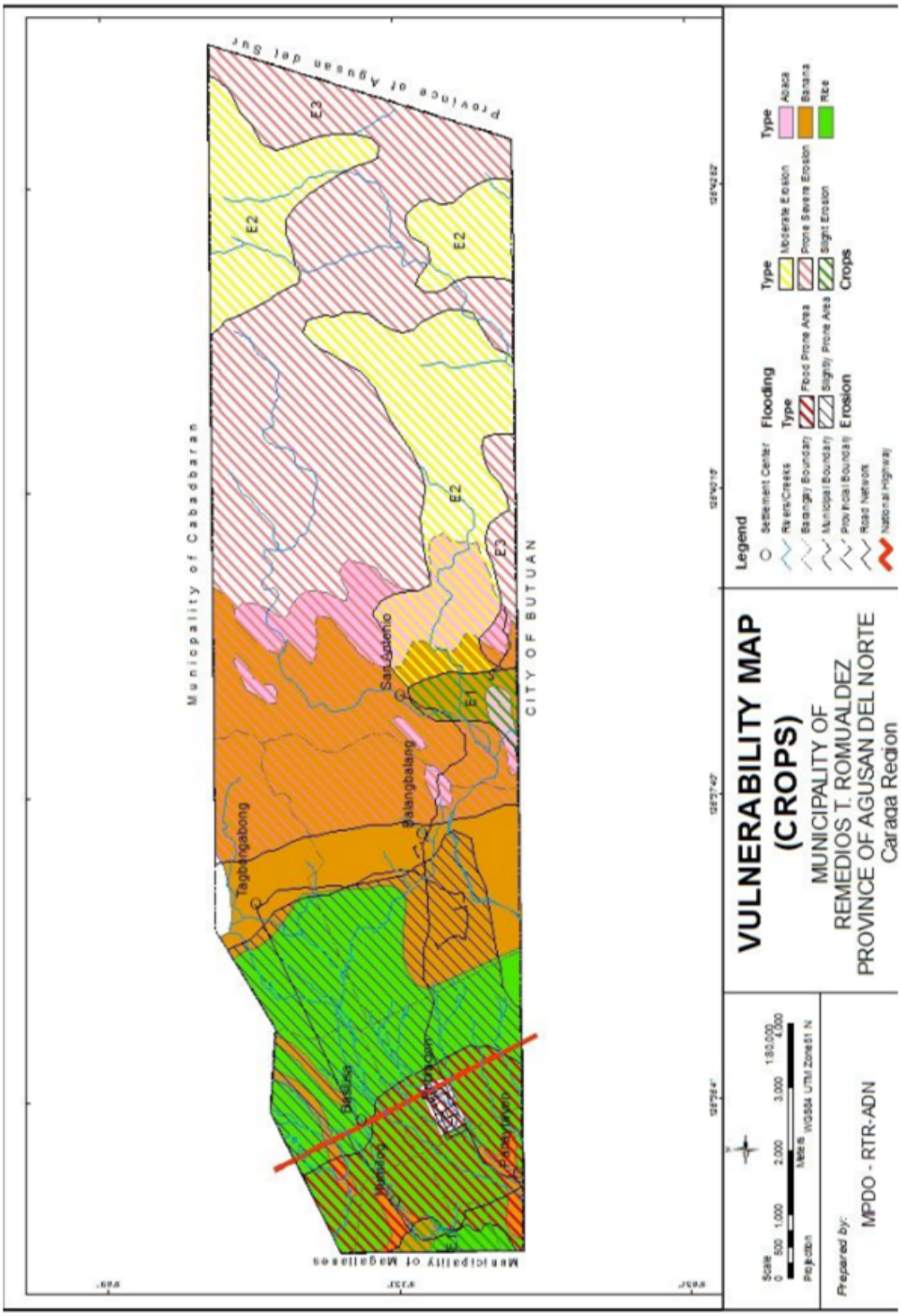
Annex A 5: Topographic Map



Annex A 6: Climate Map



Annex A 7: Hazard Map



Annex A 8: Vulnerability Map (Crops)

ANNEX *B*

List of Annexes (B)- Tables

Annex B1: Past Adaptation Strategies

Past Adaptation by affected people and place	Year					
	Flooding 2003	**Flooding 2005**	**Flooding 2006**	**Flooding 2007**	**flooding2009**	**Pest & Diseases Infestation 2009**
Communities	• Adjust planting calendar • Cleaning of canal/ drainage system	• Adjust planting calendar	• Adjust planting calendar	• Adjust planting calendar	• Adjust planting calendar	• Fallow planting calendar • Adapt synchronous planting
LGU's	• Provision of seed subsidy • Declare state of calamity-release of relief assistance (food) • Dredging of creeks • Seed Subsidy Program • Planting of trees in forest reserve • Rehab of road network • Construction of canals/drainage	• Provision of seed subsidy • Declare state of calamity-release of relief assistance (food) • Dredging of canal • Planting of trees in forest reserve • Rehab of road network • Construction of drainage canal	• Provision of seed subsidy • Declare state of calamity-release of relief assistance (food) • Cleaning/rehab of drainage canal • Planting of trees in forest reserve • Rehab of road network • Mass production of organic fertilizer • Rice Production Loan Assistance	• Provision of seed subsidy • Declare state of calamity-release of relief assistance (food) • Cleaning/ rehab of drainage canal • Planting of trees in forest reserve • Rehab of road network • Mass production of organic fertilizer • Rice Production Loan Assistance	• Provision of seed subsidy • Declare state of calamity-release of relief assistance (food) • Dredging of creeks • Planting of trees in forest reserve • Rehab of road network • Rice Production Loan Assistance • Rice Production Loan Assistance • Mass Production of Organic Fertilizer	• Crop Insurance Scheme • Technology transfer • Conduct Farmers-Field-School • Vermie composting • Rice Production Loan Assistance • Implementation of Organic Farming Technology System • Rice Production Loan Assistance • Rice Production Loan Assistance • Mass Production of Organic Fertilizer
Farmers	• Conduct replanting to affected areas • Adjust planting calendar	• Conduct replanting to affected areas	• Conduct replanting to affected areas	• Conduct replanting to affected areas	• Conduct replanting • Make their owned organic fertilizer	• Early harvesting • Make their owned organic Fertilizer • Light trapping for pest mgt.

Annex B 2. Details of the Climate Change Adaptation Practice

Climate Change Adaptation Practice	Location	Description	Origin of Practice		Climate Drivers	Impacts	Extent of Use
	A. Household Level B. Barangay/ Community Level C. Municipal level D. Provincial level (Indicate the specific name of Barangay or municipality where practiced)	(Answer the ff: 1. What is being done? 2. Materials Used? 3. How is it being done? 4. Why is it being done?)	**Locally Initiated** A. Adopted B. Modified	**Externally Introduced** A. Adopted B. Modified	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)	A. Increased income B. Generated employment C. Reduced poverty D. Environmental E. Others (Please Specify)	(percentage of use in a certain area) A. Low – 1- 33% B. Moderate – 34-66% C. High – 67-100%
1. **Improvement and Maintenance of Drainage System**	b & c	1. Ripraping/Periodic cleaning of canal 2. concrete material 3. construction 4. Control flooding	a		a & c	B & E reduce flooding	B
2. **Promotion of Organic Farming**	a. b & c	1. IEC/prod's of organic fert. 2 . FITS Center/Farm by product 3. FFS & Meetings 4. organic farming implementation		A & b	f. declining soil fertility	A, b. c. d	B

3. **Strengthening of RBO's**	b	1. Organized 2. Education materials 3. Meetings 4. Strengthen linkages		a	f.	e.	b
4. **Construction of Warehouse for every Flatbed Dryers**	b	1. Construct Warehouse 2. Const. Material 3. Construction 4. Storage of Farm products		a	e	e	a
5. **Planting of Trees for Watershed Preservation**	B & c	1. Planting of trees of watershed area 2. Trees seedling (Narra) 3. Through CBRM Project/PO's 4. Reforestation		a	All of the above	d	b
6. **Seed Subsidy Program**	a	1. Seed distribution 2. Cert. Seeds 3. Through farmers masterlist 4. Reduce farm expenses		a	e	A & c	c
7. **Financial & Technical Assistance**	A,	1. Provision of funds/ and AT's 2. Funds 3. Cash & input release 4. to avail low interest rate/ AT support to improved farming skill	a		f.	A & C	B

8. **Adjust Planting calendar**	b	1. IEC 2. Planting Calendar 3. Meeting/ distribution of planting calendar 4. Reduce pest infestation/flood		a	A,b & E	A, C, D	c
9. **Expanded crop insurance program**	b	1. Apply to PCIC 2. Facilitated by MAO 3. Insured crop/ life of farmers		a	All of the above	e. refund of indemnity claim	b

Annex B 3: Assessment of Past Adaptation Strategies

Hazards	Past Adaptation by affected People and Places	Sufficiency	Constraints
Hazard 1: Strategies	Floods		
	>Seed Subsidy Program	Presence of Seed Growers to supply seed for the whole rice area	Delayed processing for release of seeds from regional office/Seed Growers
	>Crop Insurance	PCIC willing to facilitate the assistance	LGU can only fund 360 has.
	>Palay Seed Rehabilitation	Available seeds for procurement	LGU can only afford to purchase 100 bags for seed rehabilitation due to limited funds
	>Rechanneling and Dredging of Creeks/ Canals	Partial implementation	20% Dev't. fund insufficient or cannot support the project
	>Rehabilitation of Roads	Partial implementation	20% Dev't. fund insufficient or cannot support the project
	>Establishment of Weather Station	Existence of manually operated weather station	Irregularity of data collection
	>Rice Loan Production Assistance	Strong LGU support & 100% collection	Limited funds-5th class Municipality
	>Cons. of Alternative Irrigation Facilities	Available source of water	Funding not available
	>Tree Planting in Watershed Area	Vast area for replanting	Funding not Available
Hazard 2: Strategies	Pest Infestation >Synchronous Farming	Available technology for the farmers to adapt	Some Farmers do not cooperate
	>Sustainable Organic Farming Technology	Available Technology	Some Farmers do not cooperate
	>Rice Production Loan Assistance	Out of 1742 has. Only 360 has. Availed the program	LGU Limited funds for the assistance
	>Light Trapping	Easy to conduct	Not all farmers cooperate in the implementation.
	>Crop insurance scheme	Available crop insurance to take	Limited funds for the assistance

Annex B 4: **Maximum Temperature, PAGASA Butuan Office**								
Month	MEAN		BIAS	Projected Change (%)		BIAS CORRECTED PROJ CHANGE		
						TMAX		
	Observed 1971-2000	Model 1971-2000		2020	2050	1971-2000	2020	2050
Jan	30.1	27.5	-2.6	1.1	2.3	30.1	31.2	32.4
Feb	30.8	28.5	-2.3	1.1	2.3	30.7	31.9	33.1
Mar	31.8	29.2	-2.6	1.2	2.8	31.8	33.0	34.6
Apr	33.1	29.8	-3.3	1.5	3.1	33.1	34.6	36.1
May	33.8	29.6	-4.2	1.3	2.9	33.8	35.1	36.7
Jun	33.0	28.9	-4.1	1.2	2.9	33.0	34.2	35.9
July	32.5	29.3	-3.2	1.3	3.0	32.5	33.8	35.5
Aug	32.8	30.0	-2.8	1.3	3.1	32.8	34.1	35.9
Sept	32.9	30.3	-2.6	0.9	2.6	32.9	33.8	35.5
Oct	32.3	28.6	-3.7	1.2	2.4	32.3	33.5	34.7
Nov	31.6	27.8	-3.8	1.0	2.3	31.6	32.6	33.9
Dec	30.8	27.2	-3.6	0.9	2.2	30.8	31.7	33.0

Annex B 5: **Rainfall, PAGASA Butuan Office (mm)**											
Month	MEAN		BIAS	Projected Change (%)		BIAS CORRECTED PROJECTED CHANGE (mm)					
						RR (mm/day)			RR Total (mm)		
	Observed 1971-2000	Model 1971-2000		2020	2050	1971-2000	2020	2050	Obs 1971-2000	2020	2050
Jan	9.9	3.9	2.5	12.8	2.6	9.7	10.9	10.0	300.7	337.9	310.0
Feb	7.6	2.7	2.8	0.0	3.7	7.5	7.7	7.5	210.0	215.6	210.0
Mar	4.8	4.5	1.1	-26.7	-35.6	5.0	3.7	3.2	155.0	114.7	99.2
Apr	3.6	5.0	0.7	-26.0	-40.0	3.5	2.6	2.1	105.0	78.0	63.0
May	3.4	6.6	0.5	-9.1	-24.2	3.3	3.0	2.5	102.3	93.0	77.5
Jun	4.5	7.6	0.6	0.0	0.0	4.6	4.6	4.6	138.0	138.0	138.0
July	5.1	7.0	0.7	-12.9	-18.6	4.9	4.3	4.0	151.9	133.3	124.0
Aug	3.4	6.0	0.6	-8.3	-8.3	3.6	3.3	3.3	111.6	102.3	102.3
Sept	4.7	5.1	0.9	2.0	-7.8	4.6	4.7	4.2	138.0	141.0	126.0
Oct	6.3	4.8	1.3	12.5	0.0	6.2	7.0	6.2	192.2	217.0	192.2
Nov	6.4	4.7	1.4	8.5	6.4	6.5	7.2	7.0	195.0	216.0	210.0
Dec	7.0	5.5	1.3	5.5	18.2	7.2	7.5	8.4	223.2	232.5	260.4

Annex B 6: Scenario Analysis Matrix (2020)

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 Devt.	7 brgys.					
	Current population growth		18,000			14% decrease of agricultural productivity (0.70ton/ha)	
	Current adaptive capacity					1.Introduce/adopt varieties of rice and other major crops such as banana abaca, cassava and other root crops. 2.Institute measure for the prevention and control of pest and diseases on rice, banana, abaca and other major crops. 3.Increase production of highbred animals such as goat, wine, cattle, carabao and horse. 4.Provide veterinary assistance for livestock to act for the prevention of diseases.	
	Current LGU budget levels						Food shortage
	W/out land conversion						
	Summation or scenario narrative	Advances in S&T are at currenr level	Population growth rate is 2.45% per annum	There is no corresponding increase in budget of the LGU which resulted to low level of adaptation capacity		Minimal investment intervention	No land conversion were made

Scenario 2: Positive	Increasing S&T devt.						
	Decreasing population growth		16,000				
	Increasing adaptive capacity					1.Improved LGU capacity though intensive capacity building activities such as but not limited to trngs, seminars, cross visits, exposure to areas with best practices. 2. Encourage establishments of agro-industrial business utilizing raw materials that are abundant in the area. 3. Intensify participation of women in development by providing access to alternative livelihood opportunities that will increase income of the family.	
	Increasing LGU budget levels						Capable to address any anticipated food shortage
	W/out land conversion						
	Summation or scenario narrative	Marked positive advancement of Science and Technology	The population growth rate markedly decreases (down to 1% per annum from 2.45%)	There is an increasing adaptation capacity with increasing budget	Without Land Conversion	The LGU is very much capable to address any anticipated food shortage by 2020.	

Annex B 7: Scenario Analysis Matrix (2050)

SCENARIO 1

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.
Current S&T devt.	8 brgys.					Low productivity in rice, and areas devoted for coconut, banana and abaca.
Current population growth	Housing backlog and new families would be forced to settle illegally on private lands.	37,933 Adversely affected: 60 to 70 % or 26,553			Unemployment is high	
Current adaptive capacity					Establish/ Install Early Warning System or PAG-ASA weather station which is automatic operated. 2. Capacitate the LGU and other stakeholders to improve current adaptive capacity thru trngs.seminars, cross-visits, forums, etc. 3. Improve LGU's capability to generate resources either internal or external by strict enforcement of local revenue ordinances and fund sourcing from NGA's, NGO's and other funding donors.	

					4. Intensify the implementation of Organic Farming Program and provide additional funding for OTOP subsidy program for farmers. 5. Create more economic opportunities to farmers and women by vigorously pursuing livelihood assistance, as the lack of capital is often considered as one of the major problems.	
Current LGU budget levels						Lacking in their capability to provide the basic necessities in life
W/out land conversion						
Summation or scenario narrative	Advances in Science and technology are at current level	Population is expected to reach to 34,434 at growth rate of 2.45% per annum	Low level of adaptive capacity and there is no corresponding increase in the budget of LGU	The present intervention investment is moderate	No land conversion were made	With current population growth would have an adverse effect to the total development of the people and its environment.

SCENARIO 2

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.
Increasing S&T devt.	8 brgys.					
Decreasing population growth	Decreasing population growth with increasing opportunities on development and with increasing adaptive capacity due to constant capacity building activities would have empower and make the people work together towards their own growth and developments.	24,637				
Increasing adaptive capacity					1.Establish marketing support program 2.Rehabilitation of existing farm to market roads and other support infrastructure 3. Appropriate funds for the maintenance and operation of early warning device. 4. Full implementation of Reproductive Health Program to include responsible parenting and natural family planning	

					5.Establishment of sanitary landfill/ solid waste disposal 6. Strict enforcement of the law on non-conversion of agricultural land especially Riceland into commercial, industrial or residential use.	
Increasing LGU budget levels						1.Provide investments and interventions to the problems, needs and aspirations of the people. 2. In terms of education, because of increasing budget allocation for the local school board, can implement projects for school improvement. This would result to increase in participation rate in elem. and high school. At least 98% of the pupils in elementary would reach high school and eventually graduate and pursue higher education or vocational courses, since parents could already afford the cost.

						3. The LGU in cooperation and coordination with the NGA's and NGO's could provide other services and facilities to the people such as good road networks, power and lighting facilities, housing thru housing development programs.
W/out land conversion	RTR would never be congested considering that there is a marked decrease in population growth.					
Summation or scenario narrative	There is marked positive advancement of Science and Technology	The population growth rate markedly decreases	There is an increasing adaptation capacity with increasing budget	Without land conversion		

SCENARIO 2

Climate Scenario: increasing temperature and decreasing rainfall	Extent of areas to be affected	No. of people to be affected	Damage to lives	Dam-age to prop-erties	Livelihood impacts	Others e.g. human health, etc.
Current S&T devt.	8 brgys.				8 to 14% or 1.40 ton/ha for rice considerable losses to crops	
Increasing population growth		59,413				
Current adaptive capacity					1.Increase agricultural production thru sustainable farming. 2 .Increase fund allocation for OTOP and Organic Farming Program. 3. Provide alternative livelihood opportunities for farmers, women, and out of school youth. 4. Strict enforcement of national laws and local ordinances on environmental management and protection and forest and watershed preservation. 5.Construction of alternative irrigation facilities in Agay river 6. Promotion of gender equality and empowerment of women thru intensive advocacy on national existing laws o women for their protection and promotion of their rights.	

					7. Strengthen People's Organizations which serves as partners in the implementation of climate change adaptation programs, such as the farmers associations and youth organizations. 8. Establish measures against land denudation, river and creek siltation and soil erosion 9.Enhance health facilities having a regular ample supply of medicine and supplements as well as the regular upgrading of the personnel 10.Enhance the capability of the MFT to carry their tasks and functions in the implementation of climate change adaptation program. 11. Intensive education on human rights and the linking of peace and order disturbances of the place.	

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Decreasing LGU budget level						With decreasing adaptive capacity, and with decreasing LGU budget, the vulnerability of the people and the areas is HIGH. The LGU would be unable to provide funds to improve farm production ,extend livelihood assistance to farmers, women and out of school youths.
						Farmers in upland brgys. Would resort to illegal cutting of trees as timber pouching, indiscriminate cutting of trees, wildlife hunting and even encroach forest reserves and watershed areas.
With land conversion	There will be many families who will lost the land they tilled and become displaced. They will be left with nothing to depend on since are depending on the lands for survival.					

Summation or scenario narrative	Advancement in Science and Technology are at current level	Population growth rate increased to 3.5% from the current level of 2.45% per annum	No improvement in the LGU's adaptation capacity coupled with decreasing budget	There will be aggressive conversion of land from agricultural to commercial and residential use		

Annex B 8: Future Adaptation Strategies

Physical/ Infrastructure		Economic	Political/Institutional
• Establishment/ install Early Warning System or PAGASA weather station which is automatic operated. • Rehabilitation of existing farm to market roads and other support infrastructures • Construction of alternative irrigation facilities in Agay river. • Establish measures against land denudation, river and creek siltation and soil erosion. • Rechanneling and dredging of creeks and canals.		• Encourage establishment of agro-industrial business utilizing raw materials that are abundant in the area. • Intensify participation of women in development by providing access to alternative livelihood opportunities that will increase income of the family. • Intensify the implementation of organic farming program and provide additional funding of Rice Production Loan for One Town One Product (OTOP) subsidy program for rice farmers. • Create more economic opportunities to farmers and women by vigorously pursuing	• Improved LGU capacity through intensive capacity building activities, such as, but not limited to training, seminars, cross-visits, exposure to other areas with best practices in the implementation of climate change adaptation projects. • Pursue implementation of Reproductive health Program to include natural family planning and responsible parenting. • Adoption of RA 10068 otherwise known as "Organic Agriculture of 2010" and other National Laws related to Agriculture by the Sangguniang Bayan • Strict enforcement of Municipal Ordinance on Agriculture and Forestry (Environmental Protection). • Strongly support the National Irrigation Administration (NIA) in its desire to turn-over the operation and management to the irrigators association. • Intensify linkages and network with National Government Agencies and Non-Government Organization for fund support to development • Protect water aquifer through strict regulation or banning of ground water extraction. Capacitate the LGU and other stakeholders to improve current adaptive capacity through trainings, seminars, cross–visits, forums, etc.

		livelihood assistance, as the lack of capital is often considered as one of the major problems. • Increase agricultural production through sustainable farming. • Provide alternative livelihood opportunities for farmers, women and out of school youth. • Establish marketing support program • Provision of Crop Insurance Scheme. • Pursue the implementation of level 3 water system	• Improve LGU's capability to generate resources either internal or external by strict enforcement of local revenue ordinances and fund sourcing from NGA's ,NGO's and other funding donors • Appropriate funds for the maintenance and operation of early warning device. • Establishment of sanitary landfill/ solid waste disposal • Strict enforcement of the law on non-conversion of agricultural land especially Riceland into commercial, industrial or residential use. • Increase fund allocation for OTOP and Organic farming program • Strict enforcement of national laws and local ordinances on environmental management and protection and forest and watershed preservation. • Strengthen People's Organizations which serves as partners in the implementation of climate change adaptation programs, such as the farmers associations, Rural Improvement clubs, women's associations and youth organizations. • Enhance health facilities having a regular ample supply of medicine and supplements as well as the regular upgrading of the personnel. • Enhance the capability of the MFT to carry their tasks and functions in the implementation of climate change adaptation program. Intensive education on human rights and the linking of peace and order disturbances of the place.

Annex B 9. Criteria/Indicators and 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)	10
2. ***Contribution to Poverty Reduction*** (potential of the adaptation practice to reduce poverty)	15
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)	8
6***. Absence of adverse impacts on other sectors/group*** (less negative impacts to other group/sectors, the more effective the CCA strategy)	8
7. ***Environmental Soundness*** (the more environmental friendly the practice, the more effective)	15
8. ***Ease of Implementation*** (the strategy is easily employed, absence of barriers for implantation)	7
9. ***Socio-cultural Acceptability*** (the more acceptable the CCA practice to greater number of stakeholders, the more effective)	0
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)	7
TOTAL	**100**

Annex B 10. Scoring of the Adaptation Practice

Climate Change Adaptation Practice	Criteria/Indicators of Effectiveness											
	Cost Effectiveness 10%	Contribution to Poverty Reduction 15%	Increase Income 10%	Contribution to Employment 10%	Size of beneficiary group 8%	Absence of adverse impacts on other sectors/ groups 8%	Environmental Soundness 15%	Ease of Implementation 7%	Socio-Cultural Acceptability 0%	Immediate Impact 10%	Potential for Upscaling 7%	Total Score 100%
1	5	7	5	5	8	8	12	7	0	8	7	72 (5)
2	8	12	10	8	6	8	15	4	0	7	7	85(1)
3	8	10	8	5	8	8	10	5	0	7	7	76 (3)
4	10	7	7	2	8	8	7	4	0	5	7	65 (8)
5	9	7	5	2	8	8	15	4	0	5	7	70(7)
6	10	7	8	2	7	8	5	7	0	10	7	71(6)
7	10	12	8	2	7	8	10	6	0	9	7	79 (2)
8	10	12	8	2	6	8	7	5	0	10	5	73(4)
9	5	5	5	2	3	8	0	7	0	10	7	52 (9)

Annex B 11. Ranking of Adaptation Practices

Ranking
1. **Promotion of Organic Farming**
2. **Financial & Technical Assistance**
3. **Strengthening of RBO's**
4. **Adjust Planting calendar**
5. **Improvement and Maintenance of Drainage System**
6. **Seed Subsidy Program**
7. **Planting of Trees for Watershed Preservation**
8. **Construction of Warehouse for every Flatbed Dryers**
9. **Expanded crop insurance program**

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