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January 23, 2019

DIR. Nicomedes P. Eleazar
Director
Department of Agriculture-Bureau of Agricultural Research
RDMIC Bldg., Visayas Avenue
Quezon City

Dear Dir. Eleazar:

The Caraga State University (CSU) would like to submit the Terminal Report of the project on '**Climate-Resilient Agri-fisheries (CRA) Assessment, Targeting & Prioritization for the Adaptation and Mitigation Initiative in Agriculture (AMIA) in Caraga Region.**' The outputs of the project will be very useful in packaging the investment portfolio for Climate Resilient Agriculture (CRA) in the Caraga Region. Through the project, the capability building of the CSU researchers together with the agriculturists of the Department of Agriculture – Regional Field Office 13 on AMIA was made possible.

Thank you for your never-ending support to the Caraga State University. We look forward to more collaborative efforts with you.

Sincerely,

ANTHONY M. PENASO, Ph.D.
President

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COMPLETION REPORT

1. Project Title

Climate-Resilient Agri-fisheries (CRA) Assessment, Targeting and Prioritization for the Adaptation and Mitigation Initiative in Agriculture (AMIA) in Caraga Region

2. Researcher (s)

Name:	Rowena P. Varela, Ph.D.
Designation:	Professor
Organization:	Caraga State University

3. Implementing Agency

3.1. Lead Agency	Caraga State University
Head of Agency	Dr. Anthony M. Penaso
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3.2. Collaborating AgencyDA- RFO 13

4. Project Duration

4.1.	Approved Duration (Y/M)	12 months
4.2.	Actual Duration (Y/M)	15 months
4.3.	Start Date of Implementation	July 2017

5. Project Site(s)

5.1.	Province:	Agusan del Norte
5.2.	City/Municipality:	Butuan City and Jabonga, Agusan del Norte
5.3.	Barangay:	Selected Barangays along the Agusan River and Lake Mainit
5.4.	Geocode	

6. Project Funding

6.1	Total Approved Budget	PhP 999,010.08
6.2.	Total Amount Released	PhP999,010.08
6.3.	Agency Counterpart	PhP120,000 (by attribution)
6.4.	Actual Expenses	
6.5.	Unliquidated Balance	

7. RDE Agenda Addressed:

   Development of Unified Vulnerability Suitability Assessment (VSA) for all areas; Development of crop modelling tools for predictive use especially for high value crops

8. Expected Technology or Information: Climate-resilient agri-fisheries (CRA) technologies and practices in Caraga Region in support of AMIA2
9. Description of Technology/Information

10. Potential Impact: Climate-resilient agriculture and fishing communities in Caraga Region

11. Target Beneficiaries/Users: Agriculture and fishing communities in Caraga Region, Planners

12. Type of Research (e.g. Basic, Applied, Policy): Applied/Policy

13. Tags/Keywords: Climate-resilient; agriculture; fishery; adaptation; mitigation; local knowledge and practices

Climate-Resilient Agri-fisheries (CRA) Assessment, Targeting and Prioritization for the Adaptation and Mitigation Initiative in Agriculture (AMIA) in Caraga Region

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December 2018

Acknowledgment

This research is an output of various organizations and individuals that share a common goal of addressing the threats of climate change to the agriculture sector in Caraga Region. The following organizations and individuals have contributed a lot in achieving the goal and objectives of this project:

Bureau of Agricultural Research of the Department of Agriculture (DA-BAR) for the financial support to undertake the research;

Centro Internacional de Agricultura Tropical (CIAT) – Southeast Asia for the training and guidance in the conduct of this research;

Caraga State University for giving time release to the faculty members to implement the project;

Department of Agriculture – Regional Field Office 13 for extending its valuable support in all aspects of the project implementation;

Municipal Agricultural Offices of the various towns of Agusan del Norte for unselfishly sharing their information aligned to climate change;

Mayor Jazmin Monton for the all-out support to the project especially in the identification of the AMIA village;

Municipal Agricultural Office of Jabonga, Agusan del Norte for the assistance in the conduct of the Focus Group Discussion (FGD), Key Informant Interview (KII) and other aspects of the research;

The farmers of Jabonga, Agusan del Norte for sharing the information about their practices on how they go about farming to evade the impact of climate change particularly flooding.

Table of Contents

List of Tables

List of Figures

Abstract

This project focused on capacity strengthening for CRA research and development, geospatial assessment of climate risks, stakeholders' participation in climate adaptation planning, documenting and analyzing CRA practices and AMIA baseline study for monitoring and evaluation. To strengthen the capacity in CRA Research and Development, the local SUC workers in agriculture and the farmers were exposed to training and workshops related to CRA and participatory mapping of crop occurrences and hazards. The CRA and CRVA maps were developed using the data collected from the farmers and secondary data from the Department of Agriculture-Regional Field Office 13 and the local government units. The findings reveal that the top 5 crops in the focused province of Agusan del Norte are rice, corn, banana, coconut, and vegetables. In the livestock part, swine and poultry are the two most common commodities while fishery is not totally reported among the municipalities. Among the municipalities in the province, flooding and drought are the reported hazards to agricultural undertakings, with flooding identified to be more damaging. In identifying the climate resilient agricultural practices, more focus is given to rice, corn, and banana since these crops are vulnerable to flooding. In the selected area for the AMIA Village in Jabonga, Agusan del Sur, rice and corn are still the key crops as reported by the farmers and the municipal agriculture office. The production of these crops is generally timed before the onset of flooding that normally occurs from December to March. The two cropping practices that are regarded as CRA practices are the corn - rice – green corn rotation and the corn – corn/squash rotation. The former CRA practice involves the planting of green corn in the crop rotation to have a shortened cropping period of 70 days instead of 105 days for grain corn production. In the latter, the corn and squash intercropping is designed to have higher profitability from squash. The squash is either sold immediately after harvest or stored for some time and sold when the price is high or used for feeds to swine and sell the swine instead. The cost benefit analyses (CBA) show that both CRA practices are profitable to the farmers. These practices likewise contributed to sustaining the environment by improving the biodiversity and minimizing the soil disturbance by reducing the number of soil cultivation. However, there is a need for the government to provide intervention in storage and marketing for the farmers' crops to optimize productivity. There were six (6) hazards identified in Agusan del Norte, namely: flood, tropical cyclone, sea level rise, storm surge, landslide, and erosion. The overall exposure results show a higher incidence of hazards in the municipalities of Jabonga and Santiago. In mapping the vulnerability of agriculture, the results show that Butuan City is the most adaptive municipality within the province concerning economic, natural, social, human, physical, anticipatory and institutional, indicating high coping mechanisms of Butuan City to respond to climate-related hazards. Most municipalities across the study sites have a low adaptive capacity index. The results show the need for the local government units (LGUs) to focus on improving their coping mechanisms by increasing its services and interventions in the various municipalities affected by climate-related pressures.

2. Rationale

2.1. Problem Statement

The Adaptation and Mitigation Initiative in Agriculture (AMIA) seeks to enable the Department of Agriculture (DA) to plan and implement strategies to support local communities in managing climate risks – from extreme weather events to long-term climatic shifts. Spearheaded by the DA System-wide Climate Change Office (DA SCCO), AMIA Phase 1 in 2015-16 implemented activities to strengthen DA's capacity to mainstream climate change adaptation and mitigation strategies in its core functions of RandD, extension, and regulation. It is also designing complementary activities for building appropriate climate responsive DA support services.

The inputs for the AMIA Phase 2 are taken from the AMIA Phase 1 results. These are used to address the next big challenge in making climate-resilient agri-fisheries (CRA) an operational strategy through field-level action that directly involves, and impacts on the livelihoods of, farming communities. AMIA2 aims to invest in the launching of CRA communities - as the initial target sites for action learning, supported by an integrated package of climate services and institutions, within a broader food system/value chain setting. The program is launching an integrated and multi-stakeholder effort to operationalize CRA at the community level in target regions.

The AMIA2 program framework consists of 8 key clusters of inter-related activities, whose cumulative and combined results are envisioned to help AMIA achieve its goal for 2016 and beyond. For each cluster, a set of projects and activities would be designed towards operationalizing the AMIA framework.

Cluster 1: Enabling environment
Cluster 2: Vulnerability assessment and risk targeting
Cluster 3: Developing knowledge pool of CRA options
Cluster 4: CRA community participatory action research initial phase
Cluster 5: Enhancing services and institutions
Cluster 6: Integrating CRA in food systems and value chains
Cluster 7: Implementing CRA on scale
Cluster 8: Knowledge Management for results

The AMIA2 framework provides overall guidance in the planning and design of research and development interventions in target regions.

1. Region I Ilocos
2. Region II Cagayan Valley
3. Region III Central Luzon
4. Region IVA Southern Luzon
5. Region V Bicol
6. Region VI Western Visayas
7. Region 10 Northern Mindanao
8. Region 11 Southern Mindanao
9. Region VII Negros
10. Caraga Region

Vulnerability to climate change is defined as: "the degree to which a system is susceptible to, unable to cope with, adverse effects of climate change, including climate variability and extremes". Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity ((IPCC), 2014)

Climate Risk Vulnerability Assessment (CRVA) of AMIA 2++ is being conducted to expand the remaining seven (7) regions in the Philippines to guide the AMIA targeting and planning for building the climate-resilient agri-fisheries communities. It determines the impacts of climate change in order to have complementary plans and implement strategies to support local communities in managing the climate related risks. It also seeks to introduce complementary activities for building appropriate climate responsive financial and other key support services.

2.2. PESTLE or SWOT

Caraga Region, located in north-eastern Mindanao, has a unique climate despite being classified under Type II which is characterized by high rainfall during the months of November to February and no defined dry season. Its climate is informally known as 'wet and very wet'. The high rainfall in the region which is distributed practically evenly all throughout the year generally results to flooding in the Agusan provinces and Butuan City. The flood that normally lasts for a week can affect settlements, agriculture and other sources of livelihood. Nonetheless, having a climate like this is not all undesirable because the even distribution of rainfall throughout the year is also the reason why Caraga Region has still the widest remaining rainforest in the country. Moreover, industrial tree plantation species (eg. *Falcata, Mangium*) have faster growth in the region compared to other regions due to this climate.

Successful implementation of AMIA2 at the regional level requires the strong collaboration and support of key research and development institutions within the region. The Regional Development Council (RDC) of Caraga has been strongly endorsing programs and projects aligned to climate change mitigation and adaptation. Being vulnerable to flooding, the RDC has identified flooding as the major calamity that can significantly affect the region. The guidelines set by the Department of Budget and Management (DBM) to allocate funds for Disaster Risk Reduction and Management due to climate change is a huge opportunity for financing Climate Resilient Agriculture (CRA) initiatives. However, a rational investment planning should be conducted by the local government units (LGUs) to maximize the funds available for this purpose. This CRA project, therefore, can facilitate AMIA2 to establish and mobilize regional teams, each led by a local State University/College (SUC), and in partnership with the corresponding Department of Agriculture - Regional Field Office (DA-RFOs).

3. Narrative Summary

3.1. Potential Impact or Goal

The project adopted the overall AMIA2 program framework, to contribute to specific outputs to targeted national-level research projects. The project envisions strengthening the capacity of SUCs and regional level agriculture and fisheries development sector towards science-based planning for CRA investments.

These project components are designed to be directly aligned with the research agenda of three AMIA2 projects: 1) climate-risk vulnerability assessment (CRVA), 2) decision-support platform for CRA, and 3) institutional and policy innovations.

3.2. Outcome or General Objective/Purpose

Through the project, the following outcomes are realized:

a. Strengthened regional capacity for CRA investment planning through the use of climate risk maps to assist LGUs in their specific CRA investment planning
b. Heightened awareness among stakeholders in climate mitigation and adaptation planning

3.3. Expected Output or Specific Objectives

Through the project, the following outputs are realized:

a. Strengthened regional capacity for CRA research and development
b. Maps of climate risks are available for LGUs as basis for CRA investment planning
c. Heightened awareness among stakeholders in climate adaptation planning
d. Effective monitoring and evaluation of CRA investments based on AMIA baseline study

4. Review of Related Literature

4.1. Literatures

Impacts of climate change on food production systems depend largely on the adaptation measures undertaken by local communities (ICCG, 2016). These adaptation strategies will also apply to the complex issues on water use and food production as affected by climate change. Climate change expressed in terms of extreme temperature and precipitation can prevent crops from growing. Extreme heat and rainfall can harm crops and reduce yields (USGCRP, 2014). Managing impacts of drought can be a challenge in areas where rising temperatures cause soils to become drier. Climate change also impacts the marine ecosystem. Some marine disease outbreaks have been linked with changing climate (USGCRP, 2014). In the US, increased water temperatures and estuarine salinities helped the oyster parasite to spread farther north along the Atlantic coast. The recognition that climate change could have negative consequences for agricultural production has generated a desire to build resilience into agricultural systems. Crop diversification can improve resilience in a variety of ways: by engendering a greater ability to suppress pest outbreaks and dampen pathogen transmission, which may worsen under future climate scenarios, as well as by buffering crop production from the effects of greater climate variability and extreme events (Lin, 2011). However, incentives in the production of a select few crops and the belief that monocultures are more productive than diversified systems have been deterrents in promoting crop diversification.

Adaptation to changes can be related to behavior. Thus researches have been done to look at behavioral patterns as basis for interventions by the government and other organizations. In the Philippines, Acosta-Michlik and Espaldon (2008) presented an agent-based framework that considers the behavioral model of farmers in three villages in a municipality. Agent-based modelling is a useful policy tool for simulating the effects of different adaptation options on reducing vulnerability as it allows representation of the dynamic changes in climate and market including the dynamic adaptive process of different groups of communities to the impacts of these changes. Simulations of adaptation options under various change scenarios showed that production support can significantly reduce future vulnerability only if complemented with appropriate market support. They reported that lack of money and information are the most important reasons why communities do not apply available technical adaptation measures, which hinder vulnerability reduction in selected villages in the municipality.

Participatory approach in managing climate change risks and adaptation requires learning among the various community stakeholders. The role of learning, particularly forward-looking learning, as a key element for adaptation and resilience in the context of climate change is still debated. Thus Tschakert and Dietrich (2010), tried to examine learning processes from a dynamic systems perspective, comparing theoretical aspects and conceptual advances in resilience thinking and action research/learning (AR/AL). Particular attention is paid to learning loops (cycles), critical reflection, spaces for learning, and power. The aim is to identify opportunities and obstacles for forward-looking learning processes at the intersection of climatic uncertainty and development challenges in Africa, with the overarching objective to enhance adaptation and resilient livelihood pathways,

rather than learning by shock. Davies et al. (2009) also tried to examine the opportunities for linking social protection, CCA and DRR in the context of agriculture and rural growth, exploring whether linking these three approaches together will help enhance resilience to shocks and stresses in agriculture-dependent rural communities. The result suggests social protection and DRR measures designed to limit damages from shocks and stresses may not be sufficient in the longer term. It will need to consider how reducing dependence on climate sensitive livelihood activities can be part of adaptive strategies for social protection to be resilient to climate change impacts. Similarly, CCA and DRR cannot effectively address the root causes of poverty and vulnerability without taking a differentiated view of poverty.

Community Risk Analysis (CRAs) is another strategy recognized that can help address challenges by fostering community engagement in climate risk reduction, particularly given that many strategies to deal with current climate risks also help to reduce vulnerability to climate change (Van Aalst et al., 2008). However, a key challenge is to keep CRAs simple to promote wide application. In simplifying the approaches, special attention in the modification of CRA tools; in the background materials and trainings for CRA facilitators; and in the guidance for interpretation of CRA outcomes are needed. The application of a limited set of CRA results to guide risk reduction in communities and to inform national and international adaptation policy is another challenge. In CRA, stronger linkages are needed among major stakeholders, particularly in addressing the translation of climate information to the community level.

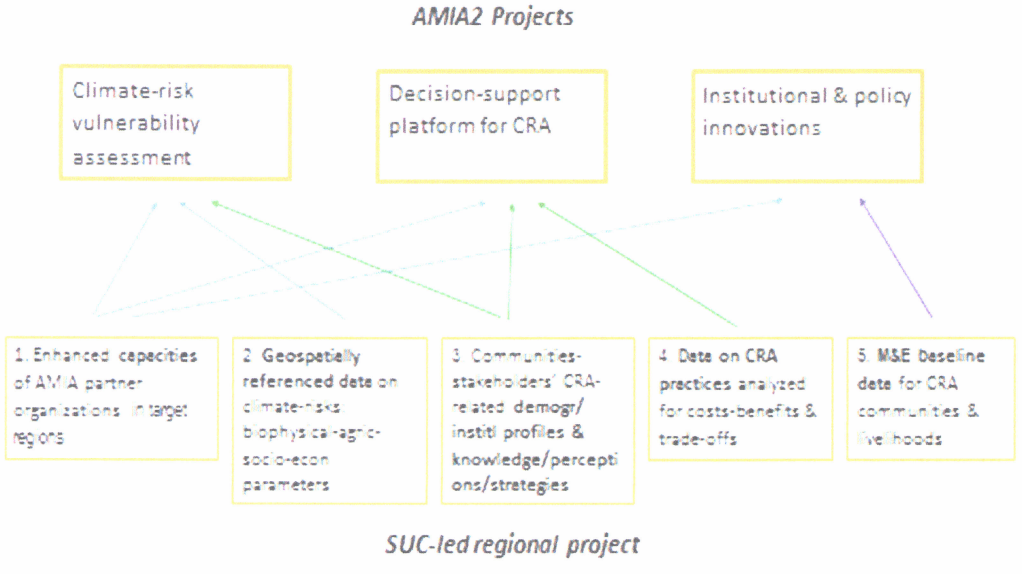
Strategies to reduce the impact of climate change through mitigation and adaptation are necessary to improve the resilience of agriculture-based communities in the various regions in the Philippines. In Mindanao, the regions in the northeastern portion have been exposed to different climate hazards like typhoon, drought, erosion and pest and diseases brought about by changing climate, inappropriate cultivation and landuse practices, among others. In 2011-2015, the northeastern Mindanao region has been hit by typhoons that caused tremendous agricultural damage. Typhoons Sendong, Agaton, Pablo and Senyang have been the most publicized ones that brought disasters to the region. In 2012, Typhoon Pablo caused an estimated PhP 16.3 B damage in agriculture in Regions 1, 4b, 6, 7, 10, 11 12 and Caraga. These experiences of northeastern Mindanao underscore the growing vulnerabilities of agriculture-dependent economy and livelihood of its farming communities.

5.0. Methodology per Objective

The project adopted the overall AMIA2 program framework, by contributing specific outputs to targeted national-level research projects. It seeks to contribute to the five key components:

1. Capacity strengthening for CRA research and development
2. Geospatial assessment of climate risks
3. Stakeholders' participation in climate adaptation planning
4. Documenting and analyzing CRA practices
5. AMIA baseline study for monitoring and evaluation

These project components are designed to be directly aligned with the research agenda of three AMIA2 projects: 1) climate-risk vulnerability assessment (CRVA), 2) decision-support platform for CRA, and 3) institutional and policy innovations.



Linking SUC-led regional project with AMIA 2 project porfolio

Component 1 - Capacity strengthening for CRA research and development

The regional project team participated in a series of trainings, workshops and learning events organized by AMIA2 projects. These trainings and workshops focused on three key methodologies: 1) CRVA, 2) CRA prioritization, and 3) CRA M and E. The project also provided training support to key research and development stakeholders in the region, by organizing an intra-regional training covering key learning contents from the national-level trainings.

Component 2 - Geospatial assessment of climate risks

The regional project team collected and organized geo-referenced data on vulnerability to climate risks of the region's agri-fisheries sector. These datasets, from both primary and secondary sources, were organized based on the methodological guidelines provided by the AMIA2 CRVA project – covering climate-risk exposure, sensitivity and adaptive capacity.

Preliminary analysis using GIS and climate modelling tools were undertaken at the regional level. The project team also participated in a national-team level joint analysis of cross-regional data.

Component 3 - Stakeholders' participation in climate adaptation planning

The regional project team likewise organized a series of stakeholders' meetings and focus group discussions (FGDs) to collect supplemental data and validate preliminary results of CRVA, as well as to undertake CRA prioritization and planning. These activities were guided by process facilitation and data collection tools developed by the AMIA2 projects on CRVA and CRA decision-support platform.

Component 4 - Documenting and analyzing CRA practices

The regional project team conducted a survey with local stakeholders using a semi-structured guide to identify and document CRA practices. The team also collected existing CRA-relevant statistical and other secondary data.

These data were systematized and analysed, using cost-benefit and trade-off analyses tools developed by the *Centro Internacional de Agricultura Tropical* (CIAT) as input to AMIA2 CRA prioritization and investment planning. These were used to contribute to developing knowledge products, such as searchable online portal, under the AMIA2 project on CRVA decision-support platform. A national working team, consisting of representatives from regional teams, have undertaken these joint tasks.

Component 5 - AMIA baseline study for monitoring and evaluation

The regional project team conducted a structured survey to collect baseline data on the target CRA communities and livelihoods as identified by AMIA2. This was undertaken following the development of outcome-oriented M and E guidelines for CRA, under the AMIA2 project on institutional and policy innovations.

Study Area

Agusan del Norte (Figure 1), is a province in the Caraga region located in the northeastern part of Mindanao. It is bounded by Butuan Bay and Surigao del Norte on the north, Surigao del Sur on the east, Misamis Oriental on the west and Agusan del Sur on the South. The province occupies a total land area of 2,730.24 sq km, reaching 3,546.86 sq km when Butuan City is included. Of the total land area (excluding Butuan City), 72.96% is considered forestland, while 25.43% is intended for agriculture, which is the main source of income of the province. Only 1.62% is

considered built-up areas, which are used for settlement, Special Economic Zones, and infrastructure and utilities (PIDS 2015).

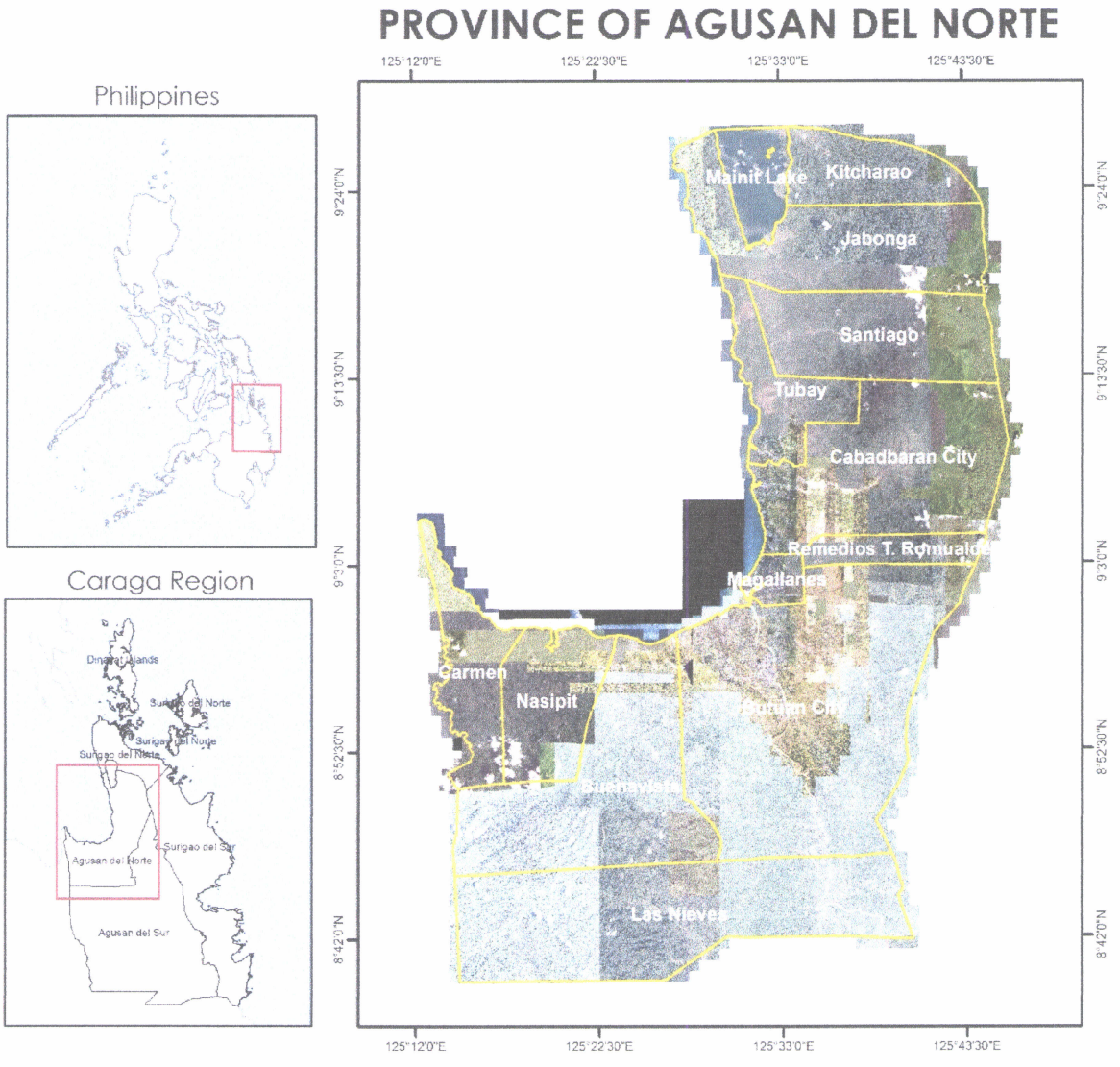


Figure 1. The Study Area: Province of Agusan del Norte

CRVA Process Workflow

The following presents an assessment of the three key dimensions of vulnerability for the agricultural sector.

- ✓ Exposure: The nature and degree to which a system is exposed to significant climate variations ((IPCC), 2014)
- ✓ Sensitivity: The increase or decrease of climatic suitability of selected crops to changes I temperature and precipitation.
- ✓ Adaptive Capacity: The ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences ((IPCC), 2014)

The sensitivity analysis is based on the assumption of a high emission scenario by 2050 (RCP 8.5) whereas the adaptive capacity component is derived from the up-to date available data mainly from 2015. The detailed composition of each component is shown in Figure 2. The resulting vulnerability assessment enables evidence-based spatial targeting of agricultural extension and financial investment in areas most at risk or tailored to a specific hazard crop or lack of adaptive capacity.

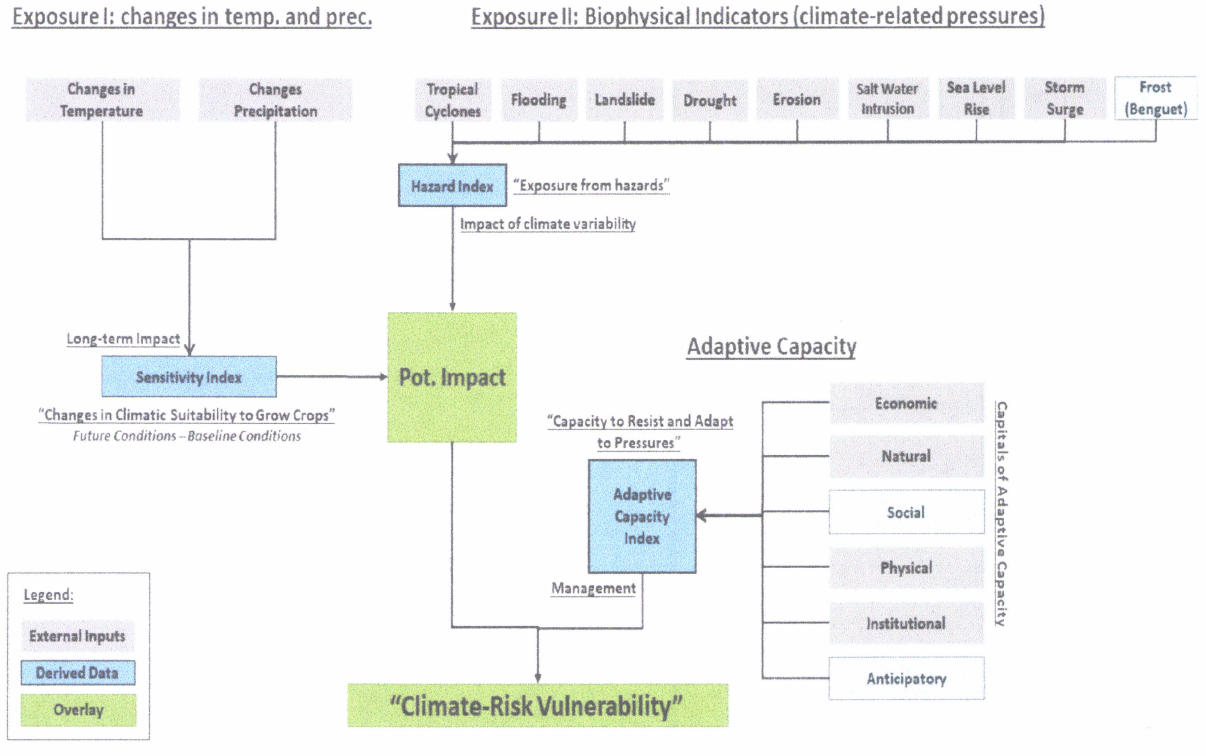


Figure 2. Climate Risk Vulnerability Assessment Framework
Source: International Center for Tropical Agriculture (CIAT), UP Los Banos, Laguna, Philippines

Sensitivity

The crop sensitivity was assessed by changes in climatic suitability of crops by the year 2050 in comparison with the baseline crop suitability. The Maximum entropy (Maxent) model was used to model crop suitability under climate change. Analyzing changes in crop suitability involves a two-step process: The first step is to assess the baseline (current climate condition) crop suitability which is based on the condition that a species is predicted to occur at a particular location if it approximately matches the environmental condition where it is observed. The second step is to predict the location of a species on a particular time slice if it matches the environmental condition where it is observed in the baseline condition.

Priority Crop Selection and Crop Occurrences

In collaboration with the other partners of the regional and local offices, the CSU AMIA researchers conducted a workshop to verify the hazards and crop

occurrences in their respective locality in the province of Agusan del Norte. This was done thru the invited local representatives in each municipality who were front liners in the agricultural sector (i.e., MAOs, Agricultural technicians, staff, among others). Participatory mapping on crop occurrences was done to acquire the point data on crop's location (Figure 3). The mapping exercise was designed to collect the data from the field rapidly. Printed (A0 size) maps were provided with features that can assist in locating the occurrence of the crops such as road networks, river networks, moderate resolution satellite images from Google Earth and administrative boundaries. The annotated information on the analog maps (output from the participatory mapping) were digitized to convert into a GIS database. With consent from the DA-RFO XIII, three priority crops were selected namely rice, corn, and banana that were subjected to CRVA mapping priority in the province.

Baseline and Future Bioclimatic Conditions

A set of selected 20 bioclimatic variables was chosen to assess climate suitability of crops and described in Table 1. For baseline conditions, the Wordclim dataset (available at Worldclim.org) (Hijmans, 2005) was used. Bio 20 (Number of consecutive dry days), a climate variable processed by the International Center for Tropical Agriculture (CIAT), was added to the bioclimatic variables from Worldclim. The bioclimatic variables are derived from monthly temperature and rainfall values and were processed to generate more biologically meaning climate variables (Hijmans, Cameron, Jones, & Jarvis, 2005). The described bioclimatic factors are relevant to understand species responses to climate change (O'Donnell & Ignizio, 2012).

Table 1. Bioclimatic variables used in crop distribution modelling

PARAMETERS	**DESCRIPTION (O'Donell, M and Ignizio, D., 2012)**
Temperature Related	
Bio_1 – Annual mean temperature	Annual mean temperature derived from the average monthly temperature
Bio_2 - Mean diurnal range	The mean of the monthly temperature ranges (monthly maximum minus monthly minimum).
Bio_3 – Isothermality	Oscillation in day-to-night temperatures
Bio_4 - Temperature seasonality	The amount of temperature variation over a given year based on the standard deviation of monthly temperature averages.
Bio_5 - Maximum temperature of warmest month	The maximum monthly temperature occurrence over a given year (time-series) or average span of years (normal).
Bio_6 - Minimum temperature of the coldest month	The minimum monthly temperature occurrence over a given year (time-series) or averaged span of years (normal).
Bio_7 - Temperature annual range	A measure of temperature variation over a given period.
Bio_8 - Mean temperature of wettest quarter	This quarterly index approximates mean temperatures that prevail during the wettest season.
Bio_9 - Mean temperature of the driest quarter	This quarterly index approximates mean temperatures that prevail during the driest quarter.
Bio_10 - Mean temperature of warmest quarter	This quarterly index approximates mean temperatures that prevail during the warmest quarter.
Bio_11 - Mean temperature of coldest quarter	This quarterly index approximates mean

	temperatures that prevail during the coldest quarter.
Precipitation Related	
Bio_12 - Annual precipitation	This is the sum of all total monthly precipitation values.
Bio_13 - Precipitation of wettest month	This index identifies the total precipitation that prevails during the wettest month.
Bio_14 - Precipitation of driest month	This index identifies the total precipitation that prevails during the driest month.
Bio_15 - Precipitation seasonality	This is a measure of the variation in monthly precipitation totals over the course of the year. This index is the ratio of the standard deviation of the monthly total precipitation to the mean monthly total rainfall and is expressed as a percentage.
Bio_16 - Precipitation of wettest quarter	This quarterly index approximates total precipitation that prevails during the wettest quarter.
Bio_17 - Precipitation of driest quarter	This quarterly index approximates total precipitation that prevails during the driest quarter.
Bio_18 - Precipitation of warmest quarter	This quarterly index approximates total precipitation that prevails during the warmest quarter.
Bio_19 - Precipitation of coldest quarter	This quarterly index approximates total precipitation that prevails during the coldest quarter.
Bio_20 - Number of consecutive dry days	Consistent number considered as dry days.

Future conditions of the crop occurrences were modelled using the MaxEnt software. The current and future conditions of the climatic variability of the crop distribution within Agusan del Norte were used to model and assess the changes in crop suitability.

Model Implementation

Maxent model is a species or crop distribution model commonly used to estimate most suitable areas for a species or crop based on probability in geographic areas where the distribution of crops is scarce (Burgman, 2002). Climate and climate change suitability of crops were assessed using a two-step process: First, the model was run and assessed for baseline conditions. Second, if those criteria for step 1 were satisfied, then we run it for future conditions. The difference (expressed as a percentage) in future and baseline suitability determines the climate change crop suitability and reflects the degree of crop sensitivity to changing environmental conditions. Higher change in a negative direction reflects the higher impact of climate change (CIAT 2017). An index was developed from -1.0 to 1.0 for CRVA. An index range from 0.25 to 1.0 indicates a loss in suitability, while -0.25 to -1.0 indicates a gain in suitability (Table 2).

Table 2. Sensitivity index based on percent change in crop suitability from baseline to the future condition

Percent Change in suitability (Range in %)	Index	Description
<= -50 (Very high loss)	1.0	Loss
>-50 and <= -25 (High loss)	0.5	
>-25 and <= -5 (Moderate loss)	0.25	
>-5 and <= 5 (No change)	0	No Change
>5 and <= 25 (Moderate gain)	-0.25	Gain
>25 and <= 50 (High gain)	-0.5	
>50 (Very high gain)	-1.0	

Source: Adapted from CIAT

Hazards

A combination of natural hazard datasets has been used to estimate the extent each municipality in the AMIA 2++ sites that are under pressure from climate and hydro-meteorological risks. Most of the datasets listed in Table 3 refers to historical databases to evaluate the current potential risk. The development of a hazard index relies on spatial analysis of the weighted combination of different historical climate-related natural hazards in Agusan del Norte using data (Table 3) that are open-sourced or developed by partner institutions, such as the Department of Agriculture (DA). Based on the hazard maps, six (6) hazards were identified for the Agusan del Norte, and these are typhoon, storm surge, flood, erosion, landslide, and sea level rise. The selection of hazards was based on consultation with project partners, such as LGUs and DA RFOs during the participatory workshop. The hazard maps represent the current risk and exposure of crops, people and institutions (Palao, et al., 2017)

Table 3. Hazards datasets used for exposure (hazard) component.

Parameter	Source	Unit of measurement, spatial and Temporal resolution
Typhoon	UNEP/UNISDR, 2013 (http://preview.grid.unep.ch/index.php?preview=data&events=cyclones&evcat=2&lang=eng)	1-kilometer pixel resolution. Estimate of tropical cyclone frequency based on Saffir-Simpson scale category 5 (> 252 km/h) from the year 1970 to 2009.
Flooding	AMIA multi-hazard map/baseline data from Mines and Geosciences Bureau, Department of Environment and Natural Resources (MGB, DENR)	1:10,000 scale. Susceptibility of flood risk for the Philippines
Drought	AMIA multi-hazard map/baseline data from National Water Resources Board	Groundwater potential for the Philippines
Erosion	AMIA multi-hazard map/baseline data from the Bureau of Soils and Water Management	1:10,000 scale. Soil erosion classified from low to high susceptibility
Landslide	AMIA multi-hazard maps/baseline data from MGB, DENR	1:10,000 scale. Landslide classified from low to high susceptibility
Storm Surge	AMIA multi-hazard maps/baseline data from Disaster Risk and Exposure Assessment for Mitigation, Department of Science and Technology (DREAM, DOST)	
Sea Level Rise	AMIA multi-hazard map	Assumption based on 5m sea level rise
Saltwater Intrusion	AMIA multi-hazard map/baseline data from the NWRB	Groundwater potential for the Philippines

Source: International Center for Tropical Agriculture (CIAT), UP Los Banos, Laguna, Philippines

Hazards Weights

The hazard weights used in this study was introduced by the lead partner of CIAT. The weights were identified through focus group discussions conducted and were represented by the different SUCs' experts/focal persons. The qualitative assessment using the following criteria 1) probability of occurrence, 2) impact of local household income, 3) impact to key natural resources to sustain productivity (refers to how key resources such as water quality and quantity, soil fertility, and biodiversity are affected), and 4) impact to food security of the country, and 5) impact to national economy. Table 4 summarizes the different weights for each island group in the Philippines. The criteria used also reflect the impact of hazards at different scales from local, landscape, and national level. A spatially-weighted sum was used to develop the hazards index for each island group (Luzon, Visayas, and Mindanao). Thus, in the case of the Agusan del Norte province, the weights of the Mindanao

cluster was adopted. For each municipality in the province, the value of the hazard index was computed and normalized using.

$$Haz\_norm = \frac{x - x_{min}}{x_{max} - x_{min}}$$

Where: Haz_norm - is the normalized values of the hazard index
X - is the original value of the indicator of the municipality
Xmax - is the highest value among all the municipalities
Xmin - is the lowest value among all the municipalities

There were five equal breaks were used to geo-visualize the map, and it was classified into 0-0.20 (Very Low), 0.20-0.40 (Low), 0.40-0.60 (Moderate), 0.60-0.80 (High) and 0.80-1.0 (Very High).

Table 4. Hazard scores per island group based on the consultation with SUCs.

HAZARDS	ISLAND GROUP		
	Luzon (%)	Visayas (%)	Mindanao (%)
Typhoon	20.00	18.21	16.95
Flood	19.05	16.40	15.25
Drought	14.25	16.17	16.95
Erosion	11.43	12.57	12.71
Landslide	8.57	10.72	14.41
Storm Surge	9.52	10.39	8.47
Sea Level Rise	5.71	8.33	5.08
Salt Water Intrusion	11.43	7.21	10.17

Source: International Center for Tropical Agriculture (CIAT), UP Los Banos, Laguna, Philippines

Adaptive Capacity

Adaptive Capacity refers to the ability of the system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences (IPCC, 2014). In this study, the AC indicators were clustered into seven (7) capitals such as Economic, Natural, Human, Physical, Social, Anticipatory and Institutional. Indicators for each cluster were identified by previous AMIA 2 and AMIA 2+ projects and CIAT. For this project, these indicators were finalized and harmonized during the workshop based on the availability of the data in the respective municipalities of the remaining AMIA 2++ expanding regions workshop. Table 5, shows the final Adaptive capacity indicators employed in Agusan del Norte province.

Table 5. Selected list of Adaptive Capacity (AC) indicators

CAPITALS						
Economic	**Natural**	**Human**	**Physical**	**Social**	**Anticipatory**	**Institutional**
Poverty incidence Inflation rate Ag. min. wage Total banks and financial institutions Number of finance cooperatives Employment in agriculture % of farmers covered by crop insurance Price of diesel Cost of electricity	% of crops irrigated % of forest and mangroves Agricultural production area Presence of irrigation	No. of private and public secondary, tertiary, and tech. vocational schools Ratio of public school teachers to students Literacy rate Public and private health services No. of public and private doctors Health services workforce No. of local citizens with PhilHealth % prevalence rate of malnourished children under 7yo Age dependency ratio	Infrastructure investment Infrastructure network % of households with access to water services % of households with access to electricity services No. of public transport Average farm size No. of farm equipment/ postharvest No. of seed growers	% of women in government No. of registered farmer groups or unions % of farmers who are member of registered unions/groups/ coops	No. of weather stations Early warning system Access to communication technology (No. of telephone companies and mobiles services)	Number of agricultural staff No. of farmers visited or consulted with agricultural extension workers

The values of the 38 indicators were integrated into the municipal shapefile boundaries. Each of the indicators was normalized and treated with equal weights. The sum of the 16 indicators provided the final adaptive capacity index. Five equal breaks were developed to establish the thresholds: 0-0.20 (Very Low), 0.20-0.40 (Low), 0.40-0.60 (Moderate), 0.60-0.80 (High), and 0.80-1.00 (Very High).

CRVA Index Using GIS

The normalized component indicators were integrated using the concept of vulnerability with the formula with a modified weighted impact factor of each component shown in Equation 2. The total vulnerability calculation of each municipality in Agusan del Norte was adopted from the Center for Tropical Agriculture (CIAT). These weighted impact factors were established through Focus Group Discussions (FGD) by the experts in the previous AMIA 2 and AMIA 2+ projects. As suggested by CIAT, the overall vulnerability assessment weights as "Sensitivity (15%)", "Hazard (15%)" and attributed the highest importance in defining vulnerability to "Adaptive Capacity (70%)".

$$Vulnerability = 0.15 * \text{Exposure} + 0.15 * \text{Sensitivity} + 0.70 * \text{Adaptive Capacity}$$

6.0. Results and Discussion per Objective

Capacity strengthening for CRA research and development

The capacity strengthening for resilient climate agriculture (CRA) research and development was conducted by the Centro Internacional de Agricultura Tropical (CIAT) in Southeast Asia. Training and workshops were conducted for the implementers of the AMIA2 which involved the SUC-based project teams and the counterparts from the Department of Agriculture Regional Field Offices (DA-RFO) of the implementing regions. For the Caraga Region, the activities related to capacity enhancement were participated by staff from the Caraga State University (CSU) and the Department of Agriculture Regional Field Office 13 (DA-RFO 13). The training and workshops focused on three key methodologies: 1) CRVA, 2) CRA prioritization, and 3) CRA MandE. The trained personnel from the Caraga State University (CSU) and the DA-RFO 13 also provided training and workshops to the Municipal Agriculturists (MAs) in the region together with their staff who is in-charge in mapping, specifically from the Province of Agusan del Norte, by organizing an intra-regional training covering key learning contents from the national-level trainings. The capacity strengthening is a continuing activity. This started with a formal training about CRA and CRVA, in which the trainers are the AMIA2 Project personnel trained by CIAT. This is followed by the informal training of the Municipal Agriculture personnel on describing the CRA practices particularly on how to make agriculture resilient and adaptive to climate change (e.g., flooding).

Participatory mapping of the crop occurrences in Agusan del Norte

The training workshops with the Municipal Agriculturists include:

1) identifying the major crops per municipality;
2) enumerating the key practices to adapt to climate change per crop;
3) community mapping of the major crops in each municipality;
4) community mapping of the climate-resilient agricultural practices.

During the workshop on participatory mapping, the participants were requested to validate the secondary sources of data concerning their community maps. The photos taken during the training-workshop on mapping with the Municipal Agriculturists and their staff are shown in Figure 3.

Figure 3. Municipal Agriculturists and staff validating the map on crop occurrences and CRA practices in their municipalities

Table 6a. List of primary crops raised in the various barangays of Cabadbaran City

Primary Crops				
Rice	Cacao	Mango	Coconut	Abaca
Sanghan A Luna Calamba Caibunan Mabini	Del Pilar Calamba Putting Bato Bayabas	Cabinet Kauswagan Del Pilar Comagascas Katugasan	Del Pilar Mahaba Puting Bato Conception Comagascas Bayabas	Mahaba Puting Bato Calamba

Table 6b. List of secondary crops raised in the various barangays of Cabadbaran City

Secondary Crops		
Banana	Corn	Vegetables
Soriano Katugasan Bayabas	Bay-Ang Sanghan Calamba Comagascas Mabini Katugasan Del Pilar Bayabas	Bay-Ang Sanghan Calamba Del Pilar Comagascas Mabini Katugasan Kauswagan

Table 6c. List of livestock raised in the various barangays of Cabadbaran City

Livestock		
Carabao	Swine	Cattle
Katugasan Comagascas Calamba	Katugasan Comagascas Del Pilar Calamba Mabini Mahaba Bay-Ang Bayabas Sanghan A Luna	Del Pilar Comagascas Calamba

Table 6d. List of issues and the CRA practices in response to climate change for the primary and secondary crops and livestock in Cabadbaran City

Crops	Climate Change Impacts	Flood/ Continuous Rain	Typhoon	Drought
Rice	typhoon, flood, pests and diseases, drought	• reduce yield • delayed harvesting • pests and diseases infestation increases • submerge crops resulting to low or washing out of newly harvested palay • stunted growth • low germination • seed in the seedbeds are washed out • fishing paraphernalia damaged/ washed out • livestock washed out, high mortality	• lodging the crops • reduced yield • Lake Mainit overflow causes submergence of crops around the lake • cause siltation	• reduced yield • stunted growth • the occurrence of pests and diseases
Coconut	typhoon, soil erosion, siltation, flood, continuous rain			
Banana	typhoon, soil erosion, siltation, flood, continuous rain			
Abaca	typhoon, soil erosion, siltation, flood, continuous rain, waterlogging, pests/diseases			
Corn	typhoon, flood, pests and diseases, drought, waterlogging, erosion, siltation			
Fish Cage	typhoon, fish kill due to dissolved oxygen, siltation/ sedimentation, continuous heavy rain, turbidity			
Gill Net	flood, turbidity, typhoon			
Livestock	flood, typhoon, diseases due to climate change			

Table 7a. List of primary crops raised in the various barangays of Butuan City

Primary Crops		
RICE	**CORN**	**BANANA**
Sto. Nino Los Angeles Tagabaca Baobaoan Aupagan Tiniwisan Basag Lemon Pigdaulan Banza	Mandamo Dankias	Sumilihon Basag Camayahan Taguibo

Table 7b. List of secondary crops and fishery in the various barangays of Butuan City

Secondary Crops		Fisheries
CACAO	**RUBBER**	**FISH POND**
Sumilihon Cabcabon	Tungao	Masao Lumbocan

Table 8a. List of primary crops raised in the various barangays of Jabonga, Agusan del Norte

Primary Crops		
RICE	COCONUT	BANANA
Baleuian Cuyago Magsaysay	Bangonay Libas San Vicente Baleguian Magdagooc	Magsaysay Bangonay Colorado Libas Bunga

Table 8b. List of secondary crops raised in the various barangays of Jabonga, Agusan del Norte

Secondary Crops	
ABACA	CORN
Bangonay San Pablo Bunga San Vicente Magdagooc Maraiging	Libas Colorado Magsaysay Cuyago Baleguian

Table 8c. List of livestock raised in the various barangays of Jabonga, Agusan del Norte

Livestock And Poultry		
Cattle	Carabao	Swine
Magsaysay Colorado Bangonay Libas	Magsaysay Colorado Bangonay Libas Baleguian	Baleguian Libas Poblacion Maraiging Bangonay

Table 8d. List of fishery projects in the various barangays of Jabonga, Agusan del Norte

Fisheries		
Fish Cage	Fish Corral	Gill Net
Poblacion Magsaysay Cuyago Baleguian San Pablo Beltran	Poblacion Magsaysay Cuyago Baleguian San Pablo Beltran	Beltran Poblacion Bunga Magdagooc San Jose San Vicente Sto. Nino

Table 9a. List of primary crops raised in the various barangays of Magallanes, Agusan del Norte

PRIMARY CROPS		
RICE	COCONUT	BANANA
Taod-Oy Guiasan	Taod-Oy Guiasan Sto.Nino Buhang Marcos Caloc-An	Taod-Oy Guiasan Sto.Nino Buhang Marcos Caloc-An Poblacion

Table 9b. List of secondary crops raised in the various barangays of Magallanes, Agusan del Norte

SECONDARY CROPS	
CACAO	VEGETABLES
Taod-Oy Caloc-An	Taod-Oy Guiasan Caloc-An Poblacion

Table 9c. List of fishery and livestock raised in the various barangays of Magallanes, Agusan del Norte

Fishery	Livestock And Poultry		
Fish Pond	Duck	Poultry/Goat/Cattle	Swine
Buhan Poblacion Guiasan Caloc-An Taod-oy	Taod-Oy Caloc-An	Caloc-an Taod-oy Guiasan	Taod-Oy Buhang Caloc-An Guiasan

Table 10a. List of primary crops raised in the various barangays of Nasipit, Agusan del Norte

Primary Crops		
RICE	COCONUT	MANGO
Aclan	Kinabjangan	Jaguimitan
Amontay	Culit	Culit
Camagong	Camagong	Kinabjangan
Culit	Ata-Atahon	Aclan
Cubi-Cubi	Triangulo	Camagong
Kinabjangan	Punta	Cubi-Cubi
	Sta. Ana	Ata-Atahon
	Aclan	Amontay
	Amontay	Sta. Ana

Table 10b. List of secondary crops raised in the various barangays of Nasipit, Agusan del Norte

Secondary Crops		
BANANA	VEGETABLES	CACAO
Jaguimitan	Jaguimitan	Aclan
Camagong	Culit	Culit
Culit	Kinabjangan	Kinabjangan
Aclan	Aclan	Cubi-Cubi
Kinabjangan	Camagong	Amontay
Ata-Atahon	Cubi-Cubi	
Cubi-Cubi	Ata-Atahon	
	Amontay	
	Sta. Ana	

Table 10c. List of fishery and livestock raised in the various barangays of Nasipit, Agusan del Norte

FISH POND	POULTRY
Sta.Ana	Ata-Atahon
Camagong	Culit
	Aclan

Table 10d. Climate change impacts on the agriculture and fishery in the various barangays of Nasipit, Agusan del Norte

CROPS	HAZARDS
Rice	typhoon, flood, pests and diseases, drought
Coconut	typhoon, erosion, siltation, flood, continuous rain
Banana	typhoon, erosion, siltation, flood, continuous rain
Abaca	typhoon, erosion, siltation, flood, continuous rain, waterlogging, pests/diseases
Corn	typhoon, flood, pests and diseases, drought, waterlogged, erosion, siltation
fish cage	typhoon, fish kill due to dissolved oxygen, siltation/ sedimentation continuous heavy rain, turbidity
fish corral	typhoon, fish kill, siltation, continuous rain, turbidity
gill net	flood, turbidity, typhoon
Livestock	flood, typhoon, diseases due to climate change

Table 10e. Climate change impacts per type of hazard on the agriculture and fishery of Nasipit, Agusan del Norte

FLOOD/ CONTINOUS RAIN	TYPHOON	DROUGHT
• reduce yield • delayed harvesting, • pests and diseases infestation increases • submerge crops resulting to low or washed out of newly harvested palay • stunted growth • low germination • seed at seedbed washed out • fishing paraphernalia damaged/ washed out • livestock wash out, high mortality	• lodging the crops • reduced yield • cause siltation	• reduced yield • stunted growth • the occurrence of pests and diseases

Table 11a. List of primary crops raised in the various barangays of Santiago, Agusan del Norte

Primary Crops	
ABACA	COCONUT
San Isidro Poblacion II Jagupit	San Isidro Jagupit Curva Poblacion I Poblacion Ii La Paz E. Mongado Tagbuyacan Pangaylan

Table 11b. List of secondary crops raised in the various barangays of Santiago, Agusan del Norte

Secondary Crops		
BANANA	RICE	CORN
San Isidro Jagupit Curva Poblacion I Poblacion Ii La Paz E. Mongado Tagbuyacan Pangaylan	Tagbuyacan	Tagbuyacan E. Mongado Poblacion Ii La Paz Jagupit

Table 11c. List of livestock raised in the various barangays of Santiago, Agusan del Norte

Livestock And Poultry		
CATTLE	CARABAO	POULTRY
San Isidro Jagupit Curva Poblacion I Poblacion II La Paz E. Mongado Tagbuyacan Pangaylan	San Isidro Jagupit Curva Poblacion I Poblacion II La Paz E. Mongado Tagbuyacan Pangaylan	San Isidro Jagupit Curva Poblacion I Poblacion II La Paz E. Mongado Tagbuyacan Pangaylan

Table 11d. Climate change impacts on the agriculture and fishery in the various barangays of Santiago, Agusan del Norte

CROPS	HAZARDS
Rice	Typhoon, Flood, Pests And Diseases, Drought
Coconut	Typhoon, Erosion, Siltation, Flood, Continuous Rain
Banana	Typhoon, Erosion, Siltation, Flood, Continuous Rain
Abaca	Typhoon, Erosion, Siltation, Flood, Continuous Rain, Water Logging, Pests/Diseases
Corn	Typhoon, Flood, Pests And Diseases, Drought, Water Logged, Erosion, Siltation
Fish Cage	Typhoon, Fish Kill Due To Dissolved Oxygen, Siltation/ Sedimentation, continuous Heavy Rain, Turbidity
Fish Corral	Typhoon, Fish Kill, Siltation, Continuous Rain, Turbidity
Gill Net	Flood, Turbidity, Typhoon
Livestock	Flood, Typhoon, Diseases Due To Climate Change

Table 12a. List of primary and secondary crops raised in the various barangays of Las Nieves, Agusan del Norte

Primary Crops		**Secondary Crops**	
CORN	RICE	COFFEE	RUBBER
Montilla	Lingayao	Casiklan	Casiklan
Pinana-An	Maningalao	Ibuan	Duian
Tinucoran	Montilla	Duoian	Ibuan
Malicato	Ambacon		
Ambacon	Mat-I		
Lingayao	Pinana-an		
San Roque			

Table 12b. List of fishery, livestock and poultry raised in the various barangays of Las Nieves, Agusan del Norte

Fisheries	**Livestock and Poultry**	
TILAPIA	SWINE	CARABAO
Marcos Calo	Maningalao	Pinana-an
Katipunan	Eg Montilla	Malicato
Maningalao		Tinuconan

Table 12c. List of climate change impacts to agriculture and fishery in the various barangays of Las Nieves, Agusan del Norte

CROPS	HAZARDS
Corn	Flooding
Rice	Flooding, Drought
Coffee	Prolonged Heavy Rains
Rubber	Prolonged Heavy Rain, Typhoon
Lowland Vegetables	Flooding, Drought
Coconut	Drought, Typhoon
Banana	Typhoon
Agri-Fisheries(Tilapia)	Flooding, Drought
Swine	Drought
Carabao	Drought

Table 12d. Impacts of hazard brought by climate change to agriculture and fishery in the various barangays of Las Nieves, Agusan del Norte

FLOOD/ CONTINOUS RAIN	TYPHOON	DROUGHT
• reduce yield • delayed harvesting, • pests and diseases infestation increases • submerge crops resulting to low or washed out of newly harvested/ reaped palay • stunted growth • low germination • seed at seedbed washed out • fishing paraphernalia damaged/ washed out • livestock wash out, high mortality	• lodging the crops • reduced yield • cause siltation	• reduced yield • stunted growth • the occurrence of pests and diseases

Crop occurrences in Agusan del Norte

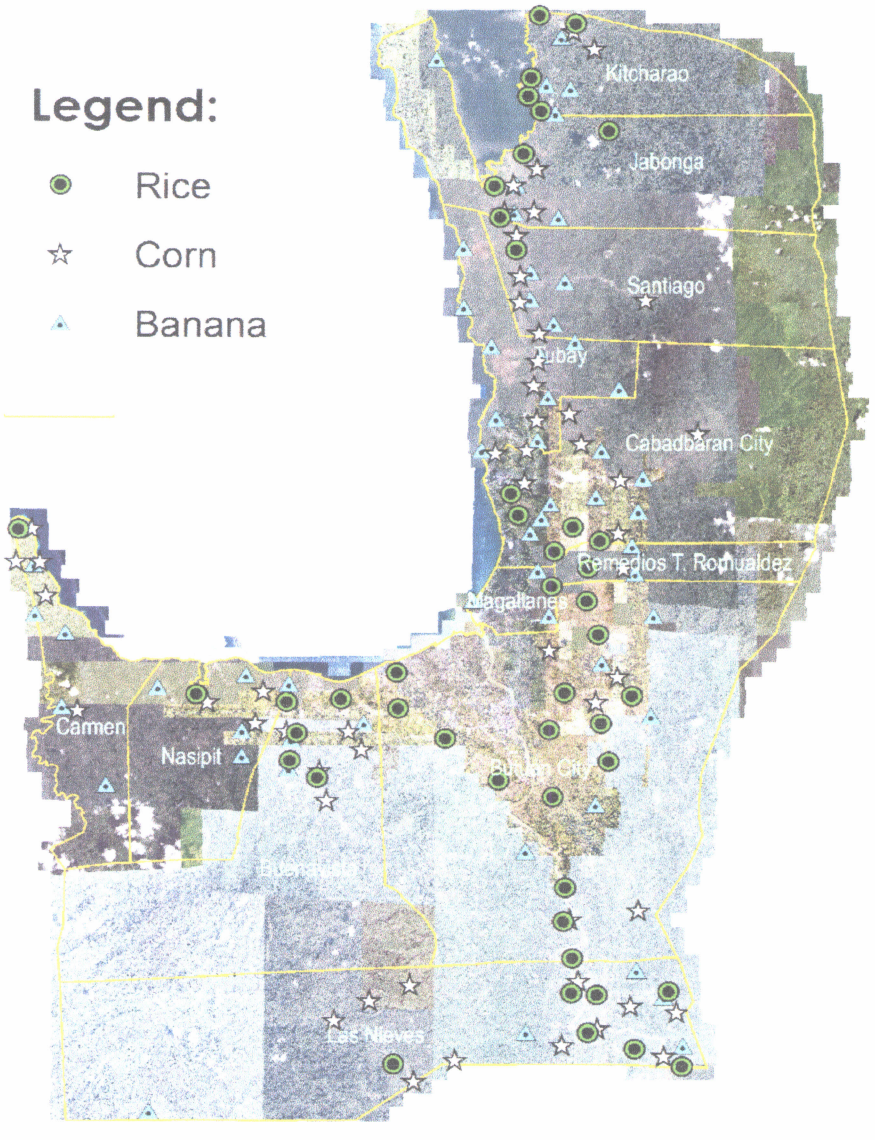


Figure 4. Crop occurrences in Agusan del Norte based on the mapping of the LGUs partners

Stakeholders' participation in climate adaptation planning

Site Visit to Jabonga, Agusan del Norte

Figure 5. Courtesy call and preliminary discussion about CRA with the a) Mayor of Jabonga, Agusan del Norte and b) Municipal Agricultural Officer

Climate Resilient Agriculture (CRA) Practices in the various municipalities of Agusan del Norte

Investment Portfolio for the CRA Practice: Corn-Squash/Corn Crop Rotation

Description of the CRA Practice

The practice allows the farmers to produce corn for two straight seasons (March-June and July-November) and squash at the same time. Flood is evaded by such production timing, enabling the farming household to produce income and set aside some amounts for saving. During the second cropping, corn is the market-oriented output; while squash is not necessarily so. Squash is stored to be used as fodder for hogs, so there is not much need for an efficient storage system for squash. Pigs are raised until the households see them right for sale. To get through the flood season, the households can use the hogs to produce income for their daily needs. This practice is common in Barangay Colorado where the flood incidence can keep the area under water for 2-3 months.

Through the CRA practice, the farmers can adapt to flooding in the area which lasts for 2-3 months. It helps the farming households minimize losses through calculated evasion from flood devastation. With this CRA practice, crop production continues to support the farmers' livelihood despite the disruption caused by flood.

Climate Resilient Agriculture Practice for Investment Prioritization

Corn-Squash/Corn Crop Rotation in Agusan del Norte

Briefer

Crop rotation is a time-tested strategy that ensures crop harvest even with climate change. It is a production system that promotes biodiversity conservation while protecting crops from pests and diseases. It also provides an economic buffer during times of inundation in the area.

The practice allows the farmers to produce corn for two straight seasons (March-June and July-November) and intercropping squash with corn in the second cropping. Flood is evaded by such production timing, enabling the farming

household to produce income and set aside some amounts for saving. During the second cropping, corn is the market-oriented output; while squash is not necessarily so. Squash is stored to be used as fodder for hogs, so there is not much need for an efficient storage system for squash. Hogs are raised until the households see them right for sale. To get through the flood season, the households can use the hogs to produce income for their daily needs. This practice is common in Barangay Colorado where the flood incidence can keep the area under water for 2-3 months.

- The CRA Practice allows farmers to earn income from corn for two seasons. This is supplemented with the sale of squash and hogs fed with squash during the flooding season in the area.
- The CRA practice makes farmers adapt to the seasonal flooding. The income sources of the farming households have been diversified to adapt to flooding. The hogs are assured of feed supply during flooding, which are sold to support the family needs.

Why Invest?

- The practice enables farmers to get through with flooding episodes in the area.
- Incomes are produced even during flood times.
- The farmers can have an alternative income source that has higher return with the sale of hogs.
- Income sources are secured despite the farmlands being put underwater with the floods.

Investment Portfolio for the Corn-Rice-Green Corn Production

Description of the CRA Practice

The risk associated with flooding that occurs annually is at first painful among the farmers in the area. In the succeeding years, the farmers have learned to accept the reality and have developed adaptations. The CRA practice of rotating crops and adjusting the production timing to suit with the onset and end of the flood in the area has been the practice of the farmers to survive the flood episode with minimal angst. Observance of the flood patterns and crudely analyzing the flood damage has guided the farmers in configuring adaptations to it eventually.

The CRA practice is a crop rotation strategy with keen consideration of the proper timing of planting and harvesting. The first cropping is the production of corn grain, followed by the production of rice. However, with the anticipated onset of rains and flood, the corn is grown only for 60-70 days for green corn production. This strategy allows the farmers to gain relatively the same income from grain corn as the green corn sells at PhP2.00/ear.

To get through with the flooding episode in Agusan del Norte, the farmers initiate to rotate corn with rice and then back to corn for green corn production before the onset of flooding. This rotation is done within 8-9 months prior to flooding to arrest any adverse effects of flood on farm household's income.

Impacts of Corn-Rice-Green Corn Production

Productivity

- With CRA, the farm households can get incremental benefits after three years of doing the rotation regularly for a period of 10 years. On computation, the annual increment is estimated to increase from Php 202.18 per hectare on the third to Php 1,307.35 per hectare on the tenth year.

Adaptation

- Against the usual practice of producing just corn following the normal production calendar, the CRA practice on corn-rice-green corn rotation can help farmers salvage planted crops by ensuring harvest before the onset of flood.

Cost-Benefit Analysis Results Highlights

Without CRA:
(Corn Production)
•Yield/ha: 3742 kg
•Price/kg: P14.4

With CRA:
(Corn-Rice –Green Corn Rotation)
•Green Corn
•Yield/ha: 4591kg
•Price/kg: P5.25
•Rice
•Yield/ha:4020 kg
•Price/kg:P16.5

Why Invest?

- The CRA practice results to reduced crop losses
- The yearly flooding episode in the area could devastate hectarage of production if farmers will stick to the usual production calendar for the production of either rice or corn. CRA on corn-rice-corn (green corn) rotation can salvage planted hectarage by having curtailed production timing at the end of the corn-rice rotation period with the production of green corn. This shortened timing enables early harvesting of the last crop (green corn), thus preventing crop damage due to flood.
- Profitable with annual incremental benefits. Based on computation, there are incremental benefits that can be incurred in the adoption of the CRA practice on corn-rice-corn (green corn) rotation. The incremental values are increasing when projected for a period of 10 years. Buffer income during flood times
- Based on computation, there are incremental benefits that can be incurred in the adoption of the CRA practice on corn-rice-corn (green corn) rotation. The incremental values are increasing when projected for a period of 10 years.
- The CRA practice can enable farmers to harvest their planted crops before the onset of flood. Thus, income from the harvested crops can be realized

and be available for use during the flood period. This income can serve as buffer income during the time land is under water and not available for farm production.

Why is it better than the Conventional Practice?

With the adjusted production timing, farmers still obtain the optimum income from their endeavors through the avoidance of crop damage due to flood. Having a shortened cropping period for green corn contributes to providing buffer income for the farming household during the flooding period. The incremental benefits are also to reckon with because it is an added value to the adoption of the crop rotation strategy.

Recommendations

- Farmers Field Schools (FFS) are encouraged to include the sharing of experiences among the CRA practitioners and field observation for the proper adoption of the corn-rice-green corn rotation strategy.
- The Municipal Agriculture Office of Jabonga should help promote the adoption of the said CRA practice to farmers experiencing similar predicaments.
- Special fund support package from the government for farmers adopting the said CRA should be available to help them take off and educate them in CBA to enhance their enterprising level.

Climate Risk Vulnerability Assessment (CRVA) of selected major crops in Agusan del Norte

Sensitivity Index

Figure 6 shows the changes in climatic suitability of the selected priority crops in Agusan del Norte (i.e., rice, corn, and banana) due to climate change by the year 2050 through climate modelling and use of species distribution model. It can be noted that several areas have increasing climatic suitability while some maintained sensitivity index due to changes in precipitation and temperature for rice suitability in some parts of the province except in Butuan City, Buenavista, and Carmen. It is, however, misleading to conclude that crops in geographic areas that experience a decrease in climate suitability will not survive. However, a reduction in yield is expected in high impact areas. Since climate is something that farmers cannot control, am improved crop production/ farming practices system that promotes healthy soil and efficient use of water is vital as a means of climate change ((Palao et al., 2017).

On the other hand, corn crop simulation in the province shows significantly decreased in climate suitability. The results emphasize the need for improvement in crop management, better provision and optimize the utilization of the water for irrigation and increase adaptation strategies to cope up such increasing climatic pressures that might affect the agricultural productivity. A positive simulation result for the banana crop with climatic suitability of both have maintained and notably increasing.

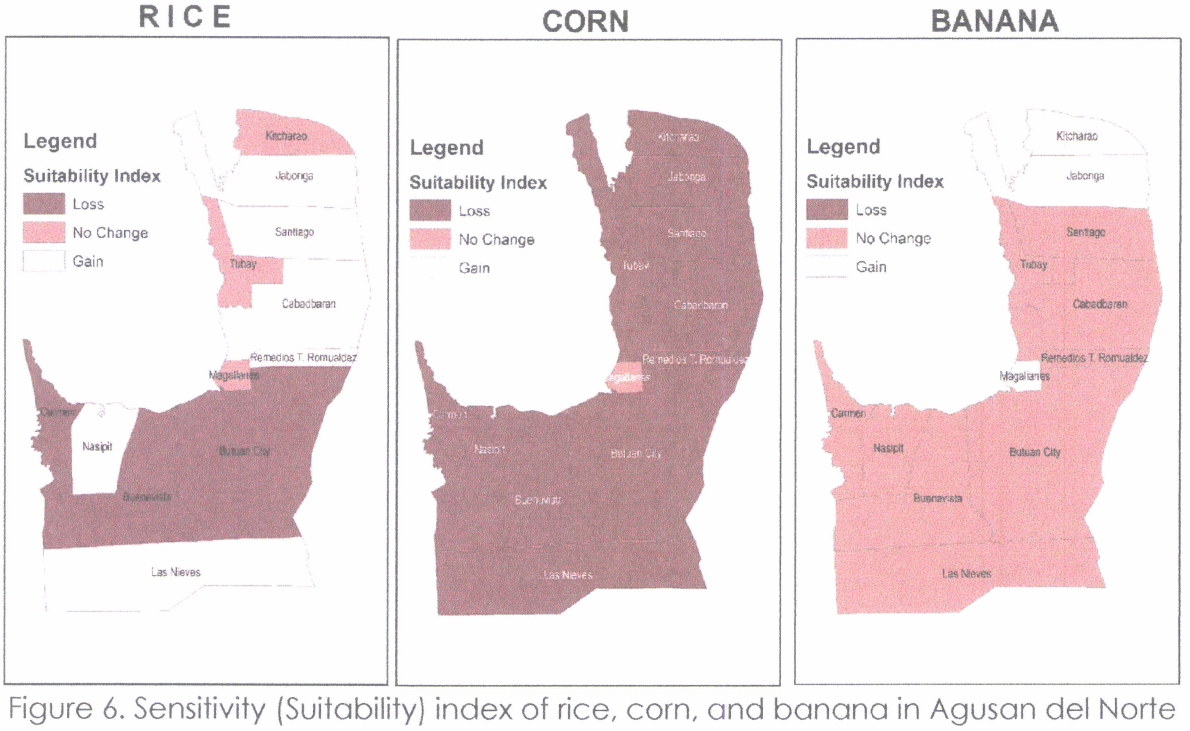


Figure 6. Sensitivity (Suitability) index of rice, corn, and banana in Agusan del Norte

Hazard Index

Figure 7 shows the degree of exposure to hazards across the twelve (12) municipalities of Agusan del Norte. Six (6) hazards were identified in said province namely: flood, tropical cyclone, sea level rise, storm surge, landslide, and erosion. The northern part of the province has a high incidence of tropical cyclone compared to other municipalities located in the southern part. Higher exposure incidence to sea level and storm surge are also observed in Butuan City since this area sits below sea level (UNISDR, 2013). On the other hand, the municipality of Jabonga is most exposed to flooding based on the geographical setting, since this area is the main outlet of Lake Mainit where all of the river tributaries in the adjacent municipalities empty into this area causing a significant overflow of the lake. Elevated areas have high exposure to landslide and erosion. Overall exposure results show with a higher incidence of hazards in the municipalities of Jabonga and Santiago in the Province of Agusan del Norte. The analysis is based on the number of pixels counts which shows the spatial coverage of hazards for each municipality.

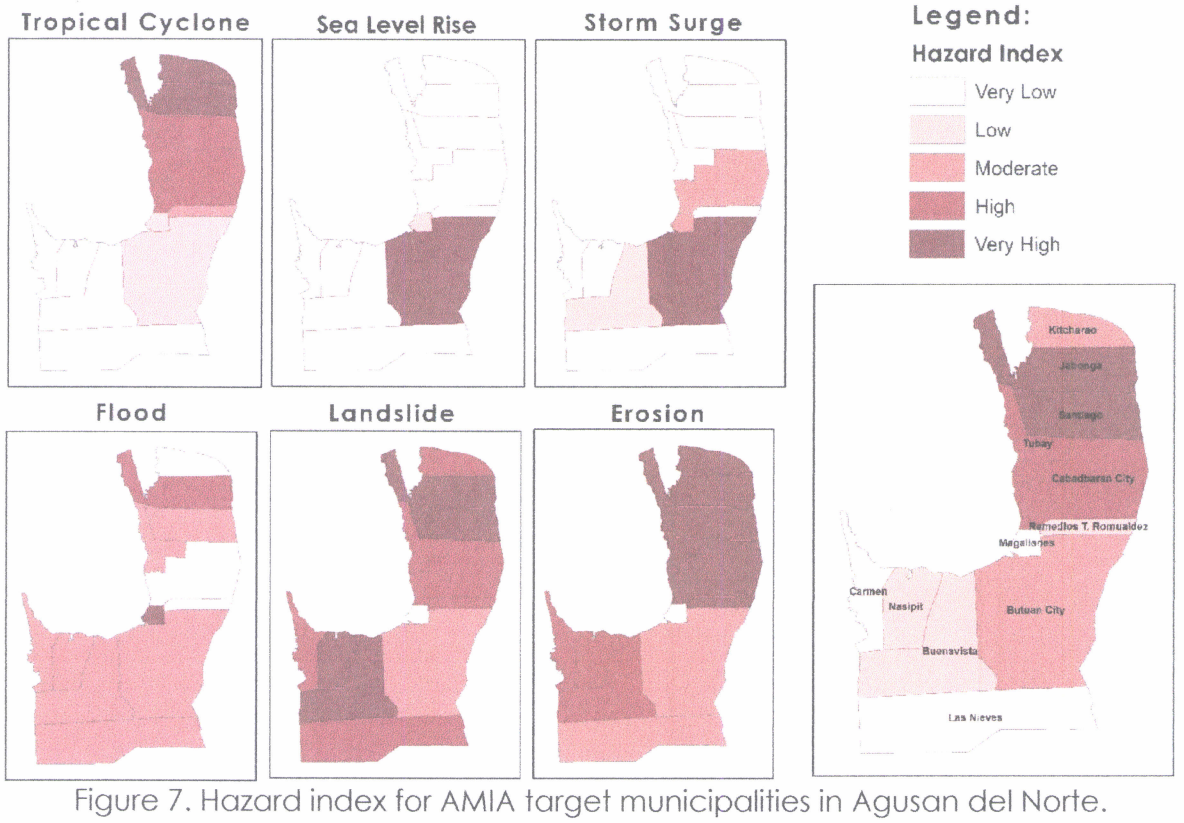


Figure 7. Hazard index for AMIA target municipalities in Agusan del Norte.

Adaptive Capacity Index

Figure 8 presents the spatial analysis of all capitals as well as the aggregated overall adaptive capacity index. Results show that Butuan City is the most adaptive municipality within the province concerning economic, natural, social, human, physical, anticipatory and institutional (Figure 8). This means that Butuan City has great coping mechanisms or strategies to respond to climate-related hazards.

However, it can be seen that most municipalities across the study sites have a very low index concerning human capital based on the indicators considered (Table 5). The overall capacity index shows 9 out of 12 or 75% of the total number of municipalities have a low adaptive capacity index. The results show the need for the local government units (LGUs) to focus on improving their coping mechanisms by adding or increasing its services and interventions in the respective communities affected by climate-related pressures.

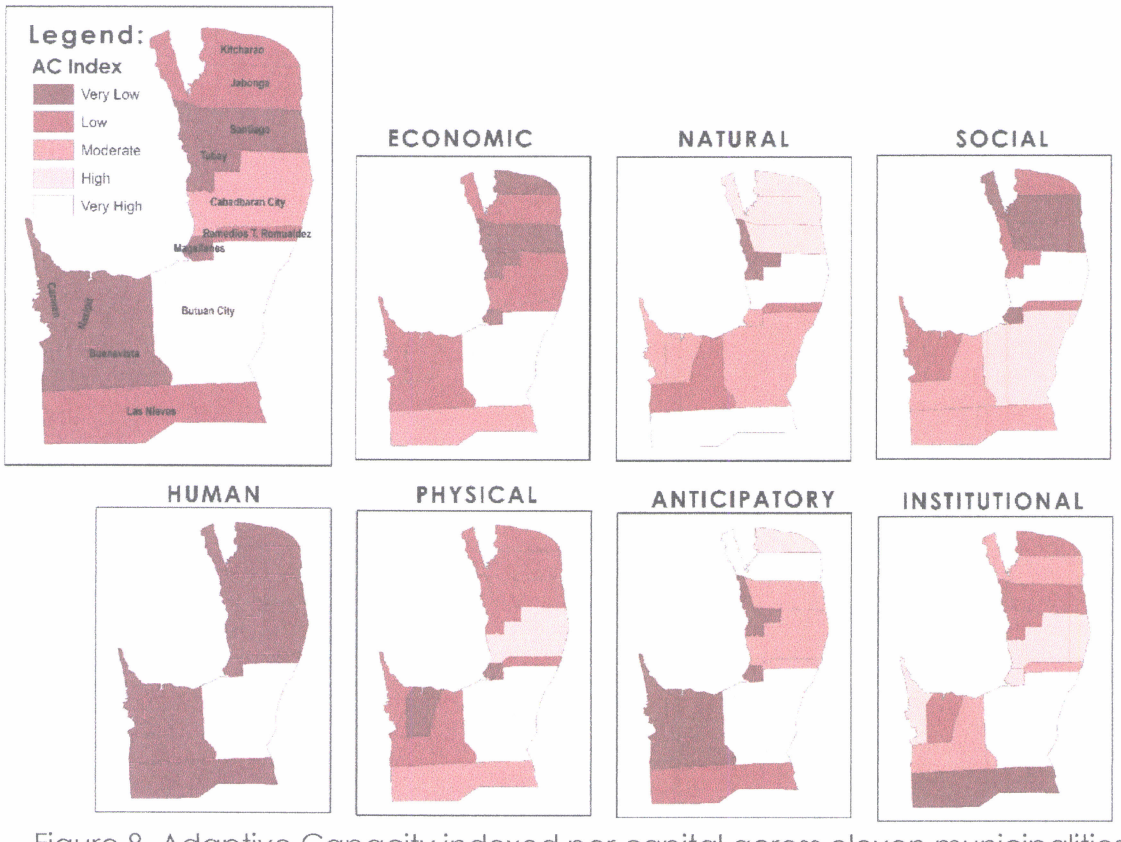


Figure 8. Adaptive Capacity indexed per capital across eleven municipalities of Agusan del Norte and Butuan City.

Total CRVA

The vulnerability model was constructed using the GIS platform to pre-process the spatial and aspatial datasets for the three components such as sensitivity, exposure, and adaptive capacity to come with the total climate risk vulnerability assessment (CRVA). The total CRV for rice and banana (Figure 9) shows that municipalities were identified as highly vulnerable (Tubay, Santiago, Magallanes, Buenavista, Nasipit and Carmen) due to high potential impact (sensitivity or exposure) but low in adaptive capacity.

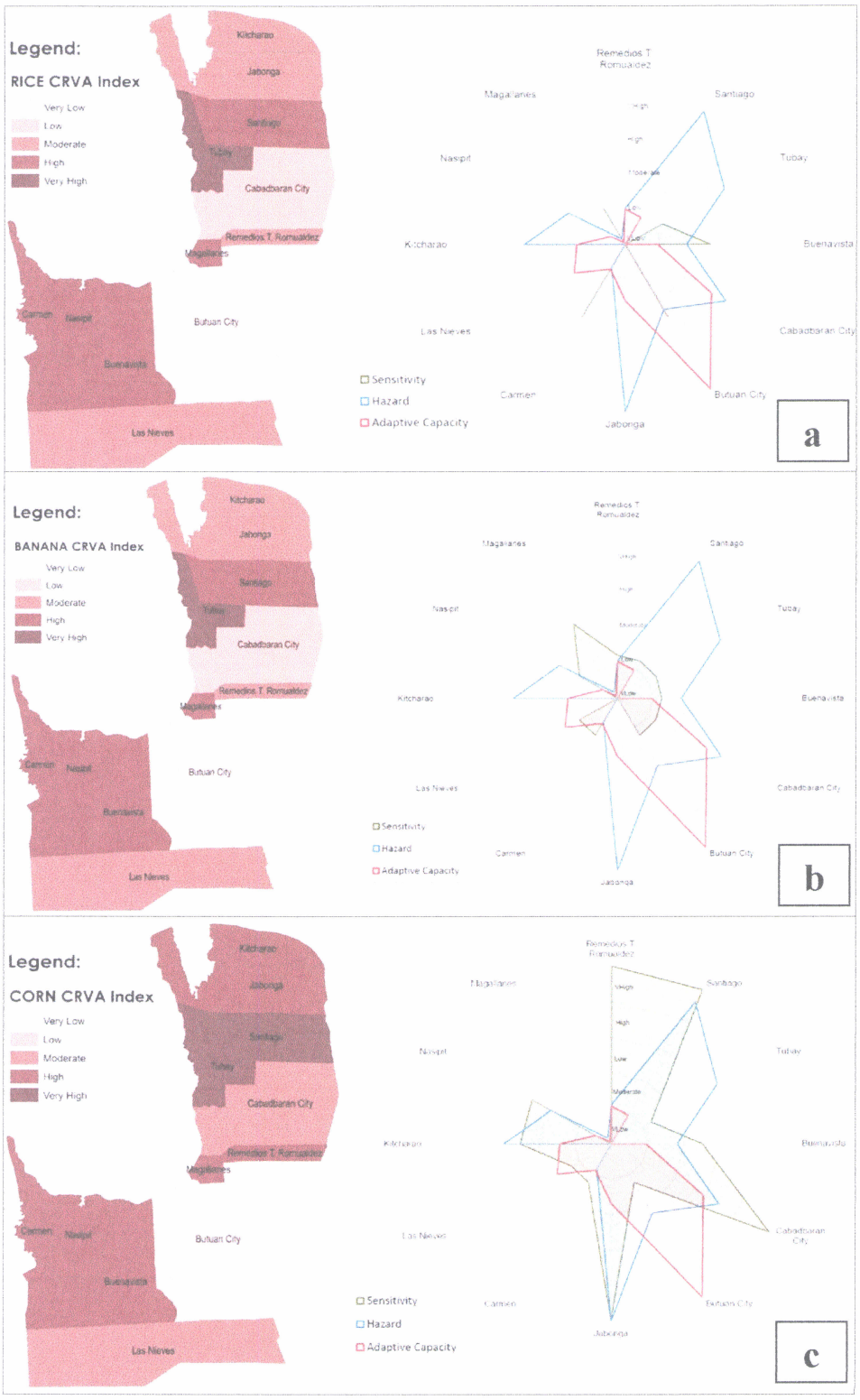


Figure 9. Climate Risk Vulnerability Index Map in Agusan del Norte for a) Rice; b) Banana; and c) Corn

A twin climate risk vulnerability assessment index result was observed for rice and banana crops. The twin index for the two crops is within the standard ranges. It differs only in decimal points per index range as in the case of the Municipality of Buenavista with CRV index of 0.65 (High) 0.62 (High) for rice and corn, respectively. On the other hand, the CRVA model result for corn shows that there was a high

vulnerability in most municipalities due to the divergence of high exposure to hazards, lower climate suitability of crop in the future and low adaptive capacity. The radar graphs show the influence of the three component drivers towards the vulnerability status of the municipalities in Agusan del Norte.

Conclusion

The project involved the capability development of the local SUC researchers in partnership with the agriculture technologists from the Department of Agriculture-RFO 13 and the Local Government Units (LGUs) of the Province of Agusan del Norte. The involvement of the local providers of technical support to agriculture enhancement has strengthened their capacity for Climate Resilient Agriculture (CRA) investment planning using climate risk maps. The previous training and workshops that the SUC agriculture researchers and the agricultural technologists from DA and the LGUs participated have prepared them in CRA investment planning. The technologists have been exposed to participatory climate risk mapping and assessing the cultural practices in farming and fishery to avoid the impacts of climate change. Through the project, however, the awareness about climate mitigation and adaptation planning of the LGU agricultural technologists and that of the farmers is heightened.

The maps of climate risks generated through this project have been made available for the Province of Agusan del Norte as the basis for CRA investment planning. The maps on sensitivity, hazard, and adaptive capacity will be useful inputs in investment planning for agriculture for adaptation to climate change. These maps will guide farmers and the LGU technologists to improve the coping mechanisms or strategies of the farming communities to respond to climate-related hazards. The maps are seen as essential in mapping vulnerability due to climate change specifically in farming and household evacuation.

In the focused area for establishing the AMIA Village in Jabonga, Agusan del Norte, CRA has already been a part of the people's survival due to their long-term exposure to flooding in the area every year. Although their response to flooding has not been labeled as CRA, they have been managing their farming calendar to evade the harsh impact of flooding on their farming endeavors annually. However, there was no valuation done for the cropping practices that they designed to avoid flooding — thus documenting the practices of farmers to make agricultural project withstand the pressures of climate change such as flooding is seen to be an essential input. The data on valuing the interventions in CRA and analyzing these employing the Cost-Benefit Ratio (CBA) has been very useful. The outputs of CRVA and CRA are useful guides in determining the feasibility of agriculture investments in the Caraga Region.

References

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Appendix 1. Communication to the Mayor of Jabonga, Agusan del Norte

Republic of the Philippines
CARAGA STATE UNIVERSITY
Ampayon, Butuan City 8600, Philippines

Phone (+63 85) 341-3249
(+63 85) 342 3047
(+63 85) 341-2296
Fax (+63 85) 342 1079
URL http://www.carsu.edu.ph
Email address: op@carsu.edu.ph

December 17, 2017

Hon. *Jasmin F. Monton*
Mayor, Municipality of Jabonga
Jabonga, Agusan del Norte

Madam:

Greetings from the Caraga State University!

We would like to inform you that the Caraga State University (CSU) is implementing until June 2018 the project on '**Climate-Resilient Agri-fisheries (CRA) Assessment, Targeting & Prioritization for the Adaptation and Mitigation Initiative in Agriculture (AMIA) in Caraga Region**'. This research project focuses on identifying the key crops and climate resilient agriculture (CRA) practices in Jabonga that will be the basis for identifying/developing alternative approaches to make agriculture and fisheries more adaptive and resilient to Climate Change. The information generated will be utilized in promoting Climate Resilient Agriculture in the chosen 'AMIA Village' which we hope to establish in Jabonga. Dr. Rowena P. Varela is the Project Leader of this initiative and she will be working with DA-RFO 13 staff and other CSU faculty members with expertise aligned to the objectives and vision of the project to make this 'AMIA Village' become a model for the promotion of AMIA in Caraga Region.

The project cannot be implemented without the Local Government supporting it. Inasmuch as the communities of Jabonga around Lake Mainit are your constituents, we identified the local government of Jabonga as the key stakeholder in this initiative. Thus in line with this, we are requesting your support to this project. We will highly appreciate if you can give the Research Team the permit to work with the Municipal Agriculture Office (MAO) and Municipal Disaster Risk Reduction and Management Office (MDRRMO) for this purpose.

Thank you and we look forward to working with you in this project.

Very truly yours,

ANTHONY M. PENASO, Ph.D.
University President

Department of Agriculture
Bureau of Agricultural Research
RDMIC Bldg., Elliptical Rd. Cor. Visayas Ave., Diliman, Q.C. 1104
Phone Nos.: (632) 928-8624 & 928-8505 • Fax: (632) 927-5691
Email:barrdegrants@bar.gov.ph· Website: http//www.bar.gov.ph

FINANCIAL REPORT

For the period July 2017 to December 31, 2018

Project Title: Climate-Resilient Agri-fisheries (CRA) Assessment, Targeting & Prioritization for the Adaptation and Mitigation Initiative in Agriculture (AMIA) in Caraga Region

Proponent: Rowena P. Varela, Ph. D.
Lead Agency: Caraga State University
Address: Brgy. Ampayon, Butuan City
Check No. / Amount / Date: OR# 4471216 dtd 6/19/17 & OR# 4471504 dtd 02/05/18

Expense Code	Approved Budget (A)	Amount Released (B)	Cumulative Expenditures (C)	Balance To Date (B-C)
Personnel Services (PS)				
A. Salary and Wages	237,772.80	237,772.80	150101.89	87,670.91
B. Honoraria	105,600.00	105,600.00	104200	1,400.00
Subtotal PS	**343,372.80**	**343,372.80**	**254,301.89**	**89,070.91**
Maintenance and Other Operating Expenses (MOOE)				
A. Travelling Expenses	140,000.00	140,000.00	172927.02	(32,927.02)
B. Communication Expenses	4,000.00	4,000.00	3645	355.00
C. Supplies and Materials	35,000.00	35,000.00	30680.44	4,319.56
D. Professional Services				-
GIS Specialist	90,000.00	90,000.00	80000	10,000.00
Socio Economist	90,000.00	90,000.00	90000	-
Agrifisheries	90,000.00	90,000.00	90000	-
E. Representation Expenses	84,000.00	84,000.00	58200	25,800.00

Subtotal MOOE	533,000.00	533,000.00	525,452.46	7,547.54
Equipment outlay (EO)	35,000.00	35,000.00	26,990.00	8,010.00
Administrative Cost (10% PS and MOOE)	87,637.28	87,637.28	54,661.28	32,976.00
TOTAL	999,010.08	999,010.08	861,405.63	137,604.45

Prepared by:

ROWENA P. VARELA, Ph. D.
Project Leader

Certified Correct:

ANNA VICTORIA T. DUCENA
Chief Accountant

Noted by:

ANTHONY M. PENASO, Ph. D.
Agency Head

RECEIPTS AND DISBURSEMENTS

CARAGA STATE UNIVERSITY
Agency Name

Nature of Account : **"Climate-Resilient Agri-fisheries (CRA) Assessment, Targeting & Prioritization for the Adaptation and Mitigation Initiative in Agriculture (AMIA) in Caraga Region"**
Office /Address : Ampayon, Butuan City
Contact Person/Number: ROWENA P. VARELA, PH. D.

ACCOUNT CODE :
GL 416-Due to Other NGA's
SL 416-56

DATE	BUR #	Payee	PARTICULARS	REF.	AMOUNT		
					DEBIT	CREDIT	BALANCE
Receipt of Fund per OR # 4471216 dtd 6/19/17						**499,505.04**	**499,505.04**
8/7/2017	184-17-08-446	ARNOLD G. APDOHAN	expenses in attendance to the CRVA Orientation and Workshop last July 24-	184-2017-08-798 184-8-23-2017 dtd 8/14/2017	9,191.16		**490,313.88**
8/7/2017	184-17-08-447	RAQUEL M. BALANAY	expenses in attendance to the CRVA Orientation and Workshop last July 24-	184-2017-08-799 184-8-23-2017 dtd 8/14/2017	9,191.16		**481,122.72**
8/10/2017	184-17-08-456	ARNOLD APDOHAN	to the Inception and Planning Workshop for CRA Prioritazation Project and Internal	184-2017-08-803 184-8-25-2017 dtd 8/15/2017	9,950.00		**471,172.72**
10/10/2017	184-17-10-689	ARNOLD G. APDOHAN	expenses in attendance to the Inception and Planning Workshop for CRA Prioritazation	184-2017-10-1171 184-10-90-2017 dtd 10/19/17	335.16		**470,837.56**
10/10/2017	184-17-10-690	JRS BUSINESS CORP	to payment for postage and couriers services for the month of September, 2017	184-2017-10-1199 10354247 dtd 10/24/17	139.00		**470,698.56**
11/27/2017	184-17-11-930	LEDANBEN S. NAKILA	expenses in attendance to the CRVA workshop last November 13-15,2017 and DA-	184-2017-11-1538 10402167 dtd 12/04/17	17,358.44		**453,340.12**
12/4/2017	184-17-12-978	LEDAN BEN S. NAKILA	rendered as contract of service personnel for the period covered November 9-30,2017.	184-2017-12-1600 10402180 dtd 12/08/2017	14,238.85		**439,101.27**
12/5/2017	184-17-12-985	PROCUREMENT SERV	Supplies and Janitorial for the Tissue Culture and Bar-Climate-Resilient Agrifisheries	184-2017-12-1613 10402182 dtd 12/11/2017	1,301.82		**437,799.45**
12/11/2017	184-17-12-1017	GP- APDOHAN, ET.AL	and project staff for the research project "Adaptation and Mitigation Initiative in	184-2017-12-1633 184-12-192-2017 dtd 12/20/2017	184,000.00		**253,799.45**
11-Dec-17	184-17-12-1016	ROWENA P. VARELA	travelling expenses in attendance to the DA-BAR Review last November 16-17,2017 at	184-2017-12-1641 184-12-191-2017 dtd 12/19/2017	10,026.04		**243,773.41**
12/13/17	184-17-12-1023	BUTUAN GOODYEAR	to payment for the provision of communication to various community in	184-2017-12-1746 10402222 dtd 12/29/2017	495.00		**243,278.41**
12/7/2017	184-17-12-1005	DATALAN COMMUNIC	for the Bar-Climate Resilient Agrifisheries Assessment.PR#184-17-11-306.PO#184-17-	184-2017-12-1742 184-1-3-2018 dtd 01/12/18	660.00		**242,618.41**
12/15/2017	184-17-12-1045	COMPAÑERO COMME	Janitorial supplies for the TISSUE LAB and DENR Lake Mainit,CHED Virtual	184-2018-01-159 184-1-24-2018 dtd 01/29/18	1,279.00		**241,339.41**
12/15/2017	184-17-12-1046	KIMSON COMMERCIA	Janitorial supplies for the TISSUE LAB and DENR Lake Mainit,CHED Virtual	184-2018-01-13 184-1-3-2018 dtd 01/12/18	1,192.00		**240,147.41**
12/15/2017	184-17-12-1047	TAMMY EMPORIUM	Janitorial supplies for the TISSUE LAB and DENR Lake Mainit,CHED Virtual	184-2018-01-14 184-1-3-2018 dtd 01/12/18	18.00		**240,129.41**

RECEIPTS AND DISBURSEMENTS

CARAGA STATE UNIVERSITY
Agency Name

Nature of Account : **"Climate-Resilient Agri-fisheries (CRA) Assessment, Targeting & Prioritization for the Adaptation and Mitigation Initiative in Agriculture (AMIA) in Caraga Region"**
Office /Address : Ampayon, Butuan City
Contact Person/Number: ROWENA P. VARELA, PH. D.

ACCOUNT CODE
GL 416-Due to Other NGA's
SL 416-56

DATE	BUR #	Payee	PARTICULARS	REF.	AMOUNT		
					DEBIT	CREDIT	BALANCE
12/19/2017	184-17-12-1055	D' HOMEMAKERS CAR	community mapping on December 19,2017.PR#184-17-12-340.PO#184-17-12-	184-2018-01-06	20,000.00		**220,129.41**
				184-1-3-2018 dtd 01/12/18			
12/20/17	184-17-12-1078	LEDAN BEN S. NAKILA	to payment for salary for the services rendered as contract of service personnel for	184-2017-12-1736	9,636.88		**210,492.53**
				10402210 dtd 12/29/2017			
12/20/17	184-17-12-1079	LEDAN BEN S. NAKILA	to payment for salary for the services rendered as contract of service personnel for	184-2017-12-1737	4,953.60		**205,538.93**
				10402212 dtd 12/29/2017			
01/08/18	184-18-01-015	LEDAN BEN S. NAKILA	to payment salary for services rendered as COS for the period covered Dec. 23-31,	184-2018-01-39	4,896.34		**200,642.59**
				10402241 dtd 01/15/18			
01/15/18	184-18-01-040	CHRISTOPHER F. SIS	to reimburse payment of TEV expense to fetch and ferry the Faculty Researchers to	184-2018-01-96	320.00		**200,322.59**
				184-1-9-2018 dtd 01/18/18			
01/18/18	184-18-01-045	ARNOLD G. APDOHAN	to payment TEV expense to attend workshop on Climate Risk Vulnerability Assessment on	184-2018-01-111	10,320.00		**190,002.59**
				184-1-19-2018 dtd 01/24/18			
01/19/18	184-18-01-052	GP - CAÑIZARES, ET.	rendered services as COS for the period covered Jan 1-15,2018.	184-2018-01-142	8,813.95		**181,188.64**
				184-1-18-2018 dtd 01/23/18			
01/26/18	184-18-01-065	DATALAN COMMUNIC	to payment for purchase of IT equipment for the operation of BAR Climate Resilient	184-2018-02-254	26,990.00		**154,198.64**
				184-2-35-2018 dtd 02/21/18			
1/31/2018	184-18-01-068	LEDANBEN S. NAKILA	attending the workshop on Climate Risk Vulnerability Assessment last January 23-25,	184-2018-02-2017	9,604.52		**144,594.12**
				184-2-29-2018 dtd 2/07/18			
01/31/18	184-18-01-069	LEDANBEN S. NAKILA	to reimburse payment of TEV expense to fetch and ferry the Faculty Researchers to	184-2018-02-208	320.00		**144,274.12**
				184-2-29-2018 dtd 2/07/18			
02/01/18	184-18-02-076	DATALAN COMMUNIC	to payment for purchase to provide I.T materials for the operation of BAR- Climate	184-2018-02-232	14,330.00		**129,944.12**
				184-2-36-2018 dtd 02/21/18			
02/02/18	184-18-02-081	JOYFUL LIFE CATERIN	2/6/2018: cancelled		-		**129,944.12**
02/02/18	184-18-02-085	LEDANBEN S. NAKILA	to reimburse payment for TEV expense in attending the meeting with the Jabonga	184-2018-02-216	505.00		**129,439.12**
				184-2-30-2018 dtd 02/08/18			
			Receipt of Fund per OR# 4471504 dtd 02/05/18			499,505.04	**628,944.16**
02/06/18	184-18-02-091	GP - CAÑIZARES, ET.	to payment salary of Cañizares, et. al for services rendered as COS personnel for the	184-2018-02-223	10,759.43		**618,184.73**
				184-2-28-2018 dtd 02/07/18			
02/06/18	184-18-02-092	LILS CATERING SERV	to payment for meals and snacks for the DA-BAR visit for Project Monitoring on Feb. 5-8,	184-2018-02-247	32,500.00		**585,684.73**
				184-2-39-2018 dtd 02/22/18			
02/21/18	184-18-02-133	GP - ASIS, ET. AL	to payment salary of Asis, et. al for services rendered as COS personnel for the period	184-2018-02-260	9,804.00		**575,880.73**
				184-2-37-2018 dtd 02/22/18			
02/20/18	184-18-02-121	BUTUAN GOODYEAR	supplies for the staff and facilitator of BAR-	184-18-03-394	3,150.00		**572,730.73**

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CARAGA STATE UNIVERSITY
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Office /Address : Ampayon, Butuan City
Contact Person/Number: ROWENA P. VARELA, PH D.

ACCOUNT CODE
GL 416-Due to Other NGA's
SL 416-56

DATE	BUR #	Payee	PARTICULARS	REF.	AMOUNT		
					DEBIT	CREDIT	BALANCE
			Climate Agrifisheries Assessment and	10538201 dtd 03/07/18			
02/21/18	184-18-02-137	DATALAN COMMUNIC	to payment for purchase I.T supplies for the	184-18-03-392	6,500.00		
			operation of BAR Climate Agrifisheries	184-3-57-2018 dtd 03/07/18			**566,230.73**
02/21/18	184-18-02-143	LILS CATERING SERV	to payment for purchase of meals and snacks	184-18-03-462	5,700.00		
			for the BAR-Climate Resilient Agrifisheries	184-3-71-2018 dtd 03/13/18			**560,530.73**
02/26/18	184-18-02-162	GLENN ARTHUR A. GA	to reimburse payment of TEV expense to	184-18-02-385	320.00		
			facilitate the Key Informant Interview in the	184-3-56-2018 dtd 03/06/18			**560,210.73**
02/26/18	184-18-02-163	RAQUEL M. BALANAY	to reimburse payment of TEV expense to	184-18-02-384	320.00		
			facilitate the Key Informant Interview in the	184-3-56-2018 dtd 03/06/18			**559,890.73**
02/26/18	184-18-02-164	LEDANBEN S. NAKILA	to reimburse payment of TEV expense to	184-13-02-282	320.00		
			facilitate the Key Informant Interview in the	184-3-56-2018 dtd 03/06/18			**559,570.73**
02/26/18	184-18-02-166	ROWENA P. VARELA	to reimburse payment of TEV expense	184-18-02-381	15,168.04		
			attended the "Workshop on Cost-Benefit	184-3-56-2018 dtd 03/06/18			**544,402.69**
02/26/18	184-18-02-165	LEDANBEN S. NAKILA	to reimburse payment for TEV expenses to	184-13-02-382	520.00		
			conduct a meeting with the Jabonga	184-3-56-2018 dtd 03/06/18			**543,882.69**
02/27/18	184-18-02-183	ROWENA P. VARELA	to reimburse payment of TEV expense to	184-18-03-403	320.00		
			facilitate the Key Informant Interview in the	184-3-58-2018 dtd 03/07/18			**543,562.69**
02/28/18	184-18-01-045	ARNOLD G. APDOHAN	2/28/2018. refund 02/07/2018	OR# 4471507-T			
						58.48	**543,621.17**
02/28/18	184-18-02-185	CHRISTOPHER F. SIS	to reimbuse payment of TEV expense to	184-18-03-405	320.00		
			facilitate for a focus group discussion last	184-3-58-2018 dtd 03/07/18			**543,301.17**
02/28/18	184-18-02-186	CHRISTOPHER F. SIS	to reimburse payment of TEV expense to	184-18-03-405	320.00		
			facilitate the Key Informant Interview in the	184-3-58-2018 dtd 03/07/18			**542,981.17**
02/28/18	184-18-02-191	PROCUREMENT SERV	to payment for purchase of common office	184-18-03-402	5,260.62		
			supplies. PR#184-18-02-60 PO#184-18-02-	10538206 dtd 03/07/18			**537,720.55**
03/06/18	184-18-03-208	GP - ASIS, ET. AL	to payment salary of Asis, et. al for services	184-2018-03-417	9,817.27		
			rendered as COS personnel for the period	184-3-58-2018 dtd 03/07/18			**527,903.28**
03/07/18	184-18-03-228	ARNOLD G. APDOHAN	to reimburse payment for TEV expense for a	184-18-03-461	320.00		
			focus group discussion last Feb 23, 2018.	184-3-72-2018 dtd 03/13/18			**527,583.28**
03/09/18	184-18-03-241	RAQUEL M. BALANAY	to reimburse payment of TEV expense for a	184-18-03-470	320.00		
			focus group discussion in the Municipality of	184-3-79-2018 dtd 03/19/18			**527,263.28**
03/09/18	184-18-03-242	LEDANBEN S. NAKILA	to reimburse payment of TEV expense for a	184-18-03-465	320.00		
			focus group discussion in the Municipality of	184-3-72-2018 dtd 03/13/18			**526,943.28**
03/09/18	184-18-03-243	GLENN ARTHUR A. GA	to reimburse payment of TEV expense for a	184-18-03-469	320.00		
			focus group discussion in the Municipality of	184-3-72-2018 dtd 03/13/18			**526,623.28**
03/20/18	184-18-03-286	GP- ASIS, ET. AL	to payment salary of Asis, et. al for services	184-18-03-506	9,907.20		**516,716.08**

RECEIPTS AND DISBURSEMENTS

CARAGA STATE UNIVERSITY
Agency Name

Nature of Account : **"Climate-Resilient Agri-fisheries (CRA) Assessment, Targeting & Prioritization for the Adaptation and Mitigation Initiative in Agriculture (AMIA) in Caraga Region"**
Office /Address : Ampayon, Butuan City
Contact Person/Number: ROWENA P. VARELA, PH. D.

ACCOUNT CODE
GL 416-Due to Other NGA's
SL 416-56

DATE	BUR #	Payee	PARTICULARS	REF.	AMOUNT		
					DEBIT	CREDIT	BALANCE
			rendered as COS personnel for the period	184-3-82-2018 dtd 03/22/18			
04/04/18	184-18-04-320	GP - ASIS, ET. AL	to payment salary of Asis, et. al for services	184-18-04-562	9,907.20		
			rendered as COS personnel for the period	184-4-99-2018 dtd 04/06/2018			**506,808.88**
04/11/18	184-18-04-353	LEDANBEN S. NAKILA	to reimburse payment of TEV expense to	184-18-04-654	220.00		
			collect Secondary Data at the Municipality of	184-4-133-2018 dtd 04/25/2015			**506,588.88**
04/11/18	184-18-04-354	LEDANBEN S. NAKILA	to reimburse payment TEV expense to collect	184-18-04-653	760.00		
			secondary data collection last April 3-6, 2018	184-4-133-2018 dtd 04/25/2015			**505,828.88**
04/17/18	184-18-04-366	LEDANBEN S. NAKILA	to reimburse payment for TEV expense to	184-18-04-706	1,795.00		
			collect the Secondary Data at the Municipal	184-4-145-2018 dtd 04/30/2018			**504,033.88**
04/19/18	184-18-04-375	GP-ASIS, ET. AL	to payment for the salary of Asis, et. al for the	184-18-04-635	9,907.20		
			services rendered April 1-15, 2018	184-4-123-2018 dtd 04/20/2018			**494,126.68**
04/24/18	184-18-04-425	LEDANBEN S. NAKILA	to reimburse payment of TEV expense to	184-18-05-574	1,638.00		
			collect Secondary Data last April 17-20, 2018	184-5-191-2018 dtd 05/30/18			**492,488.68**
05/08/18	184-18-05-459	GP- ASIS, ET. AL	to payment salary of Asis, et. al for services	184-18-05-736	9,905.82		
			rendered as COS for the period covered April	184-5-150-2018 dtd 05/08/18			**482,582.86**
05/10/18	184-18-05-487	LEDANBEN S. NAKILA	to reimburse payment TEV expense to	184-18-05-856	1,620.00		
			facilitate Key Informant Interview for CBA	184-5-184-2018 dtd 05/28/18			**480,962.86**
05/17/18	184-18-05-515	GP - ASIS, ET. AL	to payment salary of Asis, et. al for services	184-18-05-823	9,815.32		
			rendered as COS personnel for the period	184-5-174-2018 dtd 05/22/18			**471,147.54**
05/22/18	184-18-05-547	GP- APDOHAN, ET. AL	to payment for honoraria for project leader	184-18-05-879	180,200.00		
			and staff of AMIA for the period December	184-6-200-2018 dtd 06/05/18			**290,947.54**
05/23/18	184-18-05-553	LEDANBEN S. NAKILA	to reimburse payment of TEV expense to	184-18-05-875	2,620.00		
			attend workshop on Climate Risk	184-5-184-2018 dtd 05/28/18			**288,327.54**
05/23/18	184-18-05-554	LEDANBEN S. NAKILA	to reimburse payment of TEV expense to	184-18-05-874	17,720.00		
			attend workshop on Cost- Benefit Analysis for	184-5-184-2018 dtd 05/28/18			**270,607.54**
05/23/18	184-18-05-557	ROWENA P. VARELA	to reimburse payment of TEV expense to	184-18-05-873	17,700.00		
			attend workshop on Cost- Benefit Analysis for	184-5-184-2018 dtd 05/28/18			**252,907.54**
05/28/18	184-18-04-425	LEDANBEN S. NAKILA	5/28/2018: adjustment per NORSA 2018-05-				
			03			240.00	**253,147.54**
06/04/18	184-18-06-604	GP - ASIS, ET. AL	to payment salary of Asis, et. al for services	184-18-06-936	9,905.87		
			rendered as COS personnel for the period	184-6-206-2018 dtd 06/07/18			**243,241.67**
06/18/18	184-18-06-667	GP - ASIS, ET. AL	to payment salary of Asis, et. al for services	184-18-06-1025	9,907.20		
			rendered as COS personnel for the period	184-6-224-2018 dtd 06/20/18			**233,334.47**

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Office /Address : Ampayon, Butuan City
Contact Person/Number: ROWENA P. VARELA, PH. D.

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GL 416-Due to Other NGA's
SL 416-56

DATE	BUR #	Payee	PARTICULARS	REF.	AMOUNT		
					DEBIT	CREDIT	BALANCE
07/03/18	184-18-07-756	GP - ASIS, ET. AL	to payment salary of Asis, et. al for services	184-18-07-1164	7,925.76		**225,408.71**
			rendered as COS for the period of June 16-30,	184-7-260-2018 dtd 07/06/2018			
11/08/18	184-18-11-1703	ROWENA P. VARELA	to payment reimbursement of TEV expense	184-18-11-2417	2,440.00		**222,968.71**
			for attending a Progress and Completion	184-11-624-2018 dtd 11/19/2018			
11/13/18	184-18-11-1730	ARNOLD G. APDOHAN	to payment reimbursement of TEV expense	184-18-11-2459	11,745.84		**211,222.87**
			attended a Progress and Completion Review	184-12-663-2018 DTD 12/4/2018			
11/13/18	184-18-11-1728	RAQUEL M. BALANAY	to payment reimbursement of TEV expense	184-18-11-2457	7,250.10		**203,972.77**
			to attend a Progress and Completion Review	184-11-638-2018 dtd 11/22/2018			
11/13/18	184-18-11-1729	ARNOLD G. APDOHAN	to payment reimbursement of TEV expense	184-18-11-2458	11,707.04		**192,265.73**
			attended the Climate-Risk Vulnerability	184-11-638-2018 dtd 11/22/2018			
08/01/18	184-18-08-967	COLUMBIA COMPUTE	to payment purchase of desktop computer	184-18-10-2076	54,661.28		**137,604.45**
			and system unit for admin offices PR# 184-18-	184-10-525-2018 dtd 10/10/2018			
12/29/2017	184-17-12-1126	ARNOLD APDOHAN	to payment for honorarium for the research		10,000.00		**127,604.45**
			project "Adaptation and Mitigation Initiative in				
06/25/18	184-18-06-700	MASANGKAY COMPU	to payment for purchase of I.T Equipments.	Butuan City	32,976.00		**94,628.45**