Adaptation and Mitigation Initiative for Agriculture (AMIA)

Department of Agriculture Regional Field Office XII Koronadal City

Climate Risk Vulnerability Assessment (CRVA) Map for the Province of South **Cotabato Province** (Rice and Corn commodity)



Climate-Risk Vulnerability Assessment (CRVA) Framework





MAXENT OR MAXIMUM ENTROPY SPECIED DISTRIBUTION MODELING

🕌 Maximum Entropy Species Distribution Mo	deling, Version 3.4.1				_	-		×
Samples		_	Env	vironmental laye	rs			
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"Bio1" "Bio2" "Bio3" "Bio4" "Bio5" "Bio6" "Bio8" "Bio9" "Bio10" "Bio12" "Bio14" "Bio14" "Bio16" "Bio17"

remove these bioclim



Bio1 = Annual mean temperature

- Bio2 = Mean diurnal range
- Bio3 = Isothermality
- Bio4 = **Temperature seasonality**
- Bio5 = Maximum temperature of warmest month
- Bio6 = Minimum temperature of coldest month
- Bio7 = **Temperature annual range**
- Bio8 = Mean temperature of wettest quarter
- Bio9 = Mean temperature of driest quarter
- Bio10 = Mean temperature of warmest quarter
- Bio11 = Mean temperature of coldest quarter



- Bio12 = Annual precipitation
- Bio13 = Precipitation of wettest month
- Bio14 = **Precipitation of driest month**
- Bio15 = Precipitation seasonality
- 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

- **SDM** evaluates the association between environmental variables and known species occurrence, and uses that information to identify space where populations could potentially occur
- SDM is also known as <u>environment niche model</u>, <u>habitat model</u>, <u>predictive habitat distribution</u> <u>model</u>, <u>range mapping model</u> to predict the distribution of species across geographic space and time using environmental data
- There are several implementations of SDMs: depends on the nature of your data Presence-Absence or Presence-Only data
- Careful selection of environmental variables Overfitting, Bias, Collinearity

Data Collection (Workshops):





Fishnet of 1km x 1km aligned to climate grid Other features included as reference



Staff from Local Government Units Agricultural Department







DATA AND MATERIALS NEEDED TO RUN MAXENT SDM

- 1. Data on crop occurrences
- 2. Climate data (baseline and future)
- 3. GIS Software (QGIS preferably)
- 4. Maxent + Java Runtime Environment
- 5. Admin boundary aggregate result





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 Image © 2020 Maxar Technologies
 image © 2020 CNES v Arbus

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Google Earth

Imagery Date: 9/17/2019 6º26'23.12" N 124º26'38.39" E elev 712 m eye at 38.79 km 🔘

Sensitivity index



Municipal	Maismean	Sens_Norm
Bagumbavan	-3.249178253579880	0.00
Columbio	24.621767871448200	-0.25
Esperanza	-6.719284586297040	0.25
Isulan	-17.340265623720200	0.25
Kalamansig	-37.732436249879200	0.50
Lambayong	-24.326800685233700	0.25
Lebak	-1.287907914225780	0.00
Lutayan	-16.622485139966000	0.25
Palimbang	-4.874474546317830	0.00
Pres. E. Quirino	-25.521273173936900	0.50
Sen. Ninoy Aquino	-22.469199350322300	0.25
Tacurong City	-13.423943605596900	0.25

PROVINCE OF SOUTH COTABATO (SENSITIVITY MAP)





Climate-Risk Vulnerability Assessment (CRVA)



Generating Hazard Index

|-----Hazards (Folder)

|-----CB_Cyclone_norm.tif

|-----CB_Drought_norm.tif

|-----CB_Flood_norm.tif

|-----CB_Landslide_norm.tif

|-----CB_SaltWaterIntrusion_norm.tif

|-----CB_SeaLevelRise_norm.tif

|-----CB_SoilErosion.tif

|-----CB_StormSurge.tif

Exposure II: Biophysical Data on Natural Hazards

Exposure II: Biophysical Indicators (climate-related pressures)



Exposure II also known as **Exposure from Hazards**, is one of the components of the CRVA Framework.

- □ It comprises the **Biophysical Indicators** (climate-related pressure) such as tropical cyclones, flooding, landslide, drought, erosion, salt water intrusion, sea level rise and storm surge.
- By assigning different weights for each hazard with respect to the three island groups in the Philippines, the Hazard Index will be generated.

Exposure II: Assign hazard weights – done with experts

Weights (%) →								
Criteria	Typhoon	Flooding	Drought	Erosion	Landslide	Storm Surge	Sea Level Rise	Salt Water Intrusion
Probability of Occurrence								
Impact to Nat'l Economy								
Impact to Food Security of the Country								
Impact to Local Household Income								
Impact to Key Natural Resources to Sustain Productivity (i.e., water quality & quantity, biodiversity, soil fertility)								

Weighting the natural hazards into a climate risk exposure

Probability of occurrence: $\{ \underline{5} = \text{ once in every year,} \\ \underline{3} = \text{ once in every 5 years,} \\ \underline{1} = \text{ once every 10 years or less} \}$

Impact: { 5 = Disastrous, 4 = Significant, 3 = Moderate 2 = Minor 1 = Insignificant}

Exposure II: Assign hazard weights – done with experts

		Ту	phoon				D	rought				E	rosion		
Critoria	Expert	Expert	Expert	Expert	Ave	Expert	Expert	Expert	Expert	Ave	Expert	Expert	Expert	Expert	Ave
Chiena	1	2	3	4	-	1	2	3	4		1	2	3	4	
Probability of Occurrence	5	5	5	5	5	3	3	3	3	3	3	5	3	3	<mark>3.50</mark>
Impact to National Economy	3	4	5	4	4	3	4	2	1	2.50	3	3	3	2	<mark>2.75</mark>
Impact To Food Security of the Country	3	5	4	4	4	3	4	2	1	2.50	3	3	2	1	2.25
Impact to Local Household Income	5	4	4	5	4.50	5	4	2	3	3.50	2	3	3	4	3
Impact to Key Natural Resources to Sustain Productivity (i.e., water quality & quantity.	4	4	5	4	4.25	4	3	2	3	3	2	3	3	4	3
Criteria			Typhoo	on Drou	ıght	Erosion	Lands	lide Sto	orm Surge	e Se	a Level R	ise Salt	twater In	t.	
Probability of Occurrence				5.00	3.00) 3.	50	3.50	1.	00		1.00	1	.00	
Impact to National Economy				4.00	2.50) 2.	75	3.00	1.	00		1.00	1	.00	
Impact To Food Security of the C	Country			4.00	2.50) 2.	25	2.25	1.	00		1.00	1	.00	
Impact to Local Household Incor	ne			4.50	3.50) 3.	00	3.00	1.	00		1.00	1	.00	
Impact to Key Natural Resources Productivity (i.e., water quality &	s to Sustai & quantity	in /,		4 25	2.00		00	2.25	1	00		1 00	1	00	
			-	4.23 1 75	3.UU) 3. 14	50 50	3.23		00		1.00		.00	
Hazard Weights			2	6 03 6 03	17.00	14.	96	18 58	5.	10		5.00 6 10	5	10 1	00.75
			2	0.55	17.30	· · · ·	50	10.00	0.	1.7		0.19	0	.1.5	00.00

Exposure II: Hazards Weights by Island Group

HAZARDS

□ Different degree

- □ Intensity and frequency
- Potential damage

ISLAND GROUPS

Unique in terms of exposure to hazards

□ Rainfall pattern

□ Land form

□ Crop distribution

Hazards		Island Group	
	Luzon	Visayas	Mindanao
Tropical Cyclones	20.00	18.21	16.95
Flood	19.05	16.40	15.25
Landslide	8.57	10.72	14.41
Erosion	11.43	12.57	12.71
Drought	14.25	16.17	16.95
Saltwater Intrusion	11.43	7.21	10.17
Sea Level Rise	5.71	8.33	5.08
Storm Surge	9.52	10.39	8.48

Exposure II: Biophysical Data on Natural Hazards



Tropical Cyclones x 16.95



Flood x 15.25



Landslide x 14.41



Drought x 12.71



Erosion x 16.95



Salt Water Intrusion x 10.17



Sea Level Rise x 5.08



Storm Surge x 8.48



Hazard Index <u>"Exposure from hazards"</u>

LANDSLIDE



TROPICAL CYCLONE

HAZARDS

Mun_Name	TC_Norm	Fld_norm	LS_norm	Ero_norm	Drt_norm	SWI_norm	SLR_norm	SS_norm	Haz_Index	Hazard_norm
BANGA	0.00	0.76	0.26	0.64	0.23	0.00	0.00	0.00	27.37	0.37
GENERAL SANTOS CITY	0.00	0.05	0.68	0.77	1.00	0.00	1.00	1.00	50.86	1.00
KORONADAL CITY	0.00	0.48	0.55	0.42	0.25	0.00	0.00	0.00	24.82	0.31
NORALA	0.00	0.80	0.24	0.44	0.02	0.00	0.00	0.00	21.59	0.22
POLOMOLOK	0.00	0.03	0.59	1.00	0.46	0.00	0.00	0.00	29.47	0.43
SURALLAH	0.00	0.48	0.54	0.49	0.51	0.00	0.00	0.00	29.97	0.44
TAMPAKAN	0.00	0.13	0.86	0.71	0.14	0.00	0.00	0.00	25.77	0.33
TANTANGAN	0.00	0.30	0.55	0.07	0.00	0.00	0.00	0.00	13.39	0.00
T'BOLI	0.00	0.02	1.00	0.94	0.39	0.00	0.00	0.00	33.27	0.53
TUPI	0.00	0.01	0.81	0.76	0.42	0.00	0.00	0.00	28.60	0.41
SANTO NIÑO	0.00	1.00	0.00	0.00	0.02	0.00	0.00	0.00	15.59	0.06
LAKE SEBU	0.00	0.00	0.91	0.73	0.22	0.00	0.00	0.00	26.12	0.34
1st 2nd 3rd										

PROVINCE OF SOUTH COTABATO (HAZARD MAP)



PROVINCE OF SOUTH COTABATO (HAZARD MAP)





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Mun_Name	Eco_Nor m	Nat_Nor m	Soc_Nor m	Human_N orm	Health_N or	Phy_Nor m	Ant_Nor m	Ins_Norm	AC_Norm	1AC_Nor m
BANGA	0.17	0.00	0.78	0.00	0.12	0.43	0.58	0.09	0.05	0.95
GENERAL SANTOS CITY	1.00	0.31	0.00	1.00	1.00	0.84	0.67	0.29	1.00	0.00
KORONADAL CITY	0.89	0.79	0.10	0.99	0.60	0.34	0.55	0.00	0.72	0.28
NORALA	0.17	0.48	0.21	0.35	0.17	0.79	0.35	0.28	0.25	0.75
POLOMOLOK	0.55	0.21	0.12	0.33	0.33	1.00	0.62	1.00	0.70	0.30
SURALLAH	0.33	1.00	0.91	0.27	0.26	0.64	0.16	0.29	0.59	0.41
TAMPAKAN	0.27	0.13	0.49	0.26	0.06	0.00	0.55	0.71	0.15	0.85
TANTANGAN	0.27	0.54	0.79	0.14	0.14	0.24	0.53	0.11	0.25	0.75
T'BOLI	0.22	0.52	0.38	0.44	0.00	0.41	1.00	0.43	0.45	0.55
ТИРІ	0.21	0.27	0.10	0.11	0.01	0.72	0.51	0.20	0.05	0.95
SANTO NIÑO	0.32	0.21	1.00	0.11	0.17	0.98	0.00	0.33	0.36	0.64
LAKE SEBU	0.00	0.28	0.20	0.22	0.11	0.70	0.29	0.20	0.00	1.00
1st										
2nd										
3rd										

Step by Step: Generating Hazard Index

Step 1: Zonal Statistics

Step 2: Normalize Hazard values

$$X_n = \frac{(X - Xmin)}{(Xmax - Xmin)}$$

Step 3: Apply Hazard Weights and Generate Hazard Index

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Step 4: Normalize Hazard Index

$$X_n = \frac{(X - Xmin)}{(Xmax - Xmin)}$$

PROVINCE OF SOUTH COTABATO (ADAPTIVE CAPACITY)



PROVINCE OF SOUTH COTABATO (ADAPTIVE CAPACITY)







Climate-Risk Vulnerability Assessment (CRVA) Framework



CORN COMMODI TY

Mun_Name	Corn_V1_ Norm	Corn_V2_ Norm	Corn_V3_ Norm
BANGA	0.85	0.64	0.59
GENERAL SANTOS CITY	0.00	0.20	0.34
KORONADAL CITY	0.15	0.00	0.00
NORALA	0.60	0.36	0.32
POLOMOLOK	0.19	0.09	0.12
SURALLAH	0.31	0.20	0.22
TAMPAKAN	0.84	0.86	0.88
TANTANGAN	0.56	0.20	0.12
T'BOLI	0.57	0.73	0.80
TUPI	0.85	0.66	0.61
SANTO NIÑO	0.46	0.14	0.10
LAKE SEBU	1.00	1.00	1.00
1st 2nd 3rd			









PROVINCE OF SOUTH COTABATO (VULNERABILITY MAP)



PROVINCE OF SOUTH COTABATO (VULNERABILITY MAP) Vulnerability Classes TANTANSAN Very Low NORAEA Low. Moderate KORONADAL CITY CANPILLON SANTO NERO III High Wery High 152 SURALLAH POROMOLOGI 142 5201 1931 GENERAL SANTOS CITY VARIATION 3 Sensitivity Index = 33% Hazard Index = 33% Adaptive Capacity = 33%

RICE







Mun_Name	Rice_V1_norm	Rice_V2_norm	Rice_V3_norm	
BANGA	0.95	0.99	0.99	
GENERAL SANTOS CITY	0.00	0.75	0.86	
KORONADAL CITY	0.15	0.64	0.70	
NORALA	0.68	0.84	0.85	
POLOMOLOK	0.20	0.69	0.76	
SURALLAH	0.33	0.75	0.80	
TAMPAKAN	0.82	0.93	0.93	
TANTANGAN	0.12	0.00	0.00	
T'BOLI	0.52	0.85	0.90	
TUPI	0.97	1.00	1.00	
SANTO NIÑO	0.52	0.71	0.74	
LAKE SEBU	1.00	1.00	0.99	
1st				
2nd				
3rd				



PROVINCE OF SOUTH COTABATO (SENSITIVITY MAP FOR RICE COMMODITY)



