



# Why Disasters Happen?

*Dexter S. Lo*

(1) Disaster Risk

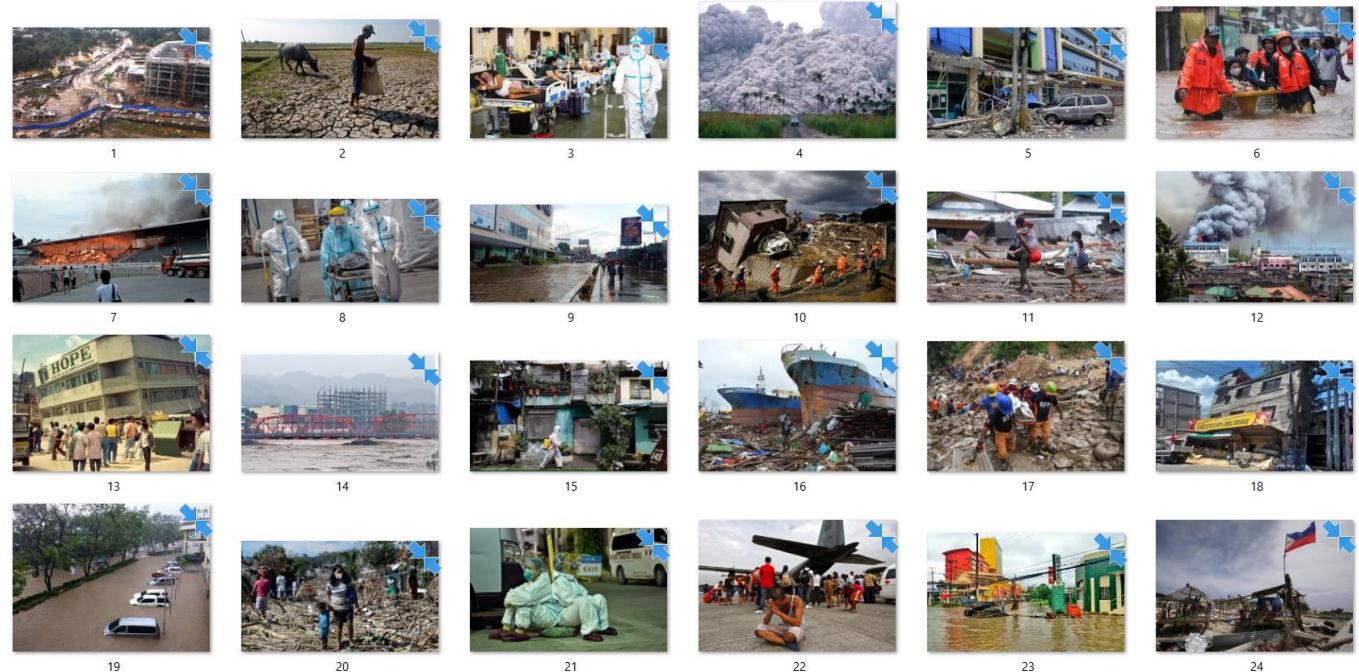
(2) Systems Thinking

(3) Resilience









Choose a picture  
that strikes you  
the most.  
Describe it.





1



2



3



4



5



6



7



8



9



10



11



12



13



14



15



16



17



18



19



20



21



22



23



24

*Is this...*  
**Hazardous?**  
**Exposed?**  
**Vulnerable?**  
**At Risk?**





*Is this...*  
**Hazardous?**  
**Exposed?**  
**Vulnerable?**  
**At Risk?**

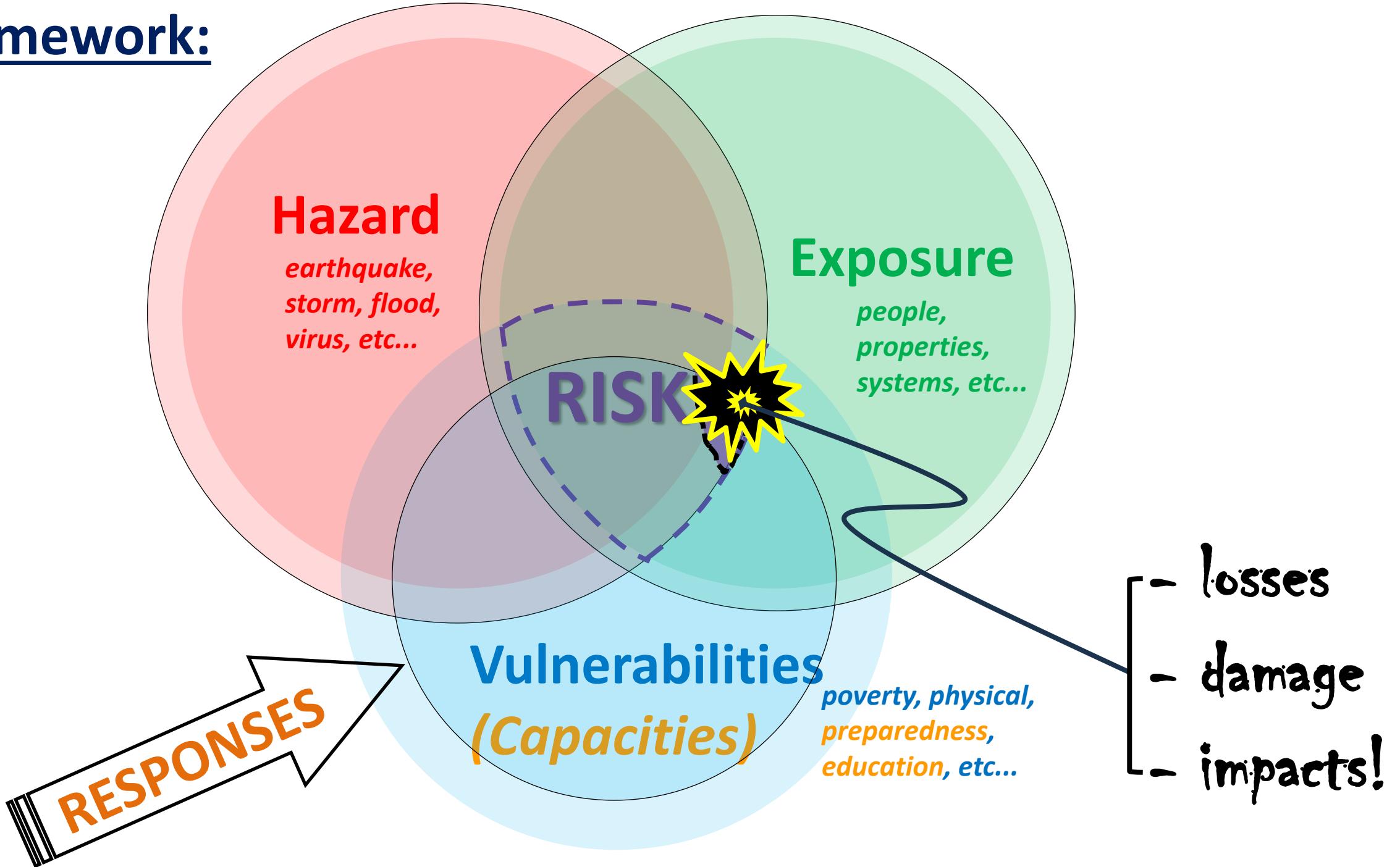
*Is this...*  
**Hazardous?**  
**Exposed?**  
**Vulnerable?**  
**At Risk?**

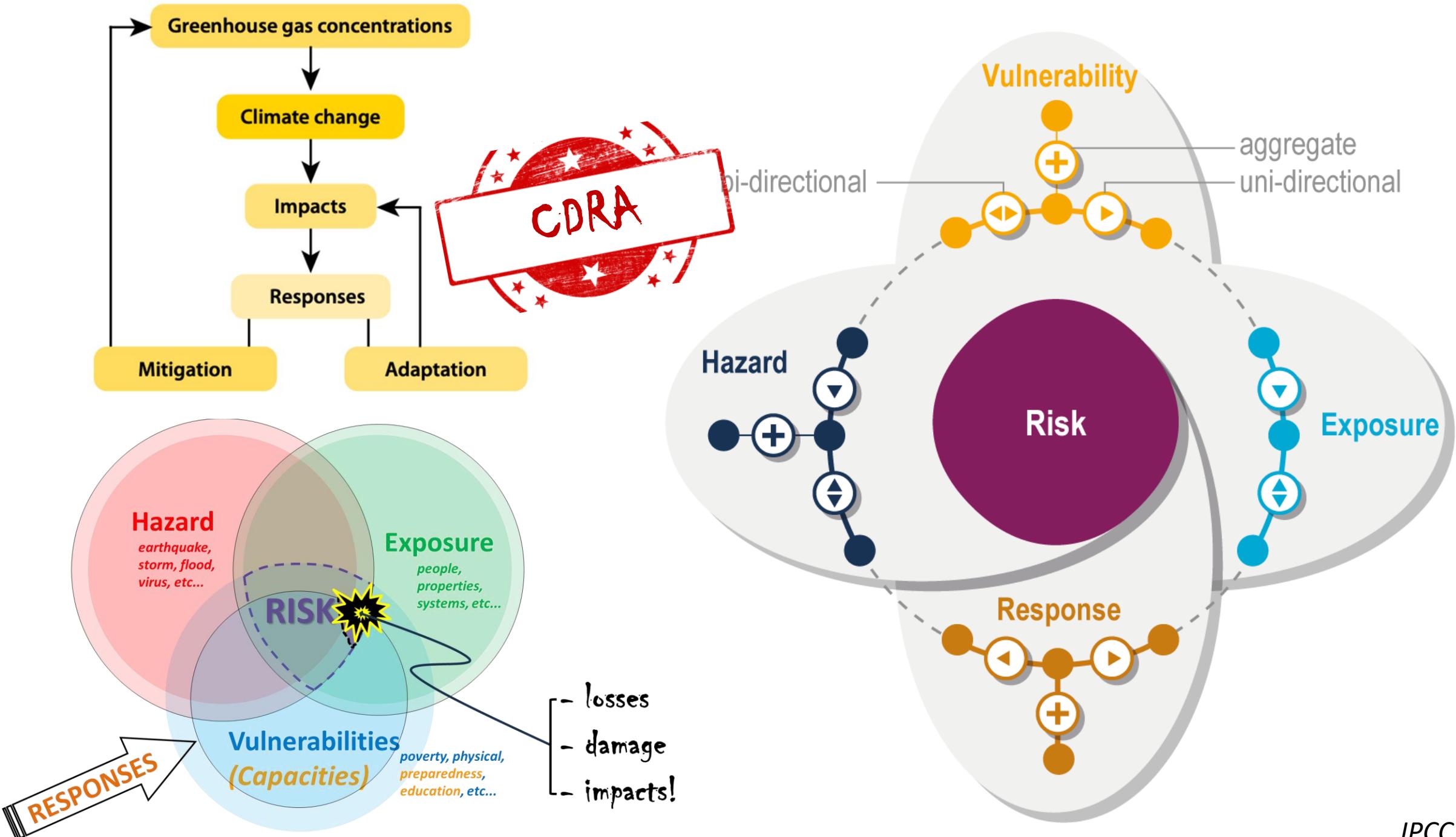


# *Why disasters happen?*

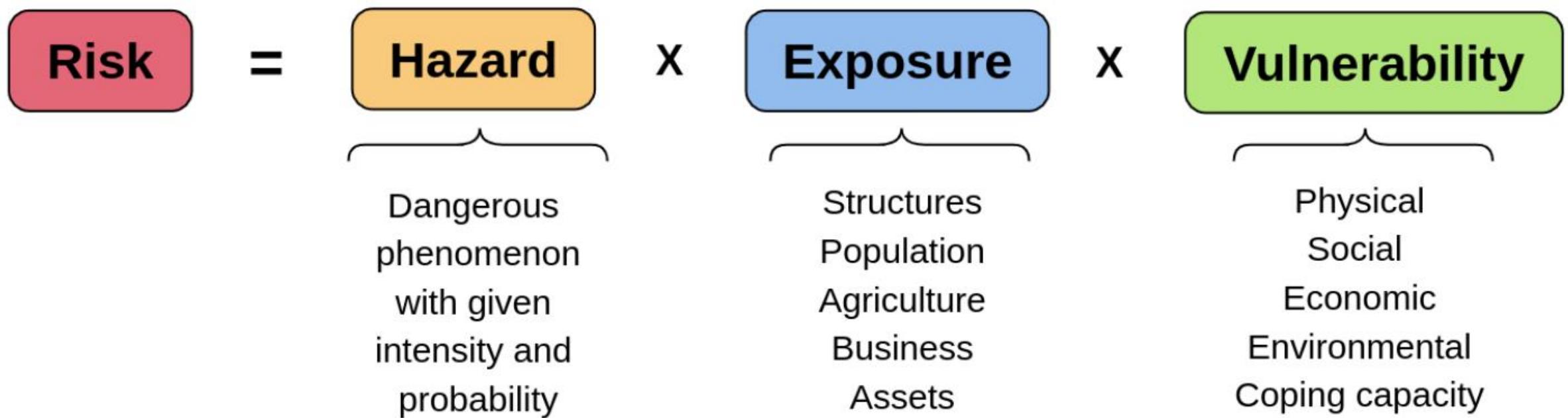


# Framework:

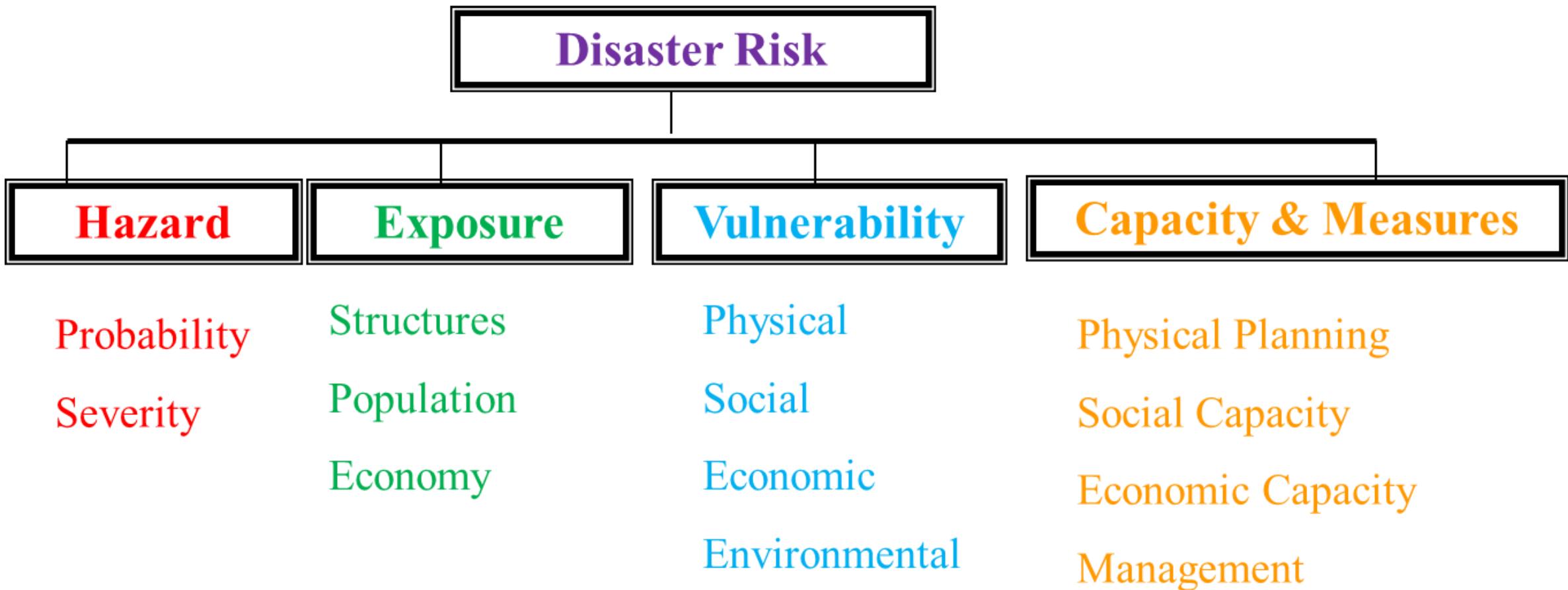




# Disaster Risk is a **complex interplay** of several factors...



# Disaster Risk is a **complex interplay** of several factors...



# Unpacking HEV

## Hazard

***Process, Phenomenon or Human Activity / Natural or Human-Induced Physical Event***

Typhoon  
Rainfall  
Temperature/ Drought  
El Niño/ La Niña  
Flooding  
Sea Level Rise/ Storm Surge  
Earthquake  
EQ-Induced Landslide  
Rainfall-Induced Landslide  
Volcanic Eruption  
Tsunami  
Terrorism/ Conflict  
Pandemic

## Exposure

***Elements at risk***

**Who and What will be affected?**

People  
Buildings  
Ecosystems  
Industrial Facilities  
Government Facilities  
Factors of Production  
(e.g., raw material, supply chain)

## Vulnerability

***Why the Elements at risk will be affected?***

**Characteristics or condition of exposed elements based on the following:**

### **Physical**

e.g., structure- quality of construction, age, location, land

### **Environmental**

e.g., degraded slopes, erosion

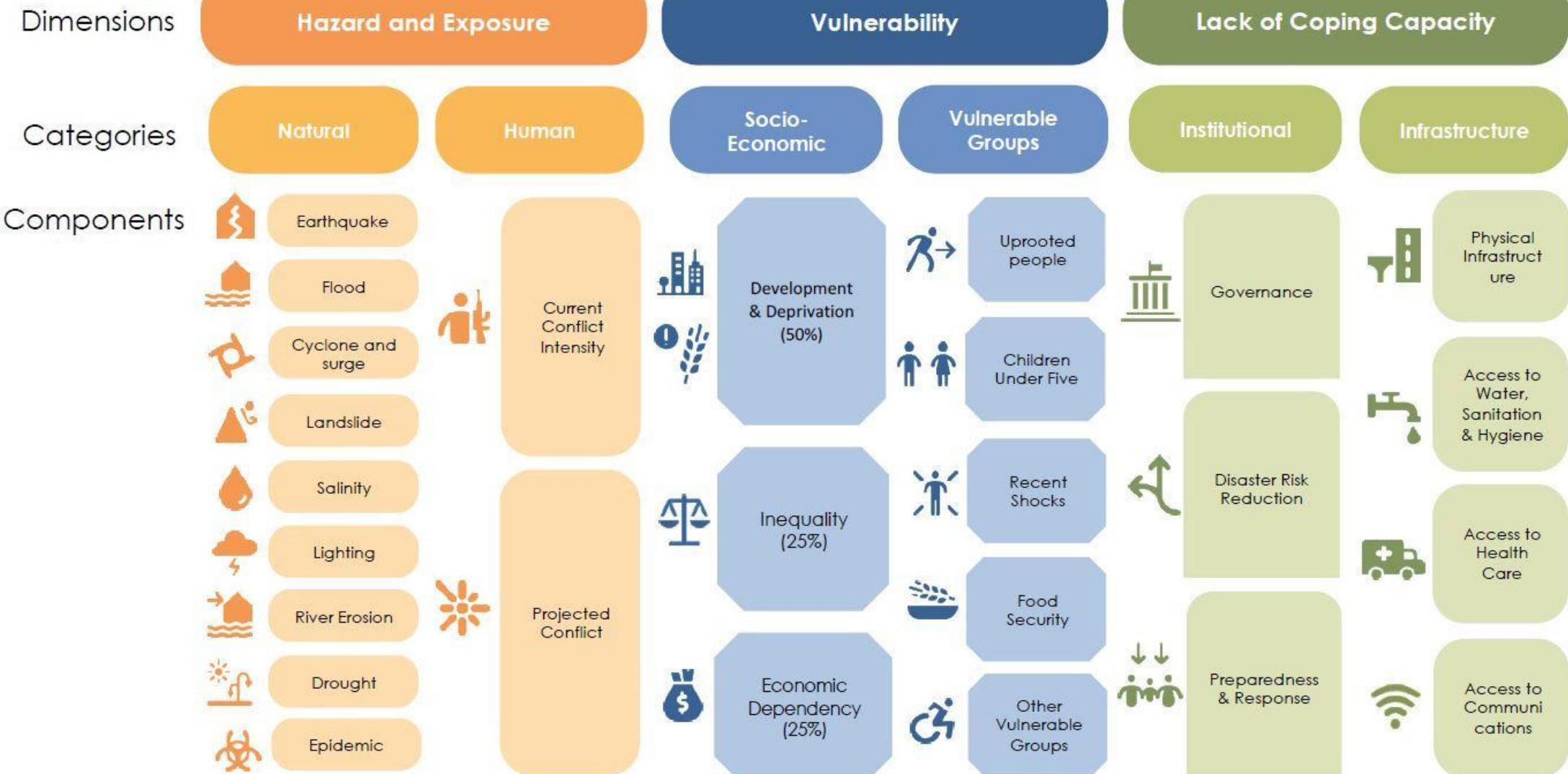
### **Socio-economic (Human root causes)**

e.g., poverty, age, gender, population in conflict

### **Organizational (Governance and Operations)**

e.g., Failure to integrate risk considerations

# RISK



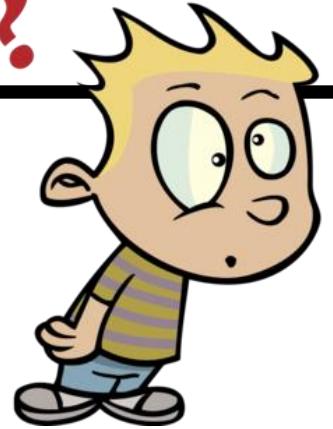
$$R = H + E + V$$

$$R = H \times E \times V$$

$$R = H \times V - C$$

$$R = \text{Freq} \times \text{Consq}$$

$$V = f(E, S, AC)$$

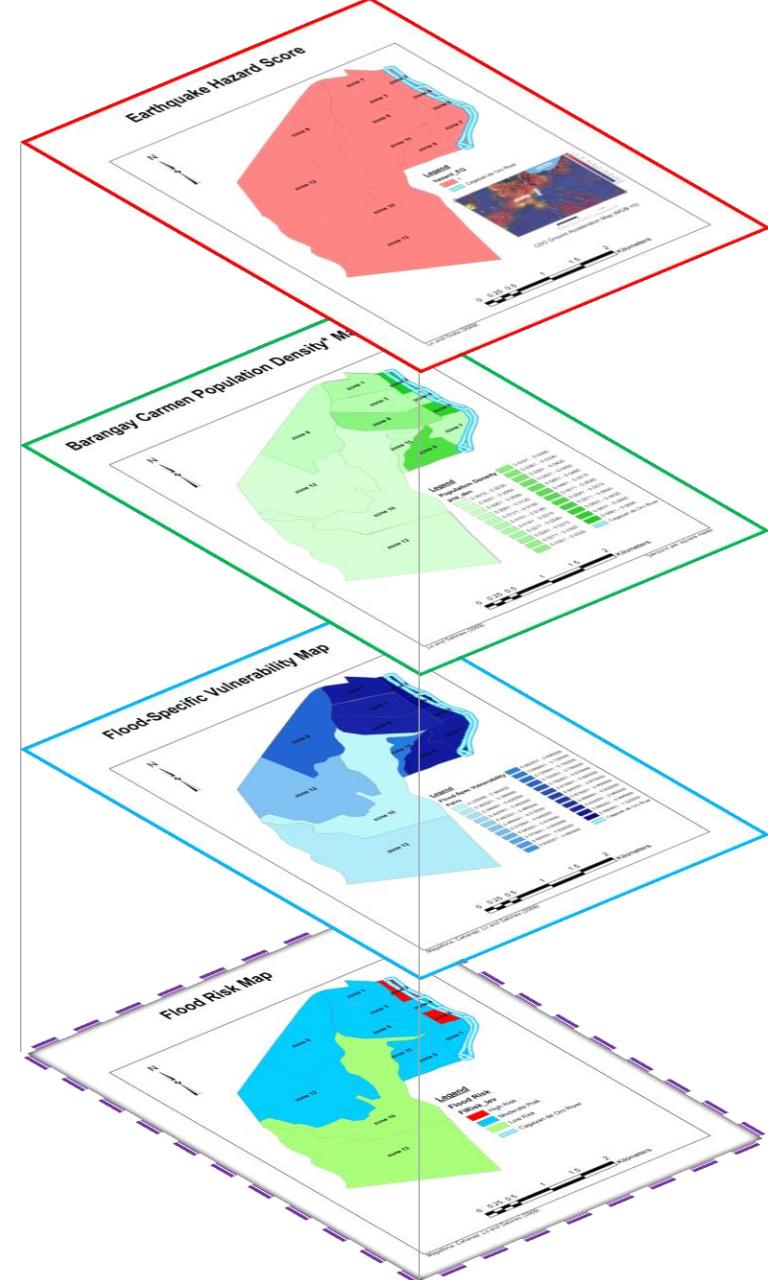


H

E

V

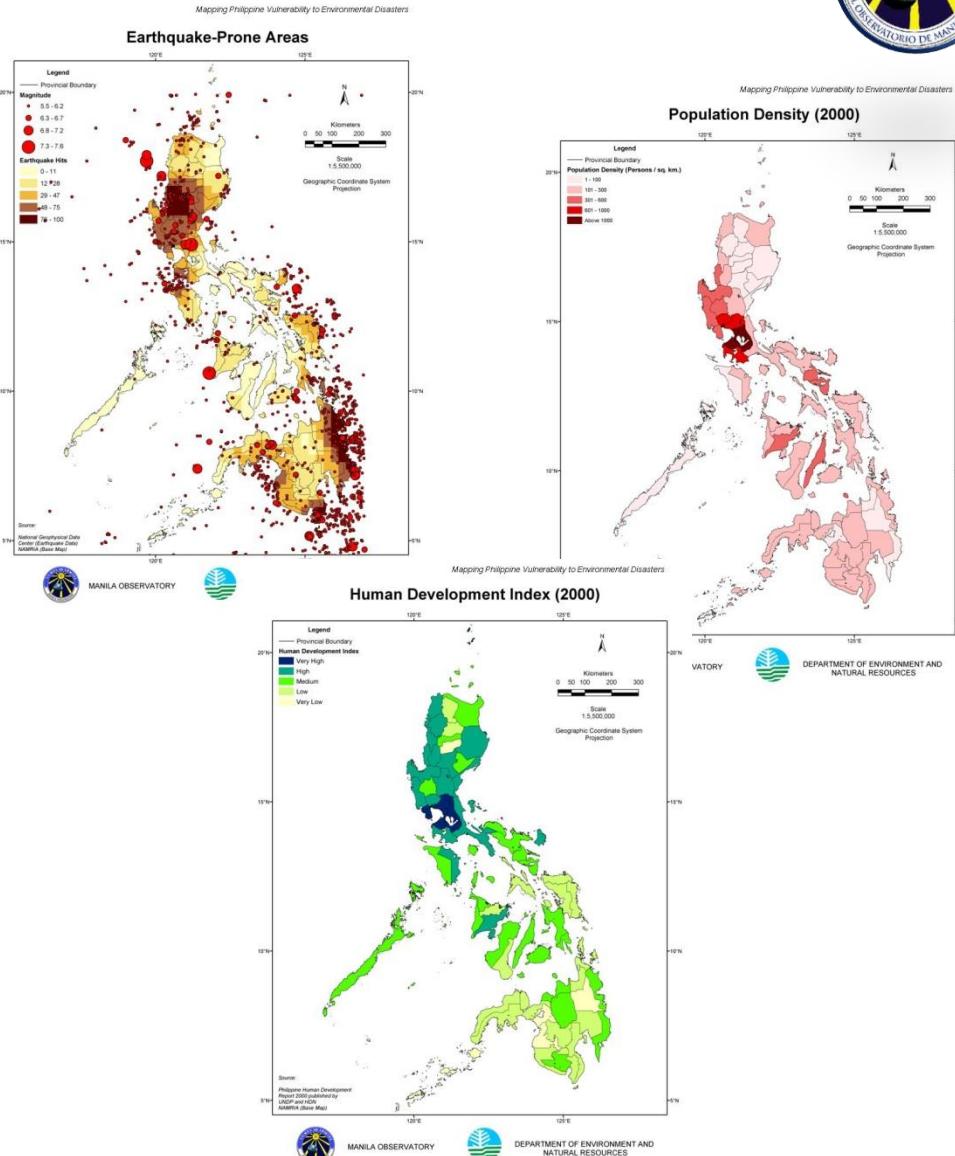
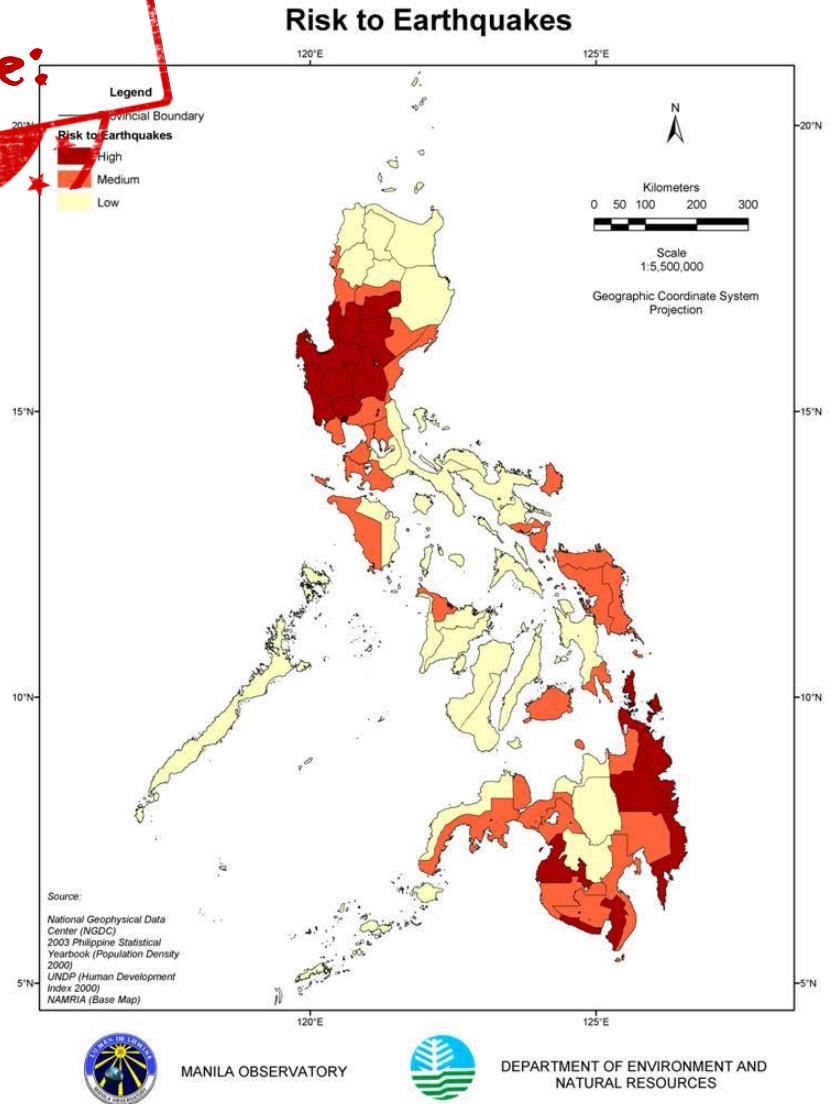
R



Compliments of:



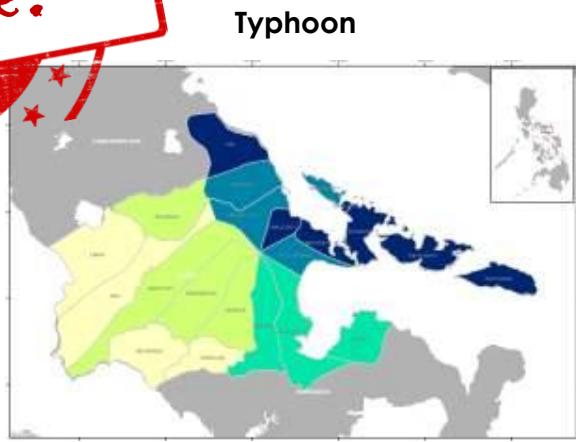
Example:





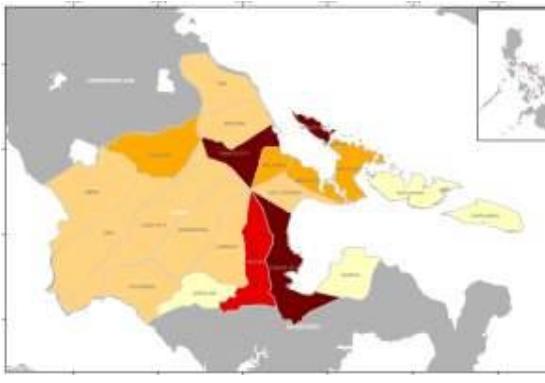
# Municipal Level Risk Mapping

Example:



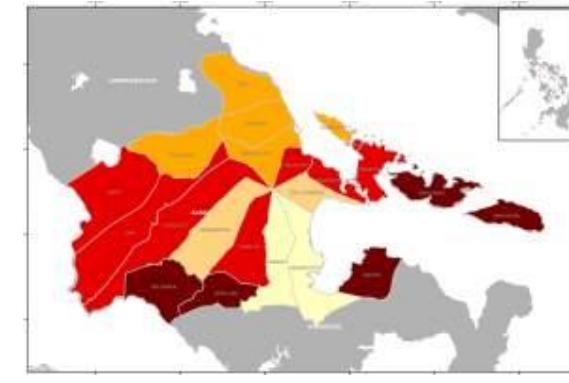
**HAZARD**

**Population Density**



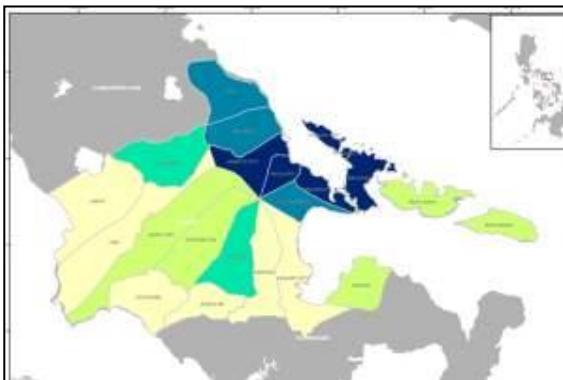
**EXPOSURE**

**Poverty Incidence**



**VULNERABILITY**

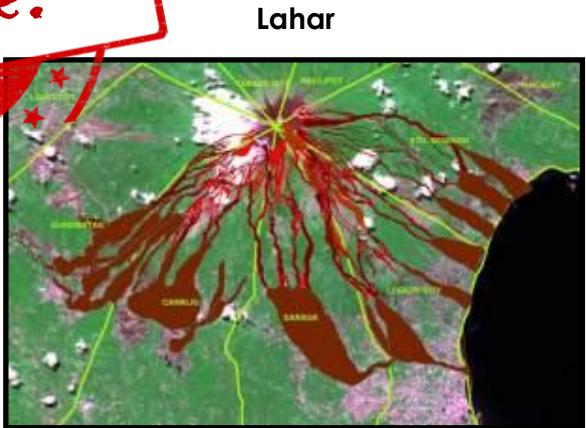
**RISK**





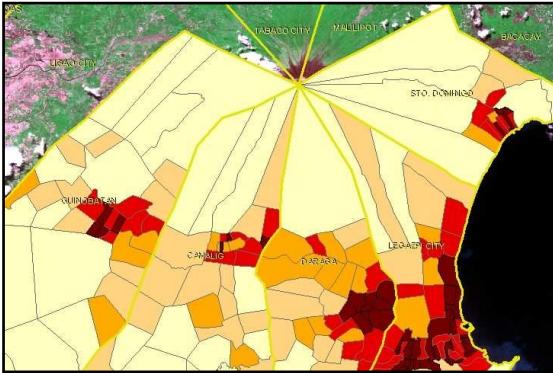
# Barangay Level Risk Mapping

Example:



**HAZARD**

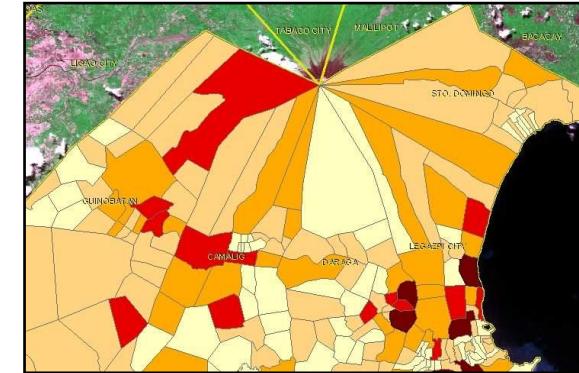
**Population Density**



X

**EXPOSURE**

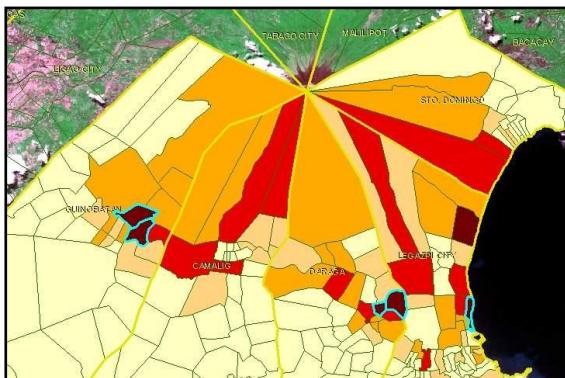
**Number of Poor Persons**



X

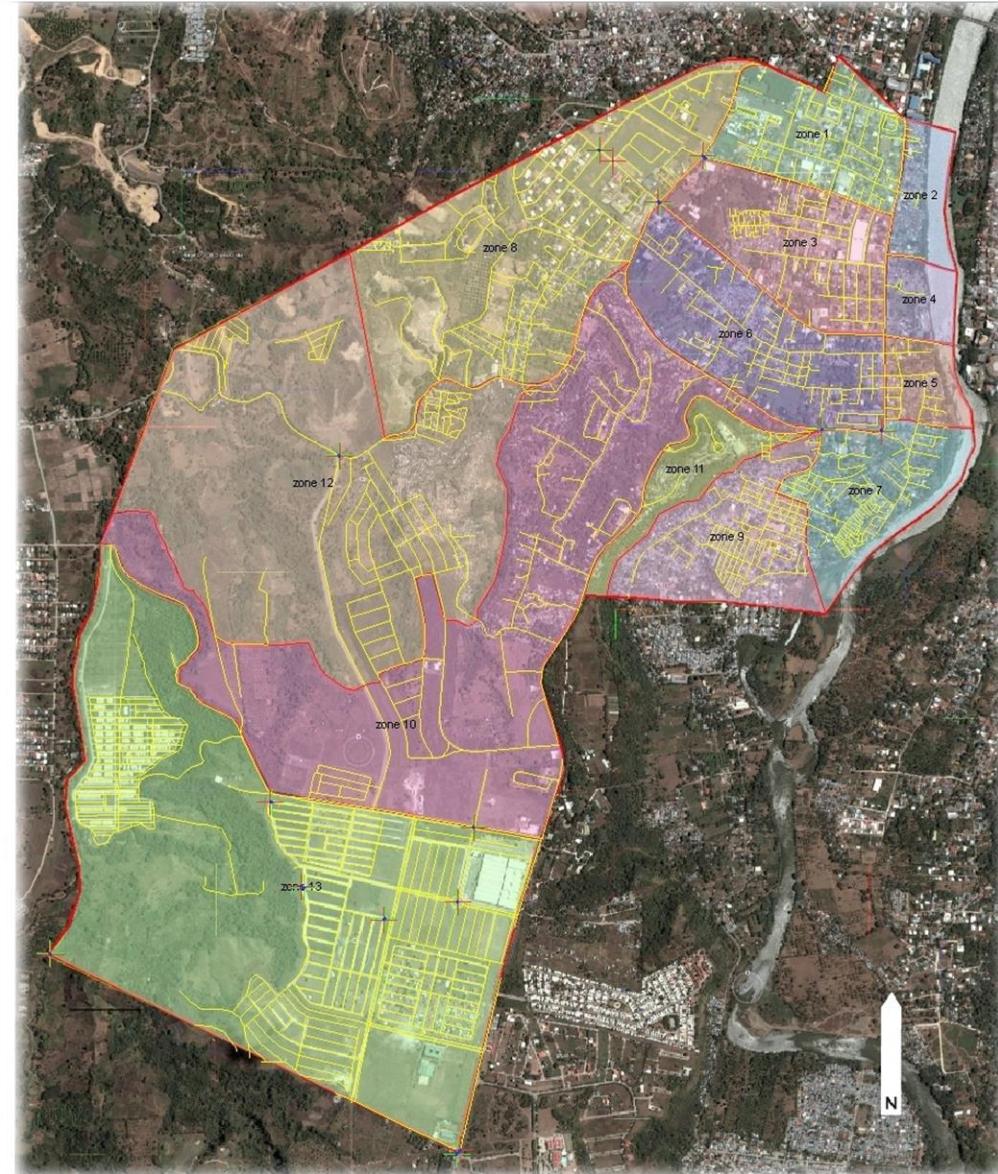
**VULNERABILITY**

**RISK**

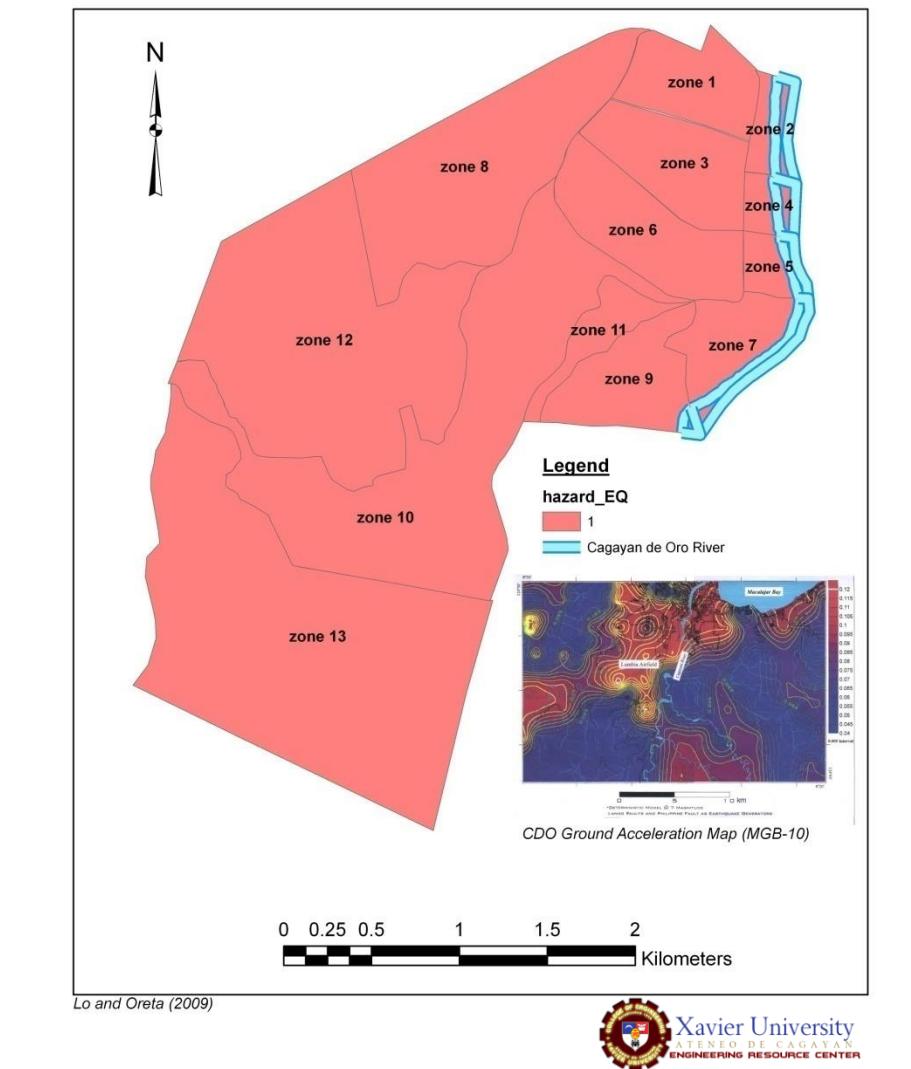


*Lo & Oreta (2009), Lo & Sabines (2009), Magallona et al (2009)*

# Disaster Risk Mapping of Barangay Carmen: Flood, Fire and Earthquake



# Earthquake Hazard Score



Zone	GA (g's)	GA / 0.4g	Hs
1	0.12	0.300	1.000
2	0.12	0.300	1.000
3	0.12	0.300	1.000
4	0.12	0.300	1.000
5	0.12	0.300	1.000
6	0.12	0.300	1.000
7	0.12	0.300	1.000
8	0.12	0.300	1.000
9	0.12	0.300	1.000
10	0.12	0.300	1.000
11	0.12	0.300	1.000
12	0.12	0.300	1.000
13	0.12	0.300	1.000

Risk

=

Hazard

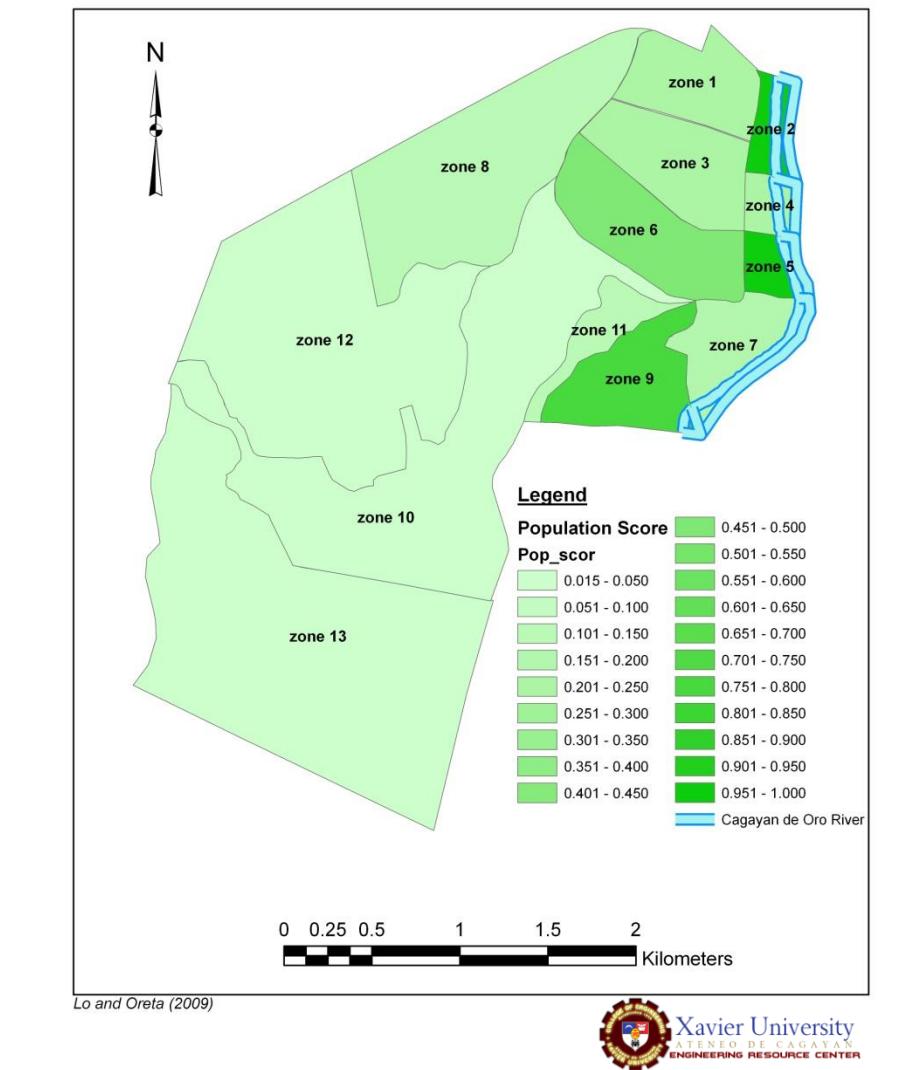
x

Exposure

x

Vulnerability

## Exposed Population Score



Zone	Est. Pop.	Population Density (per m <sup>2</sup> )	Ps
1	5000	0.0157	<b>0.236</b>
2	5000	0.0667	<b>1.000</b>
3	6000	0.0143	<b>0.214</b>
4	1100	0.0156	<b>0.235</b>
5	6000	0.0646	<b>0.969</b>
6	15000	0.0301	<b>0.451</b>
7	3500	0.0120	<b>0.179</b>
8	8000	0.0073	<b>0.109</b>
9	20000	0.0532	<b>0.798</b>
10	8000	0.0011	<b>0.017</b>
11	1200	0.0071	<b>0.107</b>
12	5200	0.0029	<b>0.043</b>
13	2500	0.0010	<b>0.015</b>

Risk

=

Hazard

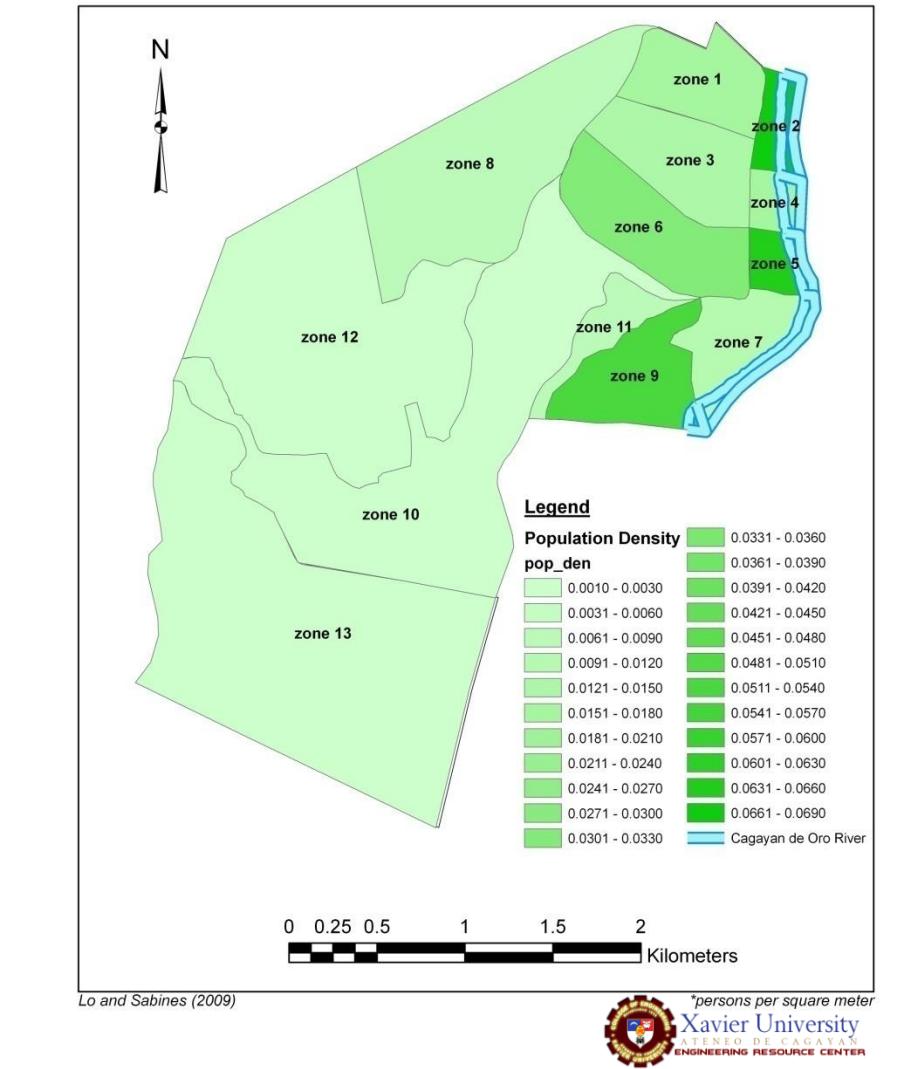
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Exposure

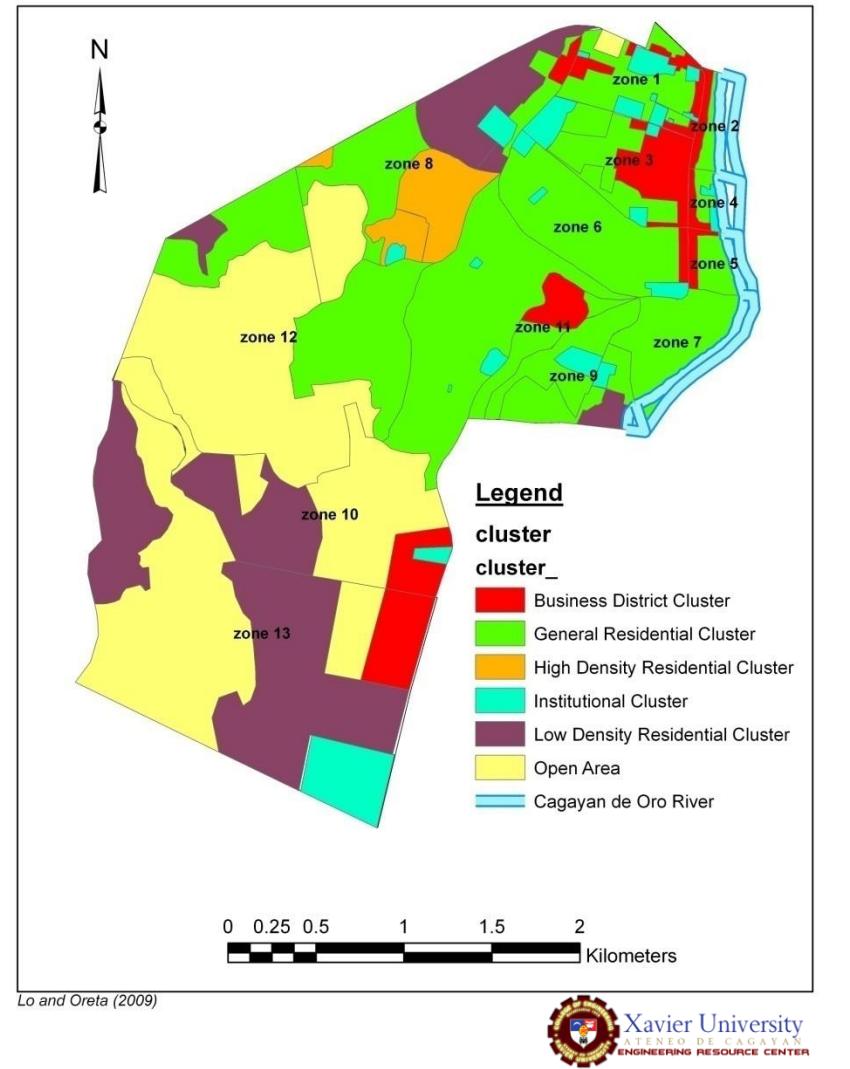
×

Vulnerability

## Barangay Carmen Population Density\* Map



## Land Use Cluster Map



Risk

=

Hazard

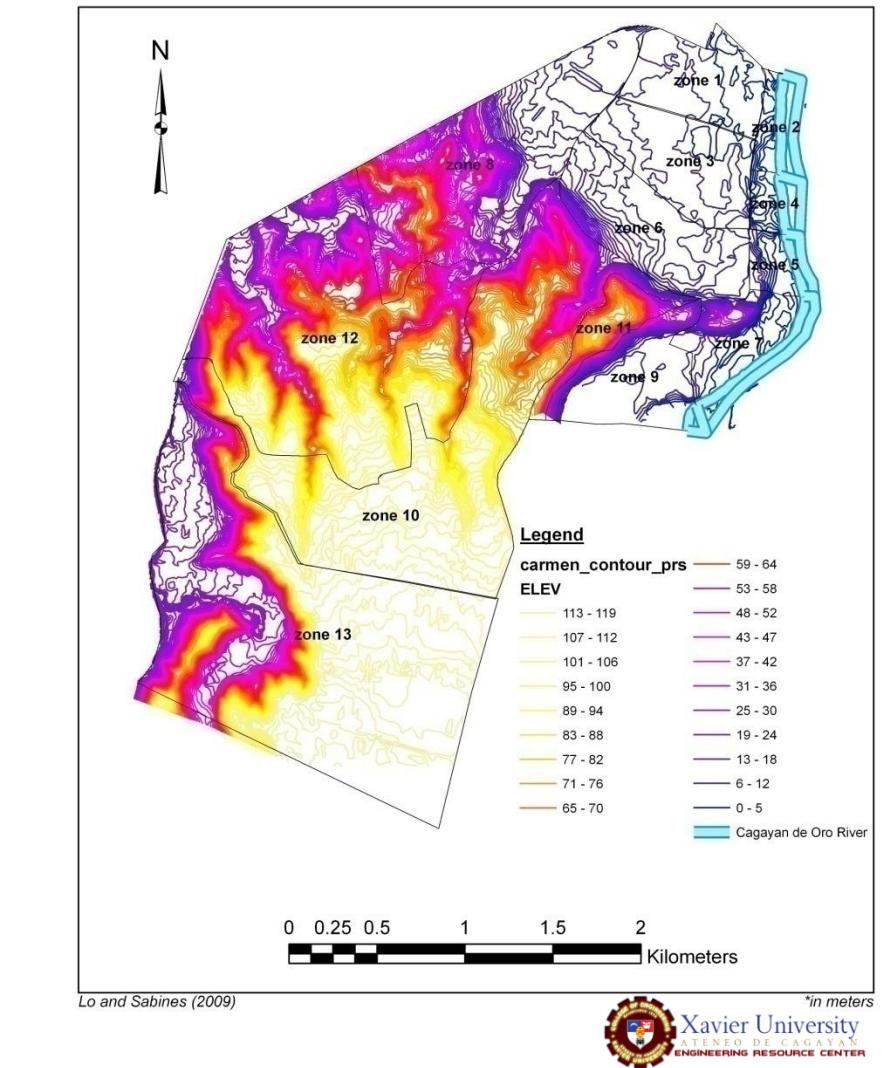
X

Exposure

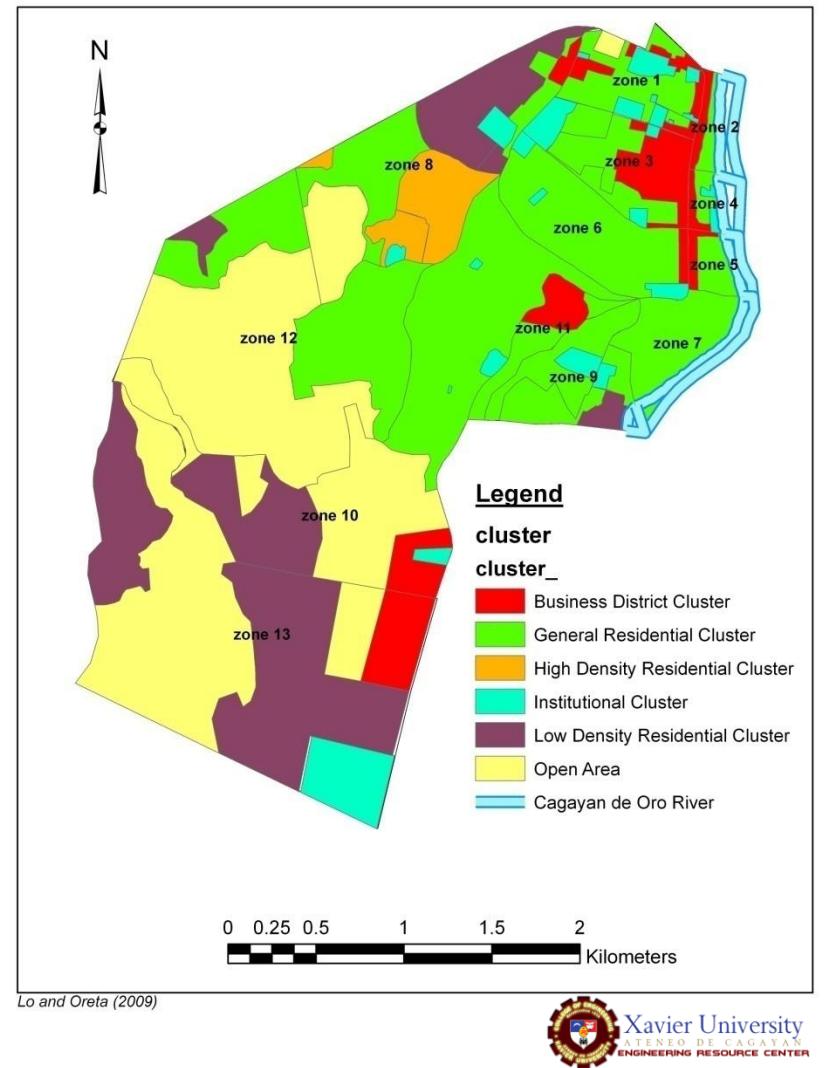
X

Vulnerability

## Barangay Carmen Stratified Contour\* Map



## Land Use Cluster Map



Risk

=

Hazard

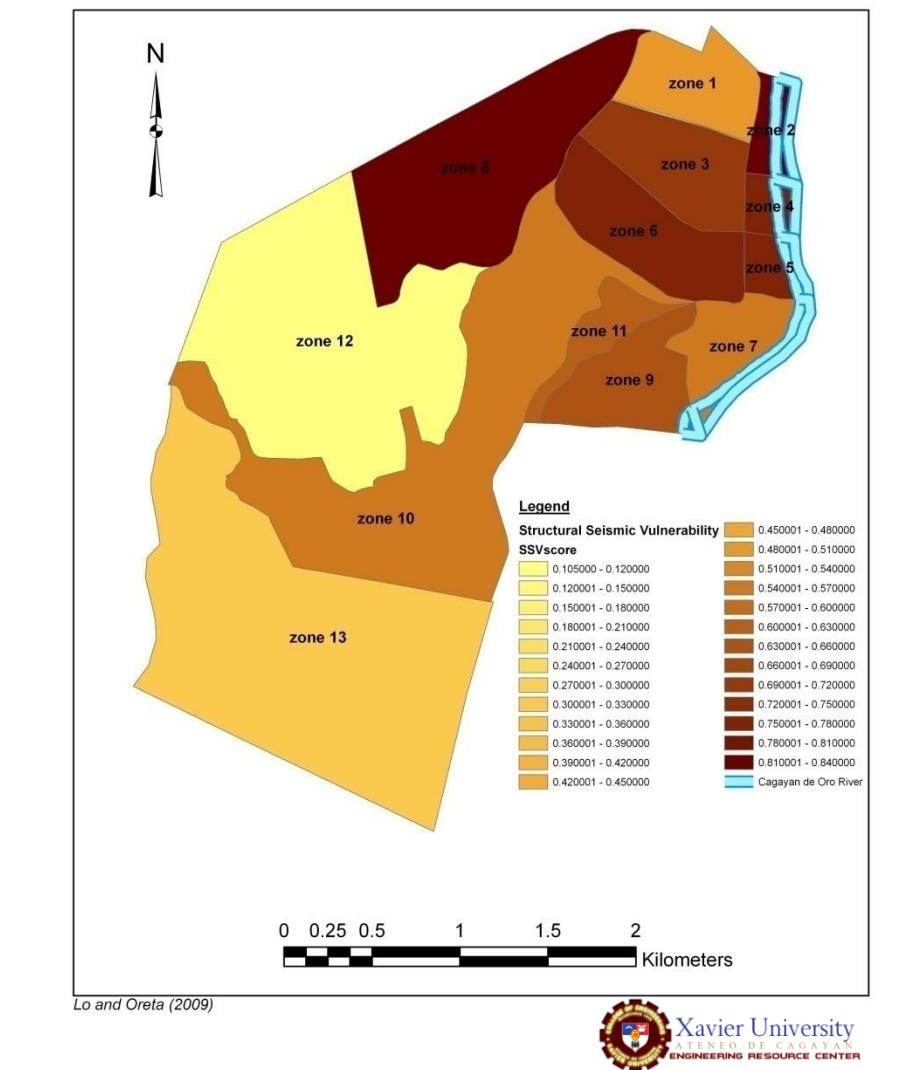
X

Exposure

X

Vulnerability

# Structural Seismic Vulnerability Map



Zone #	SSV	FEMA	SSVs
1	0.29132	3.4	<b>0.510</b>
2	0.76620	1.3	<b>0.814</b>
3	0.48171	2.1	<b>0.703</b>
4	0.58735	1.7	<b>0.757</b>
5	0.58887	1.7	<b>0.757</b>
6	0.59582	1.7	<b>0.760</b>
7	0.31250	3.2	<b>0.543</b>
8	0.79040	1.3	<b>0.819</b>
9	0.41101	2.4	<b>0.652</b>
10	0.32370	3.1	<b>0.559</b>
11	0.37107	2.7	<b>0.615</b>
12	0.15964	6.3	<b>0.105</b>
13	0.20676	4.8	<b>0.309</b>

Risk

=

Hazard

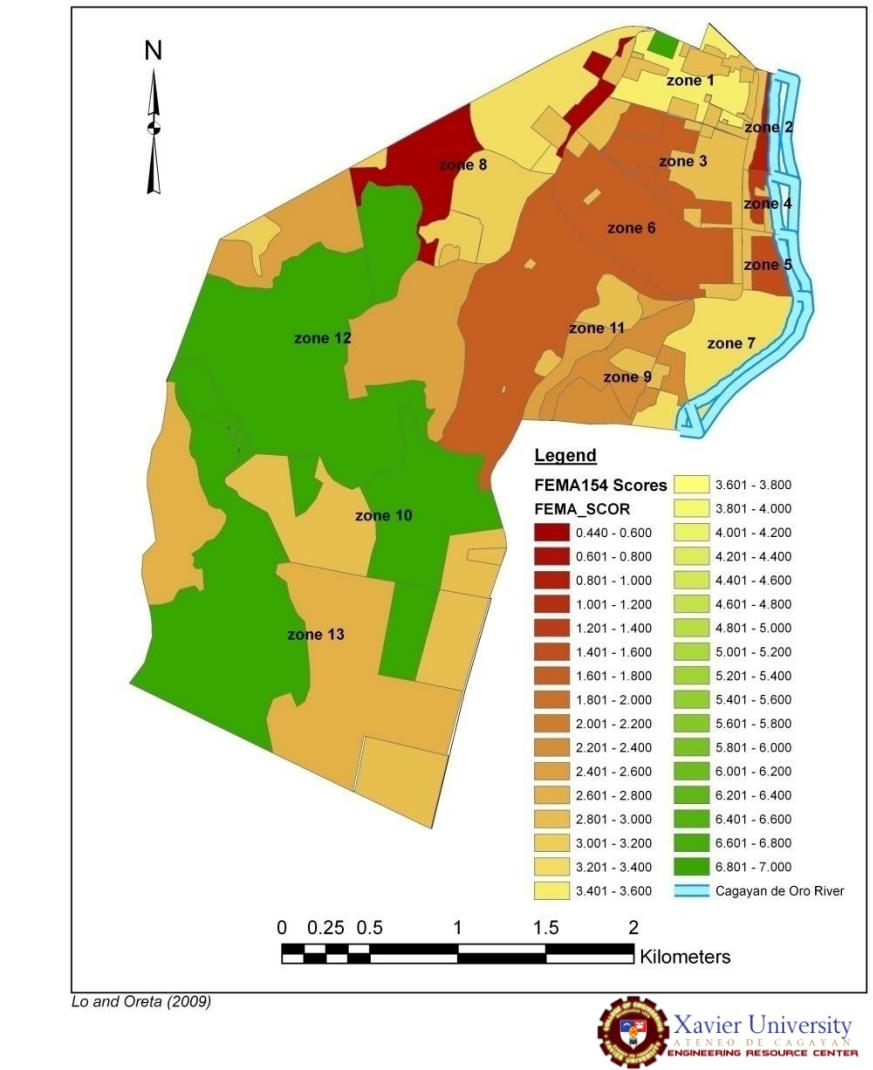
×

Exposure

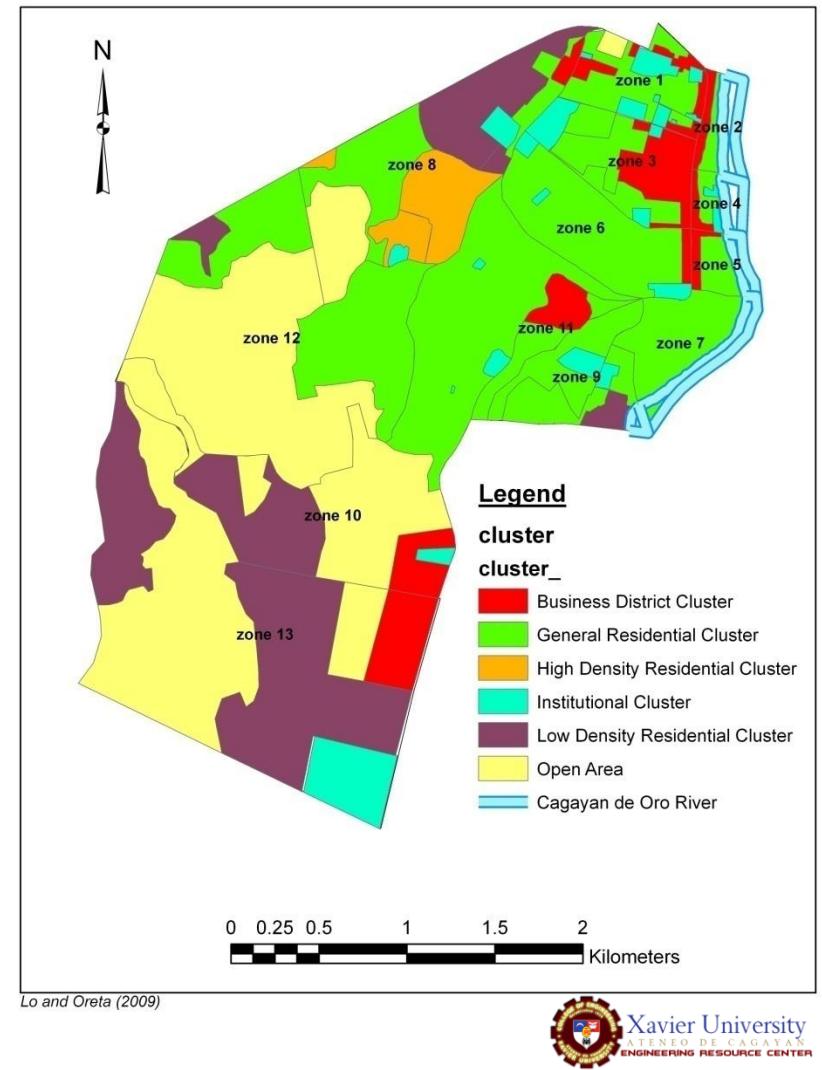
×

Vulnerability

## Earthquake Vulnerability Scores per Cluster



## Land Use Cluster Map



Risk

=

Hazard

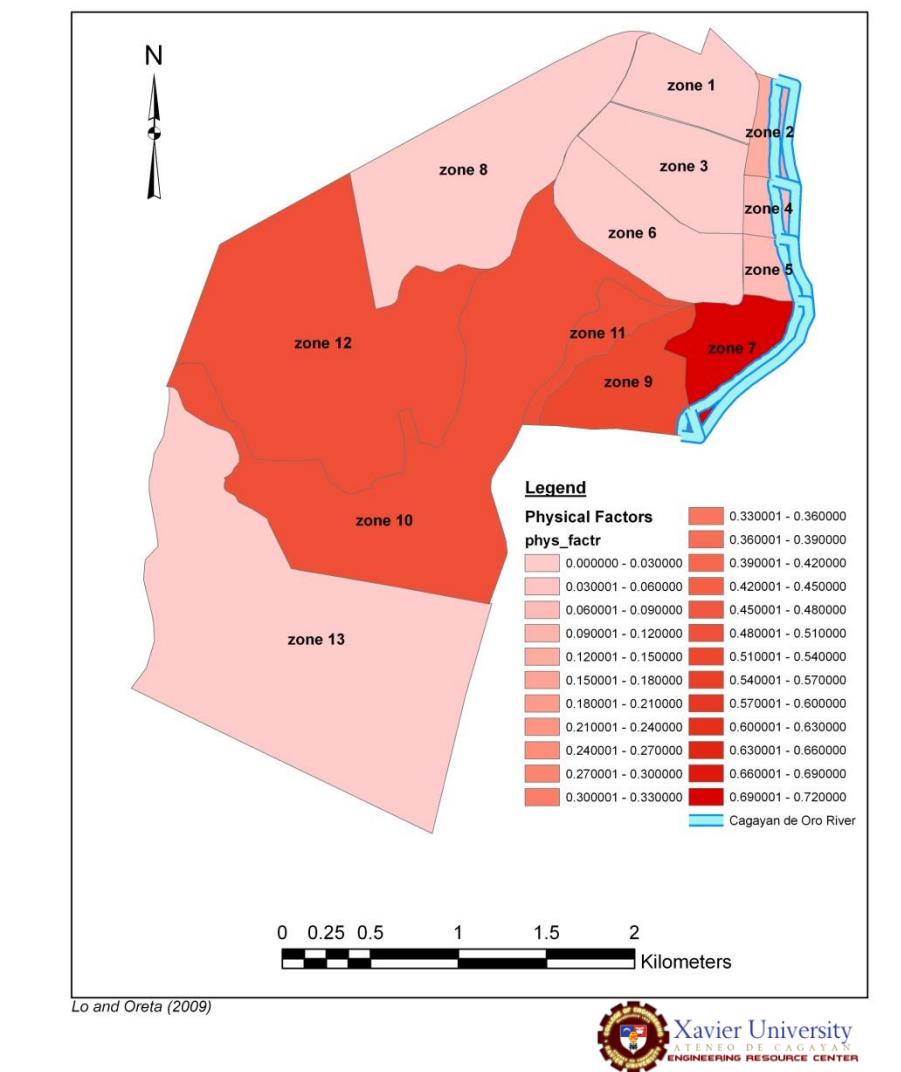
X

Exposure

X

Vulnerability

## Physical Aggravating Factor



Zone	Sf	Wf	Phf
1	0	0.000	<b>0.000</b>
2	0	0.244	<b>0.122</b>
3	0	0.000	<b>0.000</b>
4	0	0.143	<b>0.071</b>
5	0	0.157	<b>0.078</b>
6	0	0.000	<b>0.000</b>
7	1	0.391	<b>0.696</b>
8	0	0.000	<b>0.000</b>
9	1	0.065	<b>0.533</b>
10	1	0.000	<b>0.500</b>
11	1	0.000	<b>0.500</b>
12	1	0.000	<b>0.500</b>
13	0	0.000	<b>0.000</b>

Risk

=

Hazard

x

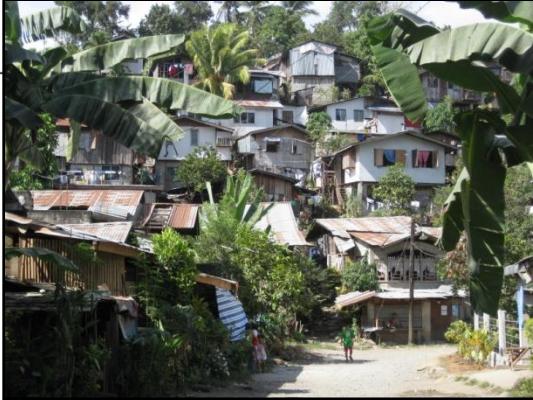
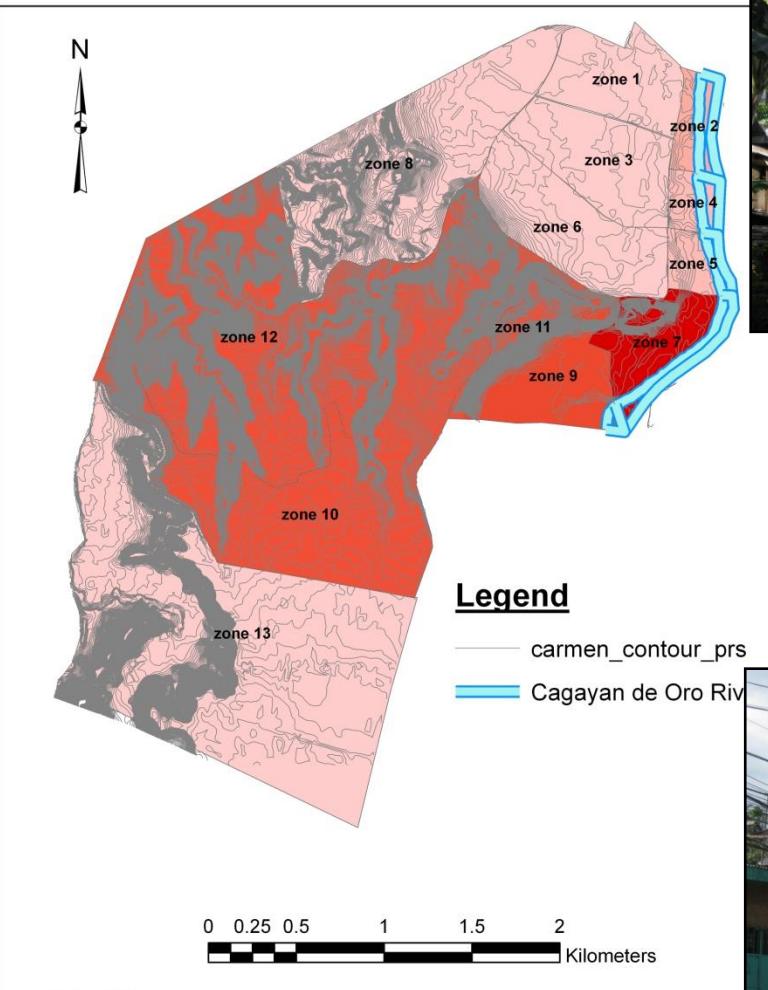
Exposure

x

Vulnerability



## Physical Factor (Contour + River Overlaid)



Risk

=

Hazard

X

Exposure

X

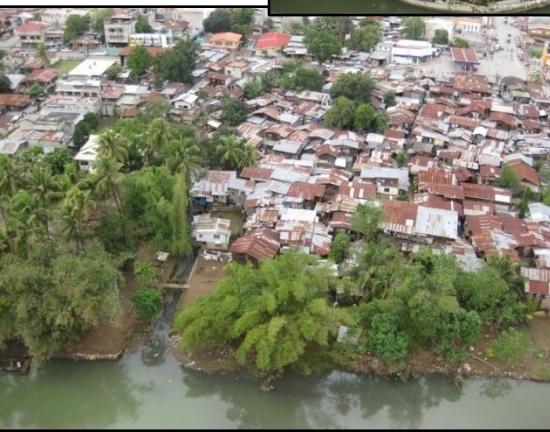
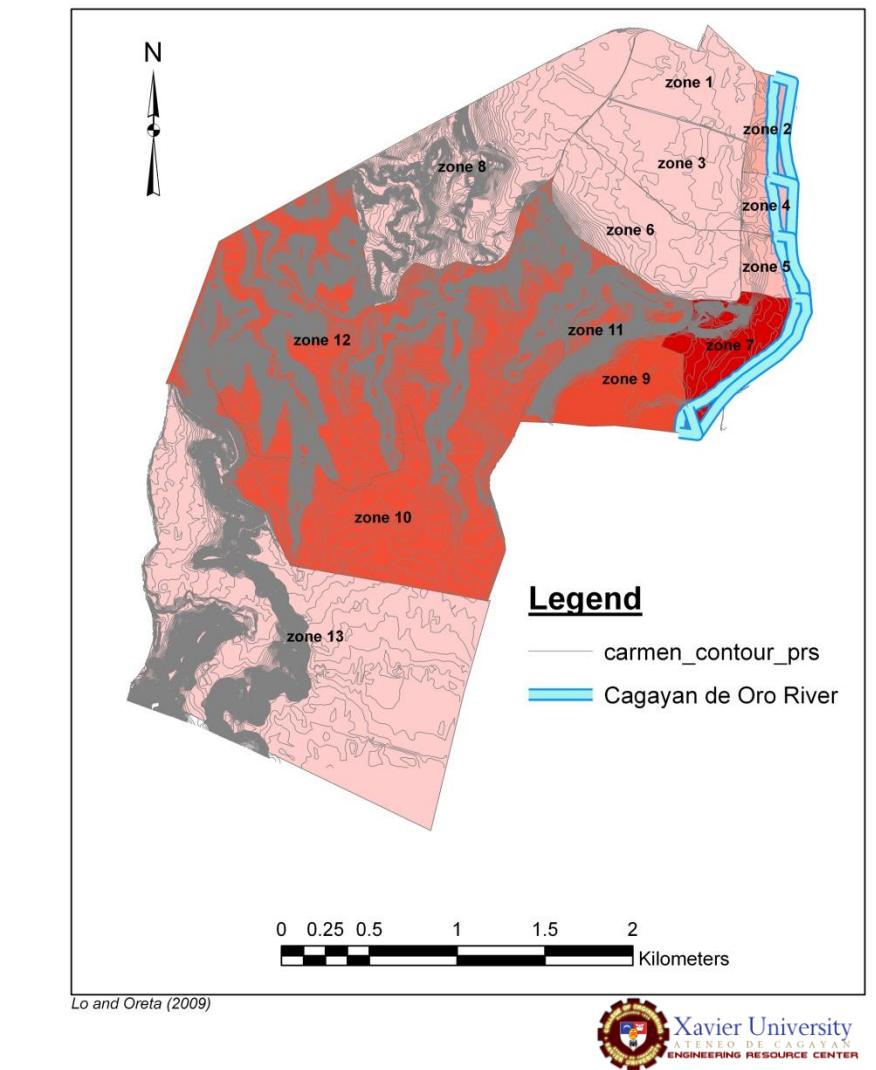
Vulnerability



Xavier  
ATENEO  
ENGINEERING

University  
DE CAGAYAN  
RESOURCE CENTER

## Physical Factor (Contour + River Overlaid)



Risk

=

Hazard

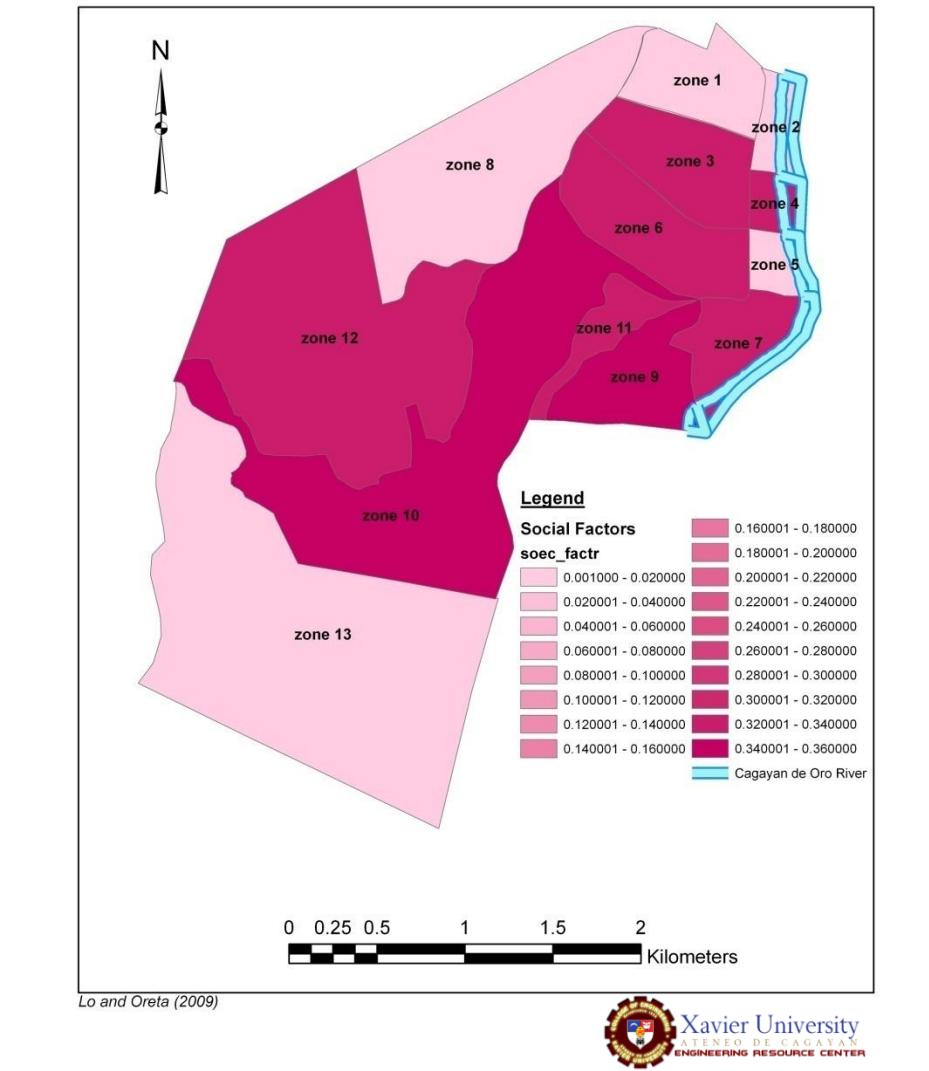
X

Exposure

X

Vulnerability

## Socio-Economic Aggravating Factor



Zon	age ≤5	age ≥60	VPf	Inc	Pf	DAf	SEf
1	111	75	0.002	30,000	0	0	<b>0.001</b>
2	111	75	0.002	15,000	0	0	<b>0.001</b>
3	241	90	0.004	5,000	1	0	<b>0.335</b>
4	46	17	0.001	5,000	1	0	<b>0.334</b>
5	254	90	0.004	20,000	0	0	<b>0.001</b>
6	534	225	0.009	5,000	1	0	<b>0.336</b>
7	398	53	0.005	5,000	1	0	<b>0.335</b>
8	731	120	0.010	15,000	0	0	<b>0.003</b>
9	2272	300	0.030	5,000	1	0	<b>0.343</b>
10	1528	120	0.019	5,000	1	0	<b>0.340</b>
11	128	18	0.002	5,000	1	0	<b>0.334</b>
12	504	78	0.007	5,000	1	0	<b>0.336</b>
13	241	38	0.003	30,000	0	0	<b>0.001</b>

Risk

=

Hazard

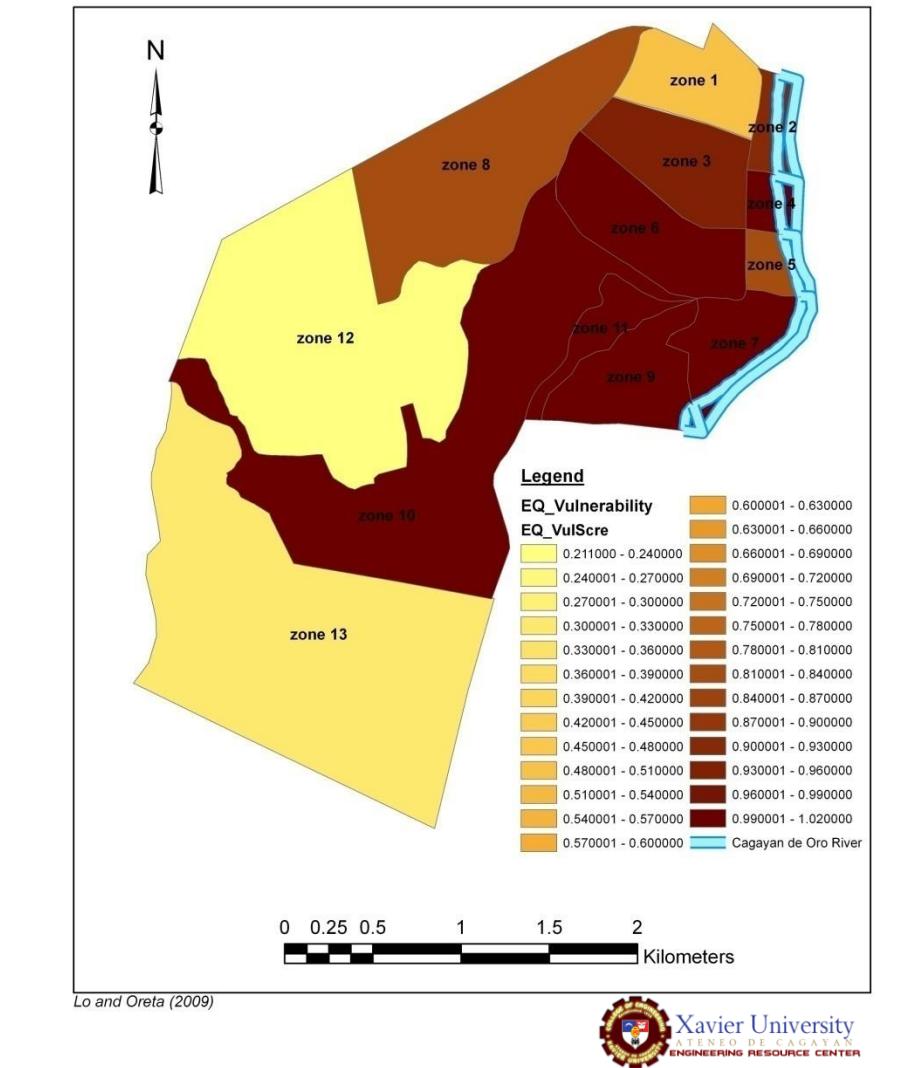
×

Exposure

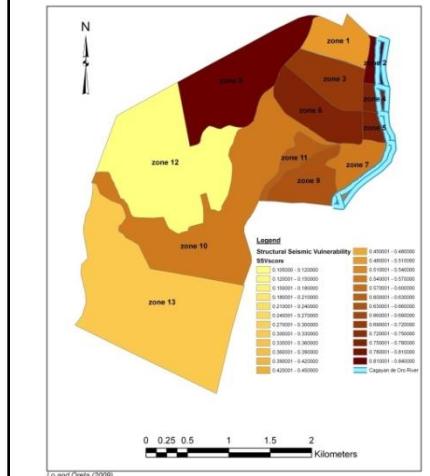
×

Vulnerability

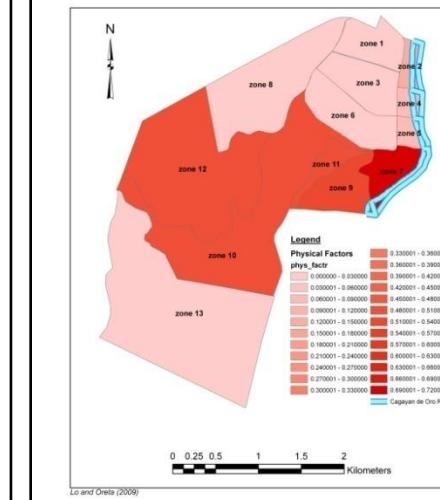
# Earthquake Vulnerability Map



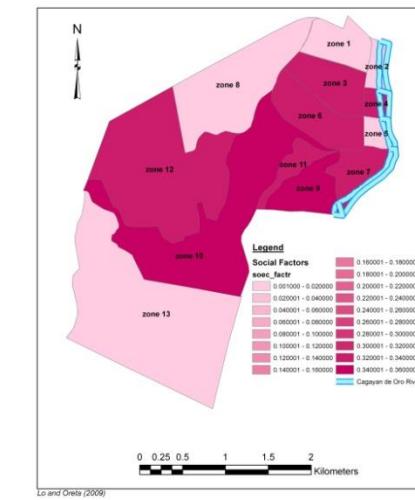
## Structural Seismic Vulnerability Map



## Physical Aggravating Factor



## Socio-Economic Aggravating Factor



Risk

=

Hazard

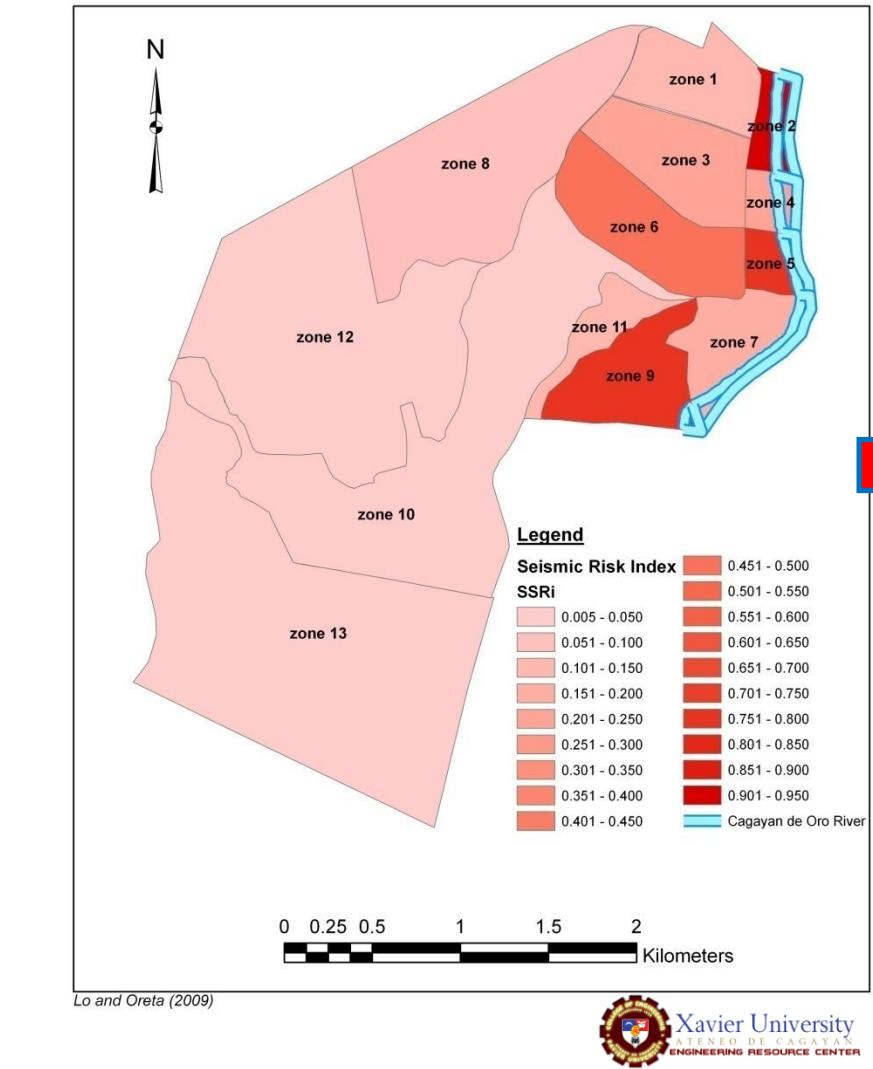
×

Exposure

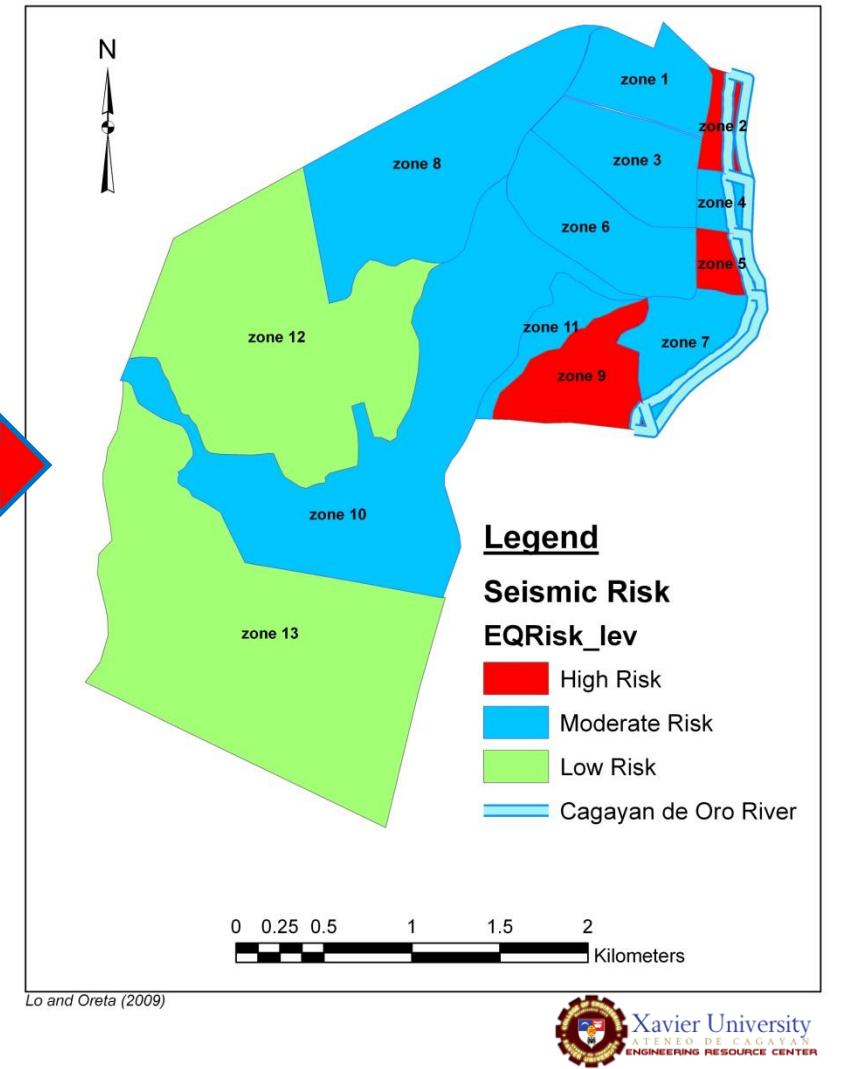
×

Vulnerability

## Seismic Risk Index Map



## Earthquake Risk Map



Risk

=

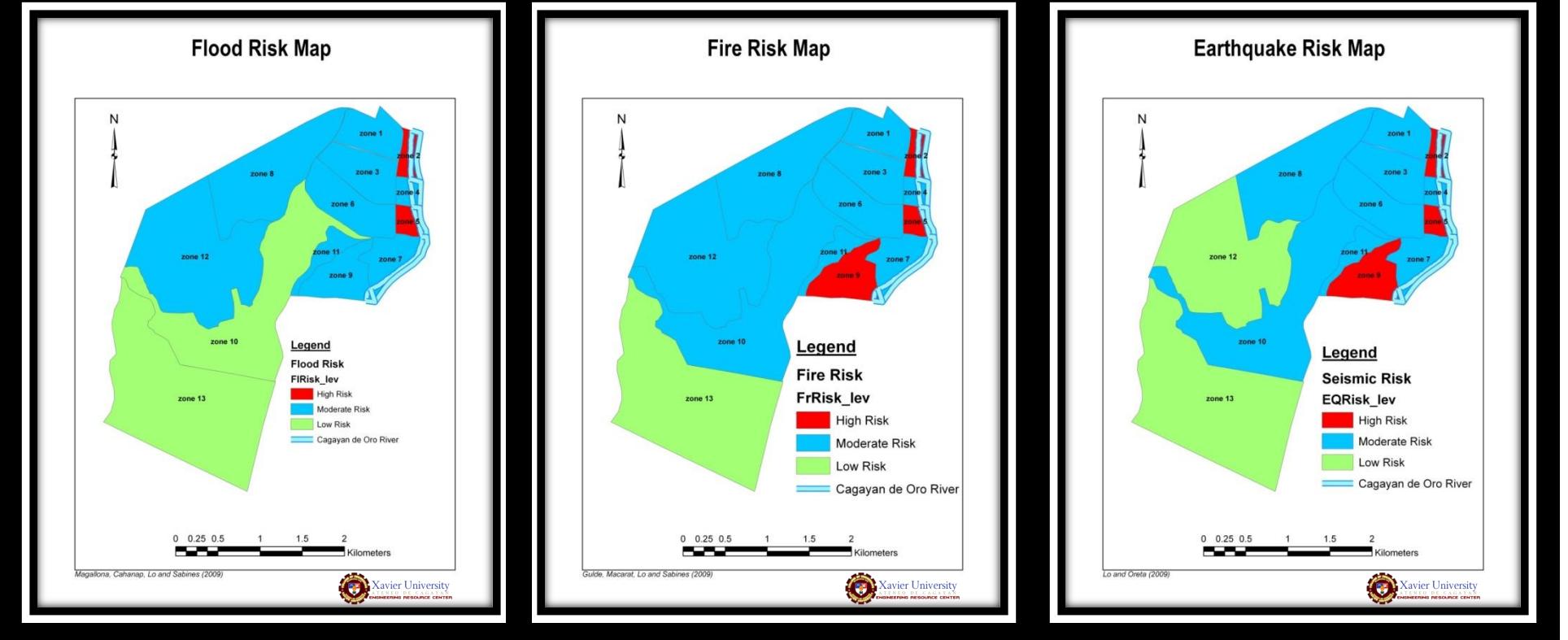
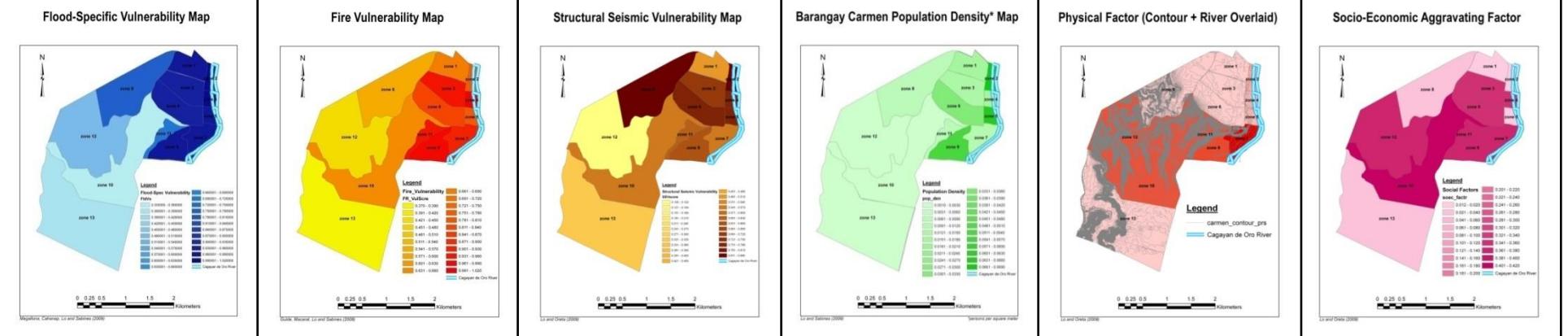
Hazard

X

Exposure

X

Vulnerability



**Risk**

=

**Hazard**

X

**Exposure**

X

**Vulnerability**

2009  
UNISDR  
Terminology  
on  
**Disaster  
Risk  
Reduction**

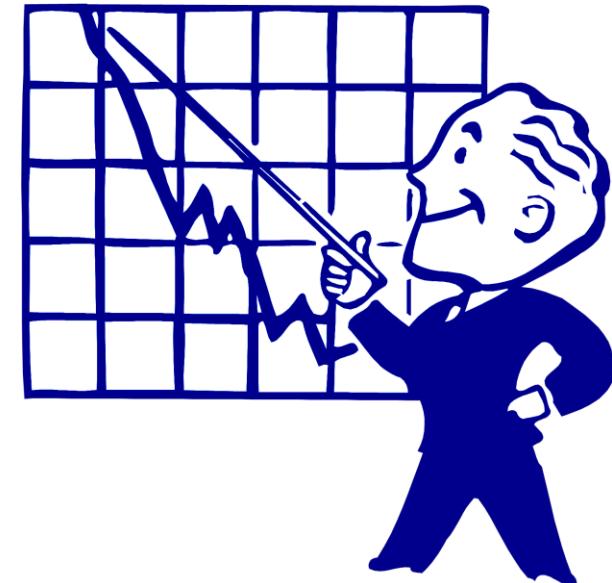


# Disaster **Risk** Assessment

A qualitative or quantitative approach to determine the nature and extent of disaster risk by analyzing potential **hazards** and evaluating existing conditions of **exposure** and **vulnerability** that together could harm people, property, services, livelihoods and the environment on which they depend.

A comprehensive risk assessment not only evaluates the magnitude and likelihood of potential losses but also **provides full understanding of the causes and impacts.**

Risk assessment, therefore, is an **integral part of decision and policy-making processes and planning**, and requires collaboration among various **stakeholders**.



## DISASTER RISK REDUCTION

**Geophysical hazards**

- *Earthquakes*
- *Tsunamis*
- *Landslides*
- *Volcanic eruptions*

**Risk assessment**

- *Based mainly on historical data*

**Long history**  
(over 1 000 years)

**Climatic hazards**  
*Storms, floods, landslides, temperature extremes, droughts, fires, etc.*

**Impacts**  
*Deaths and injuries, population shifts, loss of resources, security and access to shelter, etc.*

**Clear political commitments:**  
*SDGs, Paris Agreement, Sendai Framework*

**Scope for coherence**  
*in DRR & CCA towards resilience*

**Need for an inclusive approach:**  
*"All-of-states and all-of-society" approaches*

## CLIMATE CHANGE ADAPTATION

**Slow onset events**

- *Sea-level rise, desertification, etc.*

**Non-disaster aspects of CCA**

- *(including positive benefits from climate change)*

**Risk assessment**

- *climate risk models and projections*

**Emerging topic**  
(since 1985)



MDA - Flood - Google Sheets

**CDRA**

MDA - Flood .XLSX ▾

File Edit View Insert Format Data Tools Help

View only

A1

OBJECTID \*

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD																		
1	OBJECTID	Shape *	Join_Count	TARGET_FID	IDD	Barangay	Zone	Land Use	Cat	Flood	Suscept	Likelihood	Expected	Fic	Magnitude	Scc	Total	Allot	(GIS Deriv	Replaceme	Affected	Valu	Exposure	Affec	Affected	Area	E	Average	Exposi	Percentag	Light	Materi	Percentage	Dilapidated	Scc	Percentage	before	1992	S	Percentage	of	Employ	Resili	Average	Sens	Percentage	in	Mit
2	1	Polygon ZM	1	1	12	CAMAMAN-A	MACAJAL	COMMERCIA	HF	4 ±1m	0.75	9.90081	1.709181	25000	427295129.4	1	17%	3	2	0	1	0	1	0.17263	3	1	4	3	0.17263	1	1	4	3	0.17263														
3	2	Polygon ZM	1	2	16	CAMAMAN-A	BONTON	COMMERCIA	HF	4 ±1m	0.75	9.90081	1.951932	25000	487983021.5	1	20%	3	2	0	1	0	1	0.197149	3	1	4	3	0.197149	1	1	4	3	0.197149														
4	3	Polygon ZM	1	3	50	LAPASAN	SAN LAZA	COMMERCIA	HF	4 ±1m	0.75	29.54104	3.373197	25000	843299373.1	1	11%	3	2	0	1	0.114187	3	1	4	3	0	1	1	4	3	0																
5	4	Polygon ZM	1	4	57	LAPASAN	LAWEBSR	COMMERCIA	HF	4 ±1m	0.75	29.54104	1.765456	25000	441363913.6	1	6%	2	1.5	0.059763	2	0	1	0.059763	2	1	4	3	0	1	1	4	3	0														
6	5	Polygon ZM	1	5	154	22	22	COMMERCIA	HF	4 ±1m	0.75	3.969589	2.842979	25000	710744646.8	1	72%	4	2.5	0	1	0	1	0	1	1	4	3	0	1	1	4	2	0														
7	6	Polygon ZM	1	6	161	24	24	COMMERCIA	HF	4 ±1m	0.75	9.543252	4.773171	25000	1193292628	2	50%	4	3	0	1	0	1	0	1	0.500162	4	1	4	3	0	1	1	4	3	0												
8	7	Polygon ZM	1	7	164	26	26	COMMERCIA	HF	4 ±1m	0.75	3.096658	1.123201	25000	280800344.8	1	36%	4	2.5	0	1	0	1	0	1	0	1	1	4	2	0	1	1	4	2	0												
9	8	Polygon ZM	1	8	187	31	LIMKETK	COMMERCIA	HF	4 ±1m	0.75	14.85862	11.91051	25000	2977629411	3	80%	4	3.5	0	1	0	1	0	1	0.80159	4	1	4	3	0	1	1	4	3	0												
10	9	Polygon ZM	1	9	378	TABLON	PUROK 13	COMMERCIA	HF	4 ±1m	0.75	30.79669	4.578718	25000	1144679615	2	15%	3	2.5	0	1	0	1	0	1	0.148676	300%	100%	4	3	0.148676	1	1	4	3	0.148676												
11	10	Polygon ZM	1	10	467	CUGMAN	ZONE 4	INDUSTRIAL	HF	4 ±1m	0.75	23.595838	13.16938	40000	5267752117	4	56%	4	4	0	1	0	1	0	1	0.588134	4	1	4	3	0.588134	1	1	4	3	0.588134												
12	11	Polygon ZM	1	11	469	TABLON	PUROK 13	INDUSTRIAL	HF	4 ±1m	0.75	94.16117	3.597502	40000	1439000062	2	4%	1	1.5	0	1	0	1	0	1	0.038206	100%	100%	4	2	0.038206	1	1	4	3	0												
13	12	Polygon ZM	1	12	539	LAPASAN	USTsP	INSTITUTION	HF	4 ±1m	0.75	22.14574	3.678734	25000	919683440.5	1	17%	3	2	0	1	0	1	0	1	0.166115	3	1	4	3	0	1	1	4	3	0												
14	13	Polygon ZM	1	13	590	6	6	INSTITUTION	VHF	3 ±1m	1	0.808749	0.361438	25000	90359612.94	1	45%	4	2.5	0.44691	4	0	1	0	1	0	1	1	4	3	0.44691	1	1	4	3	0.44691												
15	14	Polygon ZM	1	14	613	22	22	INSTITUTION	HF	4 ±1m	0.75	3.706746	1.326335	25000	331583790.5	1	36%	4	2.5	0	1	0	1	0	1	0	1	1	4	2	0	1	1	4	2	0												
16	15	Polygon ZM	1	15	631	36	Zone-1	INSTITUTION	HF	4 ±1m	0.75	2.778796	0.490927	25000	122731673.9	1	18%	3	2	0	1	0	1	0	1	0.176669	3	1	4	3	0.176669	1	1	4	3	0.176669												
17	16	Polygon ZM	1	16	656	KAUSWAGAN	ZONE 7	INSTITUTION	VHF	3 ±1m	1	10.99687	4.275668	25000	1068916956	2	39%	4	3	0	1	0	1	0	1	0	1	1	4	2	0	1	1	4	2	0												
18	17	Polygon ZM	1	17	695	BONBON	ZONE 3	INSTITUTION	VHF	3 ±1m	1	3.120232	1.60701	25000	40175275.8	1	52%	4	2.5	0.515029	4	0	1	0	1	0	1	0	100%	100%	4	3	0	1	1	4	3	0										
19	18	Polygon ZM	1	18	776	CUGMAN	ZONE 2	INSTITUTION	HF	4 ±1m	0.75	12.21193	4.184178	25000	1046044376	2	34%	4	3	0.342645	4	0	1	0	1	0	1	0	100%	100%	4	3	0.342645	1	1	4	3	0.342645										
20	19	Polygon ZM	1	19	787	FS CATANICO	ZONE 1	INSTITUTION	HF	4 ±1m	0.75	0.715323	0.150503	25000	37625717.03	1	21%	4	2.5	0	1	0.210398	4	0	1	1	4	3	0.210398	1	1	4	3	0.210398														
21	20	Polygon ZM	1	20	887	CAMAMAN-A	RAMONA	RESIDENTIAL	HF	4 ±1m	0.75	530.0334	9.67436	15000	1451153949	2	2%	1	1.5	0.018252	1	0	1	0	1	0	1	1	4	2	0.018252	1	1	4	3	0.018252												
22	21	Polygon ZM	1	21	1033	MACASANDIG DISTRICT	RESIDENTIAL	VHF	3 ±1m	1	287.6451	30.66768	15000	4600152105	4	11%	3	3.5	0	1	0.106616	3	0	1	1	4	3	0.106616	1	1	4	3	0.106616															
23	22	Polygon ZM	1	22	1134	22	22	RESIDENTIAL	HF	4 ±1m	0.75	6.570795	4.546357	15000	681953502.6	1	69%	4	2.5	0	1	0	1	0	1	1	4	2	0	1	1	4	2	0														
24	23	Polygon ZM	1	23	1142	24	24	RESIDENTIAL	HF	4 ±1m	0.75	0.205610	1.106449	15000	165967287.3	1	54%	4	2.5	0	1	0	1	0	1	1	4	2	0	1	1	4	2	0														
25	24	Polygon ZM	1	24	1145	26	26	RESIDENTIAL	HF	4 ±1m	0.75	3.917764	2.279964	15000	341994576.4	1	58%	4	2.5	0.581955	4	0	1	0	1	0	1	1	4	3	0	1	1	4	3	0												
26	25	Polygon ZM	1	25	1170	31	PUROK 6	RESIDENTIAL	HF	4 ±1m	0.75	3.570398	0.67902	15000	101853048.6	1	19%	3	2	0	1	0	1	0	1	1	4	2	0	1	1	4	2	0														
27	26	Polygon ZM	1	26	1171	31	LIMKETK	RESIDENTIAL	HF	4 ±1m	0.75	0.570398	0.4562	15000	6842997.34	1	13%	3	2	0	1	0	1	0	1	1	4	2	0	1	1	4	2	0														
28	27	Polygon ZM	1	27	1187	35	Zone-1	RESIDENTIAL	HF	4 ±1m	0.75	3.711831	0.711266	15000	106689963.4	1	19%	3	2	0	1	0	1	0	1	1	4	2	0	1	1	4	2	0														
29	28	Polygon ZM	1	28	1195	36	Zone-1	RESIDENTIAL	HF	4 ±1m	0.75	1.694742	0.78069	15000	117103551.9	1	46%	4	2.5	0.460654	4	0	1	0	1	0	1	1	4	3	0.460654	1	1	4	3	0.460654												
30	29	Polygon ZM	1	29	1268	KAUSWAGAN	ZONE 4	RESIDENTIAL	VHF	3 ±1m	1	322.1090	27.37088	15000	4105632336	4	8%	2	3	0	1	0	1	0	1	1	4	2	0	1	1	4	2	0														
31	30	Polygon ZM	1	30	1699	CUGMAN	ZONE 1	RESIDENTIAL	HF	4 ±1m	0.75	446.8383	9.97292	15000	1495938047	2	2%	1	1.5	0	1	0	1	0	1	100%	100%	4	2	0.022319	1	1	4	3	0.022319													
32	31	Polygon ZM	1	31	1701	CUGMAN	ZONE 2	RESIDENTIAL	HF	4 ±1m	0.75	446.8383	24.14803	15000	3622204623	3	5%	2	2.5	0.054042	2	5%	2	0	100%	100%	4	3	0.054042	1	1	4	3	0.054042														
33	32	Polygon ZM	1	32	1707	TABLON	PUROK 13	RESIDENTIAL	HF	4 ±1m	0.75	529.4363	21.21295	15000	3181943089	3	4%	1	2	0	1	0	1	0	100%	100%	4	2	0.040067	1	1	4	3	0.040067														
34	33	Polygon ZM	2	33	1719	TABLON	PUROK 9	RESIDENTIAL	HF	4 ±1m	0.75	529.4363	11.14466	15000	1671700227	2	2%	1	1.5	0	1	0	1	0	100%	100%	4	2	0.021025	1	1	4	3	0.021025														
35	34	Polygon ZM	1	34	1758	AGUSAN	ZONE 1	RESIDENTIAL	HF	3 ±1m	0.75	277.0289	29.72539	15000	445880784	4	11%	3	3.5	0.107301	3	11%	3	0	100%	100%	4	3	0.107301	1	1	4	3	0.107301														

Critical Facility ▾ Population ▾ Lifelines Power ▾ Lifelines Roads ▾ Mineral ▾ SAFDZ ▾ NPAAD ▾ Landuse ▾

Search

**Nabahaan ang Barangay Carmen gumikan sa kusog nga ulan dala sa Bagyong Kulba. Naguba ang mga balay nga daplin sa suba, ug dili maagian ang ubang mga dalan.**

Sumala sa mga **residente**: **paspas kaayo misaka ang tubig baha** ug mikalit lang kini ug sulod sa ilang mga panimalay. **Wala pa man gud daw nahuman ang dike** nga **nakababag unta** sa maong **tubig baha** gikan sa suba.

Maayo nalang kai **nakadagan sila** deretso sa **Covered Court** kai **natudloan og nasinati naman sila** sa **disaster drill**. Apan **gipangsakwat** gayud ang mga **tigulang ug bata aron dili maanod**.

Is this...  
Hazardous?  
Exposed?  
Vulnerable?  
At Risk?



*Describe your picture...*

What **Hazard** is there?  
Who / What are **Exposed**?  
Are they **Vulnerable**? **Why**?  
Are they at **Risk**?



Is this...  
Hazardous?  
Exposed?  
Vulnerable?  
At Risk?

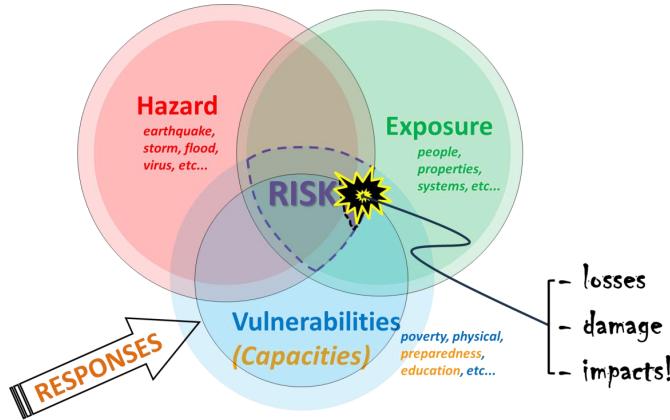


*Describe your picture...*



What **Hazard** is there?  
Who / What are **Exposed**?  
Are they **Vulnerable**? **Why?**  
Are they at **Risk**?  
**What should be done?**





*Describe your picture...*

What **Hazard** is there?

Who / What are **Exposed**?

Are they **Vulnerable**? Why?

Are they at **Risk**?



What should be done?

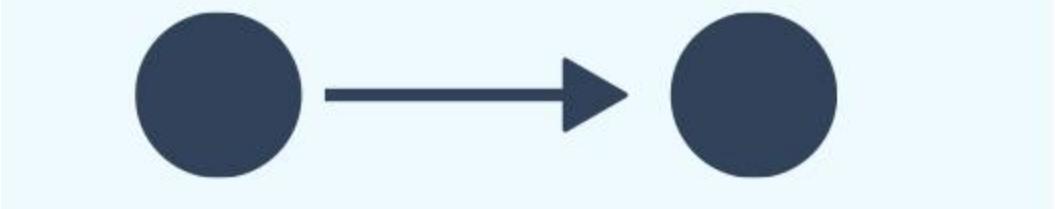
Which sector(s)  
should be doing this?  
[choose top 3]



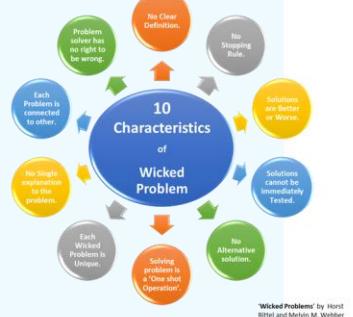
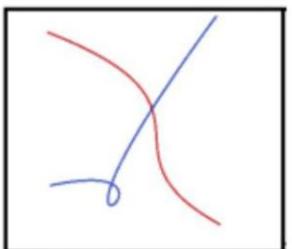
- Human Development
- Local Economy
- Infrastructure
- Environment
- Human Security



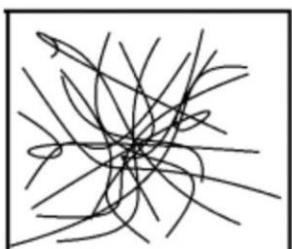
# Traditional thinking



Traditional or  
Tame Problems



Wicked Problems

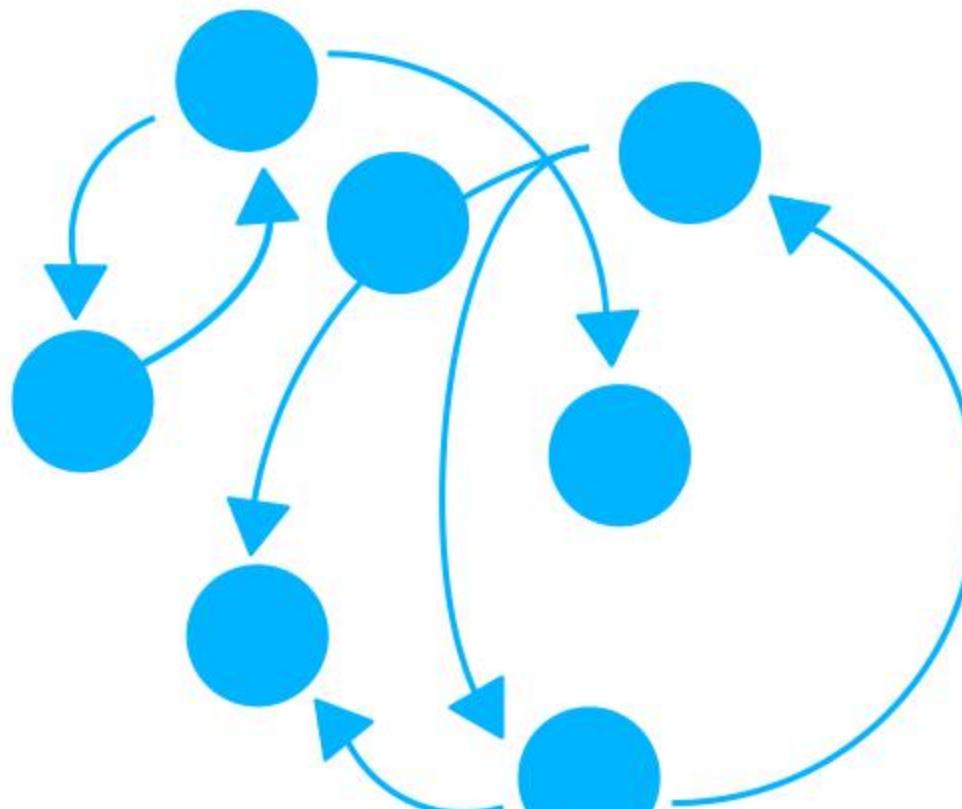


- Well-defined
- Traditional linear process of problem-solving methods
  - understand the problem which can include data gathering and analysis,
  - then formulate and implement a solution



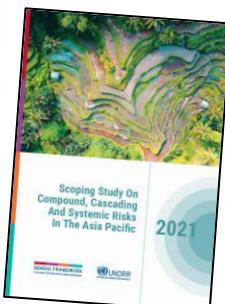
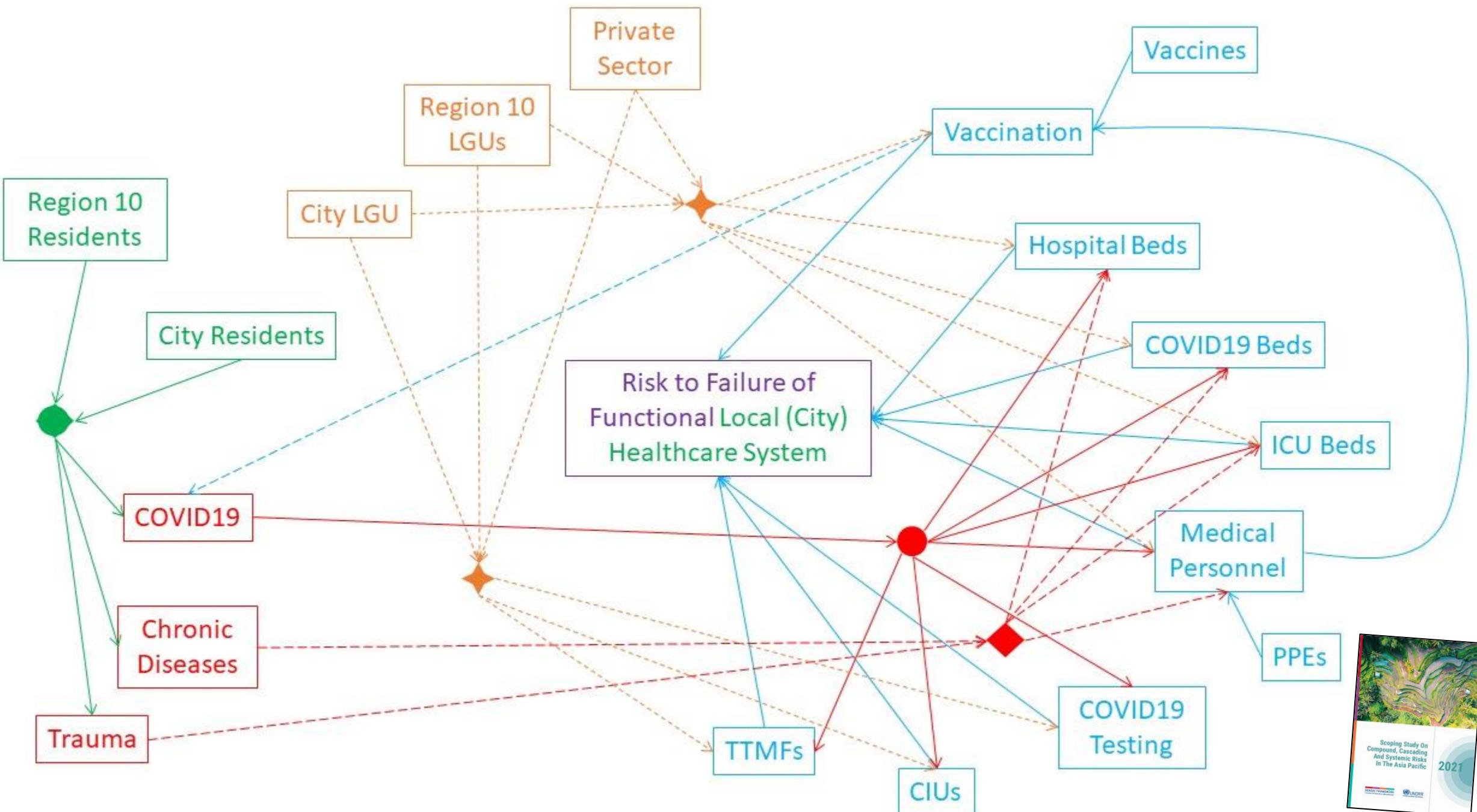
Dennehy & De Smet  
<http://2014.innofin.org/public/docs/Proceedings/WS1.pdf>

# Systems thinking



- Multiple stakeholders - many decision-makers with conflicting values
- Dependence on human cognitive abilities (creativity) & social abilities (teamwork)

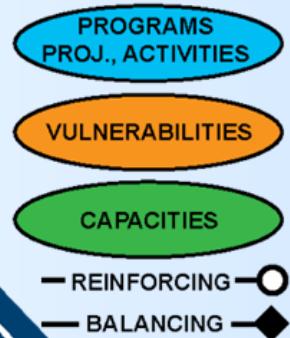
(Hevner et al., 2004)



## SYSTEMS MAP

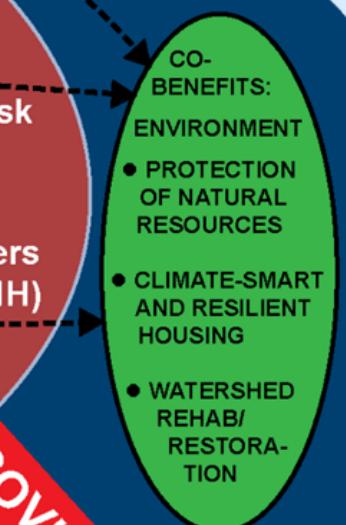
### FLOODING

### Symbols



### COVID-19

### FLOODING



### INFRASTRUCTURE

ROAD  
OPENING (44M)

Primary and secondary roads essential to the supply chain

PUBLIC  
PROCESSING  
PLANTS

STORAGE  
FACILITIES

DISRUPTED  
SUPPLY CHAIN

FLOOD  
MITIGATION (85M)

FLOODED  
LIFELINE UTILITIES/  
SUPPLY CHAIN

PRESENCE OF ADAPTATION/  
MITIGATION MEASURES

AGRO-HOUSING  
PROJECT

DECREASED FOOD  
SECURITY DUE TO  
SUPPLY CHAIN DISRUPTION,  
DECREASED ACCESS/  
AVAILABILITY

COMMUNITY  
VEG PRODUCTION

RESTRICTED  
MOBILITY DUE TO  
QUARANTINE

DRYPACKBET  
FOOD TECH

ACCESS TO  
FIN. ASSISTANCE

MULTI-SEC  
PARTNERSHIPS  
(PRIVATE SEC.,  
ACADEME)

SUMMER PROG. FOR  
EMP. OF STUDENTS (SPES)

PHP85.6M  
income  
loss affecting  
44% of  
labor force

LOCAL  
ECONOMY

>19K HH at risk  
to flooding  
Urban poor  
informal settlers  
(approx. 22K HH)

HUMAN  
DEVELOPMENT

COVID-19

EMPLOYMENT  
STATUS

CITY VACC  
RATE

COORDINATED  
DISASTER RELIEF  
EFFORTS

DRYPACKBET  
FOOD TECH

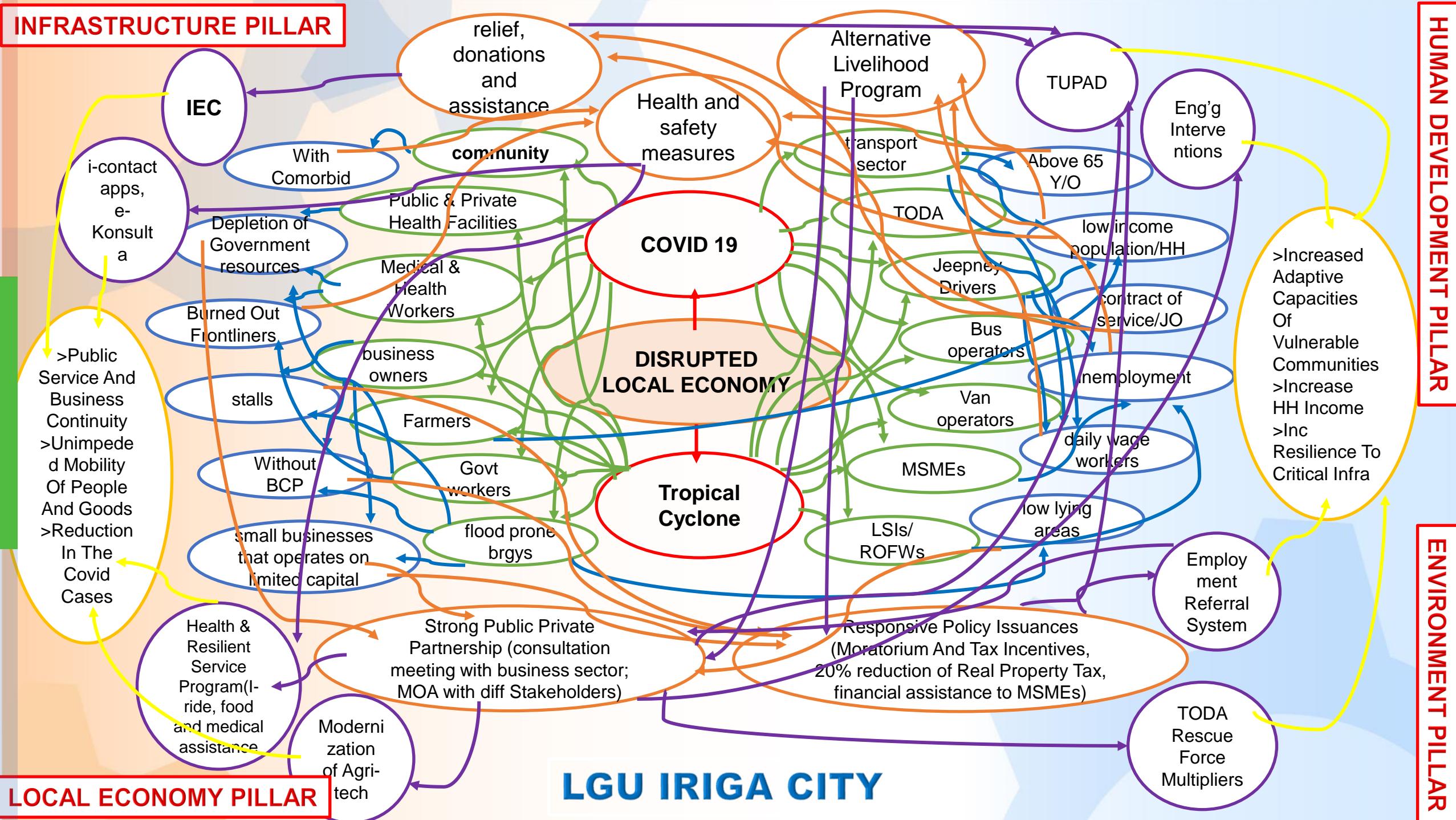
ACCESS TO  
FIN. ASSISTANCE

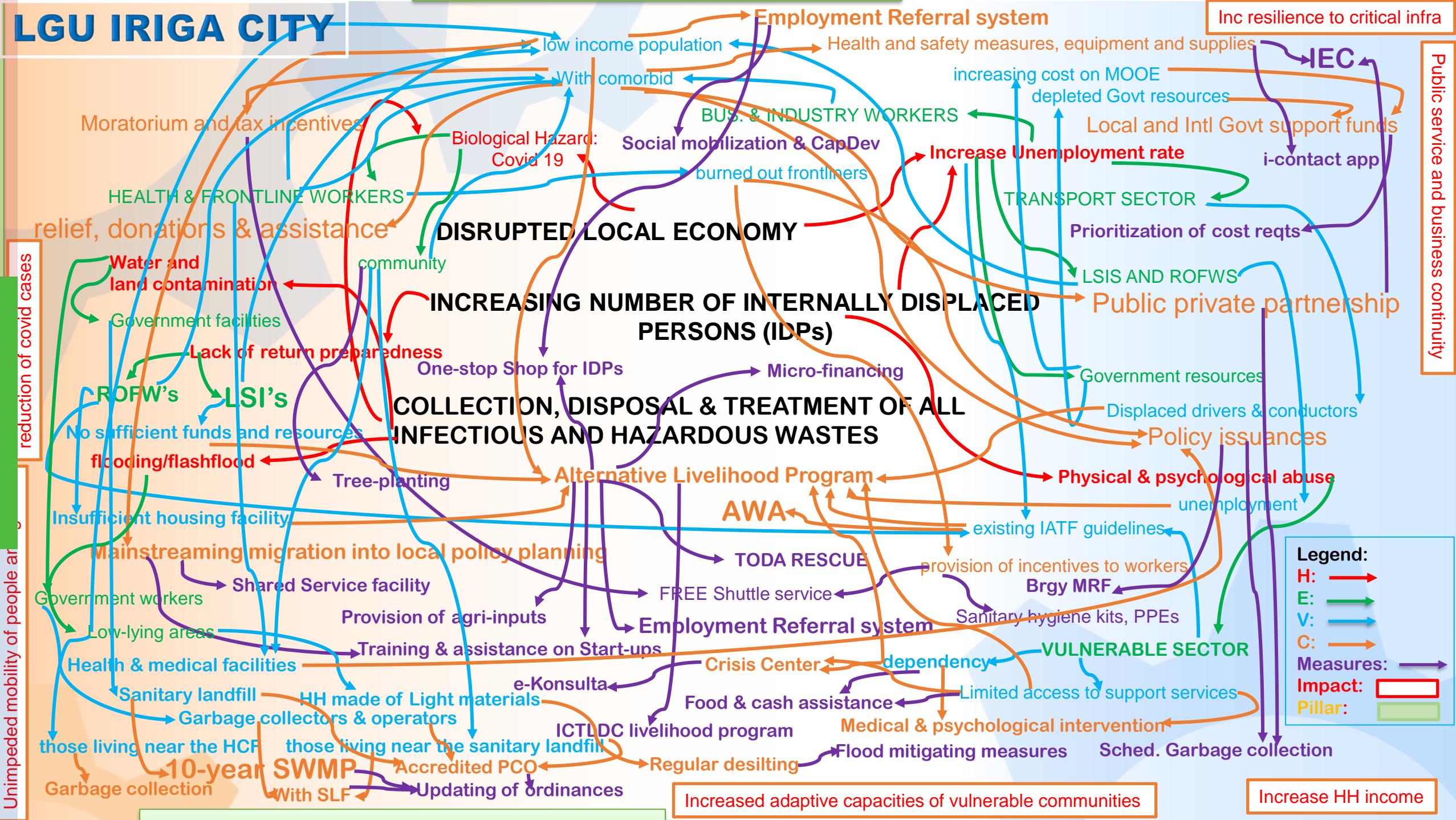
SUMMER PROG. FOR  
EMP. OF STUDENTS (SPES)

MULTI-SEC  
PARTNERSHIPS  
(PRIVATE SEC.,  
ACADEME)

SUMMER PROG. FOR  
EMP. OF STUDENTS (SPES)

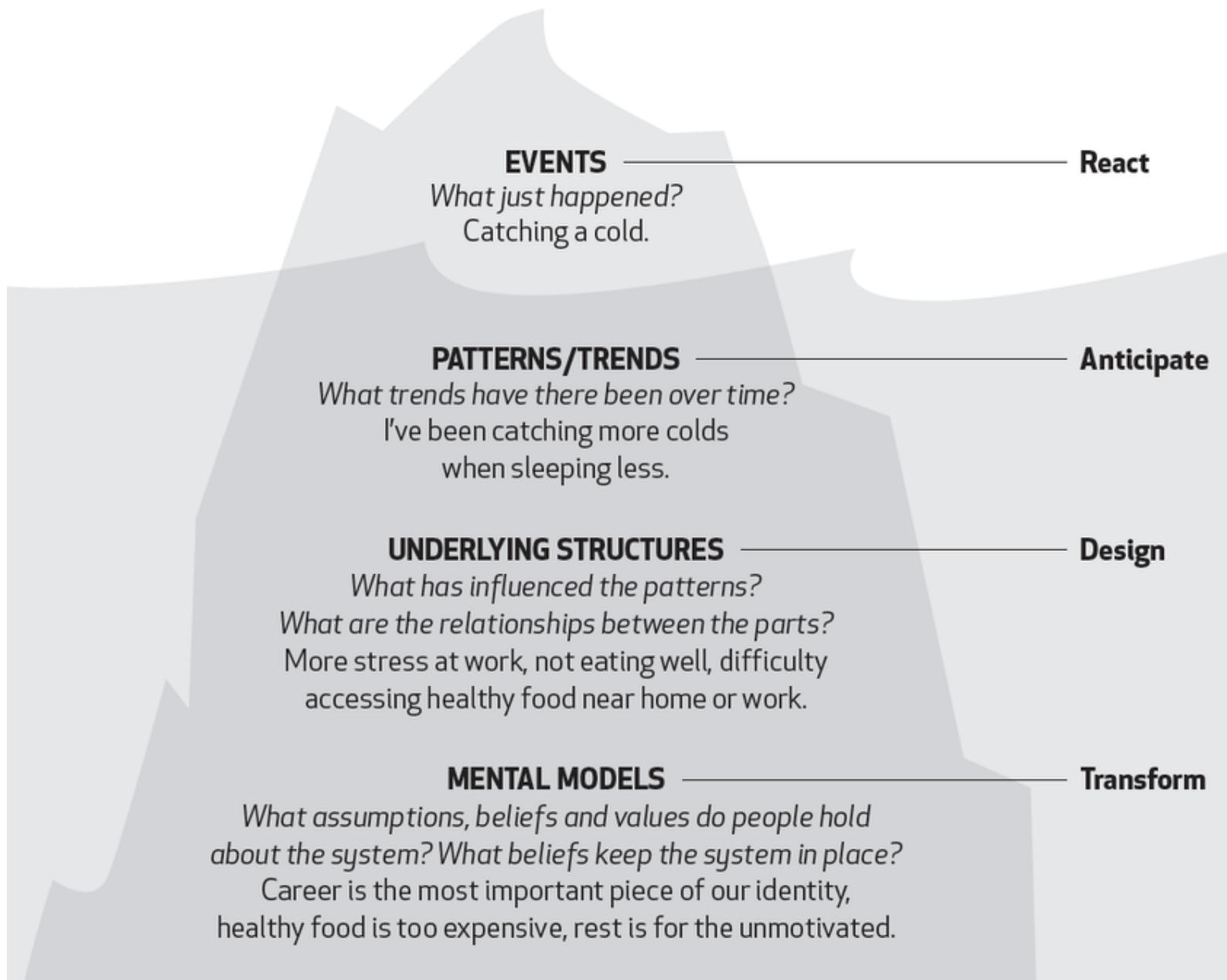
SUMMER PROG. FOR  
EMP. OF STUDENTS (SPES)



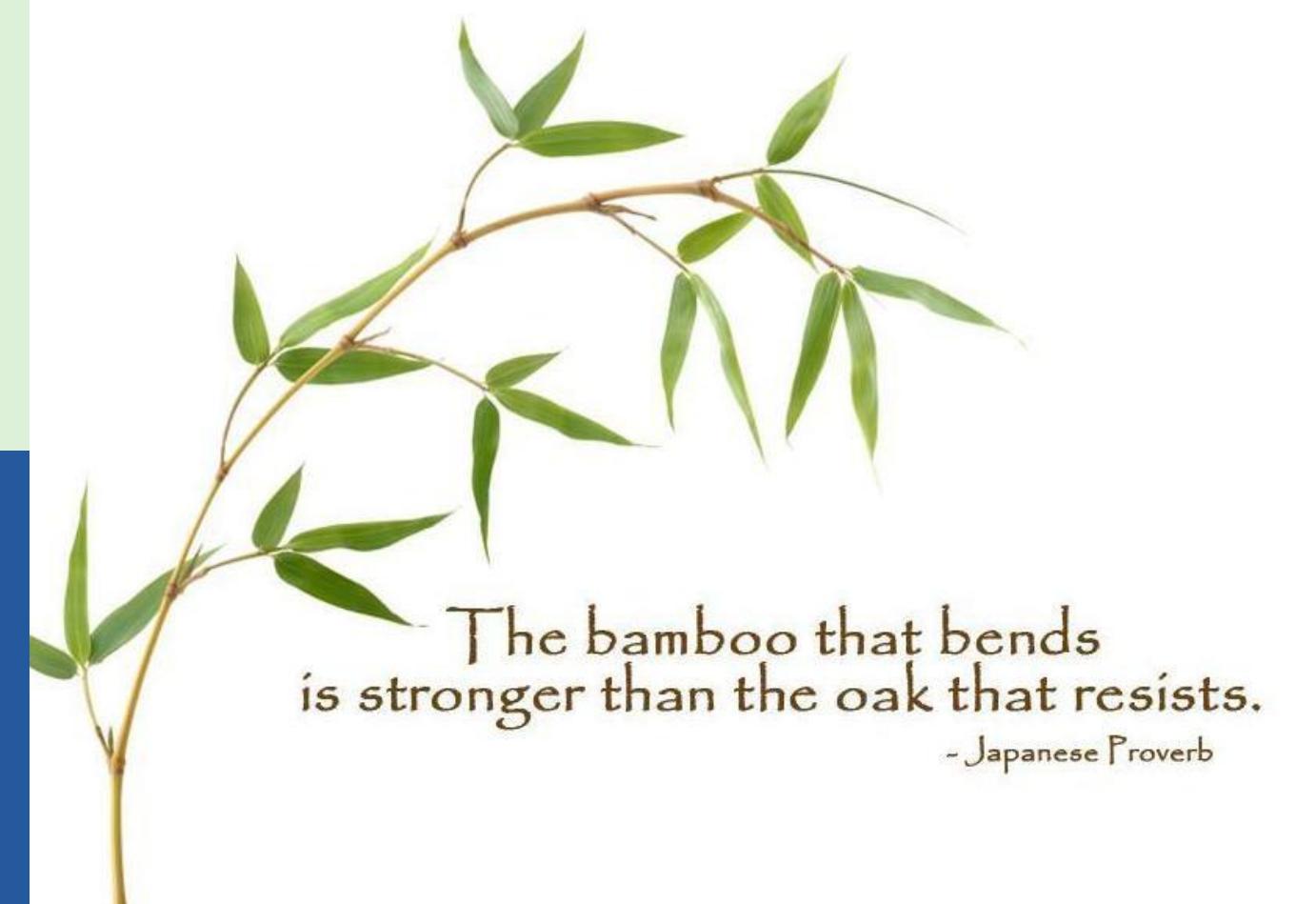


# THE ICEBERG

## A Tool for Guiding Systemic Thinking



# RISK TO RESILIENCE



The bamboo that bends  
is stronger than the oak that resists.

- Japanese Proverb



2009  
UNISDR  
Terminology  
on  
**Disaster  
Risk  
Reduction**



# Disaster Risk

The potential loss of life, injury, or destroyed or damaged assets which could occur to a system, society or a community in a specific period of time, determined probabilistically as a function of **hazard**, **exposure**, **vulnerability** and **capacity**.

2009  
UNISDR  
Terminology  
on  
**Disaster  
Risk  
Reduction**



# Resilience

The **ability** of a **system, community or society** exposed to **hazards** to resist, absorb, accommodate, adapt to, transform and recover from the effects of a **hazard** in a timely and efficient manner, including through the preservation and restoration of its **essential basic structures and functions** through risk management.



## New Research Framework “Disaster Resilience Model”

$$R = f(D, A, T)$$

Where

R: Resilience

D: Damage =  $f(H, E, V)$

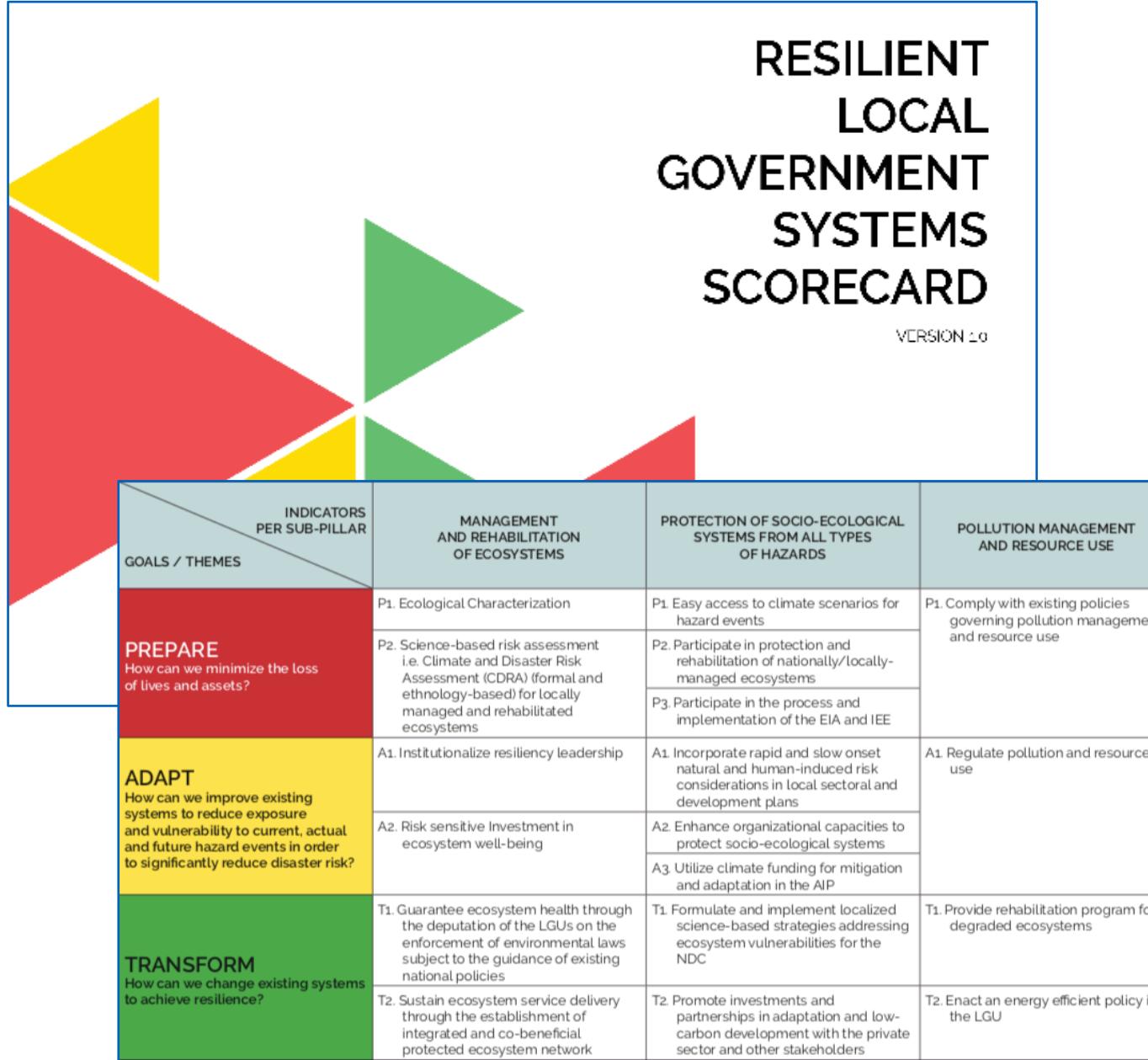
A: Human Activities

T: Time

**“resist, absorb, accommodate, adapt to,  
transform and recover from the effects  
of a hazard in a timely and efficient...”**



# NRC Resilience Scorecard



## PREPARE (Year 1)

**53** Performance Indicators  
**99** Minimum Requirements  
**79** MOVs

## ADAPT (Year 2)

**32** Performance Indicators  
**82** Minimum Requirements  
**78** MOVs

## TRANSFORM (Year 3)

**33** Performance Indicators  
**78** Minimum Requirements  
**29** MOVs

# Sample Scorecard: Baseline and Updated Resilience Scorecard (PREPARE Phase)

## Cagayan de Oro

PREPARE Theme Summary Scorecard of Cagayan de Oro City as of January 2019											
HUMAN DEVELOPMENT			LOCAL ECONOMY			INFRASTRUCTURE			ENVIRONMENT		
HEALTH	EDUCATION	SOCIAL PROTECTION	LIVELIHOODS	MSMES	LARGE BUSINESSES	HOUSING	BUILDINGS	LIFELINESS	ECOSYSTEM	SOCIO-ECO SYSTEM	POLLUTION MGMT & EFFICIENT USE OF RESOURCES
Functional Local Health Board (LHB)	Functional Local School Board (LSB)	Functional Local Social Protection Team/SPT (Province; city/municipality; barangay levels)	Presence of data inventory on informal economy	Presence of data inventory on MSMEs	Tax incentives on CDRA related investments based on CDRA to include new construction	CDRA-based inventory of residential housing (including man-made structures)	CDRA-based inventory & audit of assets related to financial, logistics, transport, power, fuel, energy, gensets, water, sanitation, telcos, food, health)	Ecological Characterization	Easy access to climate scenarios for hazard events	Comply with existing policies governing pollution management and resource use	
Presence of Disaster Risk Reduction Management in Health (DRRM-H) Plan	Compliance of the SDRRM Team with the CSSMT indicators related to Preparedness, Prevention and Mitigation	Establish DSWD Social Protection Programs	Livelihood opportunities assessment	Integrate science-based public-private partnerships (PPP)/joint projects	Network of accessible resilient evacuation centers & temporary shelters	Harmonization & compliance to codes and standards (building code, fire code, etc) with preventive maintenance program for assets	CDRA-based audit of infrastructure (roads, bridges, seaports, airports)	Science-based risk assessments i.e. CDRA (formal and ethno-based) for locally managed restoration of healthful ecosystem	Participate in protection and rehabilitation of nationality/locally managed ecosystems		
	Support the Compliance of the SDRRM Team with CSSMT indicators pertaining to prevention, mitigation & preparedness	Comply with social Protection Requirements of SGIG (Seal of Good Local Government)	Capability building on financial literacy, CDRA, etc.	Formulate Business Continuity Management (BCM)	Implement data management and recovery initiatives	Building emergency plan	Early warning Systems		Participate in the process and implementation of the EIA and IEE		
						Continuity plans for the provision of critical services (related to financial, logistics, transport, power, fuel, energy, gensets, water and sanitation, telcos, food, health services, security, peace and order)					

### Jan 2019 Baseline Scorecard

Red Ratings = Not Achieved

Yellow Ratings = Partially Achieved/ Ongoing

Green Ratings = Fully Achieved/Accomplished

PREPARE Theme Summary Scorecard of Cagayan de Oro City as of October 2020											
HUMAN DEVELOPMENT			LOCAL ECONOMY			INFRASTRUCTURE			ENVIRONMENT		
HEALTH	EDUCATION	SOCIAL PROTECTION	LIVELIHOODS	MSMES	LARGE BUSINESSES	HOUSING	BUILDINGS	LIFELINESS	ECOSYSTEM	SOCIO-ECO SYSTEM	POLLUTION MGMT & EFFICIENT USE OF RESOURCES
Functional Local Health Board (LHB)	Functional Local School Board (LSB)	Functional Local Social Protection Team/SPT (Province; city/municipality; barangay levels)	Presence of data inventory on informal economy	Presence of data inventory on MSMEs	Tax incentives on CDRA related investments based on CDRA to include new construction	CDRA-based inventory of residential housing (including man made structures)	CDRA-based inventory & audit of assets (related to financial, logistics, transport, power, fuel, energy, gensets, water, sanitation telcos, food, health)	Ecological Characterization	Easy access to climate scenarios for hazard events	Comply with existing policies governing pollution management and resource use	
Presence of Disaster Risk Reduction Management in Health (DRRM-H) Plan	Compliance of SDRRM Team with the CSSMT indicators related to Preparedness, Prevention and Mitigation	Establish DSWD Social Protection Programs	Livelihood opportunities assessment	Integrate science-based public-private partnerships (PPP)/joint projects	Network of accessible resilient evacuation centers & temporary shelters	Harmonization & compliance to codes and standards (building code, fire code, etc) with preventive maintenance program for assets	CDRA-based audit of infrastructure (roads, bridges, seaports, airports)	Science-based risk assessment i.e., CDRA (formal and ethno-based) for locally managed restoration of healthful ecosystem	Participate in protection and rehabilitation of nationality/locally managed ecosystems		
	Support the Compliance of the SDRRM Team with CSSMT indicators pertaining to prevention, mitigation & preparedness	Comply with social Protection Requirements of SGIG (Seal of Good Local Government)	Capability building on financial literacy, CDRA, etc.	Formulate Business Continuity Management (BCM)	Implement data management and recovery initiatives	Building emergency plan	Early warning Systems		Participate in the process and implementation of the EIA and IEE		
						Continuity plans for the provision of critical services (related to financial, logistics, transport, power, fuel, energy, gensets, water and sanitation, telcos, food, health services, security, peace and order)					

### October 2020 Updated Scorecard

# ADAPT

HUMAN DEVELOPMENT			LOCAL ECONOMY			INFRASTRUCTURE			ENVIRONMENT		
Health	Education	Social Protection	Livelihood	MSMES	Large Businesses	Housing	Buildings	Lifelines	Ecosystem	Socio-ecosystem	Pollution Management and Resource Use
Expanded & Functional Local Health Board	LGU-managed adaptive measures to complement adaptive strategies of SDRRM Plan	LGU-managed Social Protection Program through the local Social Protection Team on promotive interventions in the context of DSWD 4 Core Social Protection Programs and Responses	Transition from informal to formal economy	Established MSME information system redundancy	Presence of investments in resilience	Institutionalization of retrofitting, rebuilding, and resettlement policies at the local level consistent with existing laws and policies, with strict adherence to the CDRA-based CLUP	Implement the guidelines on the redesign, retrofitting, and demolition of risk-enhancing public and private infrastructure	Institutionalize retrofitting, rebuilding, and upgrading policies at the local level consistent with existing laws and policies & strict adherence to the CDRA-based CLUP	Ecosystems-based resiliency leadership institutionalized	Ecosystems are factored into a multi-hazard risk analysis annually or as needed, which includes pandemics and emerging risks, in the CDRA and informs the LCCAP, the DRRMP, the measures against pandemics and other emerging risks, and all other development plans, budgeting, and financing	Regulate resource use and pollution
Updated DRRM-H Plan based on CDRA of LGU	Support compliance of SDRRM Team with CSSMT Indicators pertaining to response & adaptation	Compliance with Accessibility Law in evacuation centers & temporary shelters & related SGLG requirements	Available financing from formal and non-formal financial channels for small businesses	Improved business environment	Established procedures for Business Continuity Plan (BCP) Monitoring	Propose design of housing alternatives & innovative solutions for exposed informal, formal and vulnerable sectors	Rehabilitate, retrofit, strengthen buildings & structures based on assessment	Formalize pre-agreements with basic utility service providers	Proactive management of resource quality and ecosystems impact	Enhance organizational capacities to protect socio-ecological systems Investment in appropriate and responsive human, technical and financial capacities and technology	
Established City-wide Local Health System (CLHS)	Support compliance of higher education institutions with DRRM requirements of CHED in the NSTP pertaining to adapt DRRM theme	Compliance with GAD requirements of SGLG	Established LGU information management system	Established procedures for Monitoring Business Continuity Plan (BCP) Implementation	Operational Data servers	Propose design of vertical collective* housing alternatives & innovative solutions	Formalize pre-agreements/protocols with various sectors	Coordinate continuity plans for immediate & inclusive access to critical services	Risk sensitive investment in ecosystem well-being	Utilize climate funding for mitigation & adaptation in the LCCAP and LDRRMP	
				<ul style="list-style-type: none"> <li>- <b>direct</b></li> <li>- <b>mobilizing</b></li> <li>- <b>enabling</b></li> </ul>		Factor in CDRA-based financing and investment planning and program of the LGUs the retrofitting, rebuilding and resettlement of the formal, informal, and vulnerable sector; exploring internal and external sources			<p>What else?</p> 		

*Risk is...*

- Real, Systemic
- Measurable
- Opportunity, Hope



# *Resilience..*

- Transdisciplinary
- Transformative
- Intergenerational







# Xavier University

ATENEO DE CAGAYAN

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