Region VIII

Climate-Resilient Agri-fisheries (CRA) Assessment, Targeting & Prioritization for the Adaptation and Mitigation Initiative (AMIA) in **Leyte Province**

Loreto, A.B. 2019. CRA Assessment, Targeting & Prioritization for AMIA in Leyte Province. Presented to DA RFO 8, Nov 18, 2019, Nipa Garden Resort, Tacloban City

Outline of Presentation

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- Rationale of the Project
- CRVA Framework and Methodology
- Highlights of Accomplishments
  - CRVA
  - CBA
- Use of the Hazards Data
- Concluding Statement

Project Information

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- Implementing Agency
  - Lead Agency: Visayas State University (VSU)
  - Collaborating Agencies: Department of Agriculture RFO VIII, Local Government Units (LGUs) Provincial Agriculture Office
- Project Duration: 18 months
- Budget Released: PhP 291,384/yr

Why do we have to deal with Climate Change?

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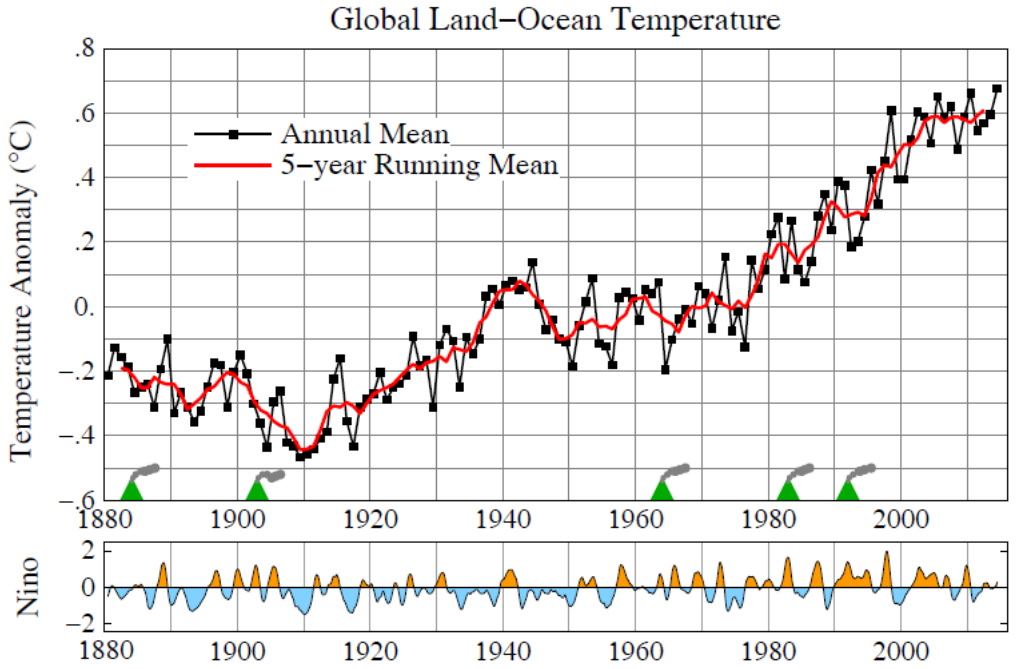
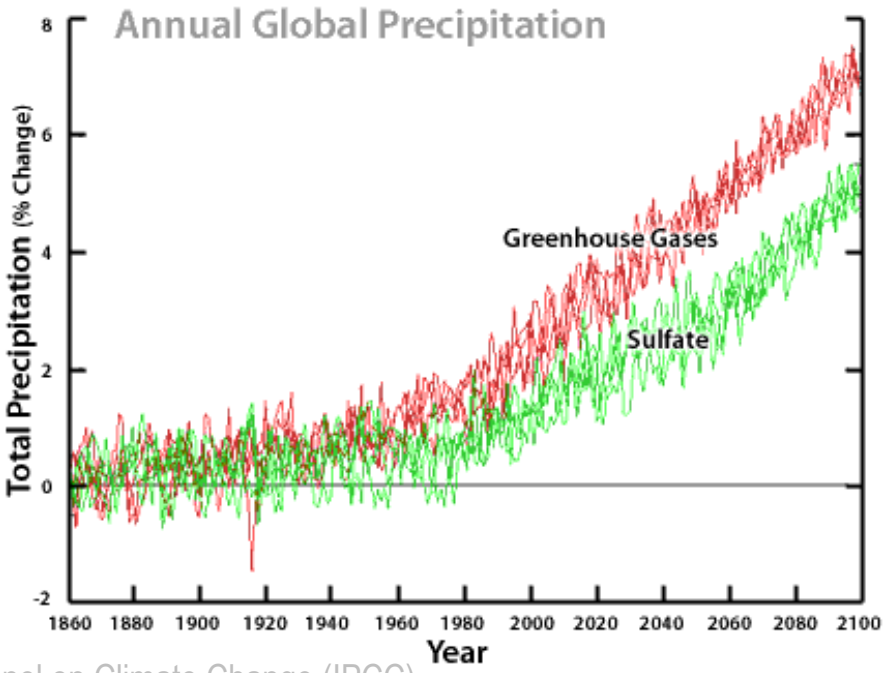
- A **change in climate** which is attributed directly or indirectly to **human activity that alters the composition of the global atmosphere** which is in addition to natural climate variability observed over a comparable period of time.

United Nations Framework Convention on Climate Change (UNFCCC)

Philippines is the 3rd ranked country affected by climate change





Source: Intergovernmental Panel on Climate Change (IPCC)

Impacts of Climate change

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Why put emphasis on Agriculture?

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Agriculture Sector

- **47%** of the total land area in the Philippines is agricultural
- **2/3** of the population depends on agriculture for livelihood
- **½** of the labor force is engaged in agricultural activities

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Philippines: Crop Production

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- Water Supply for Irrigation – greatest impact
- Flooding in many areas
- Strong winds due to typhoons


Effect of El Niño in Cotabato, March 12, 2019


Effect of El Niño in Zamboanga (500 ha.), March 12, 2019

Future Changes in Extreme Events (PAGASA)

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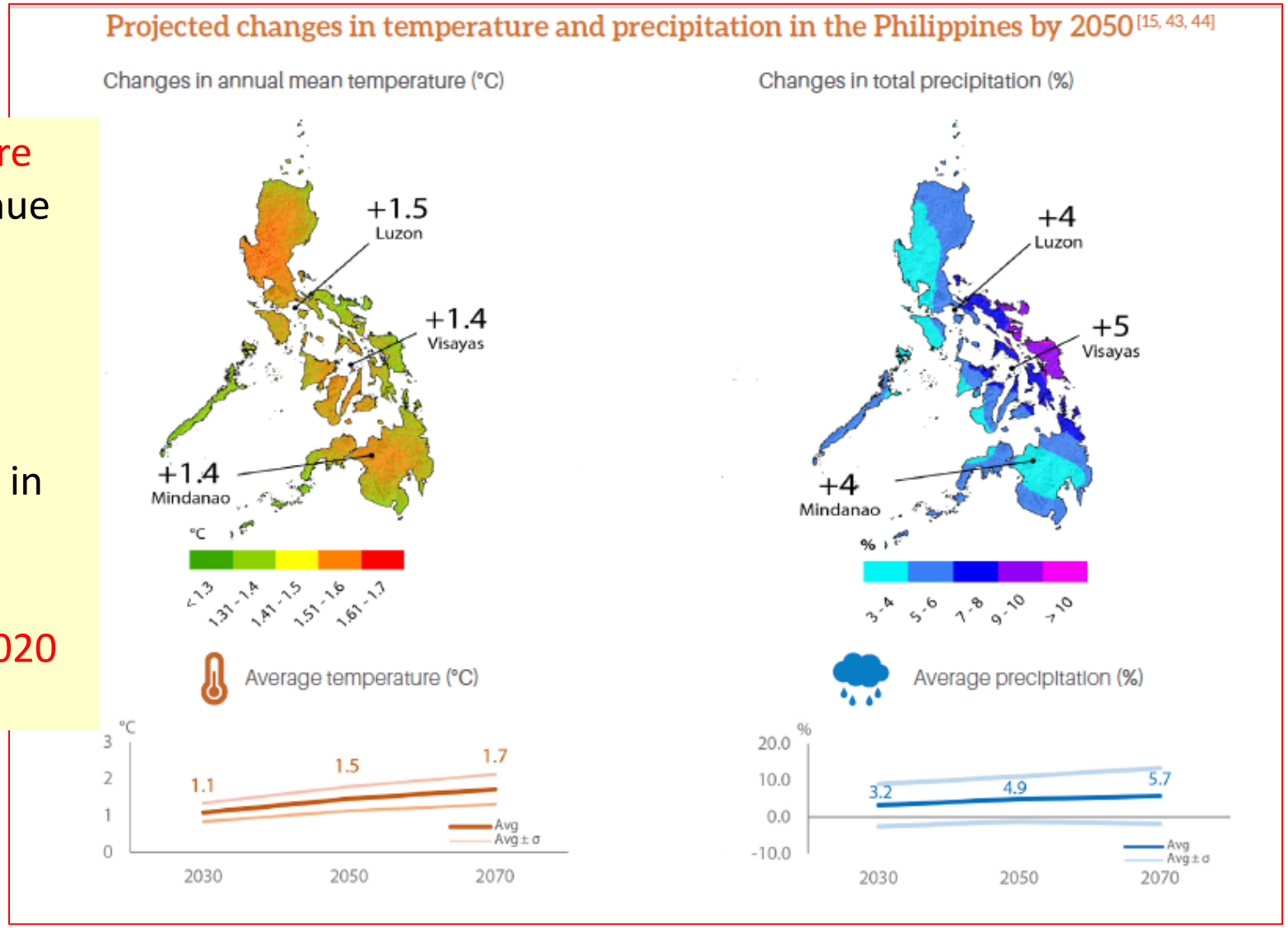
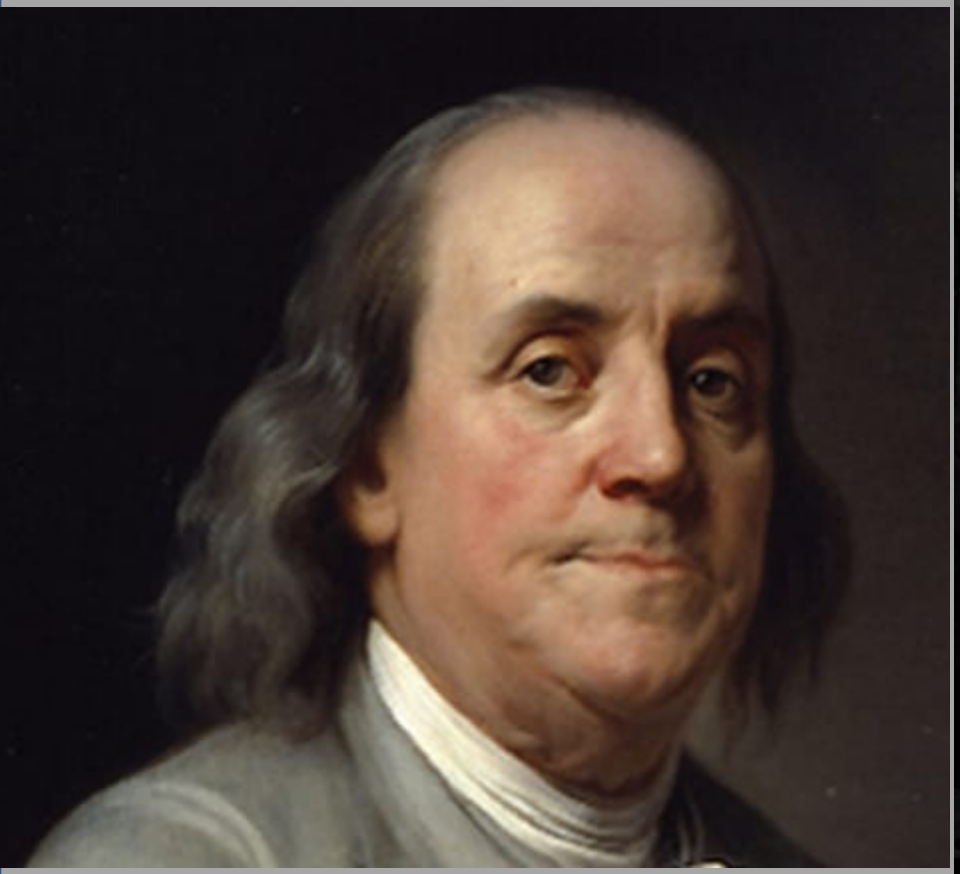
- It is very likely that hot temperature and heavy precipitation will continue to become more frequent in the future.
- Number of days with maximum temperature >35°C is expected to increase in all parts of the country in 2020 and 2050.
- Extreme rainfall is projected to increase in Luzon and Visayas in 2020 and 2050.



Leyte, J.E.D. 2019. Climate Change Impacts. Presentation during the CRVA Training at VSU for DA RFO's nationwide.




"BY FAILING TO PREPARE,
YOU ARE PREPARING TO FAIL."
— Benjamin Franklin
Bplans

Objectives

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- To assess climate risks in the region's agriculture sector through geospatial & climate modelling tools.
- To document and analyze local CRA practices in the province to support AMIA knowledge-sharing and investment planning.
- To provide support to the DA-RFO8 in establishing AMIA baseline for outcome monitoring and evaluation of CRA communities and livelihoods.

Major Deliverables

- Vulnerability Maps of Priority Crops in the Province
- Technical Brief of a Climate-Resilient Agriculture (CRA) Practice

Progression of AMIA (CRVA/CBA) Projects

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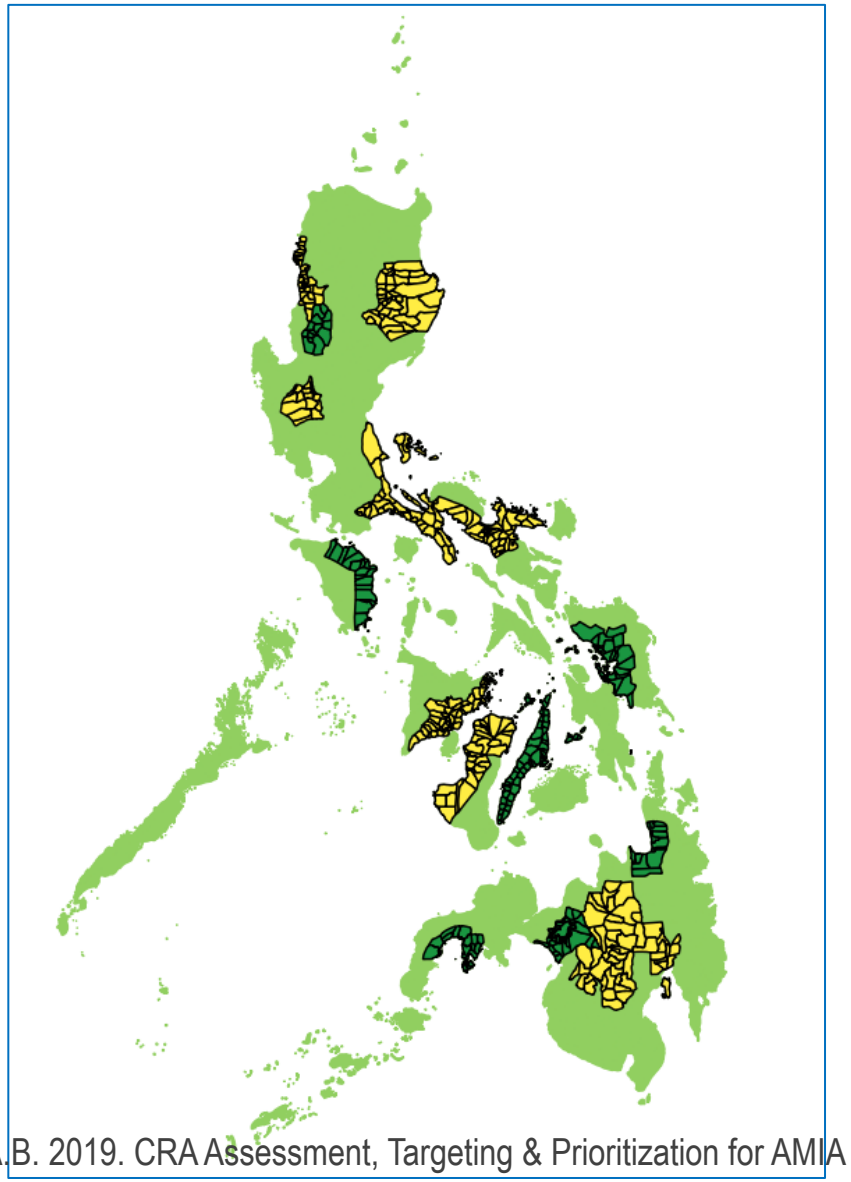

Region	Province	Partner SUC
Ilocos Region (Reg. 1)	Ilocos Sur	Mariano Marcos State University
Cagayan Valley (Reg. 2)	Isabela	Isabela State University
Central Luzon (Reg. 3)	Tarlac	Tarlac Agricultural University
CALABARZON (Reg. 4A)	Quezon	Southern Luzon State University
Bicol (Reg. 5)	Camarines Sur	Partido State University
Western Visayas (Reg. 6)	Iloilo	Iloilo State College of Fisheries
Northern Mindanao (Reg. 10)	Bukidnon	Central Mindanao University
Davao (Reg. 11)	Davao City	Univ. of Southeastern Philippines
Soccsksargen (Reg. 12)	North Cotabato	University of Southern Mindanao
Negros Island (Reg. 18)	Negros Occ.	Visayas State University

2016

Region	Province	Partner SUC
Cordillera Admin Region	Benguet	UPLB
MIMAROPA	Mindoro	UPLB
Central Visayas	Cebu	Visayas State University
Eastern Visayas	Samar	Visayas State University
CARAGA	Agusan del Norte	Caraga State University
ARMM	Lanao del Sur	Mindanao State University
Zamboanga Peninsula	Zamboanga Sibugay	Mindanao State University

2017

Region	Province	Partner SUC
Central Visayas	Bohol, Negros Oriental, Siquijor	Visayas State University
Eastern Visayas	So. Leyte, Biliran, Eastern Samar, Northern Samar	Visayas State University

2019

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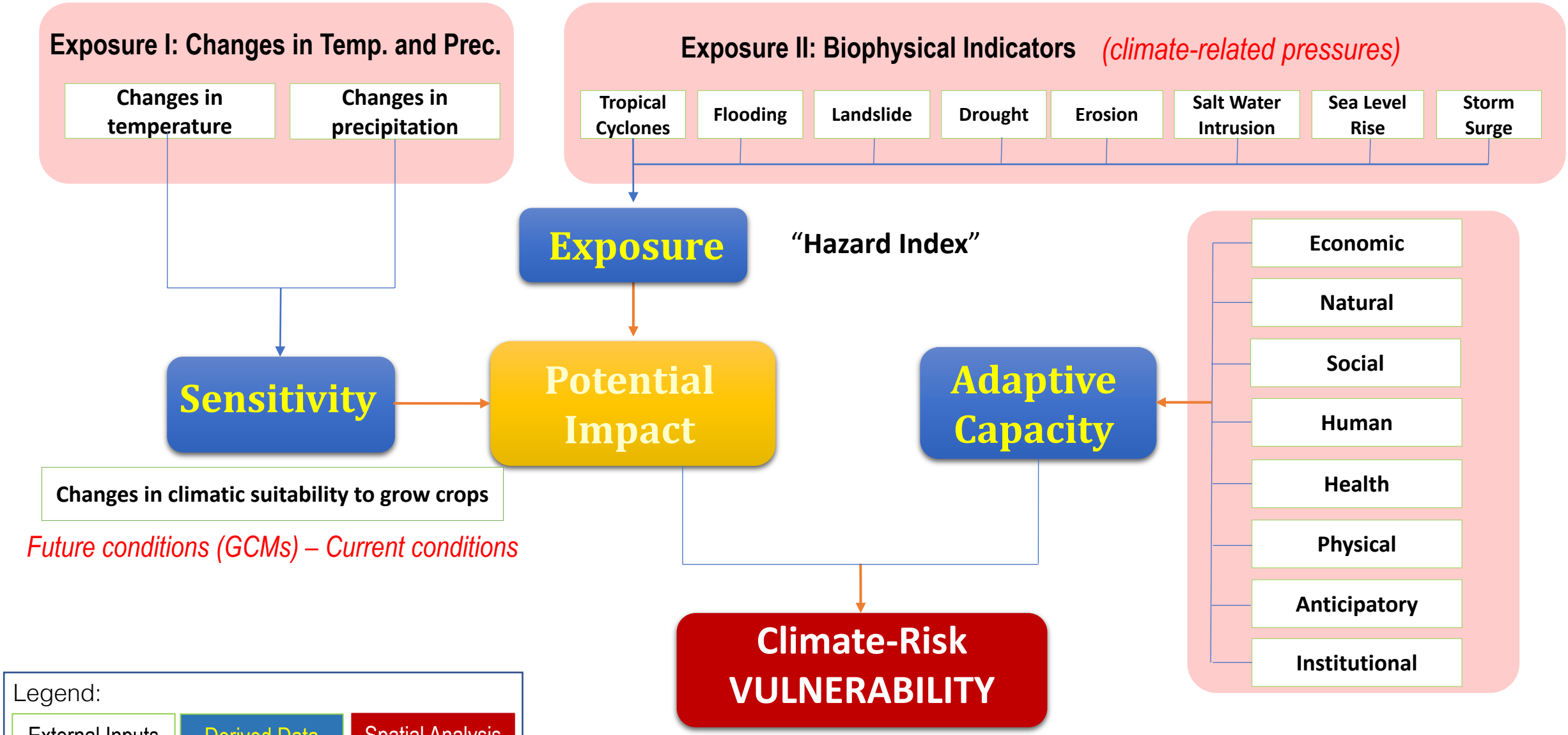
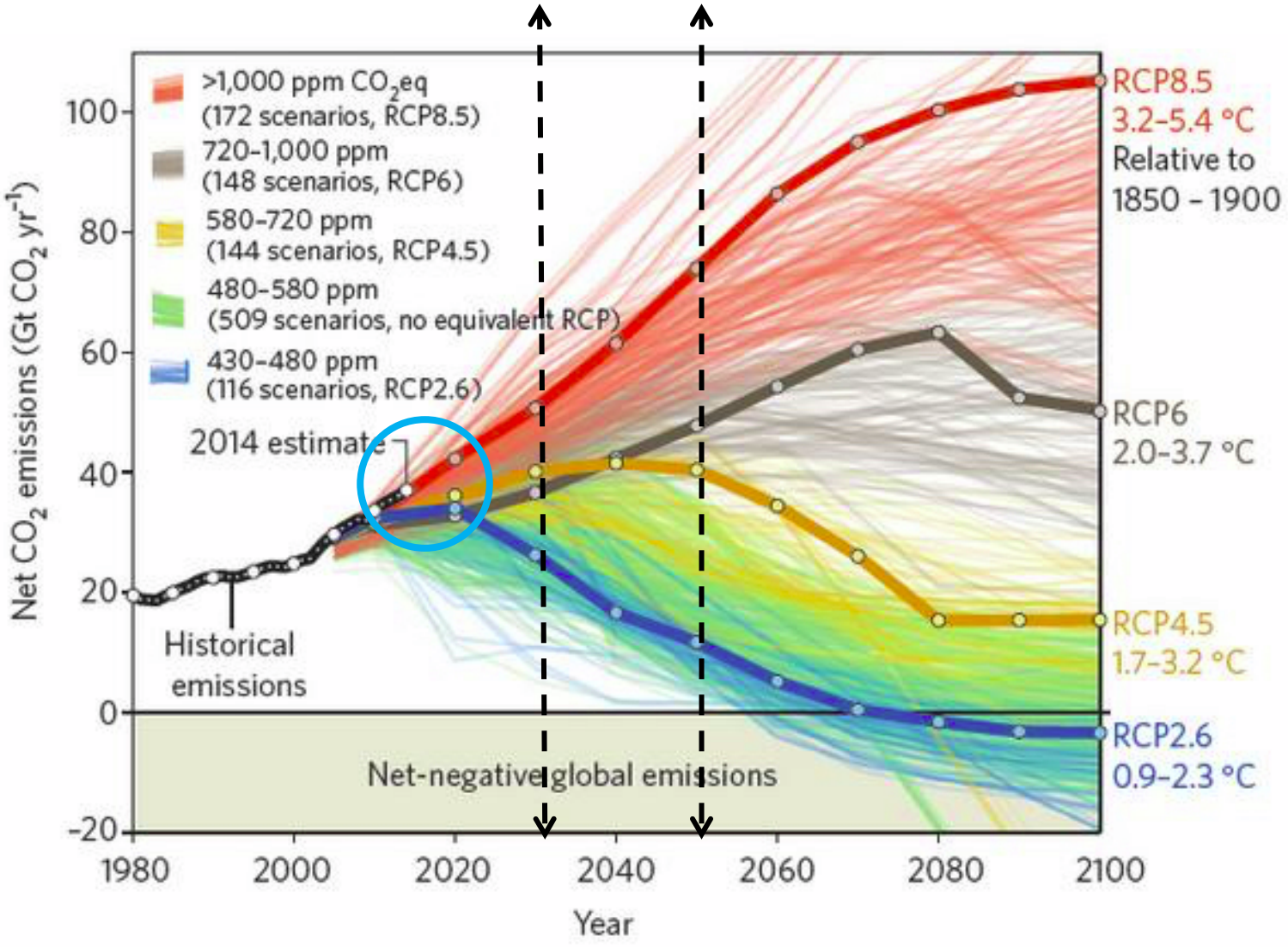
Climate-Risk Vulnerability assessment (CRVA) Framework



Palao, et.al. 2017. A CRVA for the AMIA program in the Philippines

Exposure I: Time slice for sensitivity analysis to climate change



Representative Concentration Pathways (RCPs)

RCP 8.5 – High emissions

This RCP is consistent with a future with no policy changes to reduce emissions. It was developed by the International Institute for Applied System Analysis in Austria and is characterized by increasing greenhouse gas emissions that lead to high greenhouse gas concentrations over time. Comparable SRES scenario A1 F1

This future is consistent with:

- Three times today's CO_2 emissions by 2100
- Rapid increase in methane emissions
- Increased use of croplands and grassland which is driven by an increase in population
- A world population of 12 billion by 2100
- Lower rate of technology development
- Heavy reliance on fossil fuels
- High energy intensity
- No implementation of climate policies

IPCC AR5 (2013)

Exposure I: Bioclimatic Variables

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Temperature Related

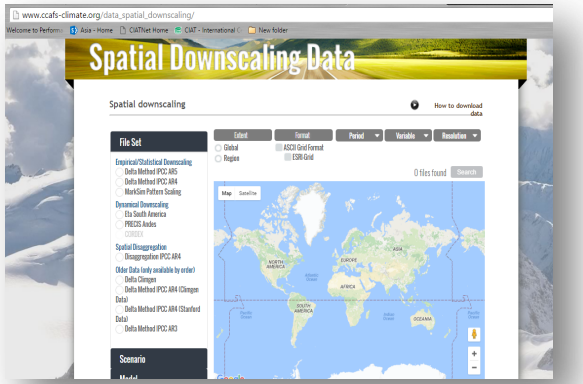
Bio1 = **Annual mean temperature**
Bio2 = **Mean diurnal range (Mean of monthly (max temp - min temp))**
Bio3 = **Isothermality (Bio2/Bio7) (* 100)**
Bio4 = **Temperature seasonality (SD*100)**
Bio5 = **Maximum temperature of warmest month**
Bio6 = **Minimum temperature of coldest month**
Bio7 = **Temperature annual range (Bio5 – Bi06)**
Bio8 = **Mean temperature of wettest quarter**
Bio9 = **Mean temperature of driest quarter**
Bio10 = **Mean temperature of warmest quarter**
Bio11 = **Mean temperature of coldest quarter**

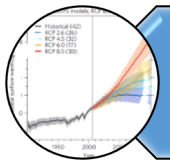
Precipitation Related

Bio12 = **Annual precipitation**
Bio13 = **Precipitation of wettest month**
Bio14 = **Precipitation of driest month**
Bio15 = **Precipitation seasonality (CV)**
Bio16 = **Precipitation of wettest quarter**
Bio17 = **Precipitation of driest quarter**
Bio18 = **Precipitation of warmest quarter**
Bio19 = **Precipitation of coldest quarter**
Bio 20 = **No. of consecutive dry days**

Slide from A. Martinez-Valle

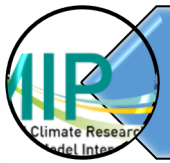
Climate data used for Sensitivity





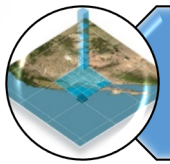
Projections based on IPCC AR5.

RCP 8.5 used in this project. Most recent and policy relevant.

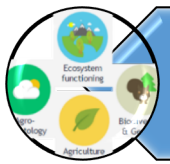


GCM models based on CMIP5

Ensemble of 33 GCMs was used



Spatially downscaled to 1km resolution
(http://www.ccafs-climate.org/statistical_downscaling_delta/)



20 Bioclimatic variables used based. Climate change can impose physiological constraints on species and affect species distributions (crop performance – yield)

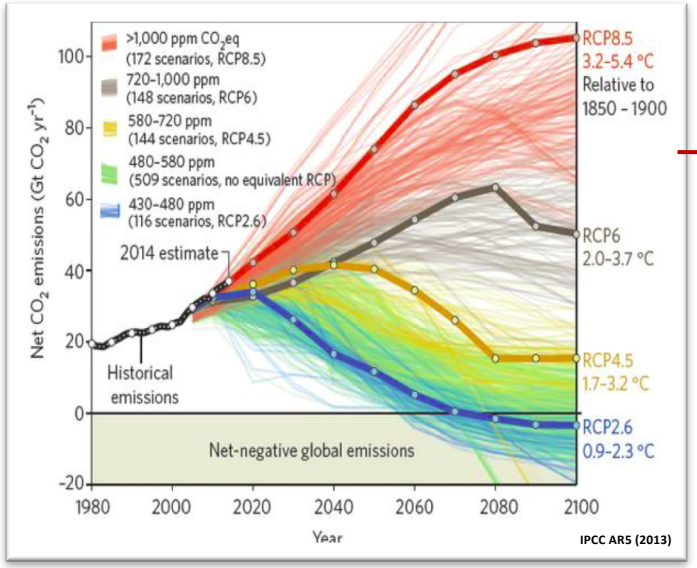
GCMs (Future conditions) and WorldClim (Current conditions) to describe changes in temperature and precipitation

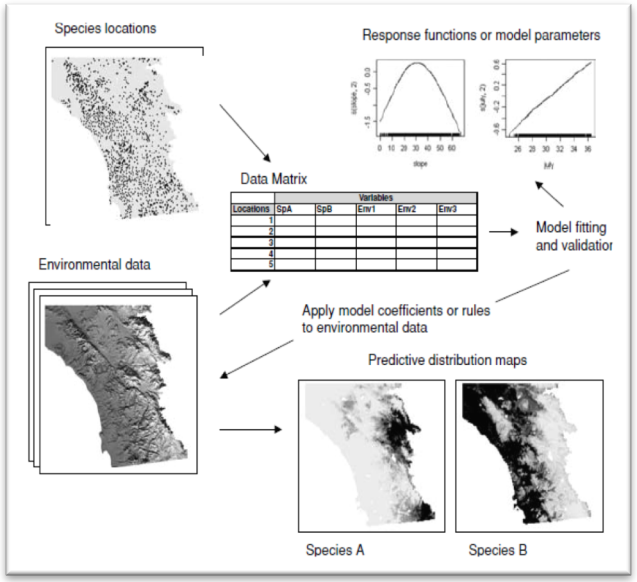
- Current (Baseline 1960–2000): WorldClim
- 2050: mean ensemble of 33 GCM, RCP 8.5

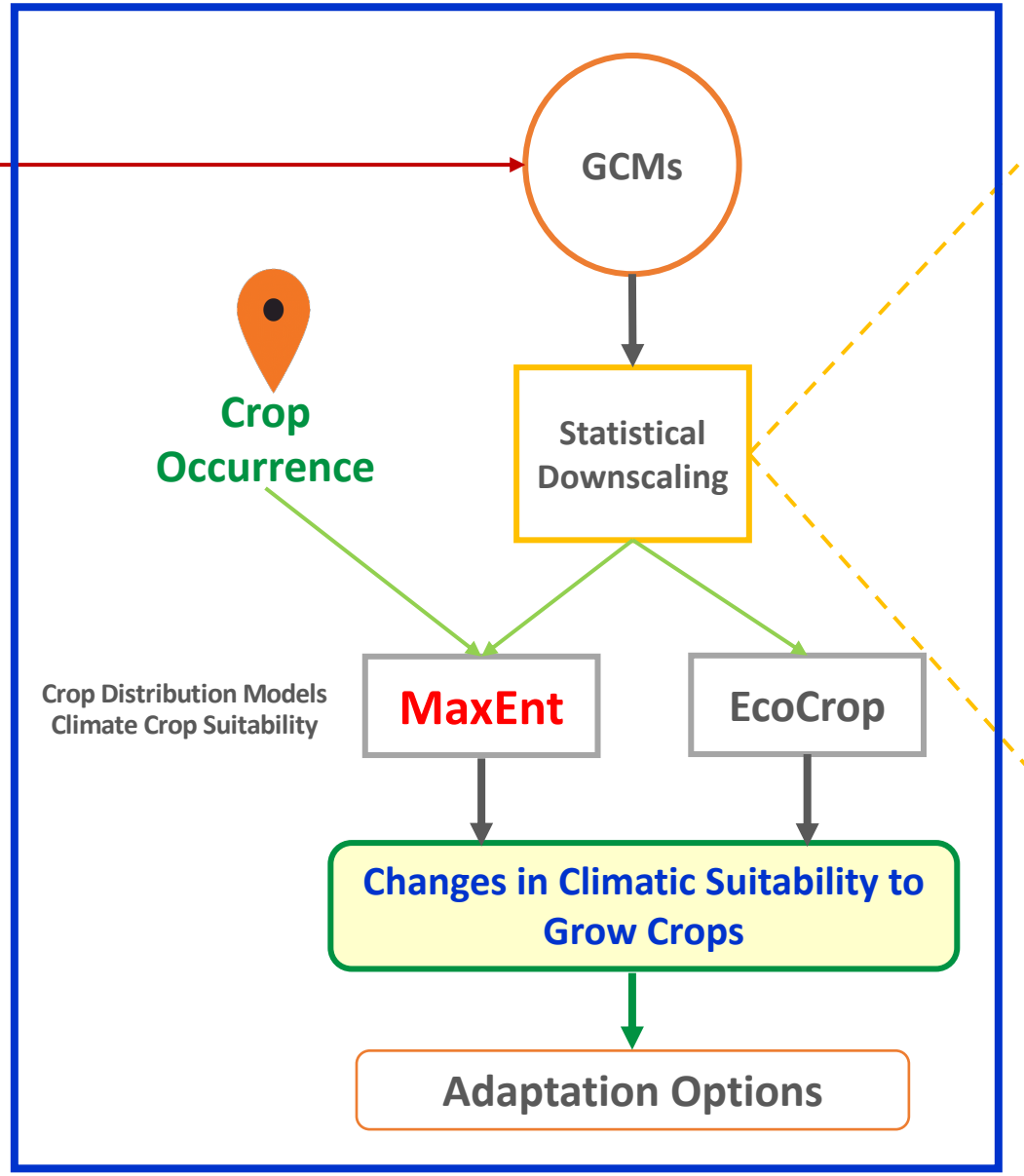
Model	Country
BCCR-BCM2.0	Norway
CCCMA-CGCM3.1 (T47)	Canada
CCCMA-CGCM3.1 (T63)	Canada
CNRM-CM3	France
CSIRO-Mk3.0	Australia
CSIRO-Mk3.5	Australia
GFDL-CM2.0	USA
GFDL-CM2.1	USA
GISS-AOM	USA
GISS-MODEL-EH	USA
GISS-MODEL-ER	USA
IAP-FGOALS1.0-G	China
INGV-ECHAM4	Italy
INM-CM3.0	Russia
IPSL-CM4	France
MIROC3.2-HIRES	Japan
MIROC3.2-MEDRES	Japan
MIUB-ECHO-G	Germany/Korea
MPI-ECHAM5	Germany
MRI-CGCM2.3.2A	Japan
NCAR-CCSM3.0	USA
NCAR-PCM1	USA
UKMO-HADCM3	UK
UKMO-HADGEM1	UK

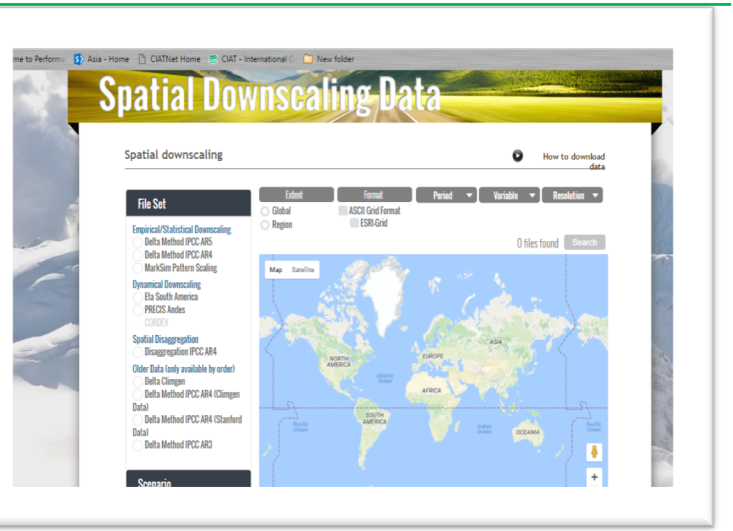
Exposure 1: Changes in Temperature and Precipitation

Representative Concentration Pathways (RCPs)









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What have we accomplished in this project?

Volume of crop production (MT) and crop occurrence points

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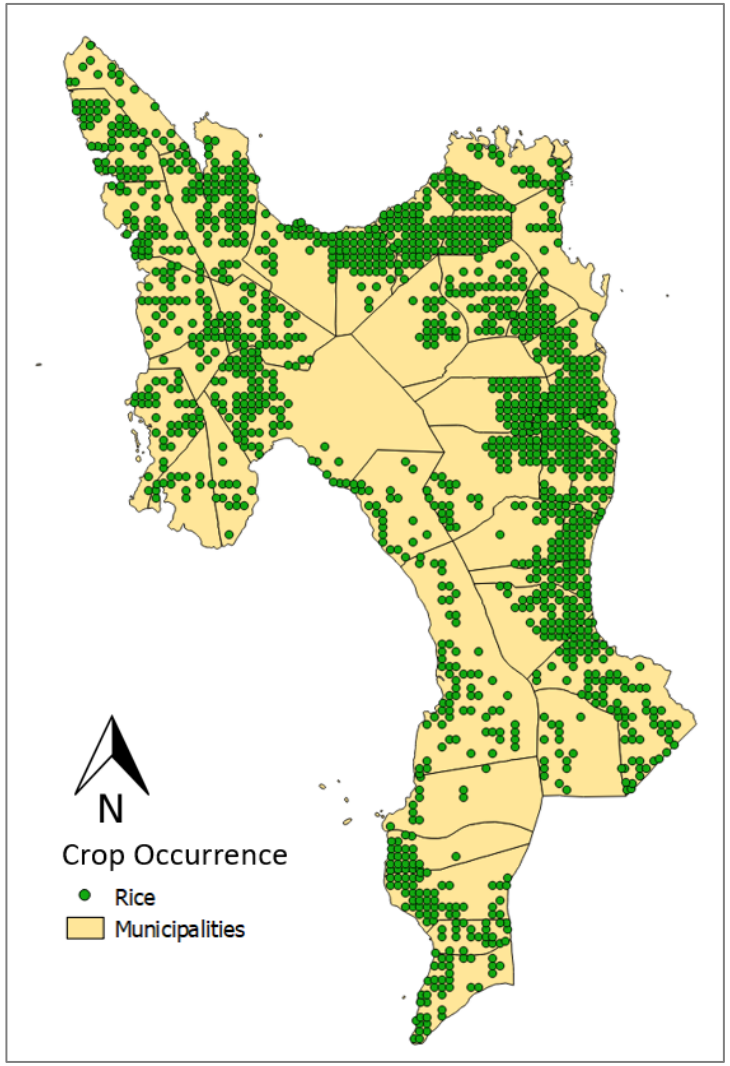
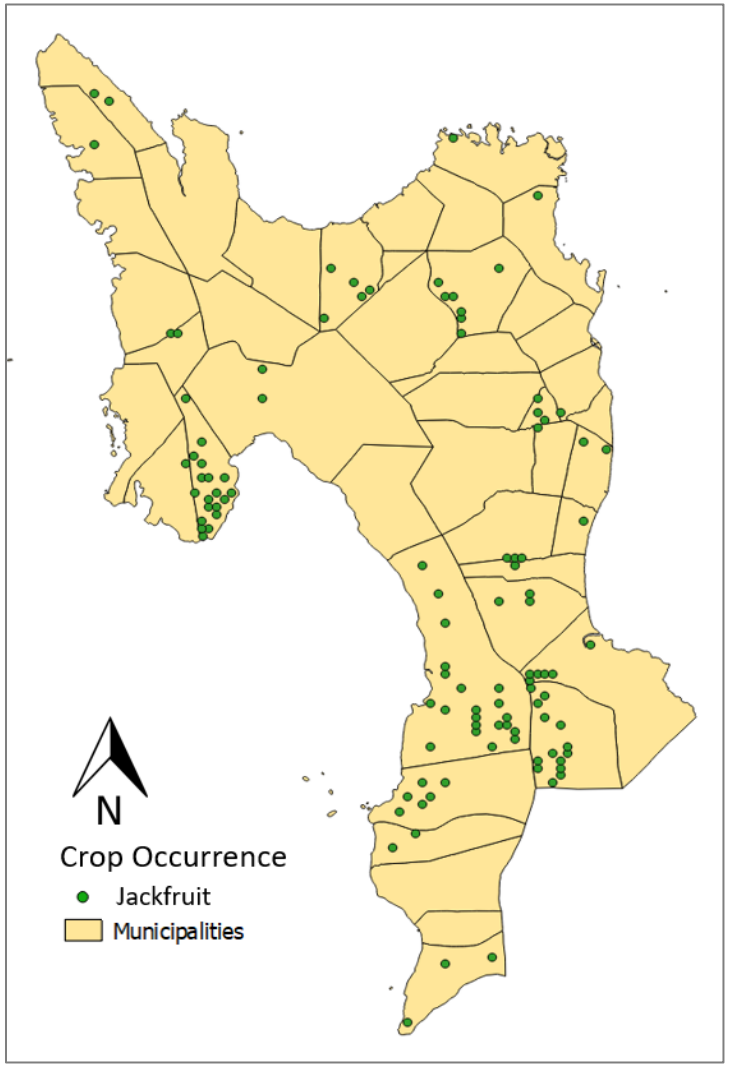
Crops	Volume of Production (MT)*	No. of Crop Occurrence Points
Abaca	1,456.83	
Banana	28,738.04	1370
Cacao	10.89	265
Cassava	40,515.88	490
Corn	48,300.16	766
Eggplant	1,369.44	235
Jackfruit	33,968.00	108
Rice	486,877.96	1523
Sweetpotato	42,544.60	322
Taro	6,142.79	

* CountryStat Database, PSA 2018





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Crop Occurrence Points

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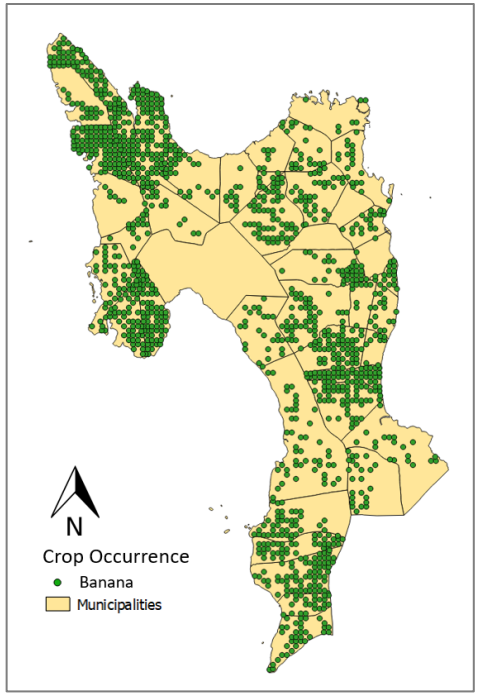

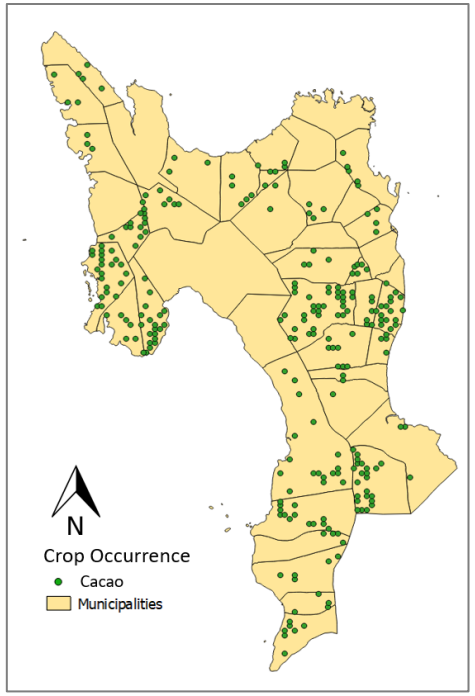

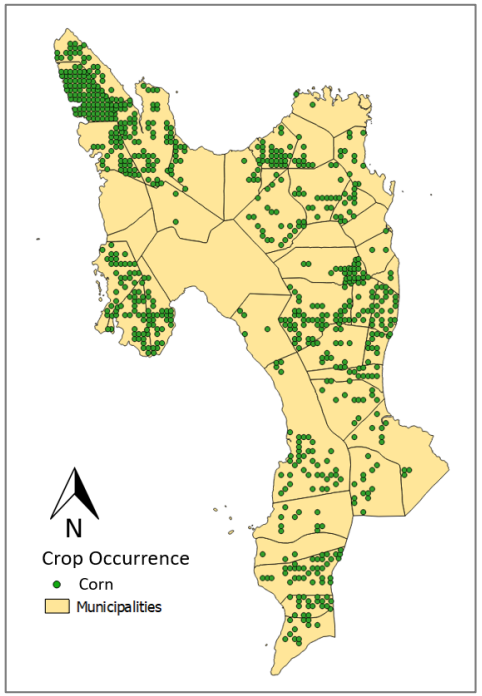

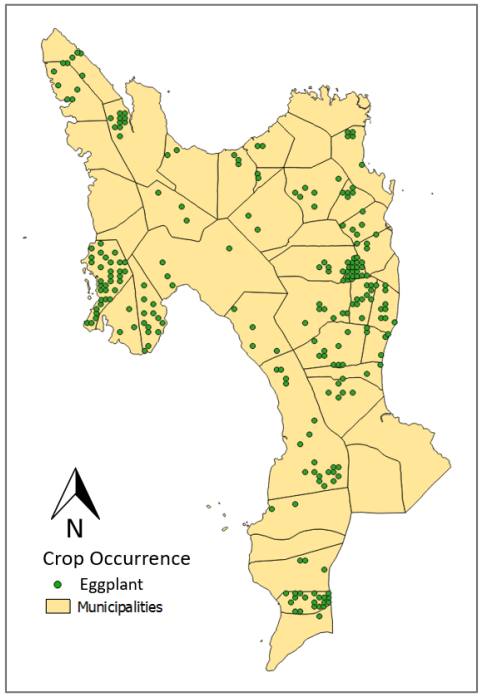

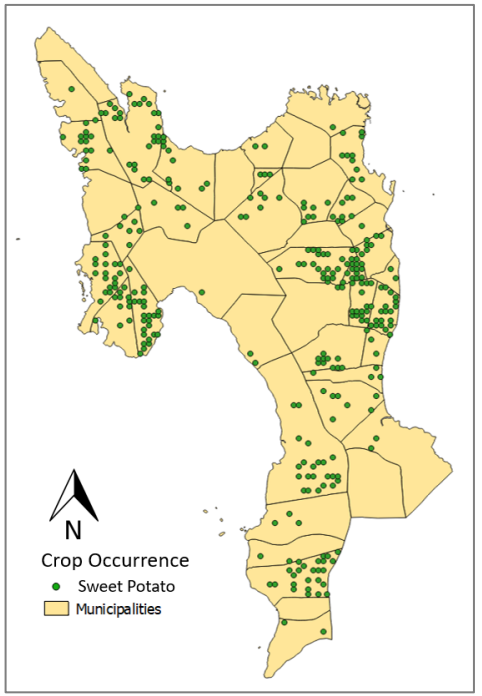

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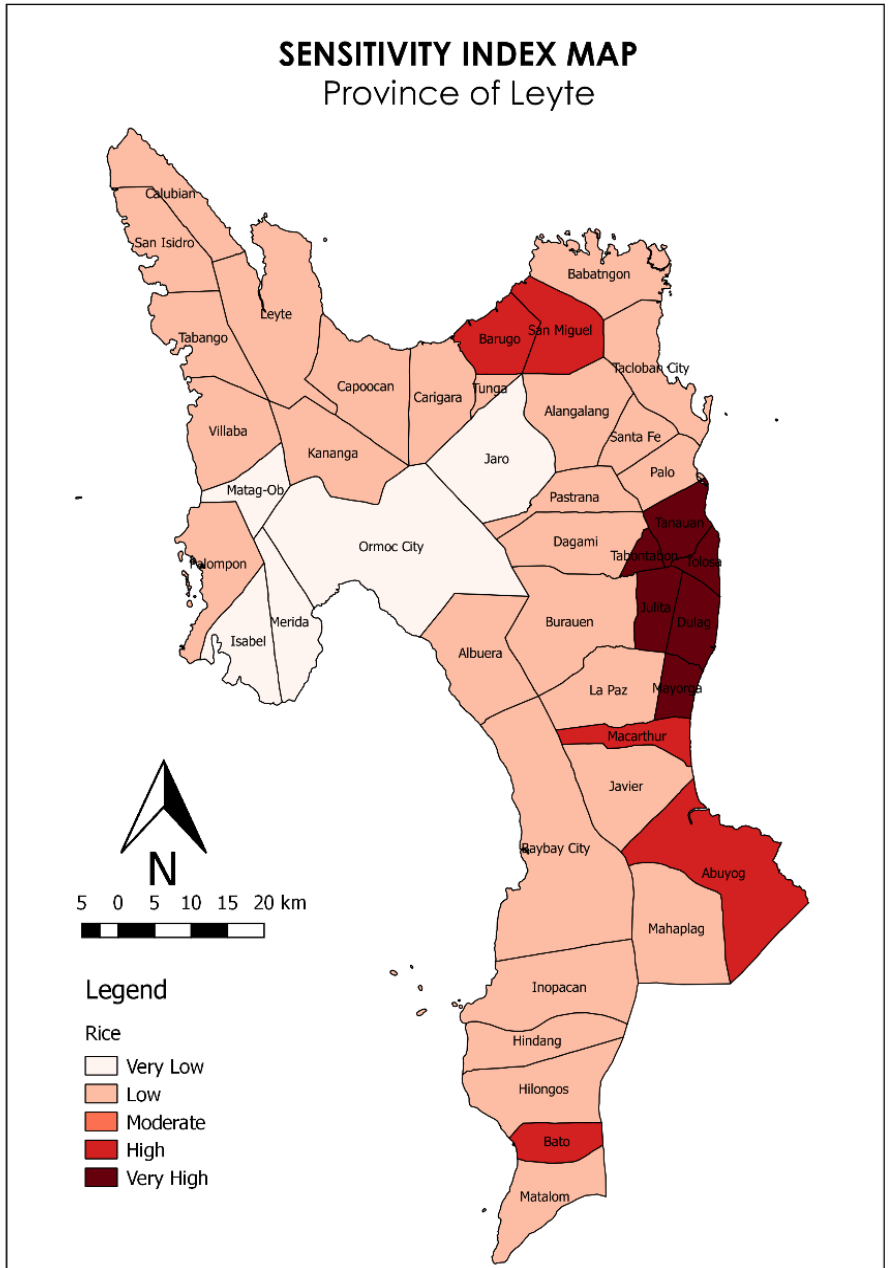
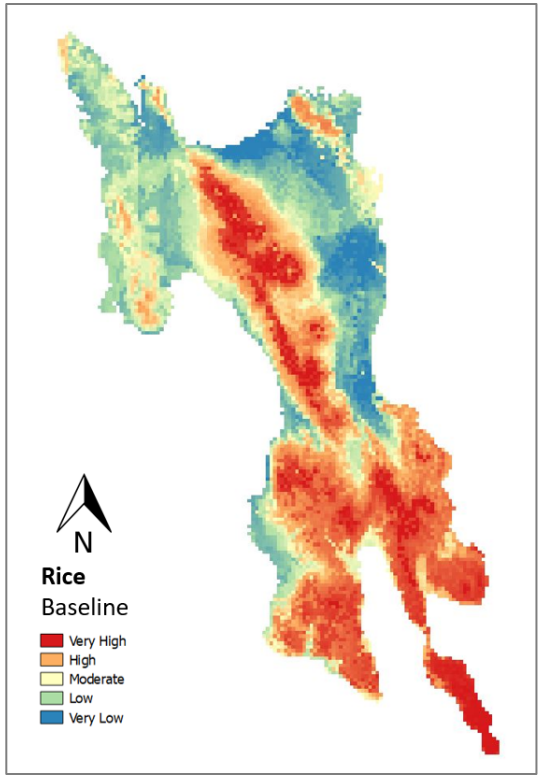
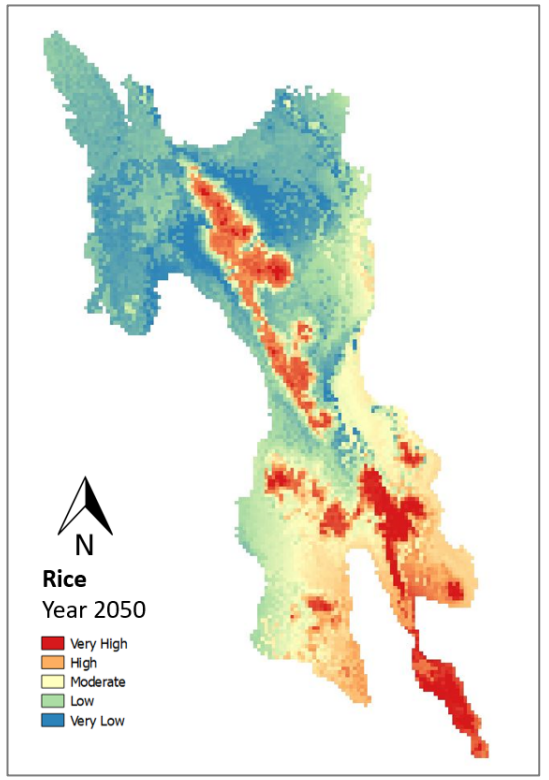
RICE

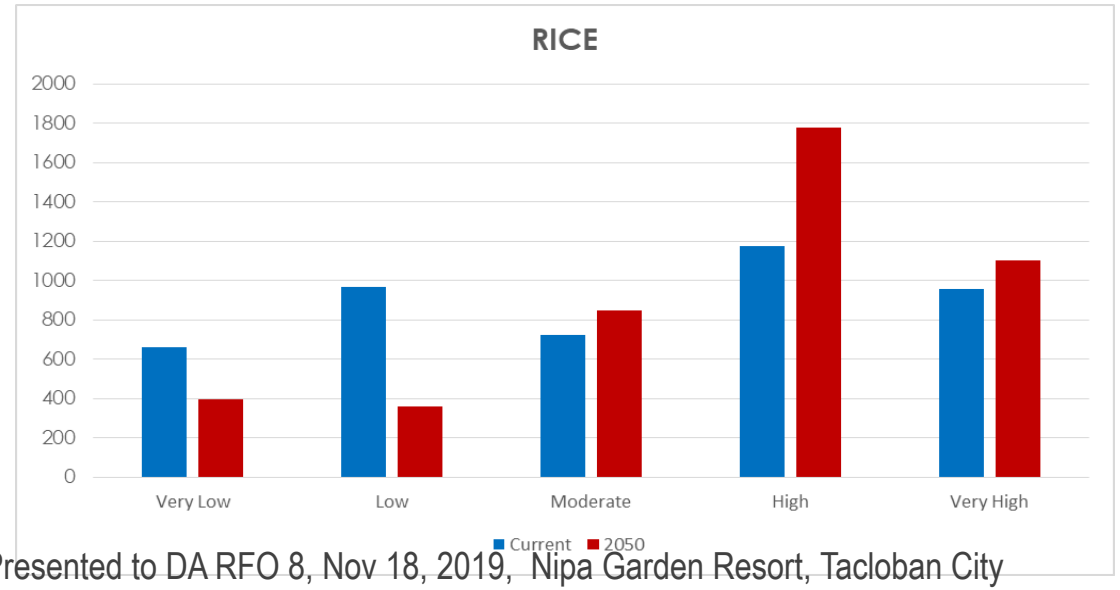
Sensitivity

The increase or decrease of climatic suitability of selected crops to changes in temperature and precipitation.





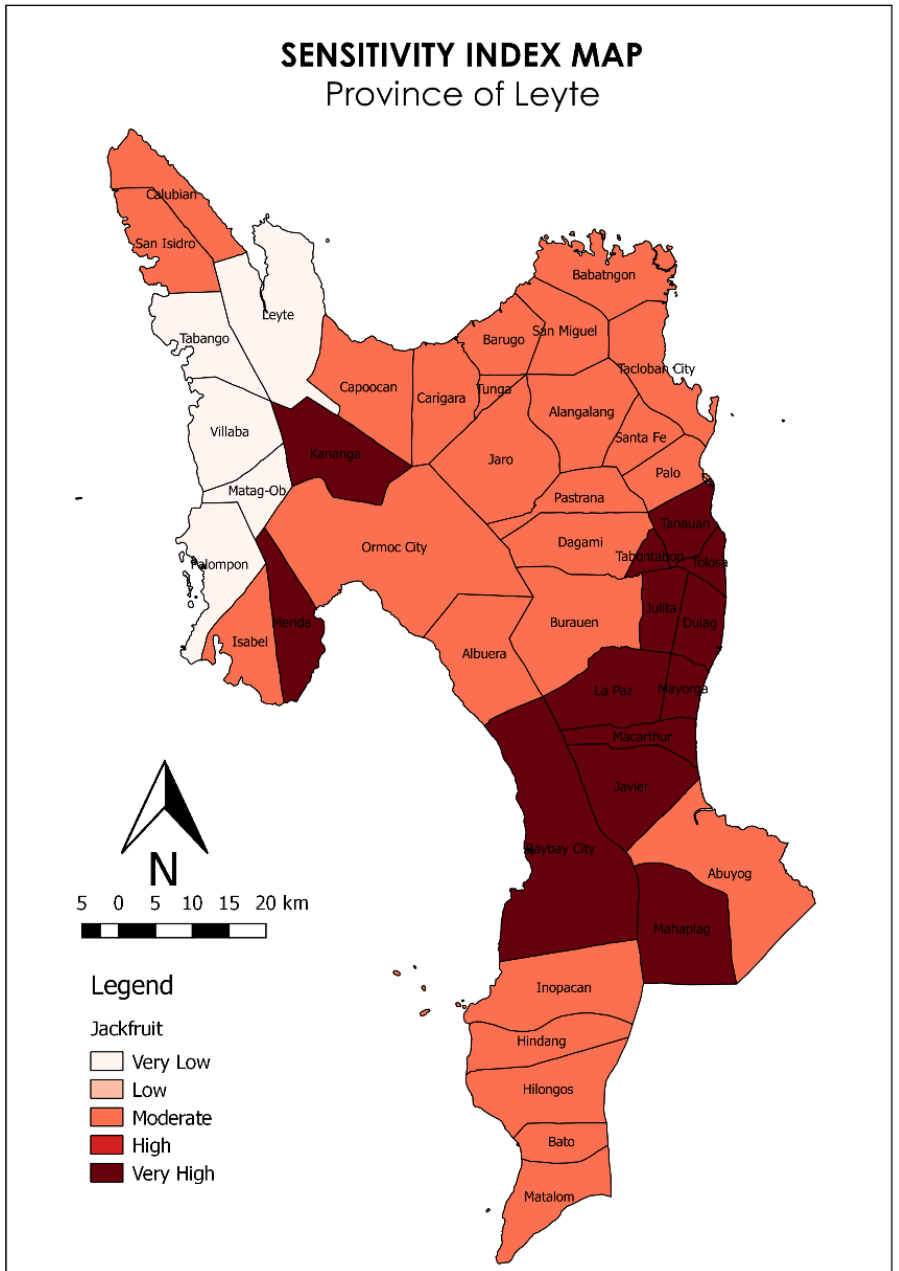


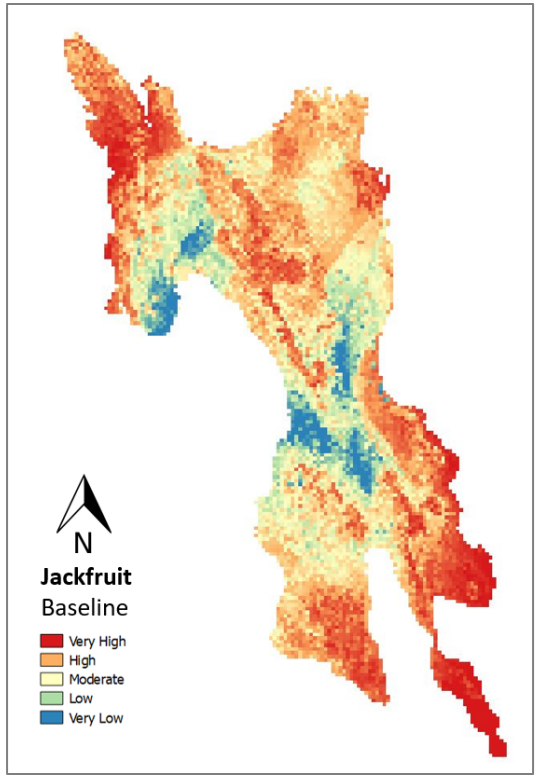


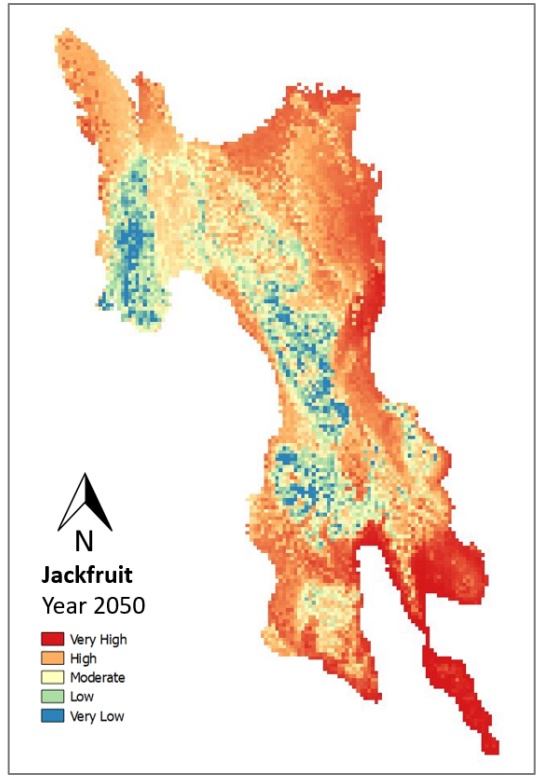
JACKFRUIT

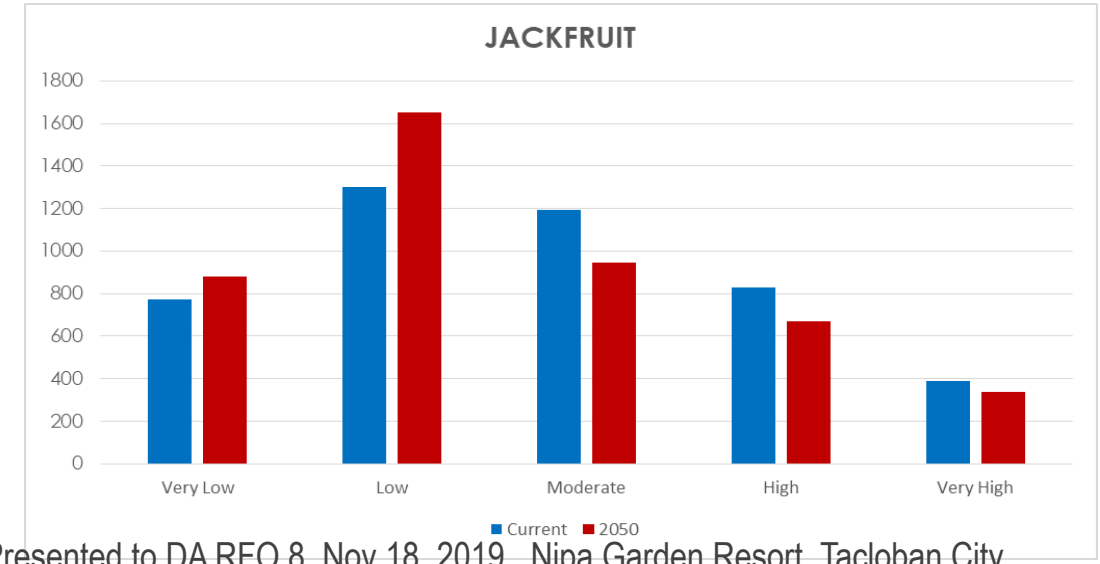
Sensitivity

The increase or decrease of climatic suitability of selected crops to changes in temperature and precipitation.





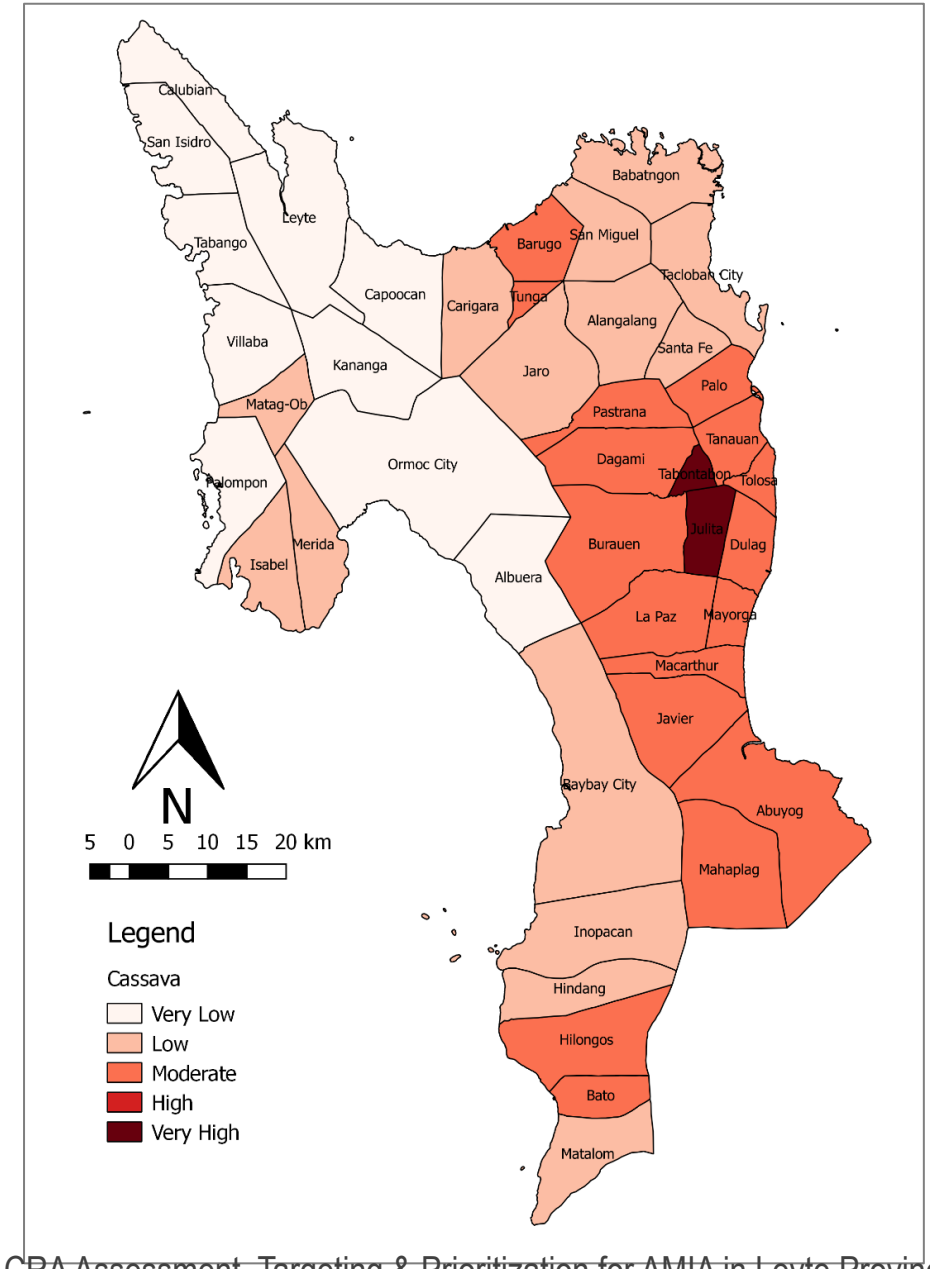


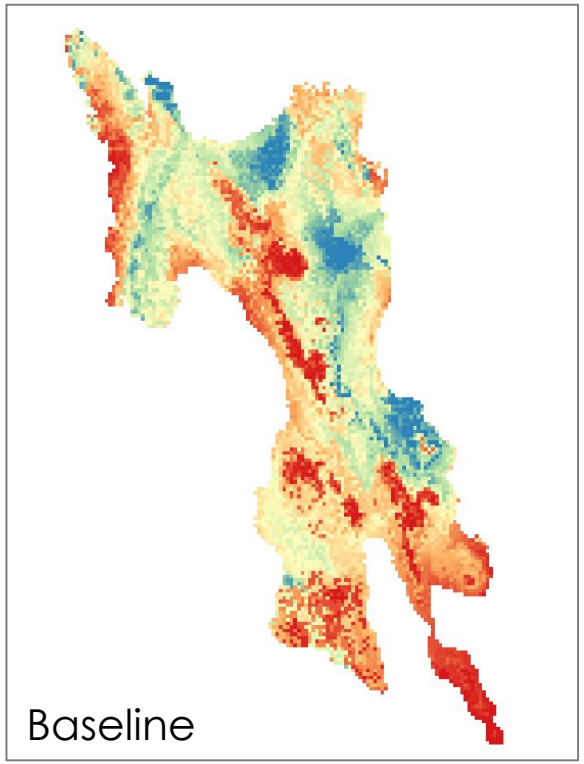


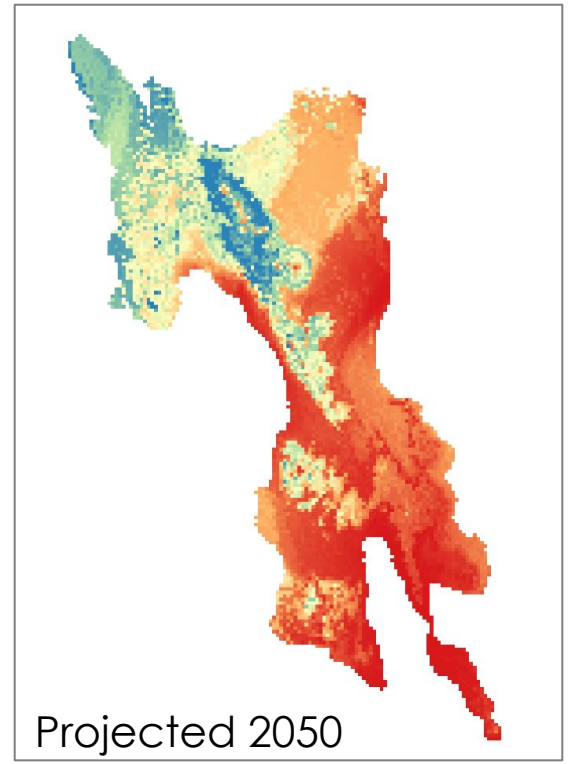
Sensitivity

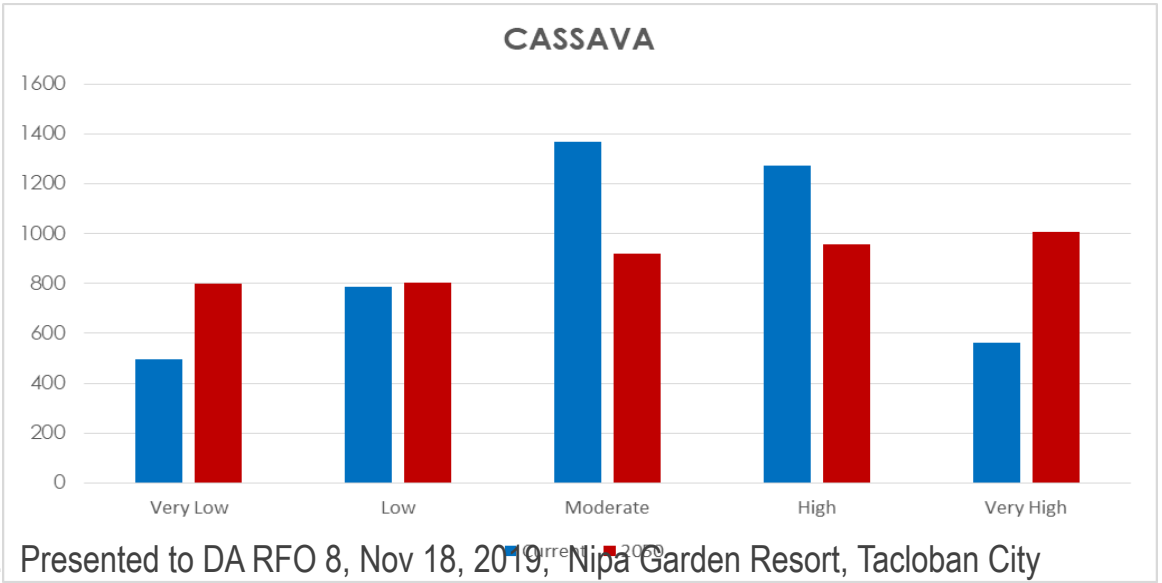
CASSAVA

The increase or decrease of climatic suitability of selected crops to changes in temperature and precipitation.





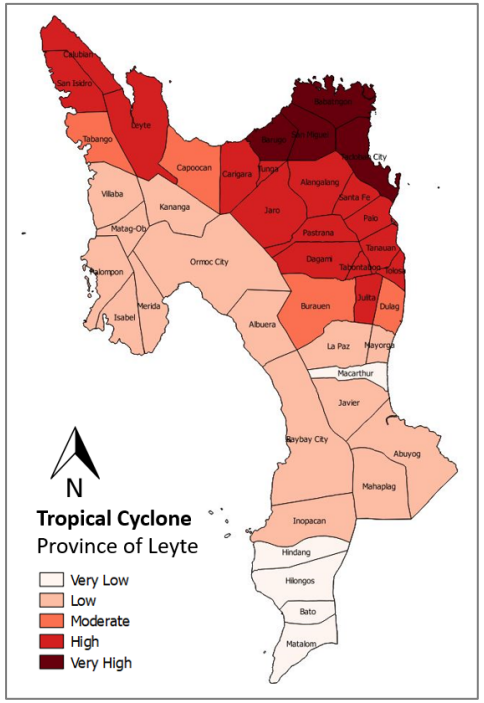


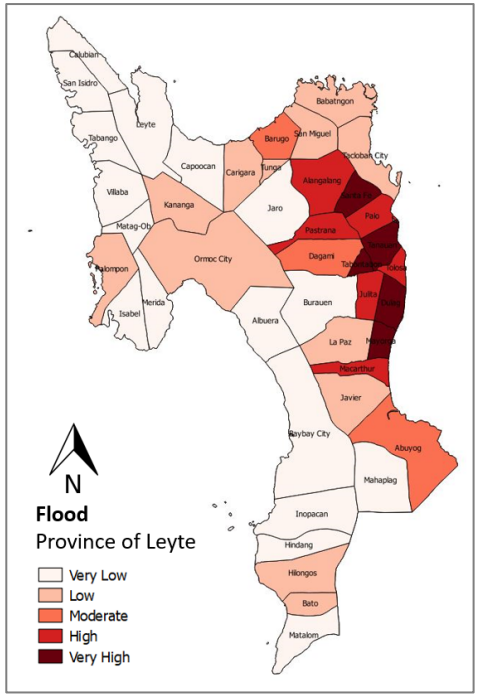


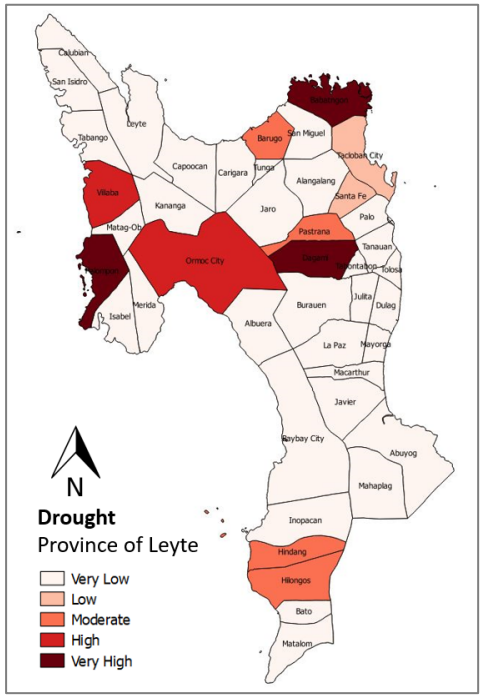
Parameter	Source	Unit of measurement, spatial and temporal resolution
Typhoon	UNEP / UNISDR, 2013 (http://preview.grid.unep.ch/index.php?preview=data&events=cyclones&evcat=2&lang=en g)	1 kilometer pixel resolution. Estimate of tropical cyclone frequency based on Saffir-Simpson scale category 5 (> 252 km/h) from 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 Philippines from the past 10 years
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 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

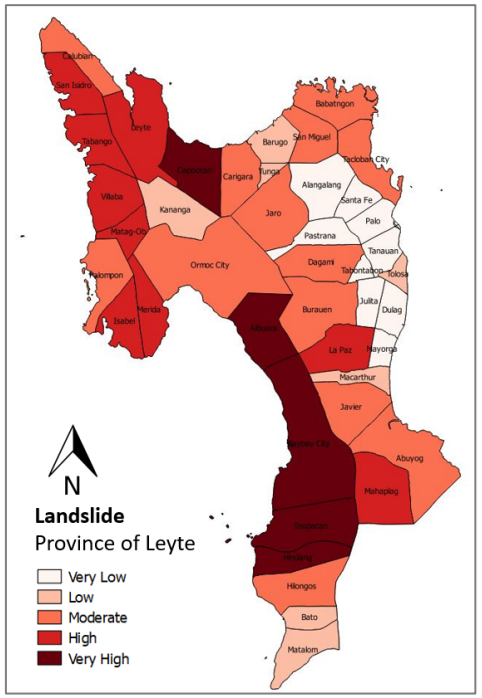
Exposure

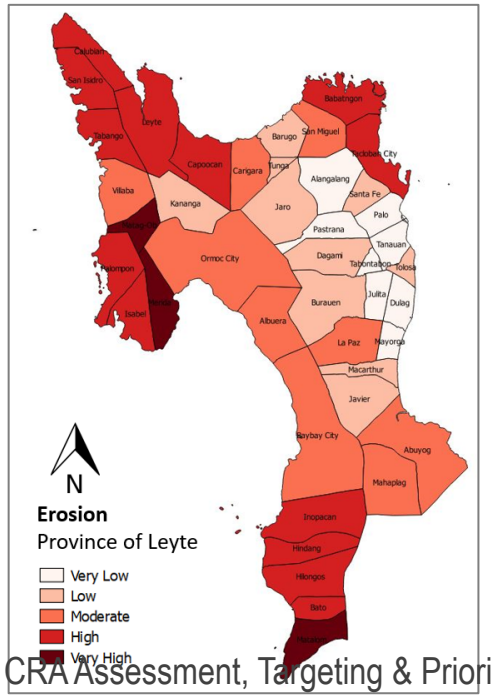
Hazards which reflects climate variability

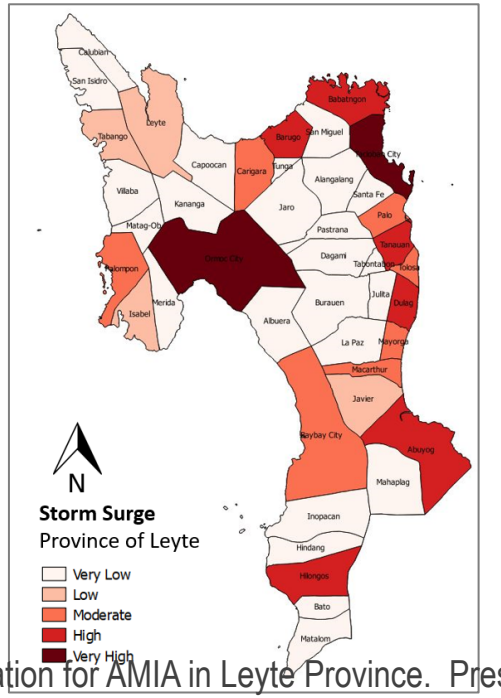


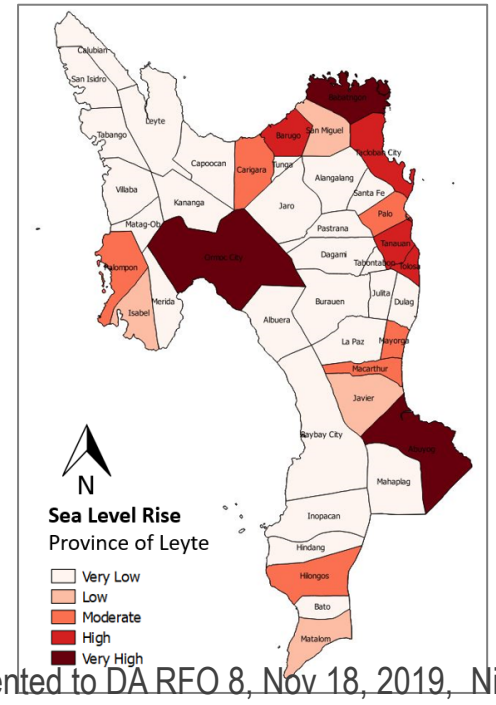


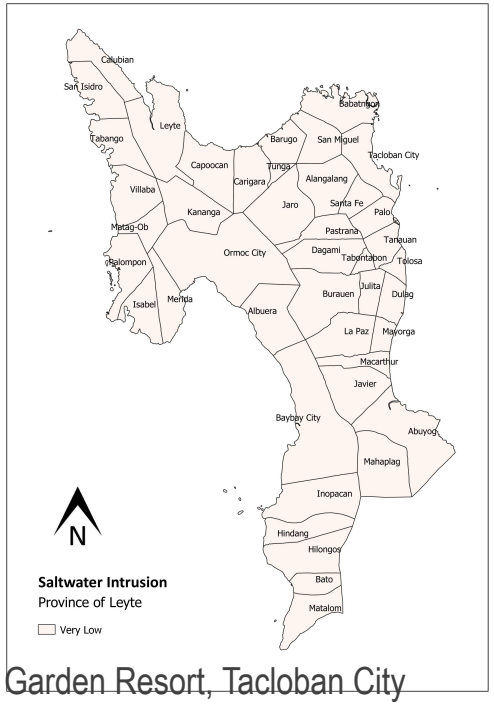












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Hazard scores per island group

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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
Saltwater Intrusion	11.43	7.21	10.17

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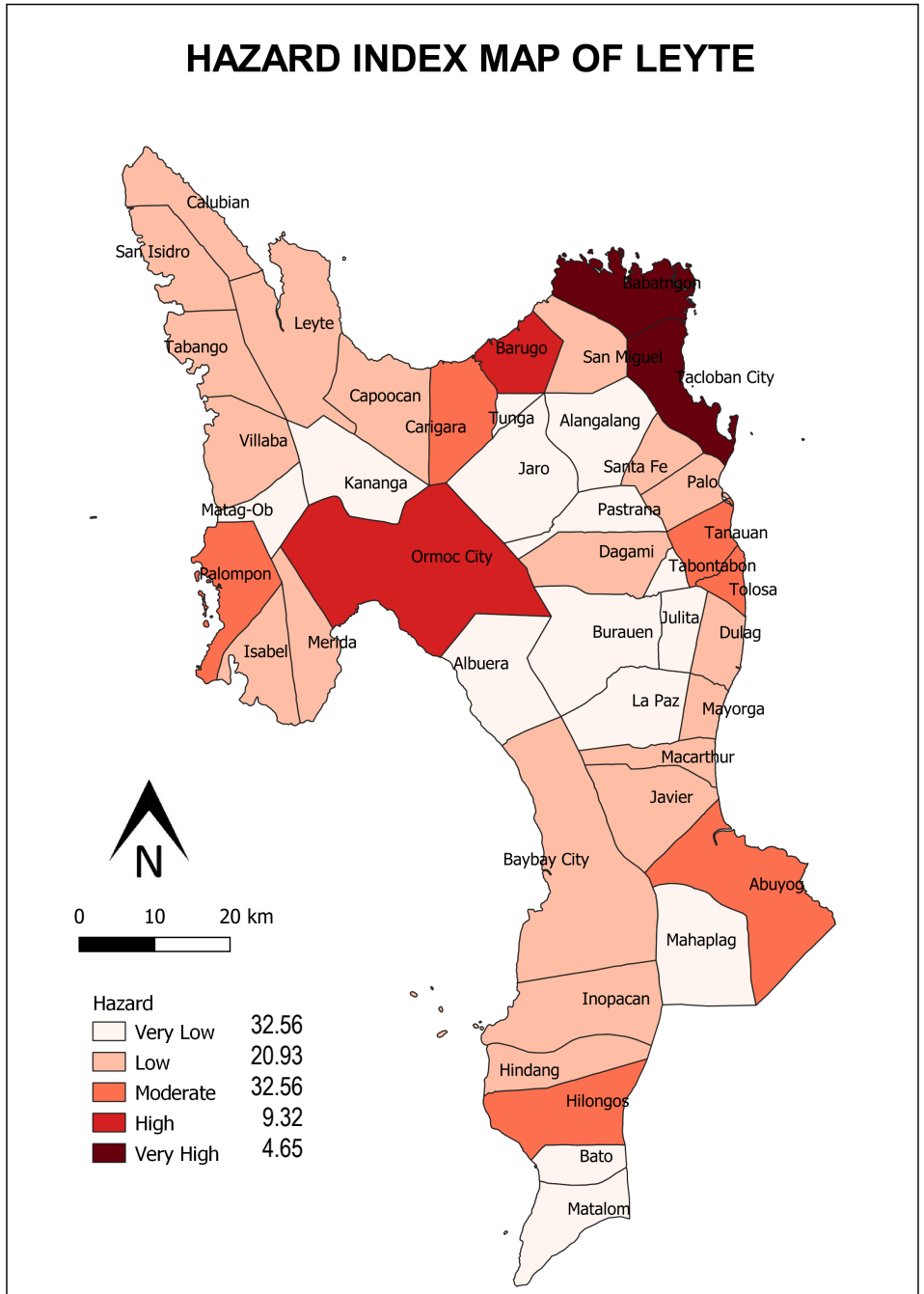
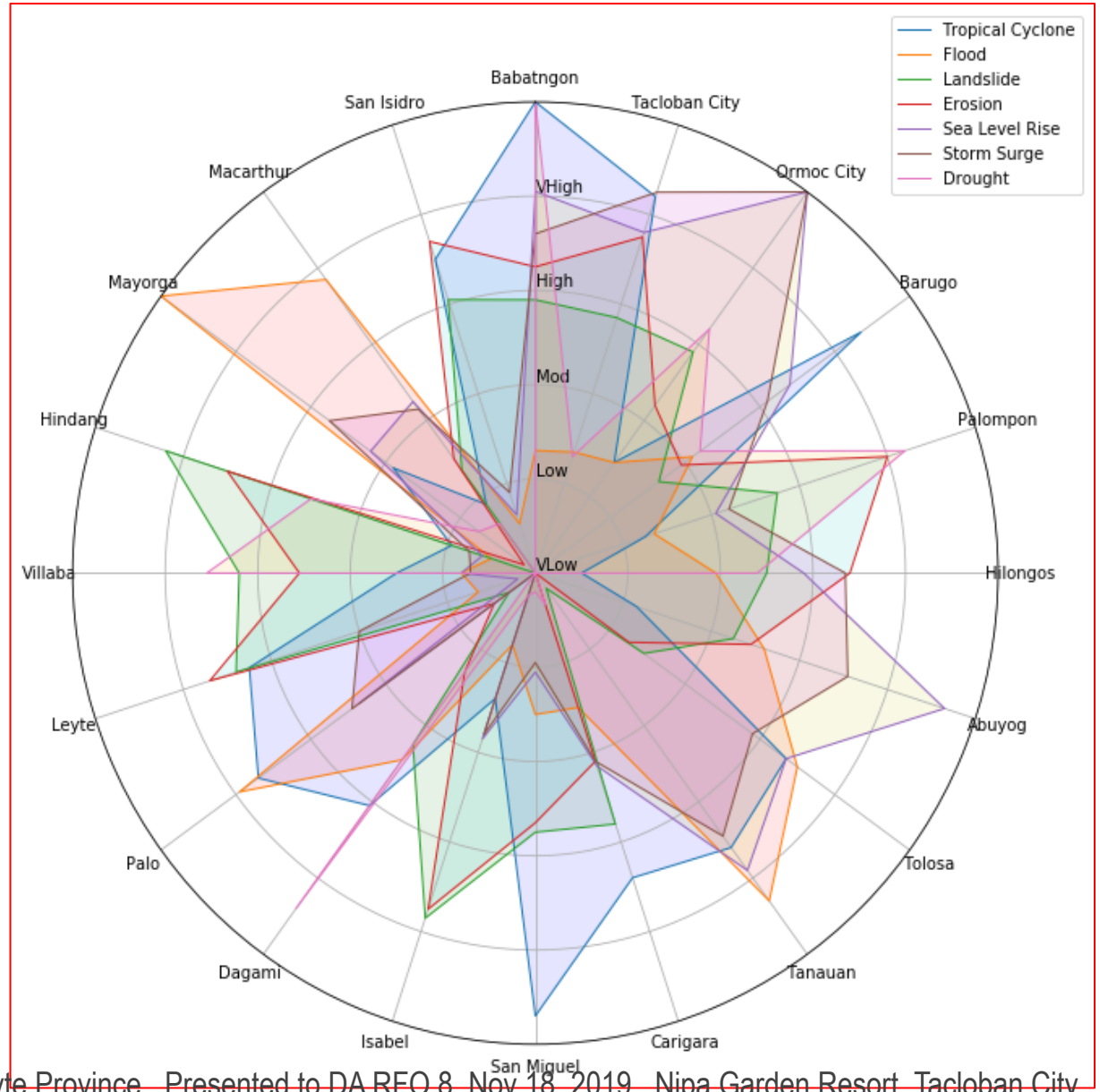


Radar Plot of the Hazards



Adaptive Capacity

Ability of the system to respond successfully to climate variability and change

PhilRootcrops

Economic	Natural	Social	Human	Health	Physical	Anticipatory	Institutional
Crop production (rice, corn, cassava, camote, pakbet and chopsuey) (In MT)	Soil organic matter (%)	Number of registered farmer groups or unions (count)	Literacy rate	Percentage of Malnourished Children Aged 7 years and Below (%)	Percentage of farmers owning their agricultural land	Number of climate change related trainings conducted (count)	Percentage of farmers consulted/visited by agricultural extension officers (%)
Revenue (In Pesos)	Forest cover(%)	Percentage of farmers with access to farmer groups or unions (%)	Ratio of School Teachers to Students (ratio)	Number of Public Health Services (count)	Average farm size (ha)	Percentage of the population with access to communication technology	Number of municipal or city agricultural staff/officers (count)
Number of financial institutions (count)	Total area of marine protected area(s) (In ha)	Percentage of women elected in local government position (%)	Number of Public Secondary School (count)	Number of Health Services Manpower (count)	Distance of farthest barangay to the nearest market (km)		
Number of finance cooperatives (count)	Percentage of farmers with access to STW (In %)		Number of Tertiary School (count)	Number of Public Doctors (count)	Number of livestock raised (count)		
Percentage of farmers with access to crop insurance (%)	Access to reliable water for irrigation		Number of Public Technical Vocational School (count)	Philhealth Membership (Count)	Percentage of crops irrigated (%)		
Dependence in agriculture (%)				Age-Dependency Ratio (count)	Road density		
Poverty incidence (%)							
Agriculture minimum wage in agriculture sector (Non-Plantation)							
Agriculture minimum wage in agriculture sector (Plantation)							

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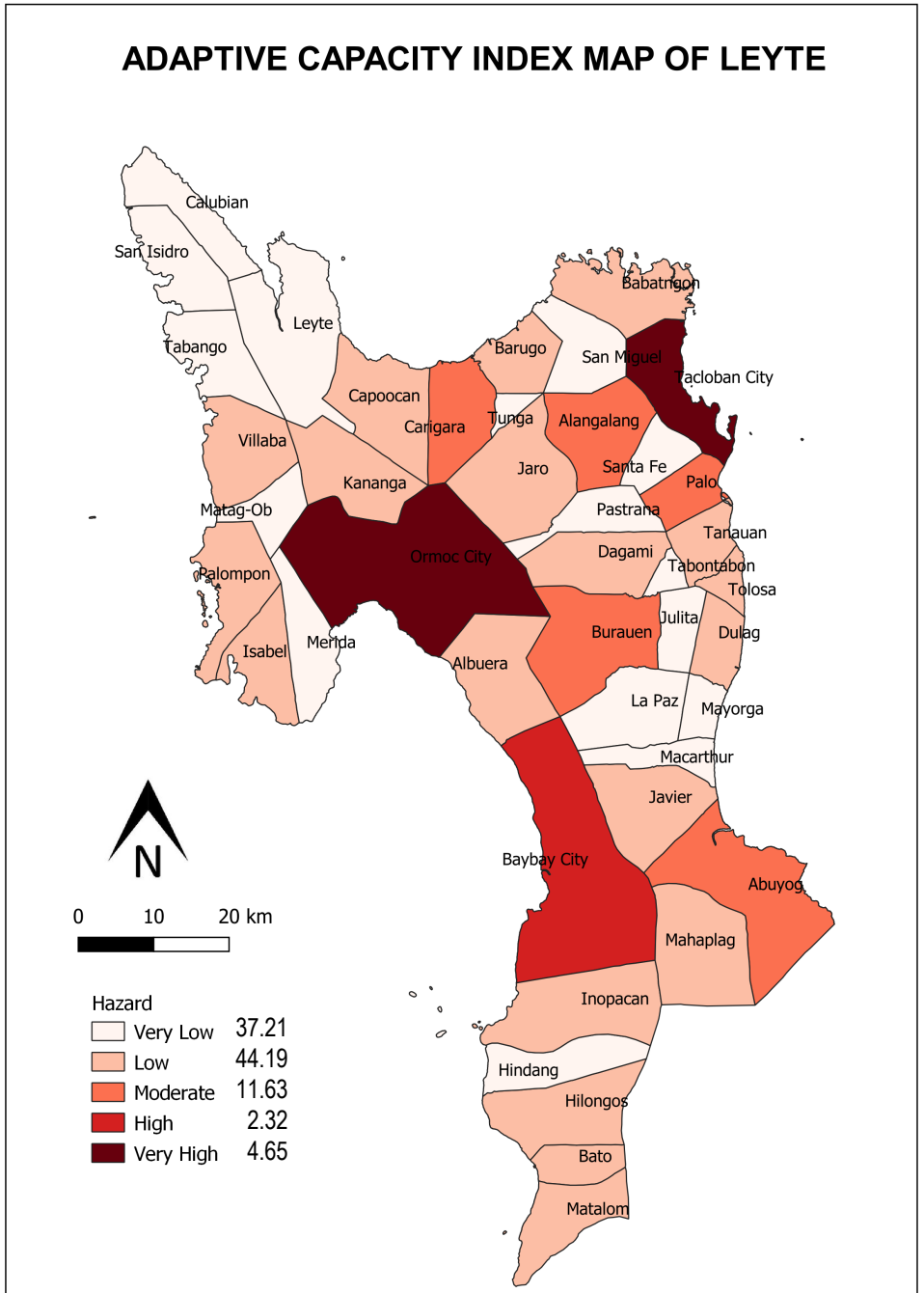
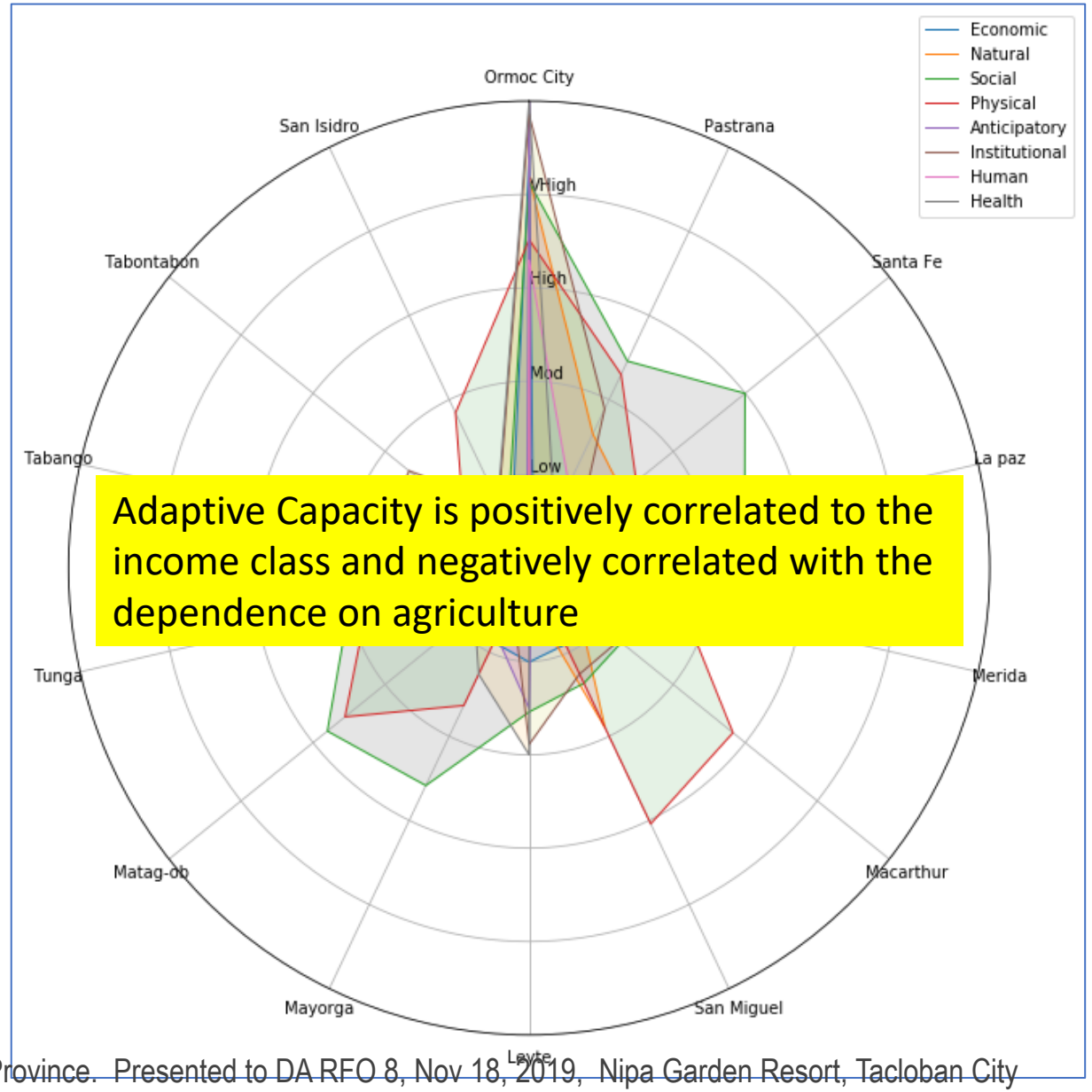


Radar Plot of the Adaptive Capacity



Adaptive Capacity is positively correlated to the income class and negatively correlated with the dependence on agriculture

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Adaptive Capacity: Economic Sub-indicators

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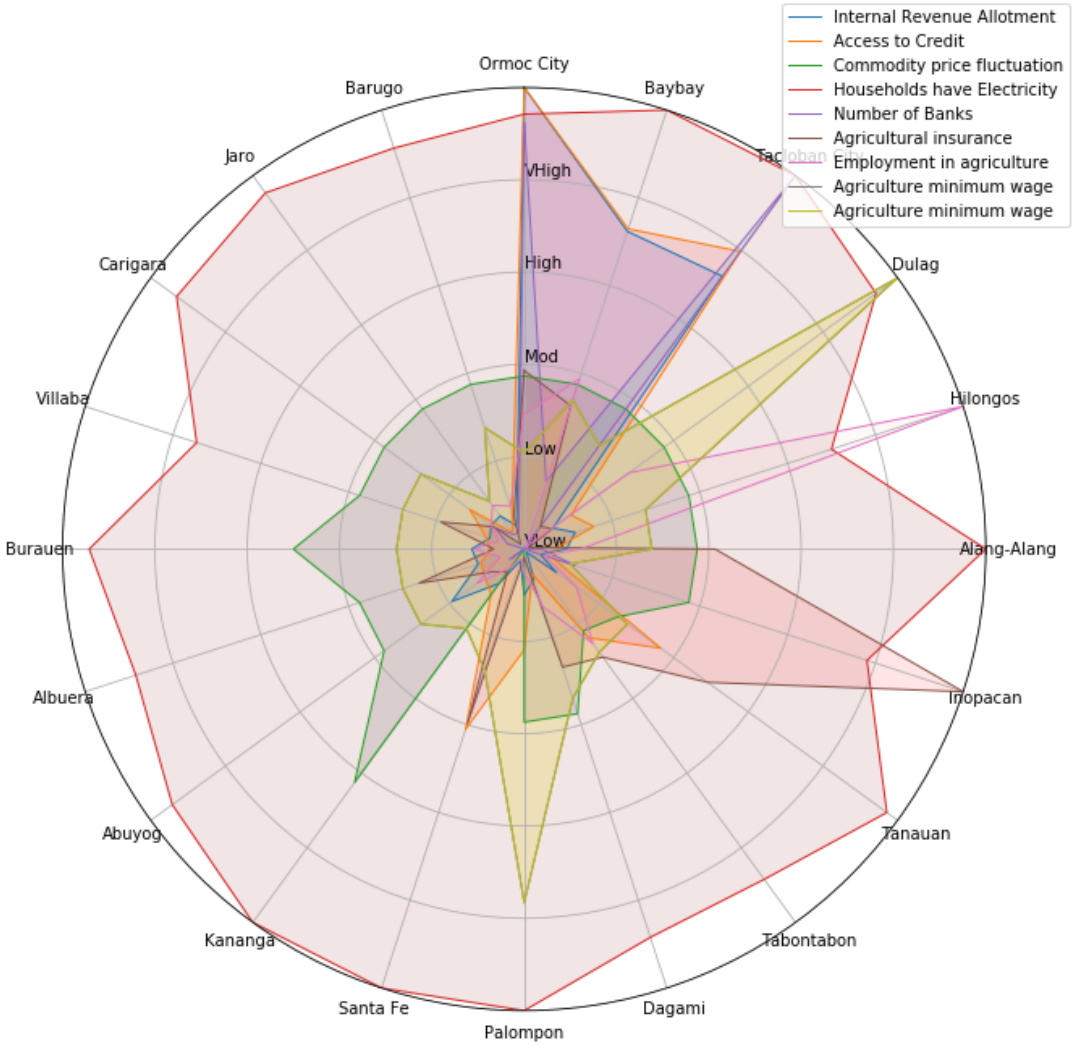

Municipality	Internal Revenue	Access to Credit	Commodity price fluctuation	Households have Electricity	Number of Banks	Agricultural insurance	Employment in agriculture	Agriculture minimum wage	Poverty incidence
Ormoc City	1.000	1.000	0.375	0.942	0.923	0.387	0.292	0.209	0.364
Baybay	0.724	0.729	0.375	1.000	0.154	0.327	0.388	0.340	0.410
Tacloban City	0.731	0.797	0.375	1.000	1.000	0.060	0.007	0.277	0.000
Dulag	0.077	0.126	0.375	0.942	0.000	0.076	0.281	1.000	0.543
Hilongos	0.116	0.158	0.375	0.700	0.000	0.010	1.000	0.277	0.631
Alang-Alang	0.092	0.067	0.375	1.000	0.038	0.413	0.122	0.277	0.724
Inopacam	0.037	0.067	0.375	0.781	0.115	1.000	0.045	0.105	0.525
Tanauan	0.087	0.366	0.250	0.971	0.000	0.491	0.141	0.277	0.436
Tabontabon	0.009	0.238	0.219	0.885	0.000	0.289	0.253	0.277	0.814
Dagami	0.068	0.058	0.375	0.885	0.000	0.269	0.131	0.340	0.831
Palompon	0.100	0.218	0.375	1.000	0.000	0.018	0.051	0.766	0.410
Santa Fe	0.026	0.410	0.000	1.000	0.000	0.397	0.022	0.277	0.778
Kananga	0.092	0.122	0.625	1.000	0.000	0.062	0.049	0.213	0.695
Abuyog	0.194	0.104	0.375	0.942	0.038	0.084	0.127	0.277	0.597
Albuera	0.105	0.098	0.375	0.885	0.000	0.239	0.055	0.277	0.665
Burauen	0.114	0.074	0.500	0.942	0.000	0.066	0.108	0.277	0.614
Villaba	0.078	0.088	0.375	0.746	0.038	0.190	0.058	0.277	0.799
Carigara	0.088	0.145	0.375	0.931	0.077	0.082	0.088	0.277	0.570
Jaro	0.088	0.044	0.375	0.954	0.038	0.013	0.117	0.128	0.804
Barugo	0.053	0.085	0.375	0.913	0.038	0.073	0.098	0.277	0.631

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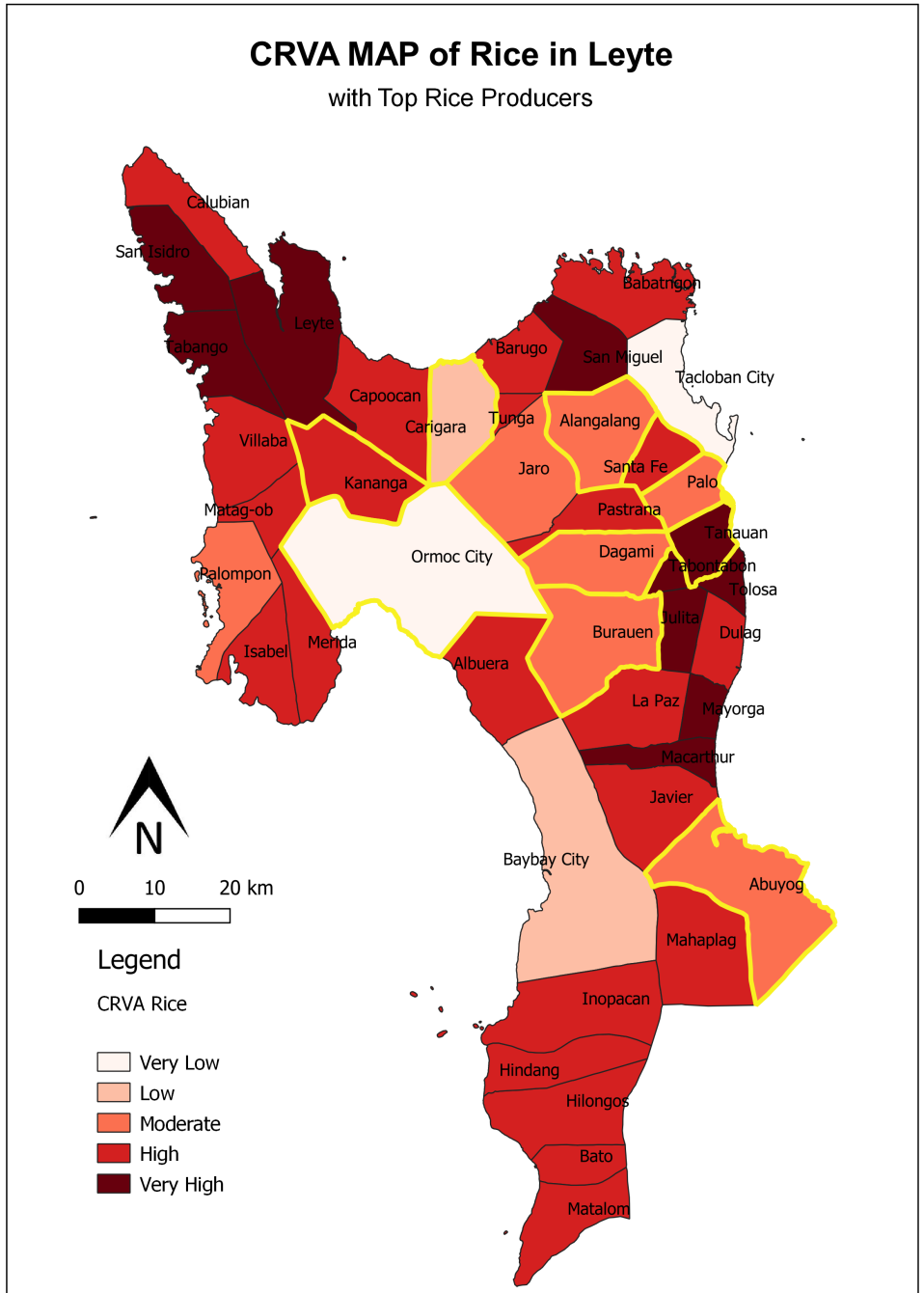
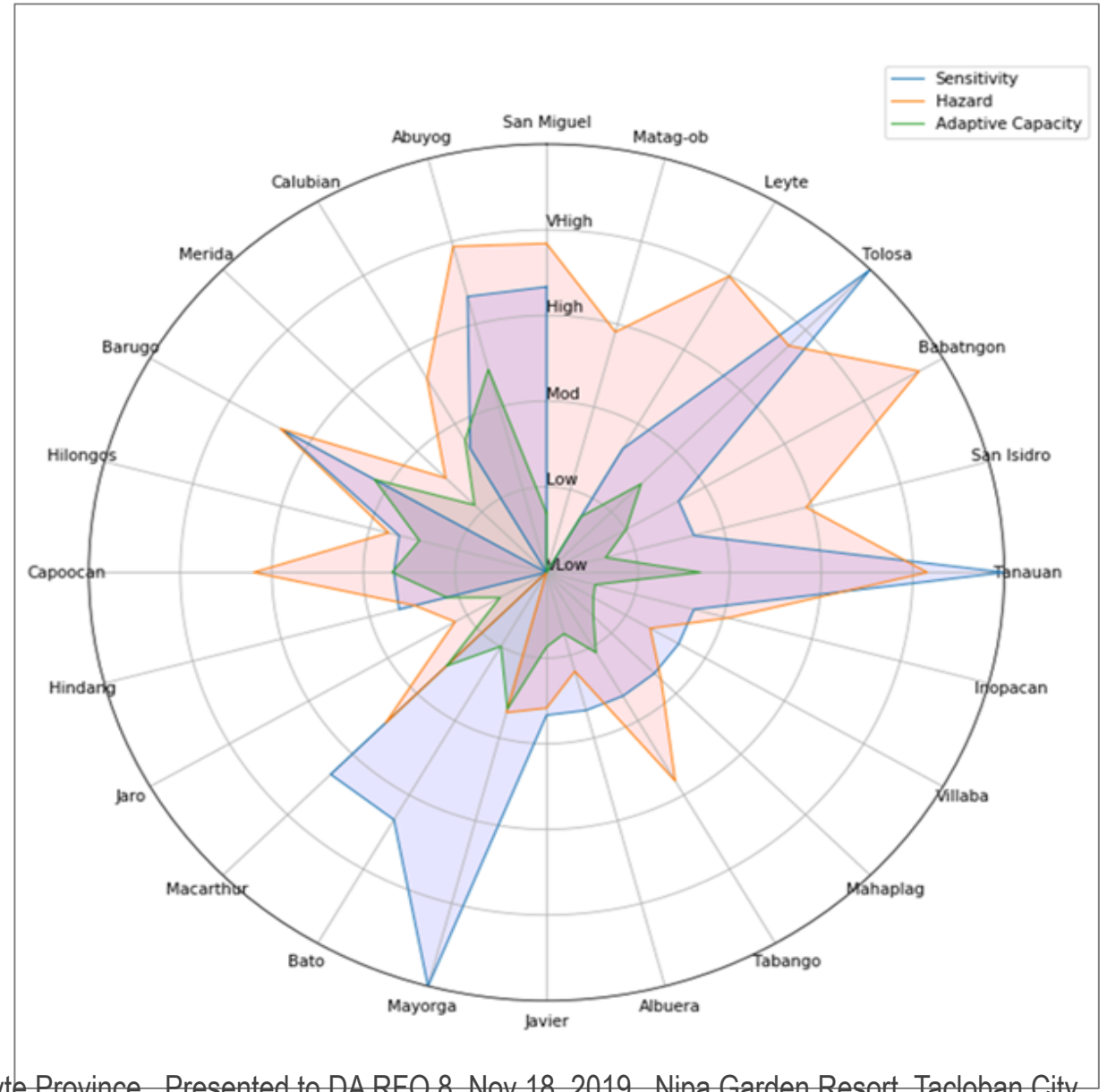


Radar Plot of the Vulnerability Components



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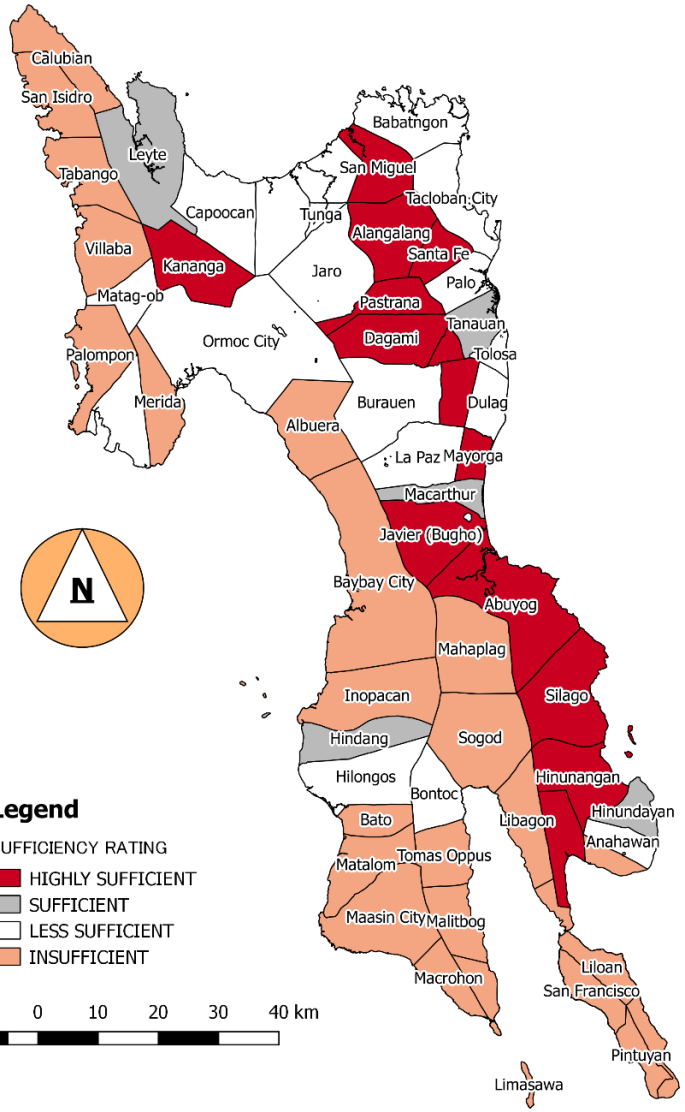
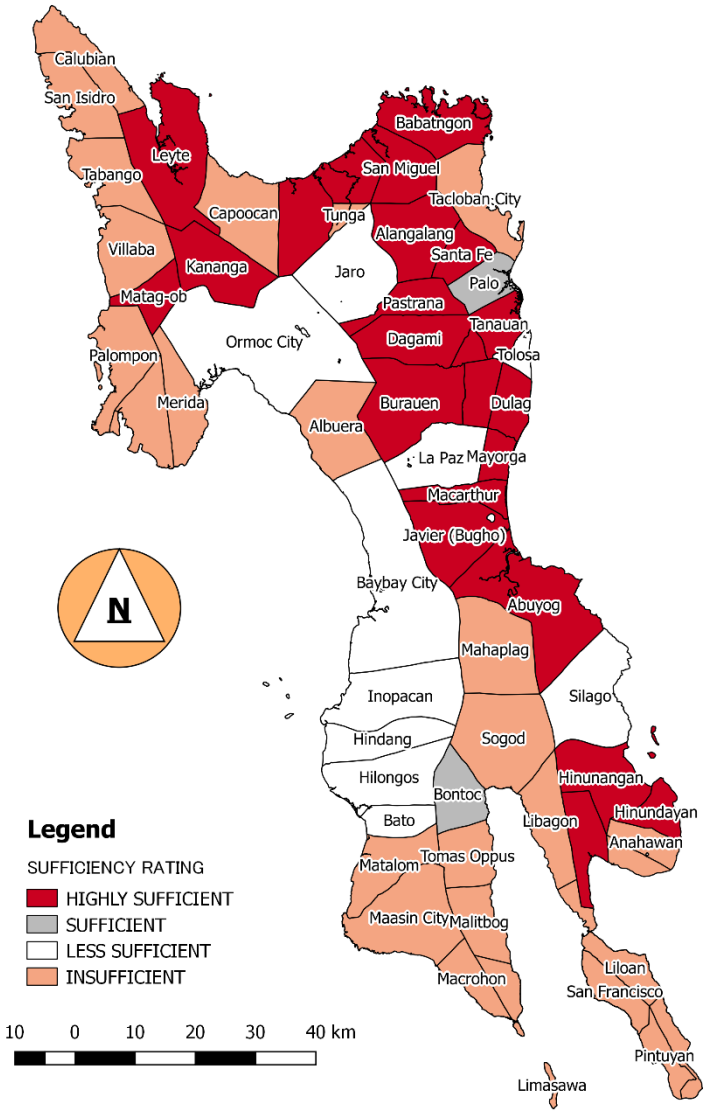
Rice Sufficiency Map per Municipality (2015)

LANDSAT 8 Satellite Image



Rice Sufficiency Map per Municipality (2015)

DA Production Data



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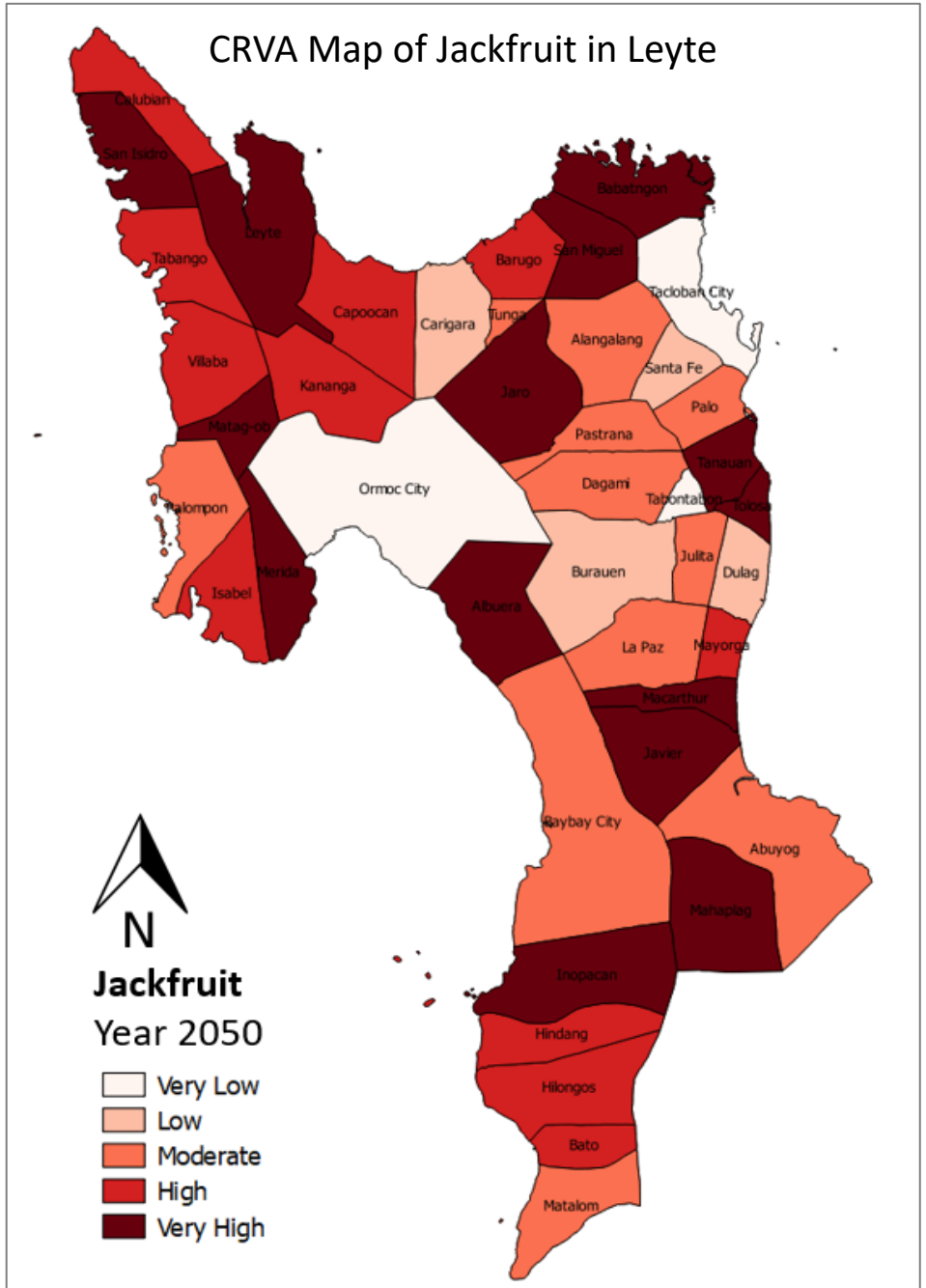
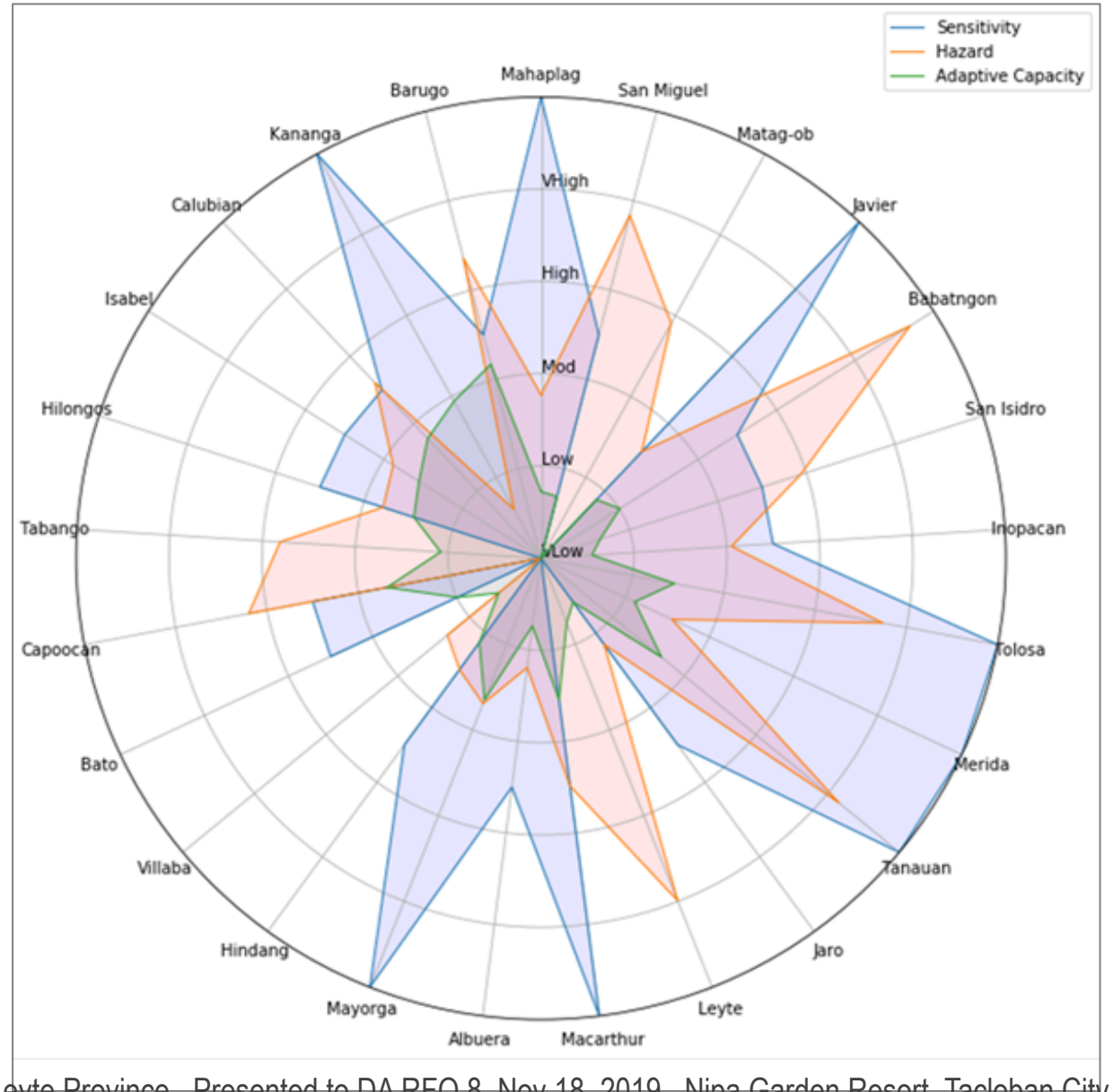
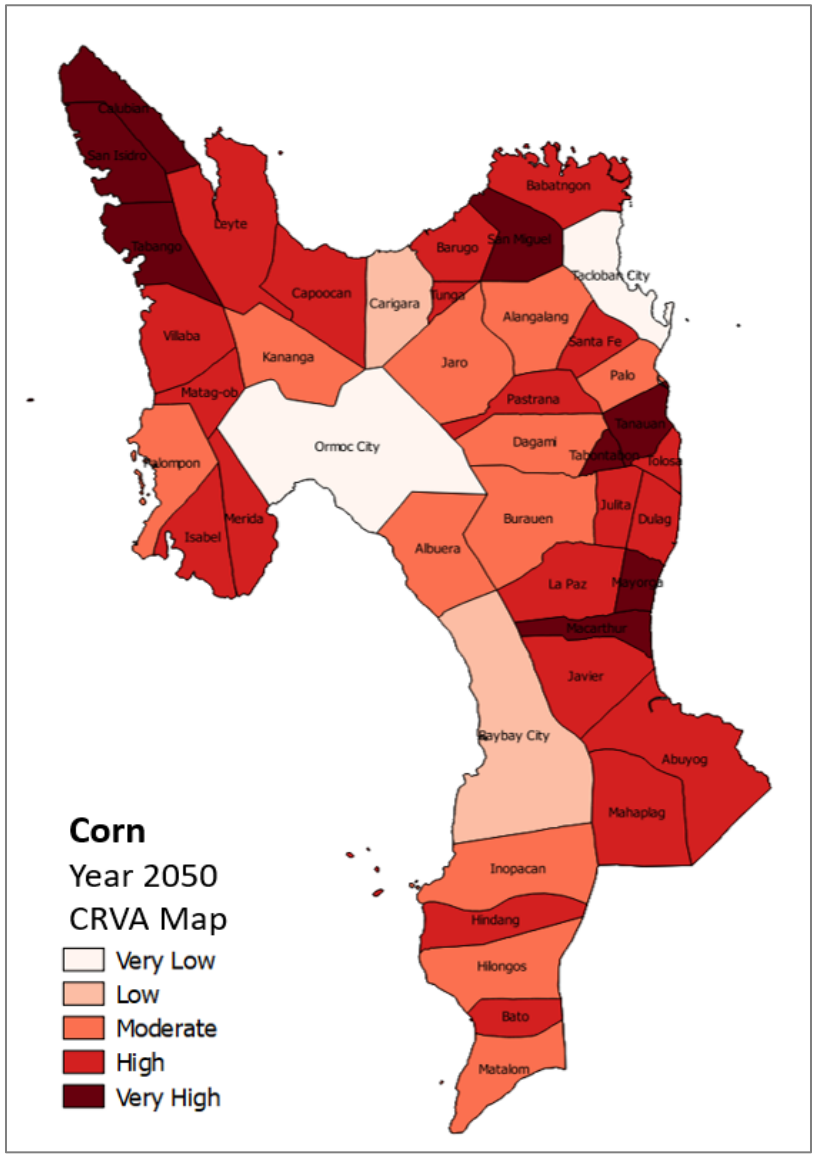
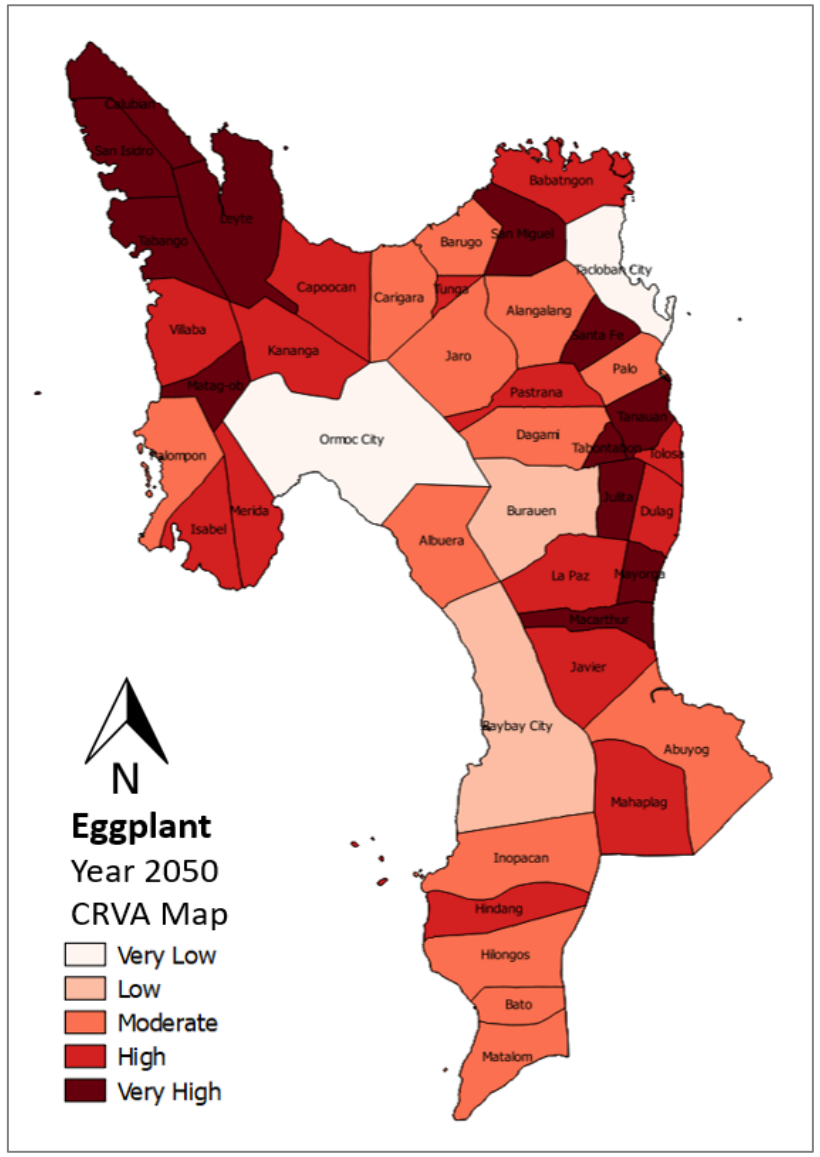


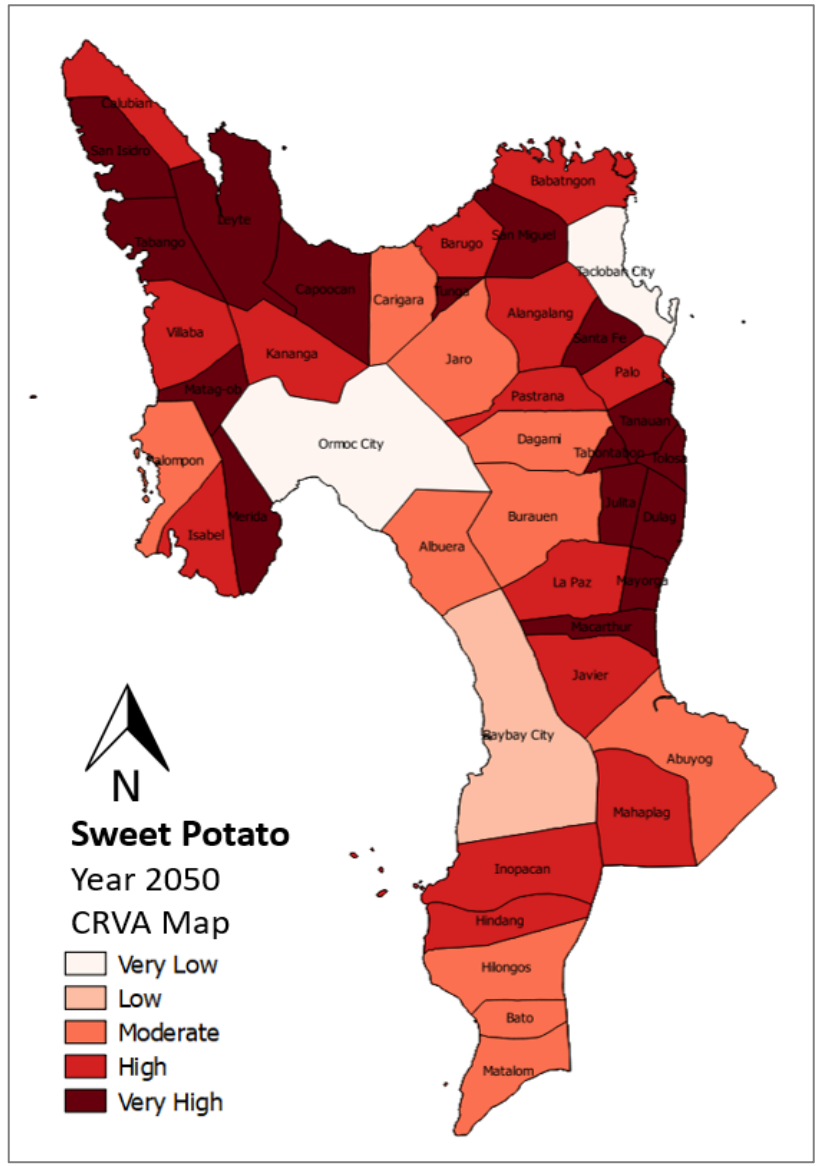
Radar Plot of Vulnerability Components



CRVA Maps of Corn Eggplant and Sweetpotato in Leyte Province







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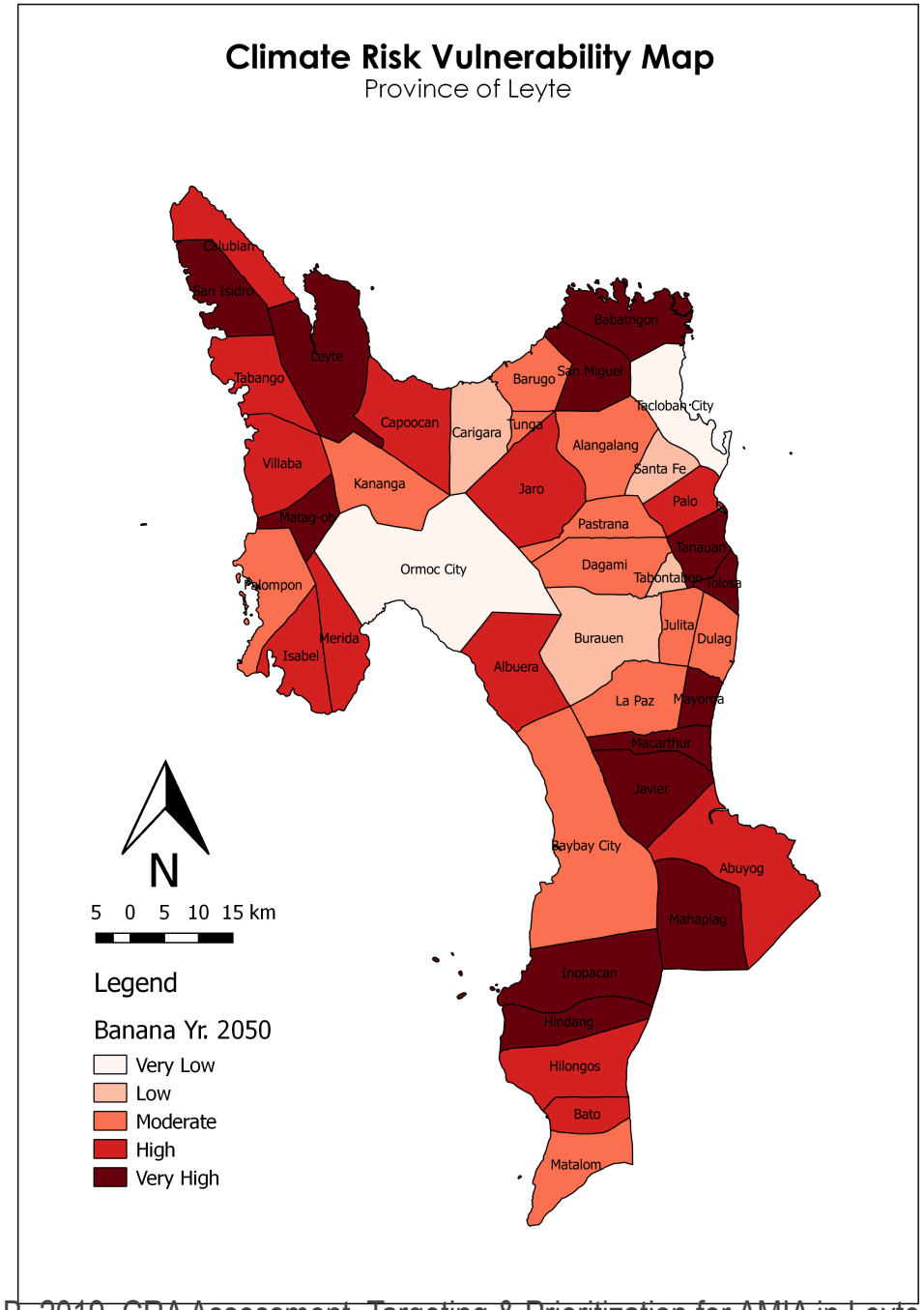
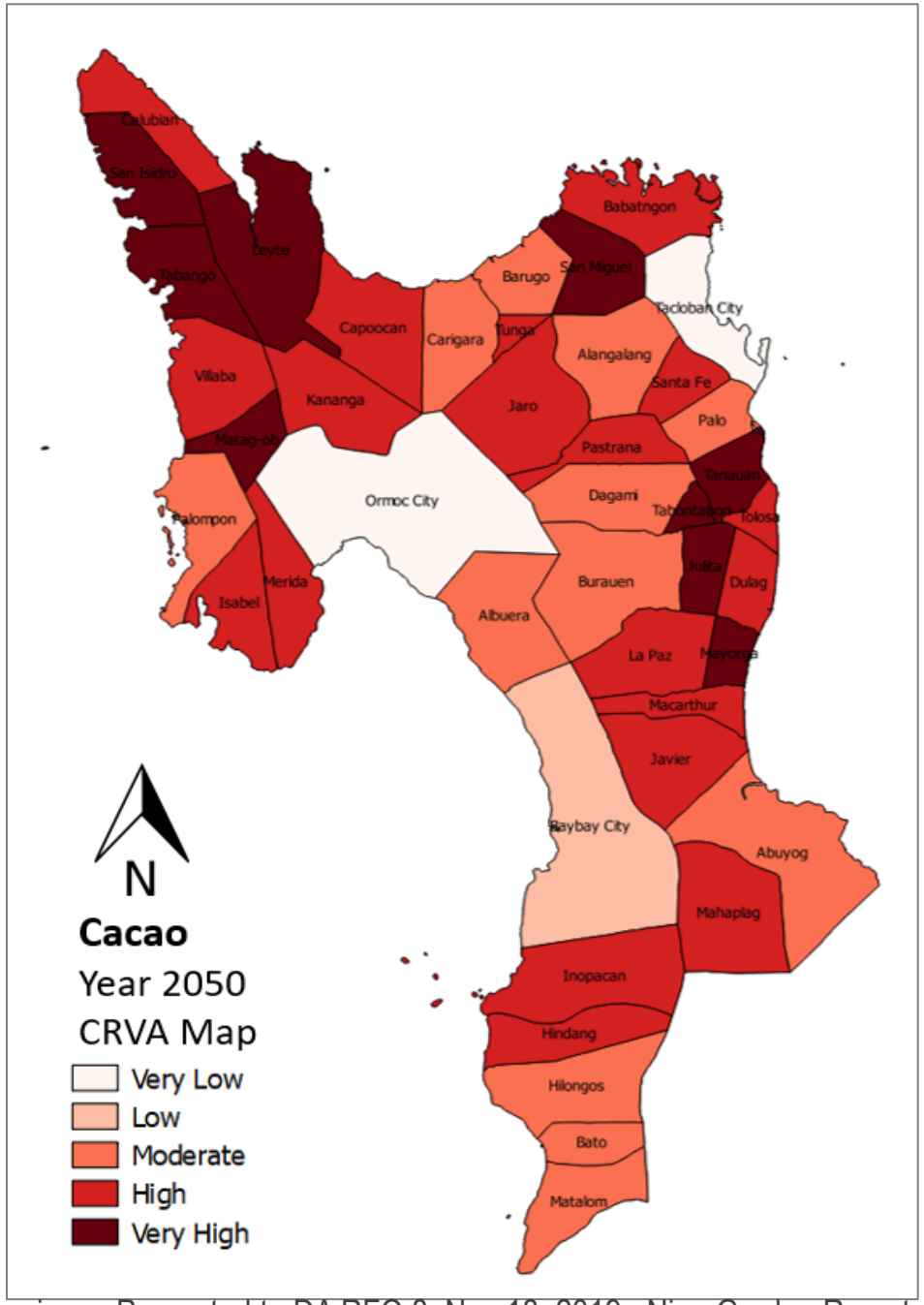

Climate Risk Vulnerability Map
Province of Leyte
Calubian
San Isidro
Leyte
Tabango
Capoocan
Villaba
Kananga
Matag-ob
Palompon
Merida
Isabel
Ormoc City
Carigara
Barugo
Babatngon
San Miguel
Tacloban City
Tunga
Alangalang
Santa Fe
Jaro
Palo
Pastrana
Tanauan
Dagami
Tabontabon
Tolosa
Julita
Dulag
Burauen
Albuera
La Paz
Mayorga
Macarthur
Javier
Baybay City
Abuyog
Mahaplag
Inopacan
Hindang
Hilongos
Bato
Matalom
N
5 0 5 10 15 km
Legend
Banana Yr. 2050
Very Low
Low
Moderate
High
Very High


Calubian
San Isidro
Leyte
Tabango
Capoocan
Villaba
Kananga
Matag-ob
Palompon
Merida
Isabel
Ormoc City
Carigara
Barugo
Babatngon
San Miguel
Tacloban City
Tunga
Alangalang
Santa Fe
Jaro
Palo
Pastrana
Tanauan
Dagami
Tabontabon
Tolosa
Julita
Dulag
Burauen
Albuera
La Paz
Mayorga
Macarthur
Javier
Baybay City
Abuyog
Mahaplag
Inopacan
Hindang
Hilongos
Bato
Matalom
N
Cacao
Year 2050
CRVA Map
Very Low
Low
Moderate
High
Very High

Pillars of Climate-Resilient Agriculture (CRA) Practices

PhilRootcrops

CRA is agriculture that sustainably…

Productivity

…increases the **productivity** and agricultural **incomes**

Adaptation

…enhances agricultural resilience (Climate Change **Adaptation**)

Mitigation

…reduces/removes GHGs emissions where possible **(Mitigation)**

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Top 10 widely adopted CRA practices in Leyte

PhilRootcrops

Rank	CRA PRACTICE	Survey Data (%)
1	Compost/ Vermicast application	72
2	Organic Agriculture Practices	67
3	Intercropping	65
4	Agroforestry	63
5	Mulching	58
6	Sloping Agricultural Land Technology (SALT)	58
7	Rice Ratooning	56
8	Use of Bio-pesticides	51
9	Use of Traditional cultivars/ varieties	44
10	Crop Switching	37

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cbatool.ciat.cgiar.org

CIAT

Cost benefit analysis tool for climate smart agricultural practices/technologies

Login Help

Online version of CBA tool
http://cbatool.ciat.cgiar.org/

CIAT

Introduction

Cost-Benefit Analysis (CBA) tool is used t
determine the **relative profitability**
alternative cropping practices, involving th
comparison of the annual flow
incremental net benefits with that
incremental costs

For more information, please contact
Ms. Lan Le (CIAT): l.le@cgiar.org

Start Login

CBA Tool was developed with funding from the International Fund for Agricultural Development (IFAD)
he CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) led by the
national Center for Tropical Agriculture (CIAT)"

Intro CBA concept.ppt

Show all

8:24 AM

Summary Farm-Level Analysis

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Indicator	Improved Production Practices of Jackfruit	Rice Ratooning
Capital Requirement (PhP)	46,154.35	50,670.00
Internal Rate of Return (IRR) (%)	79.55	187.24
Net Present Value (NPV) (PhP)	17,328.77	173,830.46
Payback Period (years)	4	2
Social IRR (%)	83.55	73.37
Social NPV (PhP)	100,134.02	88,109.77

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3 Pillars of Climate Resilient Agriculture (CRA)

IMPROVED PRODUCTION PRACTICE OF JACKFRUIT

(Artocarpus heterophyllus) In Leyte Province, Eastern Visayas Region

DESCRIPTION OF PRACTICE

Improved production practices of Jackfruit is a combination of practices in Techno Demonstration Project conducted at Mahaplag Leyte on top the existing conventional practice in the region. The improved practices for jackfruit production involve the usage of grafted *EVIARC Sweet* Jackfruit variety, standard planting distance (8m x 8m), trimming and pruning, bagging, ringweeding and application of fertilizers and pesticides. This involves application of *Metarhizium anisopliae* and tagging of fruits in addition to the previous common practices. The application of *Metarhizium anisopliae* eliminates detrimental insect pests and diseases damage while tagging of jackfruit improves the efficiency in monitoring of fruits and harvesting.

Impacts of improved jackfruit production practices

Productivity

The CRA Practice (Improved Jackfruit Production Practice) attained higher fruit yield than those of conventional or traditional one. On average, the annual production output of CRA adoptors is higher by 130% or five more fruits per tree than those of the non-cra growers.

Adaptation

Infestation of pests and diseases is known to escalate along with the increase in temperature. Since *Metarhizium anisopliae* drives out harmful pests, the crop becomes more adaptable to the adverse effects of climate change.

Mitigation

Improved jackfruit production practice improves output of jackfruit farmers. The application of *Metarhizium anisopliae* provides natural protection into the expected damage of fruits from detrimental insects that carries diseases, and harmful effects of inorganic chemicals that damages the environment and thereby contributes to climate change.

Cost-Benefit Analysis (CBA Highlights

Indicator	Without CRA	With CRA
Yield Per Has (Kg)	27,000.00	36,000.00
Yield Per Tree (no. of fruits)	15	20
Average weight of fruits (kg)	12	12
Revenue (In Php)	810,000.00	1,080,000.00

Note: Farm Gate Price/kg: Average -30 ; Maximum- 50 ; Minimum-20

Financial Indicator	Values
Net Present Value (NPV)	17,328.77
Internal Rate Value (NPV)	79.55%
Payback Period (PP)	4
Initial Investment (1 has)	Php 46,154.35 (USD 888.78)

Payback Period 4 years

Assumptions: Exchange rate- 51.93; Finacial period-12 years; Market interest rate 12%

Recommendation

Why invest?

Improvement of the conventional practice in jackfruit production is very important as this provide coping mechanism brought about by detrimental elements and also mitigation to climate change. The natural process of eliminating pests and diseases through the application of *Metarhizium anisopliae* can provide greater benefits to farmers and the environment. Meanwhile, the tagging systems provides efficient solution through effective monitoring system relative to production of fruits. Collectively, the improved practice increases income and profitability of jackfruit farmers through increase farm outputs and reduction in yield loss.

Cost Benefit Analysis

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Overview

Jackfruit (EVIARC Sweet variety) is considered a banner commodity in Eastern Visayas. Regarded as the sweetest jackfruit variety, the fruit attracted attention from consumer and farmers in the region creating strong demand for production. The island province is generally suitable for jackfruit production given its climate, geology, topography, land use and soil factors (Asio, V.B et al., 2011, unpublished). Currently, there are about 1,258 hectares of agricultural land planted with jackfruit in the region producing an average number of fruit per tree of15-30 annually. Regarded as nemesis of Jackfruit, Phytophthora is a disease carried by chrysomelid beetle, curculionid beetle, snout beetle, ponerinae ants (black), myrmecinae ants (red), tree hoppers, fruit borer, and mealy bug (Borines, L.M. et al., 2013). The disease causes the tree to inhibit canker lesions, yellowing, wilting and rotting. Meanwhile fruit borers attack the jackfruit in its early fruiting stage causing an estimated production loss of about 30%-40%.

Despite suitability of jackfruit to growing conditions, this crop faces several challenges both imposed by climate and damages caused by disease such as Phytophthora and fruit borers. In 2013, Super Typhoon Yolanda lambasted the region causing widespread devestation to agriculture including to jackfruit. In fact, Jackfruit farmers in Ormoc City recalled the enormous damage brought by the said typhoon. Then most of their planted jackfruit tree were toppled by strong winds.

Why the CRA practice is better than the conventional practice?

The application of *Metarhizium anisopliae* and tagging provide good advantages to jackfruit farmers. The application of *Metarhizium anisopliae* drives out harmful pests that carries diseases. Tagging improves production efficiency through effective monitoring of fruits. These two practices altogether contributes more output that is absent to the conventional jackfruit production practice.

The CRA Practice can replace:
1. Inorganic pesticide application

The CRA Practice uses:
1. *Metarhizium anisopliae*
2. Tags and proper record keeping

Current Adoption Rate
5%
in Mahaplag, Leyte, Eastern Visayas

Note: Reported adoption rate of the CRA practice inputs indicated above were based on rough estimation after site immersion and/or survey

Study Site

Data Gathering

Key Informant Interview

The CRA practice was selection based on the opinion of experts. Experts; i.e., professors from the Visayas State University and agriculturists from the Department of Agriculture (DA) Region in providing insights on emerging improved Jackfruit practices that can be considered climate-resilient. Ocular inspection and periodic field visits were done to validate the existing CRA practice. Identified crops and corresponding CRA practice were selected based on economic importance and potential for commercialization in the region.

Farmer Interview

16
Farmers Interview

Ormoc City and Mahaplag, Leyte

Cost-Benefit Analysis Results

The CRA practice requires an initial investment of PhP 46,154.35 per hectare (USD 888.76). An annual incremental cost of about PhP 7,000.00 (134 USD) was incurred from operation cost, service cost and input maintenance for adopting the CRA. Based on the CBA, the annual incremental benefit was estimated at PHP 255,048.00 (4911.40 USD). Then, based on this benefit an estimated payback period of 4 years was achieved based on the actual amount invested at the planned investment horizon. In addition, the estimated net present value (NPV) of the investment in 12 years is valued at PhP899,883.03 (17,328.77USD)

ASSUMPTIONS

Farm-level Analysis

Payback Period
4 years

Net Present Value
Php 899,888.03
(17, 328.77 USD)

Internal Rate of Return
79.55%

Social and Envi NPV
Php 100,134.02
(1,928.25 USD)

Social IRR
83.55%

Externalities
Reduced carbon emmision through reduction of inorganic pesticide application

Aggregate Analysis

Sensitivity Analysis

The CRA practice will still be profitable even with:

Farm Gate Price of Output = below 10-20 percent

Recommendations

Where & When?

Adopting the Improved Jackfruit Production practice is a profitable investment for jackfruit farmers. The CRA practice is best adopted during the fruiting stage of the crop. Generally, the CRA is feasible in suitable jackfruit growing areas in Eastern Visayas and in other parts of the country

What?

Improved Jackfruit Production practice provides great benefits to jackfruit farmers in Leyte and Eastern Visayas as a whole. Besides, providing EVIARC sweet jackfruit variety to the farmers, government agricultural agencies especially the provincial agriculture of Leyte should work on campaigning the use of *Metarhizium anisopliae* and tagging system for jackfruit. These can be done through farm visits of successful farms in Mahaplag, Leyte currently using the practice. Establishing a jackfruit demonstration farm employing the improved production practice in areas with large concentration of jackfruit farms should be done to ensure high adoption.

Who ?

Adoption of the CRA practice is both highly profitable for small scale and large scale operations for jackfruit production. However one limiting factor that concerned agencies must be taken cared of is to ensure sufficient supply and distribution of *Metarhizium anisopliae*. Efficient channels of distribution is through commercialization of the fungus as a viable option.

Loreto, A.B. 2019. CRA Assessment, Targeting & Prioritization for AMIA in Leyte Province. Presented to DA RFO 8, Nov 18, 2019, Nipa Garden Resort, Tacloban City

What are the other uses of the data?

CDRA process

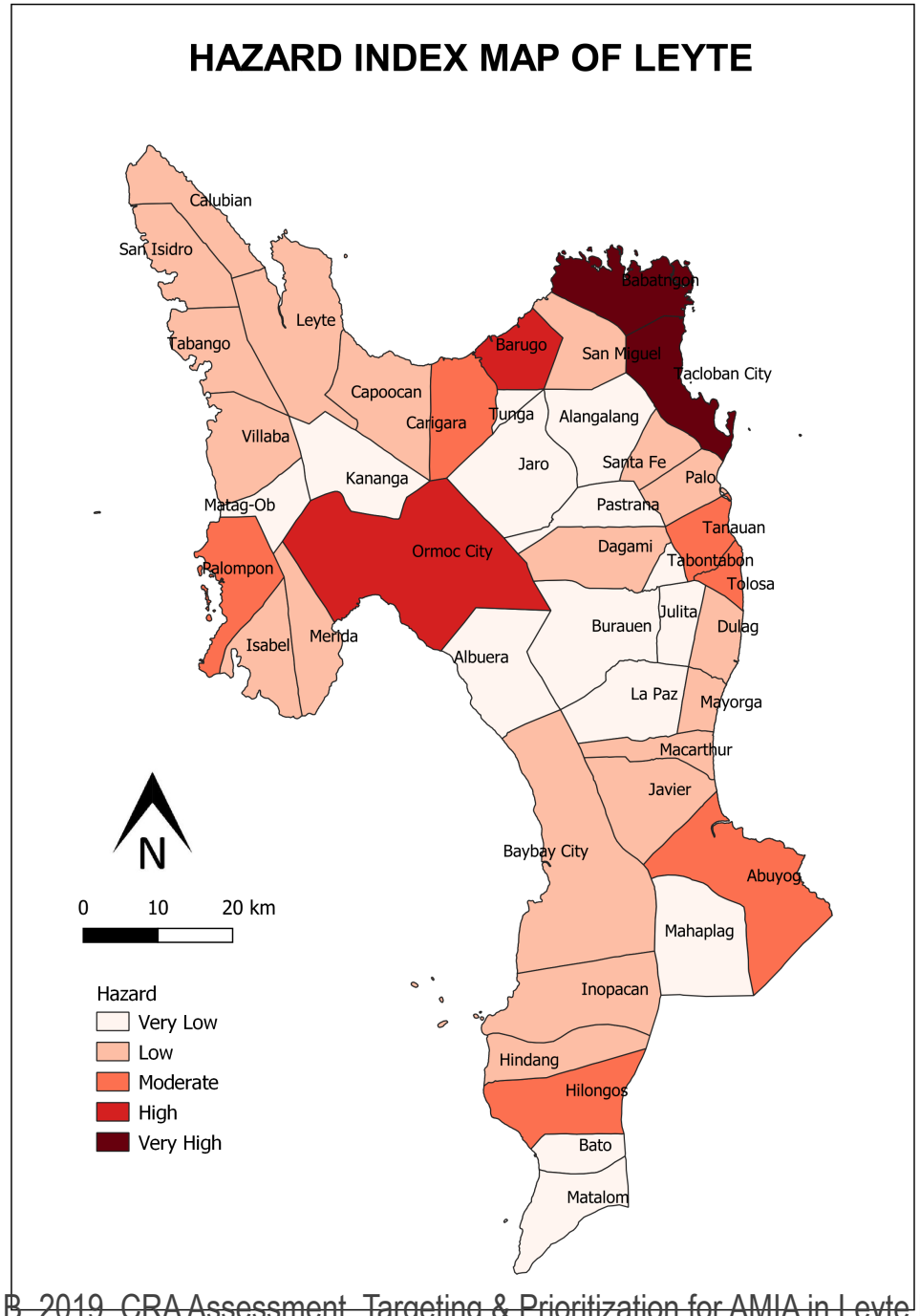
ANALYZE

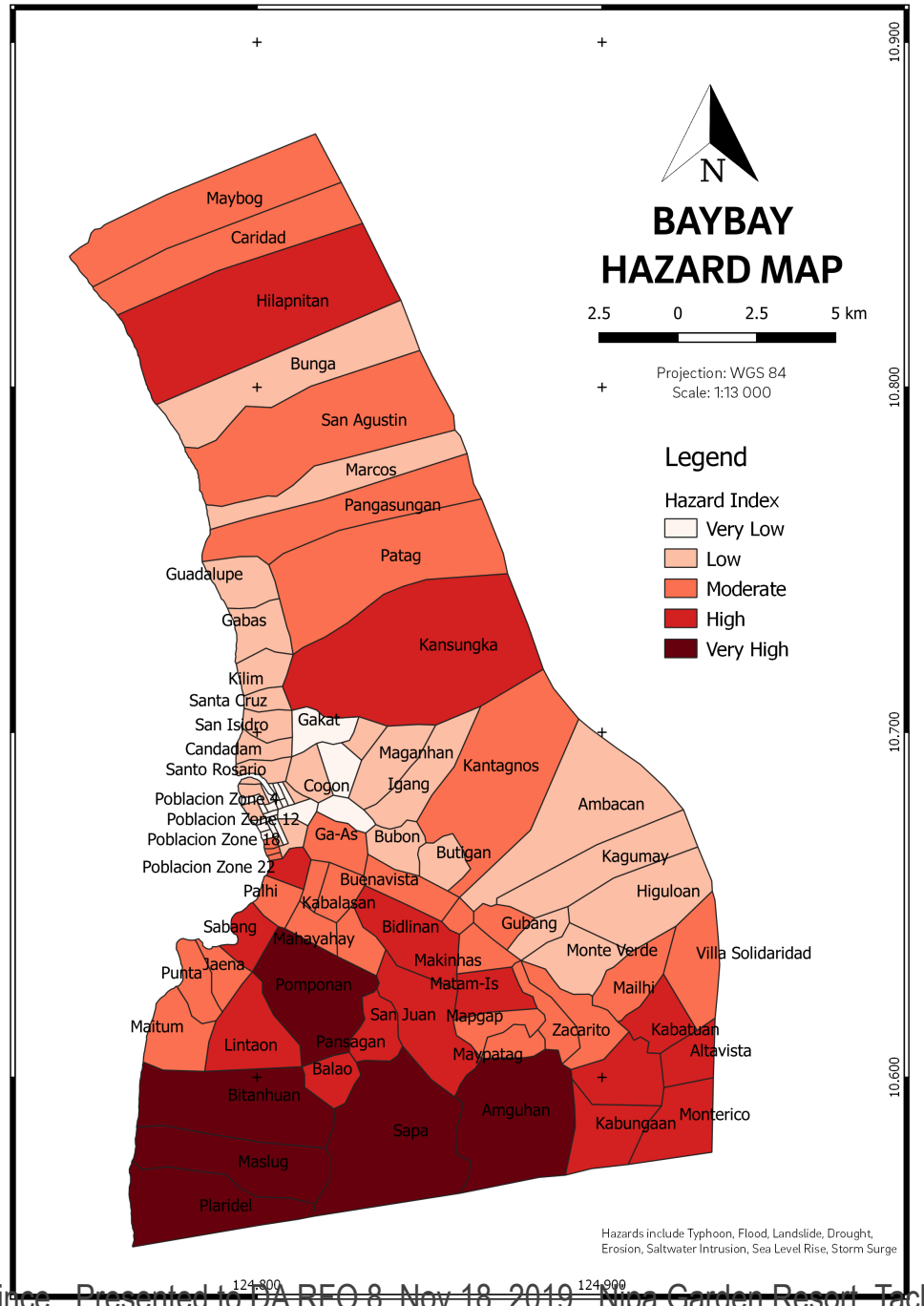
- Hazard
- Exposure
- Vulnerability/ sensitivity
- Adaptive capacities

Risks | Vulnerabilities

Exposed elements in an ECOSYSTEM (Forest, Agri, Urban, Coastal)

1. People
2. Urban areas
3. Agriculture, forestry and fishery production areas
4. Critical point facilities
5. Lifelines and other infrastructure


HAZARD INDEX MAP OF LEYTE
Calubian
San Isidro
Leyte
Tabango
Barugo
Babatngon
San Miguel
Tacloban City
Capoocan
Carigara
Tunga
Alangalang
Villaba
Jaro
Santa Fe
Palo
Kananga
Matag-Ob
Pastrana
Tanauan
Ormoc City
Dagami
Tabontabon
Palompon
Tolosa
Julita
Dulag
Burauen
Merida
Isabel
Albuera
La Paz
Mayorga
Macarthur
Javier
Baybay City
Abuyog
Mahaplag
Inopacan
Hindang
Hilongos
Bato
Matalom
N
0 10 20 km
Hazard
Very Low
Low
Moderate
High
Very High


BAYBAY
HAZARD MAP
N
2.5 0 2.5 5 km
Projection: WGS 84
Scale: 1:13 000
Legend
Hazard Index
Very Low
Low
Moderate
High
Very High
Maybog
Caridad
Hilapnitan
Bunga
San Agustin
Marcos
Pangasungan
Patag
Guadalupe
Gabas
Kansungka
Kilim
Santa Cruz
San Isidro
Gakat
Candadam
Santo Rosario
Maganhan
Kantagnos
Cogon
Igang
Ambacan
Poblacion Zone 4
Poblacion Zone 12
Poblacion Zone 18
Poblacion Zone 22
Ga-As
Bubon
Butigan
Kagumay
Palhi
Buenavista
Higuloan
Kabalasan
Sabang
Bidlinan
Gubang
Mahayahay
Monte Verde
Villa Solidaridad
Jaena
Punta
Makinnas
Matam-Is
Mailhi
Pomponan
San Juan
Mapgap
Maitum
Lintaon
Pansagan
Zacarito
Kabatuan
Maypatag
Altavista
Balao
Bitanhuan
Amguhan
Kabungaan
Monterico
Sapa
Maslug
Plaridel
Hazards include Typhoon, Flood, Landslide, Drought, Erosion, Saltwater Intrusion, Sea Level Rise, Storm Surge
10.900
10.800
10.700
10.600
124.800
124.900

ELEVATION Map

FLOOD Susceptibility Map

LANDSLIDE Susceptibility Map

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Climate and Disaster Risk Assessment (CDRA)

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Table 4. Hazard Susceptibility Inventory Matrix, Municipality of Baybay, Province of Leyte.

Barangay	Flood	Rain-Induced Landslide	Storm Surge	Drought	Sea Level Rise
A	B	C	D	E	F
Poblacion Zone 1-9	✓	✓	✓		✓
Palhi		✓	✓		
Hipusngo	✓	✓	✓		✓
Guadalupe	✓	✓	✓		✓
Gabas	✓	✓	✓		✓
Imelda	✓	✓	✓		
Sto. Rosario					
Maganhan		✓			
Kambonggan	✓	✓	✓		✓
Poblacion Zone 10	✓	✓			✓
Poblacion Zone 11	✓	✓	✓		
Poblacion Zone 12	✓	✓			
Poblacion Zone 13	✓	✓	✓		✓
Poblacion Zone 14	✓	✓	✓		✓
Poblacion Zone 15	✓	✓	✓		✓
Poblacion Zone 16	✓		✓		✓
Poblacion Zone 17		✓	✓		✓
Poblacion Zone 18		✓	✓		✓
Poblacion Zone 19		✓			
Poblacion Zone 20		✓	✓		

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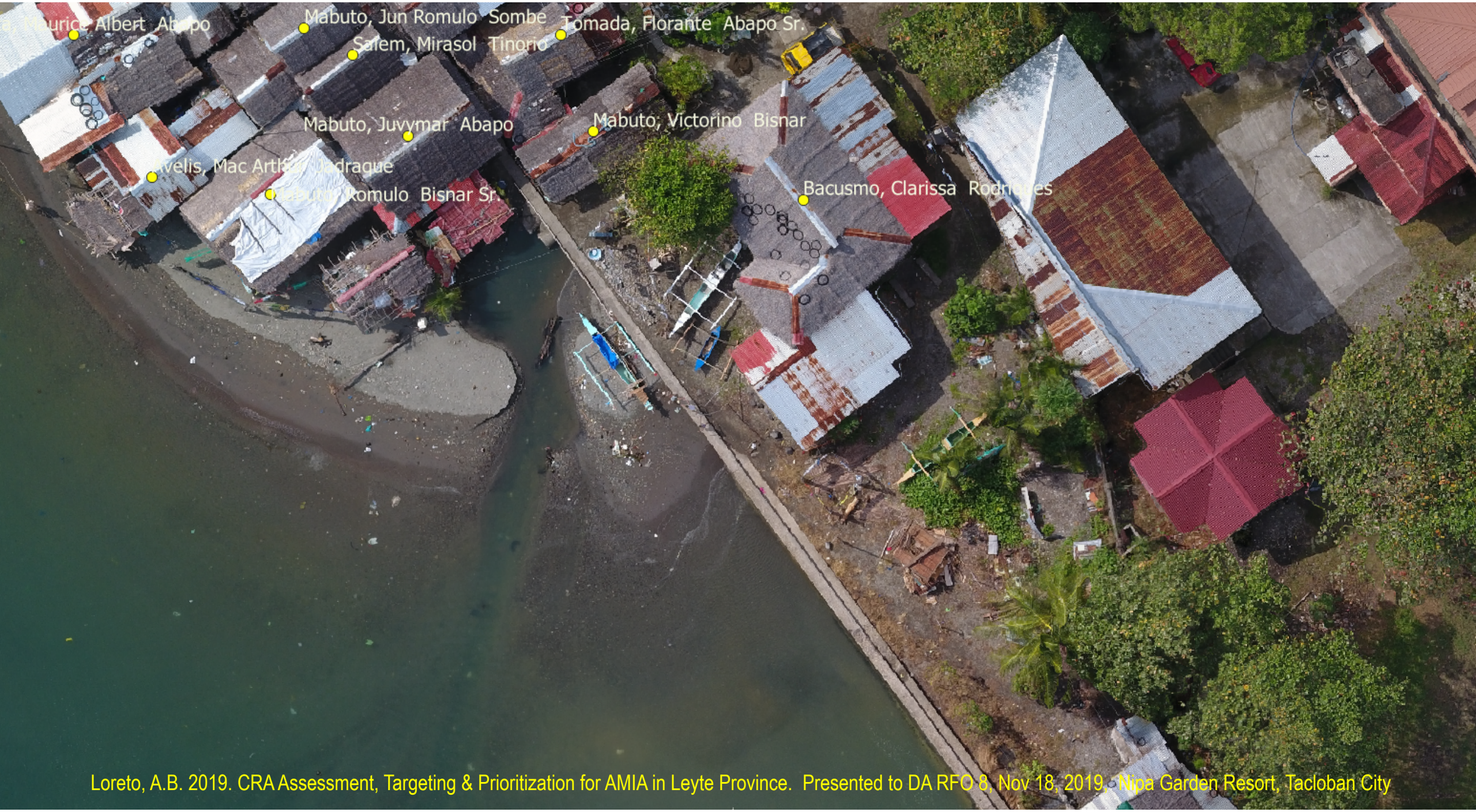

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Problems Met

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- Municipal and Barangay administrative boundaries do not conform to those known by the locals
- Some MAO and Technicians did not attend in the Crop Occurrence Workshops or submit the required data
- Changing geospatial modeling procedure by CIAT

Moving Forward . . .

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- Functional Climate Change & DRR Office
  - Climate Information System of the key production areas of important crops
  - AMIA results as basis in realigning programs in agriculture
    - Level of Analysis: Barangay level

- Entice participation of the LGU by providing them base maps that are useful for their extended CLUP and LCCAP

The VSU Project Team

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