

# Smart systems for climate change governance and disaster resiliency

A.M.F. Lagmay

Scientist



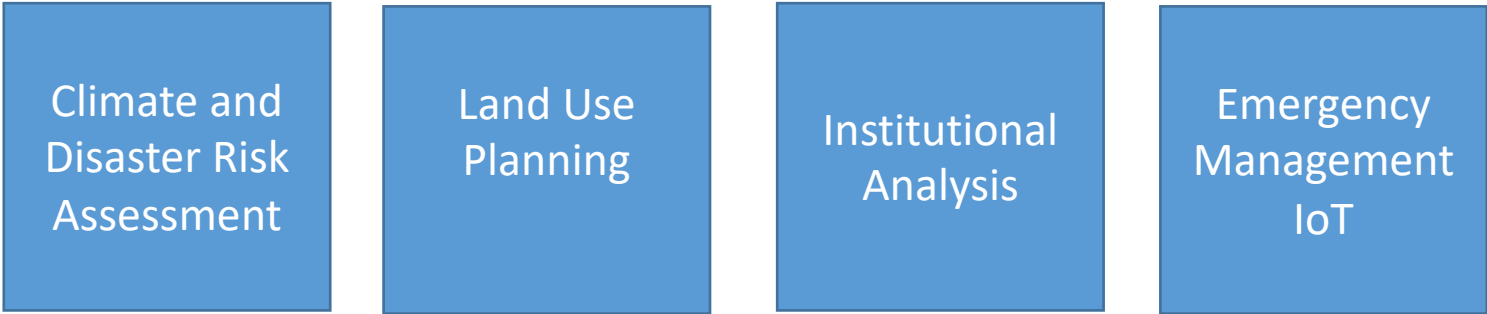
## Special Provision in the 2018 General Appropriations Act:

"The University of the Philippines Resilience Institute (UP RI), together with other state universities and colleges, shall support the Climate Change Commission in training LGUs to formulate and complete Local Climate Change Action Plans (LCCAP) and Comprehensive Land Use and Development Plans (CLUDP). The UPRI shall empower LGUs with science-based information and technologies for development planning, such as Climate Vulnerability and Disaster Risk Assessment (CVDRA) and multi-scenario, probabilistic hazard maps."





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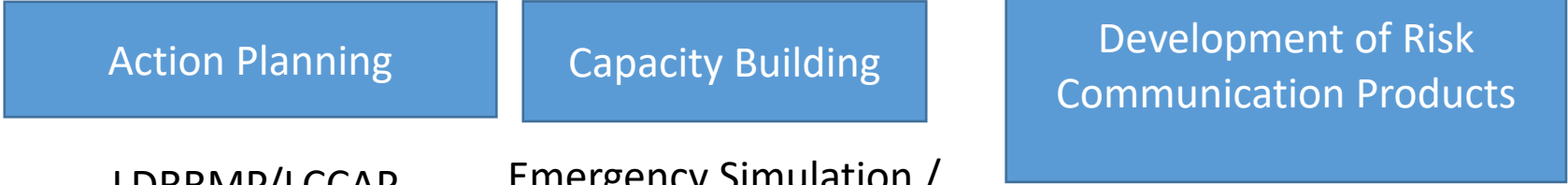
CDR Atlas  
Climate Change  
Adjusted Hazard  
Maps

CDRA-enhanced  
CLUP and CDP

ONA, CTNA  
CPs & Evac Plan  
Emergency Protocols

DSS (IoT)  
EOC set-up

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LDRRMP/LCCAP

Emergency Simulation /  
Table-top exercises

Knowledge Products  
Risk Communication Plan

# Timeline is based on experience of UP Resilience Institute fellows

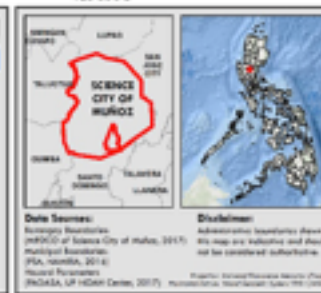
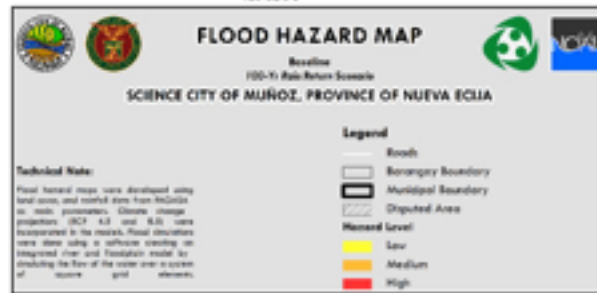
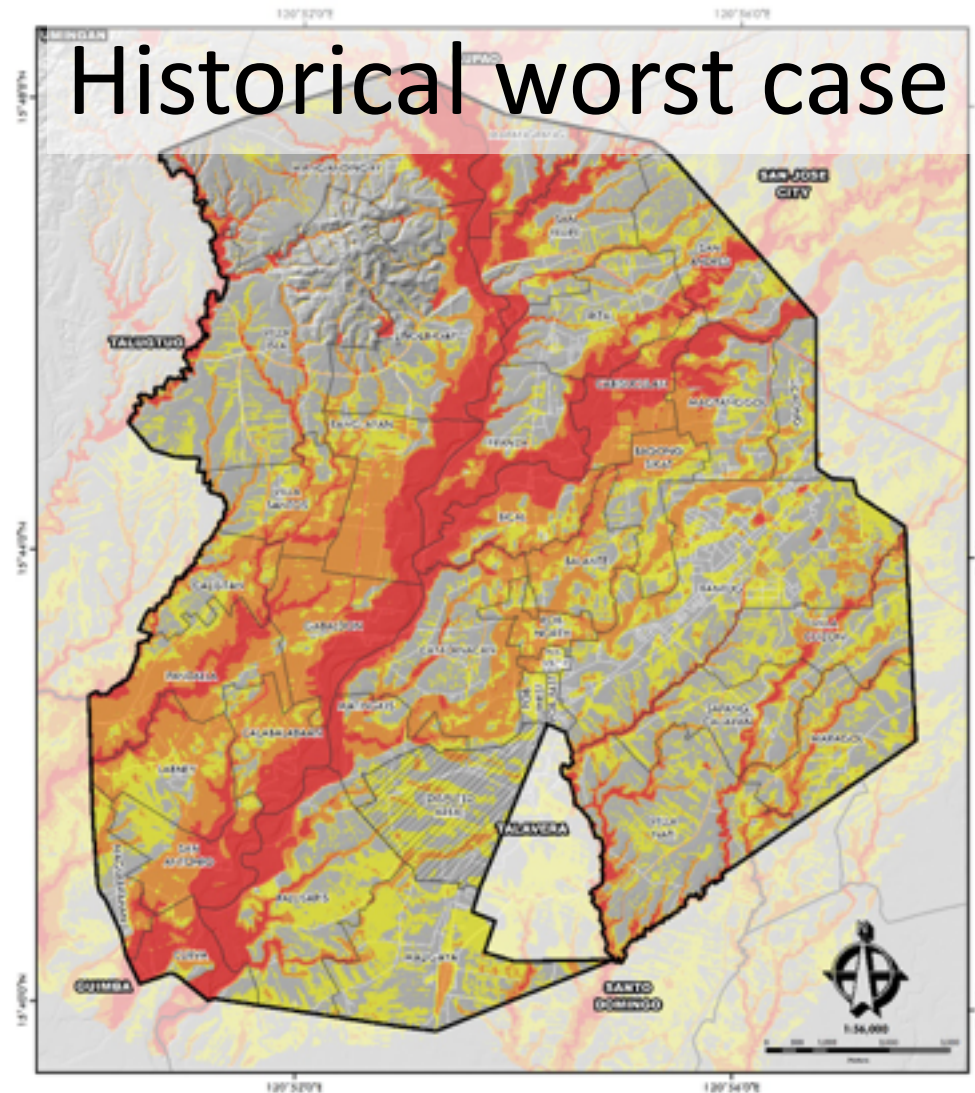
- LCCAP
  - Taysan, Batangas
  - Science City of Munoz, Nueva Ecija
  - Naga City, Cebu (ongoing)
- CLUP
  - Taysan, Batangas
  - Padre Garcia, Batangas
  - Science City of Munoz
  - Makati
  - Mabalacat, Pampanga
  - Arayat, Pampanga
  - Magalang, Pampanga
  - Santa, Rita, Pampanga
  - Iriga City, Pampanga
  - Naga City, Cebu (ongoing)
  - CDO (Ongoing)
- CDRA
  - Majay, Laguna
  - Dumangas, Zaragga, Passi City, Iloilo
  - Tuguegarao City and Iguig, Cagayan
  - 30 poor municipalities of Samar and Leyte
  - Naga City, Cebu (ongoing)
- LDRRMP/CP
  - 51 LGUs of Cebu City
  - Tinambak, Camarines Sur
- Many others



# Basic Principles

- Science-based with climate change projections
- Participatory
- Capacity building
- Transdisciplinary (deep pool of experts composed of ~200 fellows from different fields of expertise)
- Sustainability (Platform that is available for use by the City of Manila)
- Advanced technologies (low-cost)

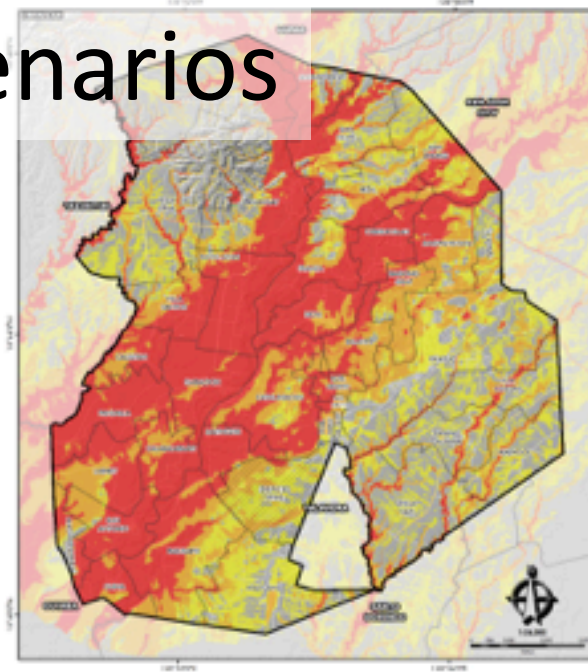
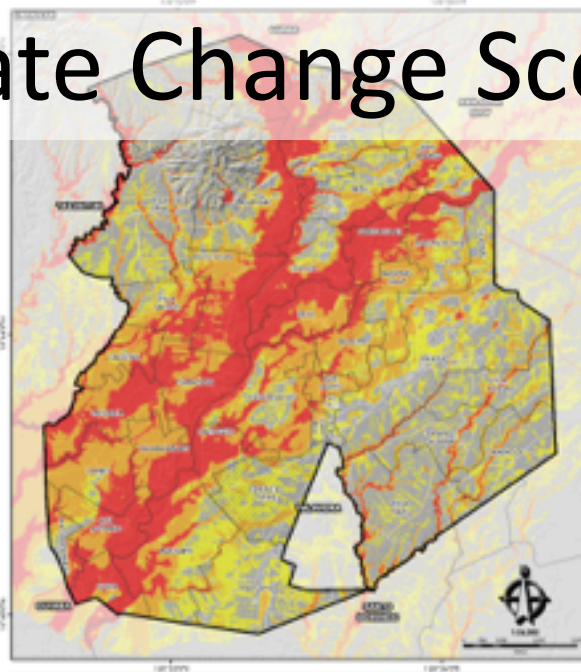
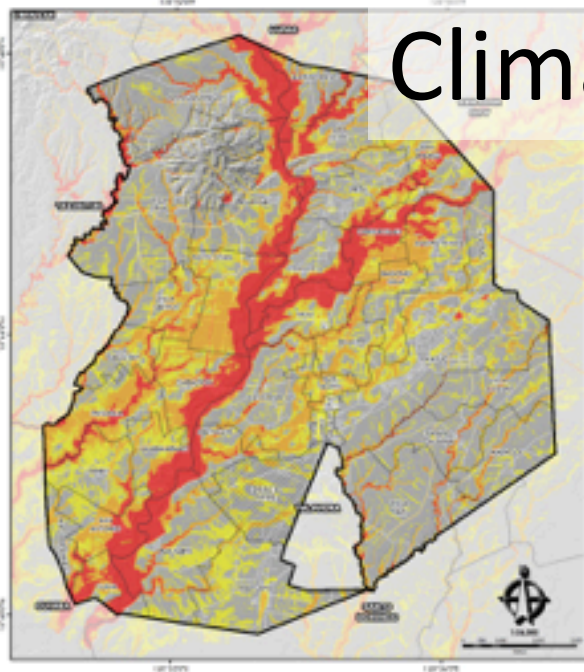
# Historical worst case



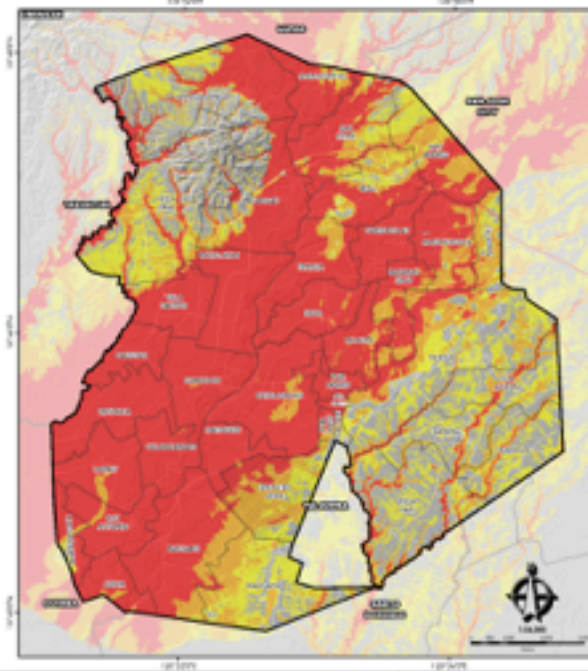
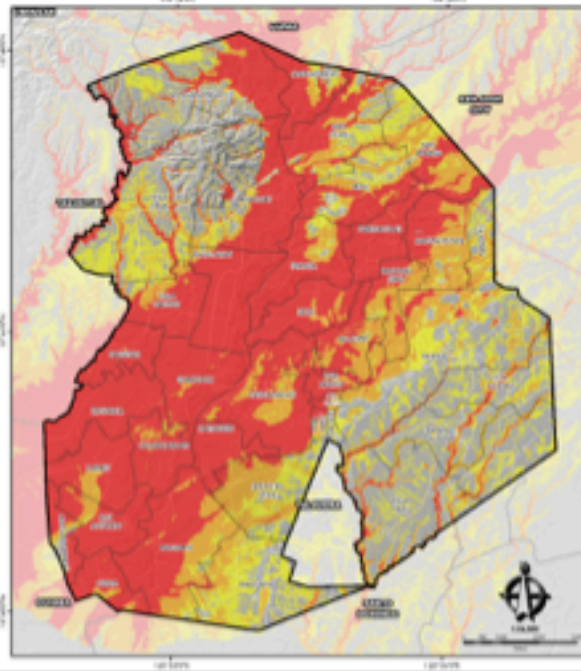
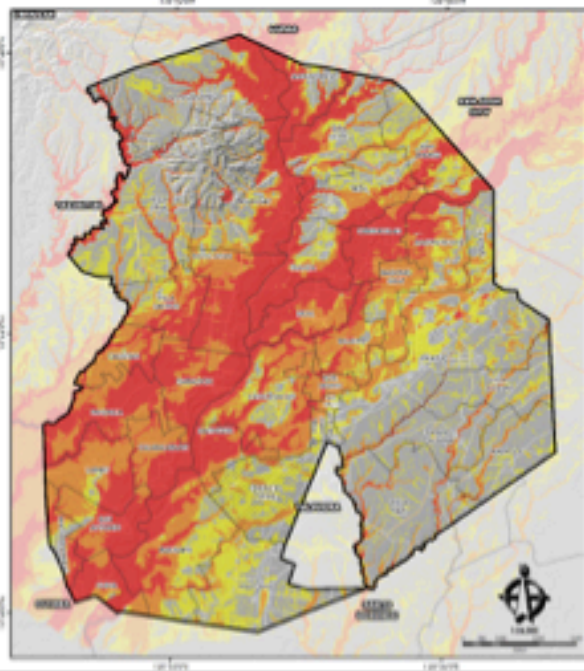


# Climate Change Scenarios

**RCP 8.5 2049**

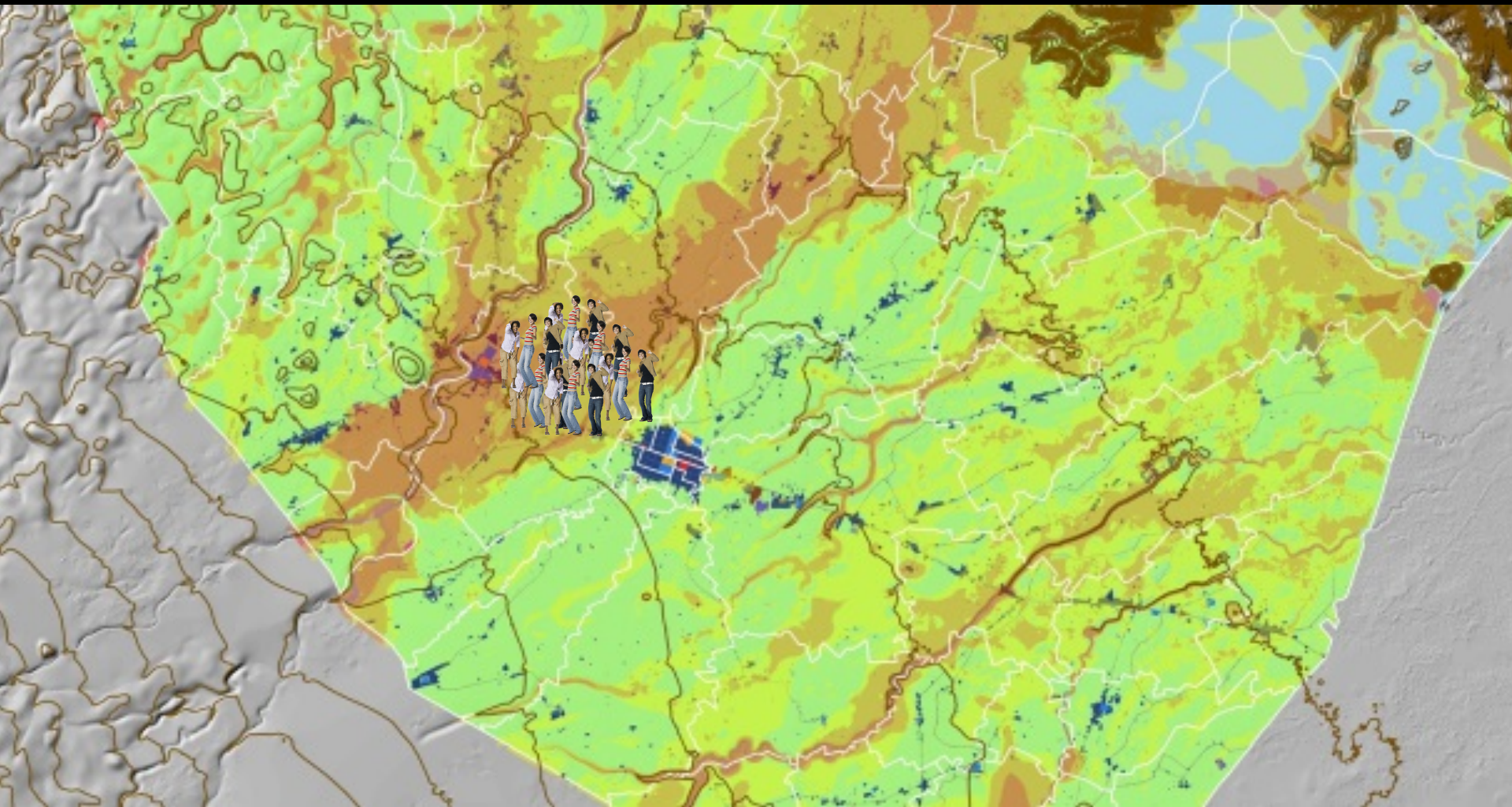


**RCP 8.5 2079**





100 –year rain  
return flood



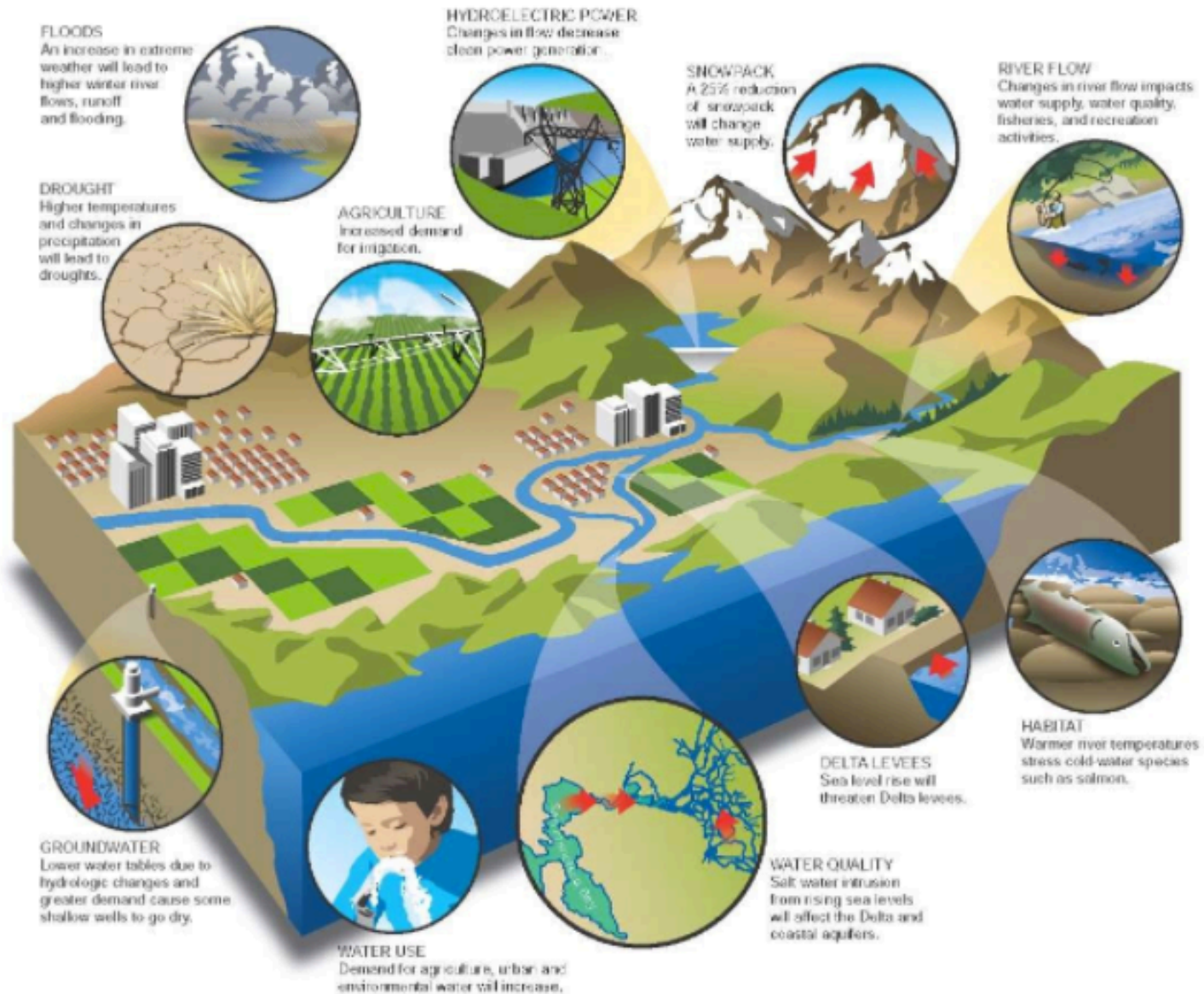


# Participatory – capacity building



# Transdisciplinary – expertise from the entire UP System

- Agriculture
- Coastal
- Water
- Health
- Forestry
- Biodiversity
- Environment
- Energy
- Education
- Tourism
- Infrastructure
- Settlement
- Mining





# Online analytics platform and repository for LCCAP and other development plans of the community

← → × ⓘ Not Secure | rebuild.noah.up.edu.ph/login?next=%2F 🔑 ☆ 📄 eBay ⋮

Welcome to Geospatial Analytics Platform!


☐ **Login Account**  
Authorized person only

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**Username**

**Password**

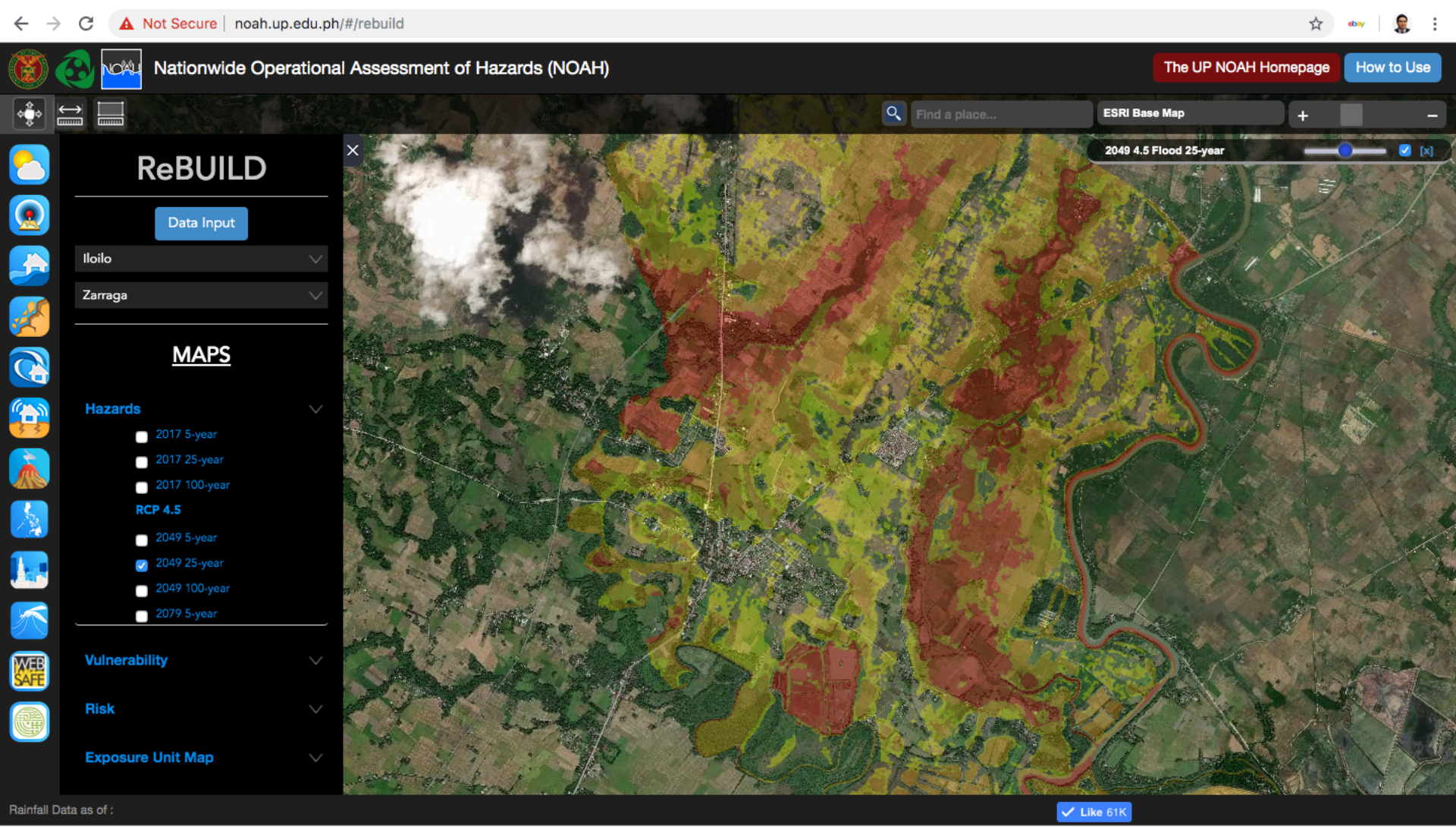
Login



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# Sustainability

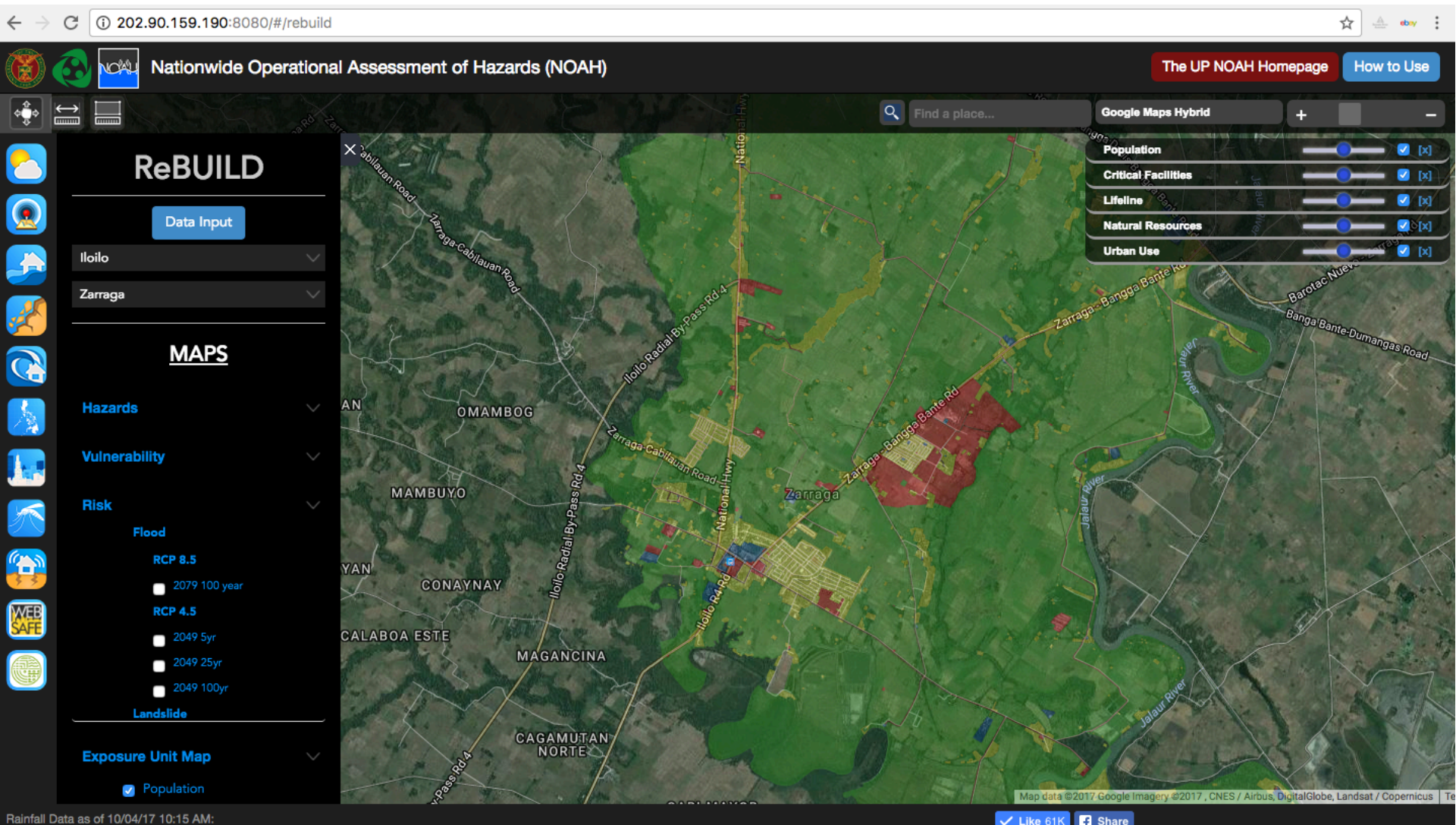
Online analytics platform and repository for LCCAP and other development plans of the community





# Sustainability

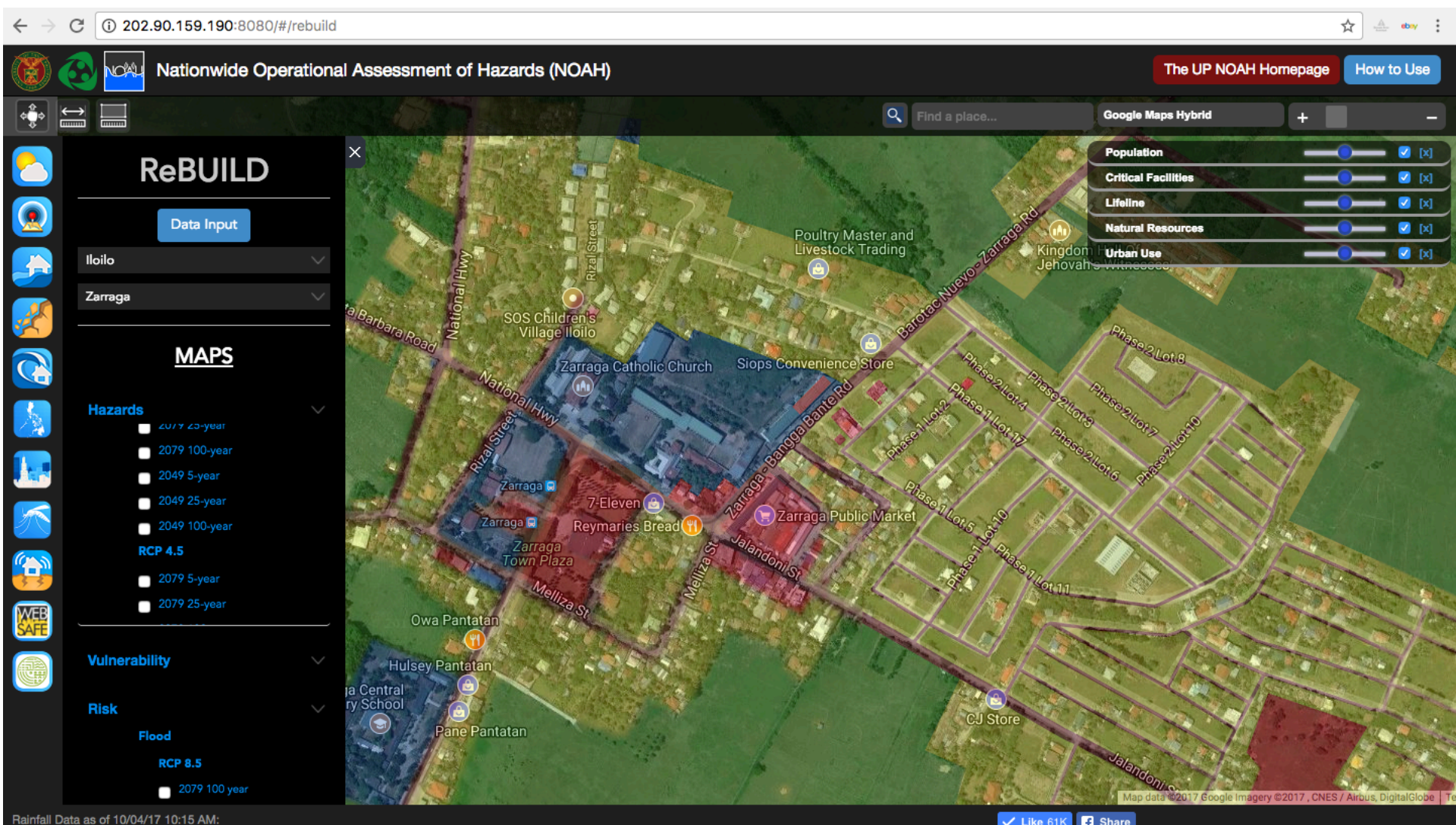
Online analytics platform and repository for LCCAP and other development plans of the community





# Sustainability

Online analytics platform and repository for LCCAP and other development plans of the community



# Sustainability

Online analytics platform and repository for LCCAP and other development plans of the community

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[[[ selectedAssessment ]]]

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DUMANGAS | Log Out

Vulnerability Assessment

Disaster Risk Assessment

Flood

Landslide

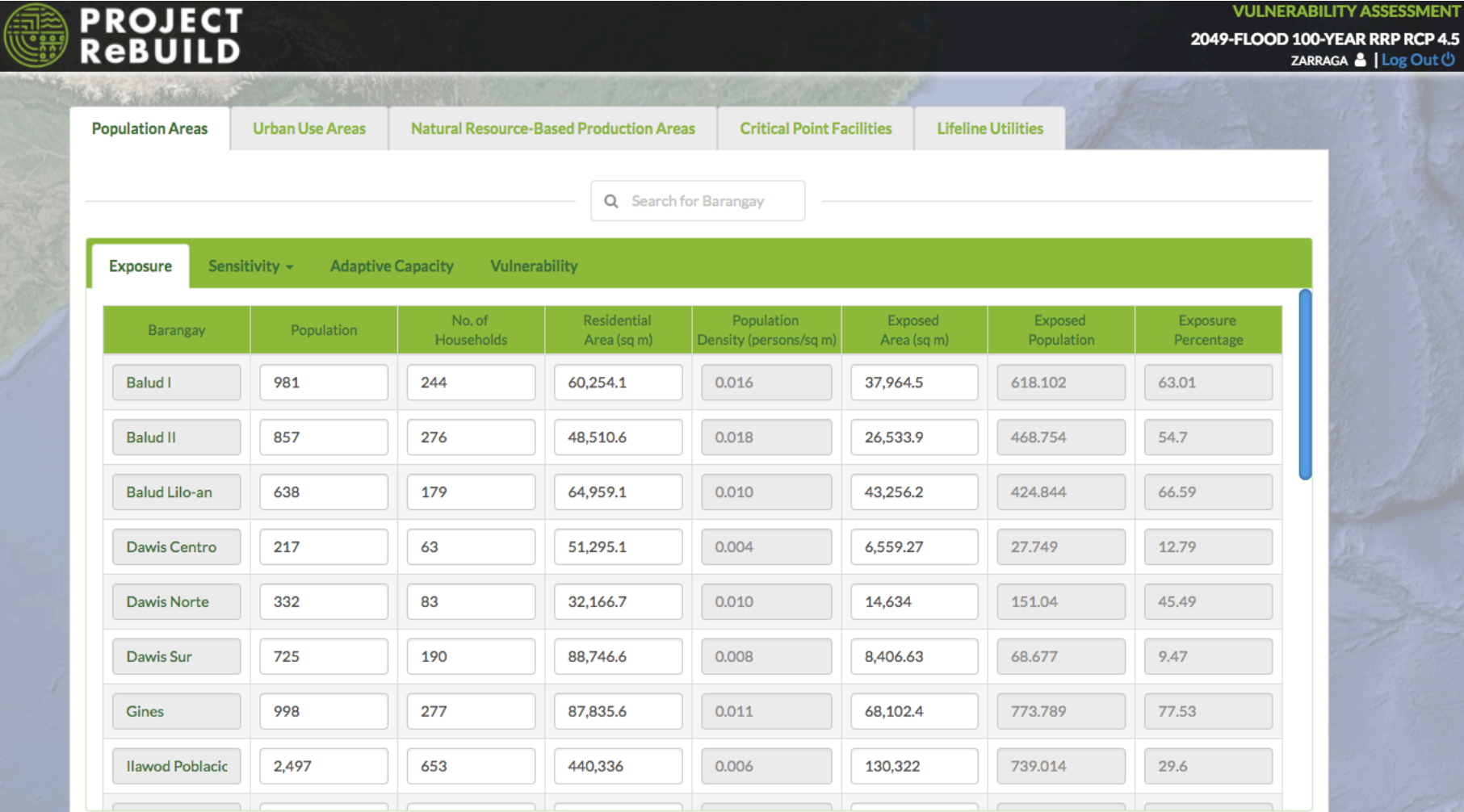
Storm Surge

Baseline Hazard	Climate Change-Adjusted Hazard
<input type="checkbox"/> Flood 5-Year RRP	2049
<input type="checkbox"/> Flood 25-Year RRP	<input type="checkbox"/> Flood 5-Year RRP RCP 4.5
<input type="checkbox"/> Flood 100-Year RRP	<input type="checkbox"/> Flood 5-Year RRP RCP 8.5
	<input type="checkbox"/> Flood 25-Year RRP RCP 4.5
	<input type="checkbox"/> Flood 25-Year RRP RCP 8.5
	<input type="checkbox"/> Flood 100-Year RRP RCP 4.5
	<input type="checkbox"/> Flood 100-Year RRP RCP 8.5
	2079
	<input type="checkbox"/> Flood 5-Year RRP RCP 4.5
	<input type="checkbox"/> Flood 5-Year RRP RCP 8.5

→ Next

# Sustainability

Online analytics platform and repository for LCCAP and other development plans of the community





# Sustainability

Online analytics platform and repository for LCCAP and other development plans of the community

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PROJECT

VULNERABILITY ASSESSMENT

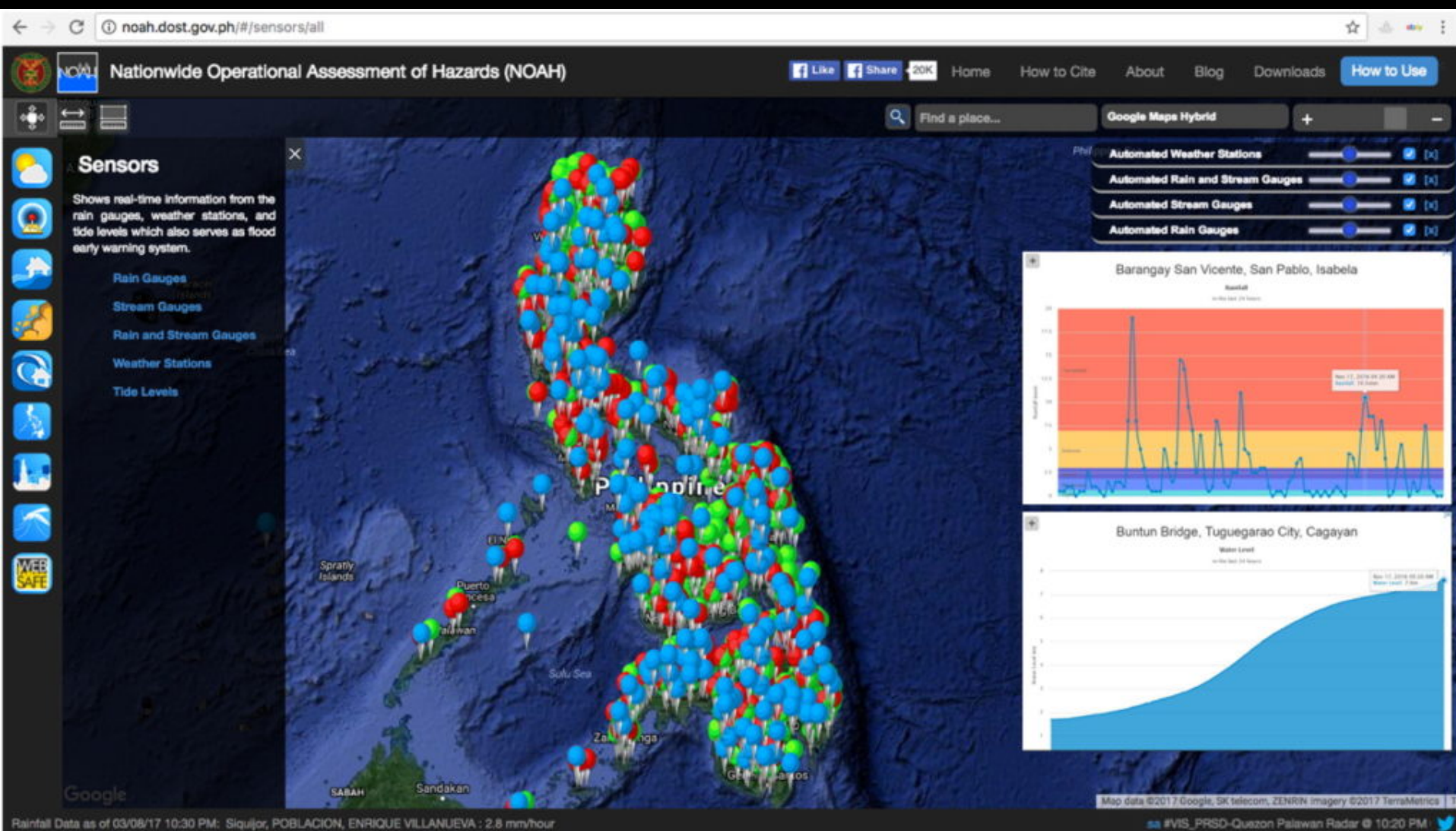
VULNERABILITY ASSESSMENT: LIFELINE UTILITIES (2049-FLOOD 100-YEAR RRP RCP 4.5)  
ZARRAGA

Exposure											Sensitivity			Impact		Adaptive Capacity				Vulnerability		
Barangay	Classification	Name	Length/Distance (km)	Construction/Replacement Cost (Php per In km)	Total Area per Road (sq m)	Exposed Area (sq m)	Exposed Length (In km)	Exposed Value (Php)	Exposure Percentage	Exposure Score	Percentage of Road in Good Condition	Percentage of Road in Poor Condition	Sensitivity Score	Exposure + Sensitivity Score	Degree of Impact Score	Indicator	Score				Vulnerability Index	Vulnerability Category
																Government Infrastructure Related Investment	Group 1	Group 2	Group 3	Average		
Balud I	Barangay Road	Jalaud Norte to Balud I	0.57	10000000	25534.2	15185.6	0	0	59.47	4	80	20	2	6	3	Farm to market road completed last December 2016	3	3	3	3	9	High
Balud II	Barangay Road	Brgy Balud II	0.53	10000000	14577.2	10329.5	0	0	70.86	4	50	50	4	8	3		3	3	3	3	9	High
Balud Lilo-an	Barangay Road	Brgy Balud Lilo-an	0.38	10000000	35993.1	23081.2	0	0	64.13	4	80	20	2	6	3	Concreting of road to be completed on May 2017	3	3	3	3	9	High
Dawis Centro	Barangay Road	Dawis centro	0.03	10000000	13341	1715.47	0	0	12.86	2	100	0	0	2	1	Rehabilitation of national road	3	3	3	3	3	Low
Dawis Norte	National Road	Dawis Norte, Highway	0.6	10000000	7785.6	3364.41	0	0	43.21	4	80	20	2	6	3	Ongoing projects include approx. 1km farm to market road c/o KALAH-I-CIDSS and road widening. There are plans to improve the roads, but there is no budget.	3	3	3	3	9	High
Dawis Sur	Barangay Road	Dawis Sur	0.62	10000000	18138.4	32.7	0	0	0.18	1	80	20	2	3	1		3	3	3	3	3	Low
Gines		Brgy Gines	2.01	10000000	44143.5	32191.2	0	0	72.92	4	80	20	2	6	3	Concreting last 2015	3	3	3	3	9	High
Ilawod Poblacion	Pathway	Poblacion Ilawod	0.09	10000000	80557.6	15196	0	0	18.86	2	100	0	0	2	1	Concreting of municipal streets	3	3	3	3	3	Low
Ilaya Poblacion		mutual homes subd. Poblacion Ilaya	0.07	10000000	52382.6	30696.5	0	0	58.6	4	96	4	1	5	2		3	3	3	3	6	Moderate
		Incendence																				

# Advanced technology (low-cost IoT) for disaster preparedness



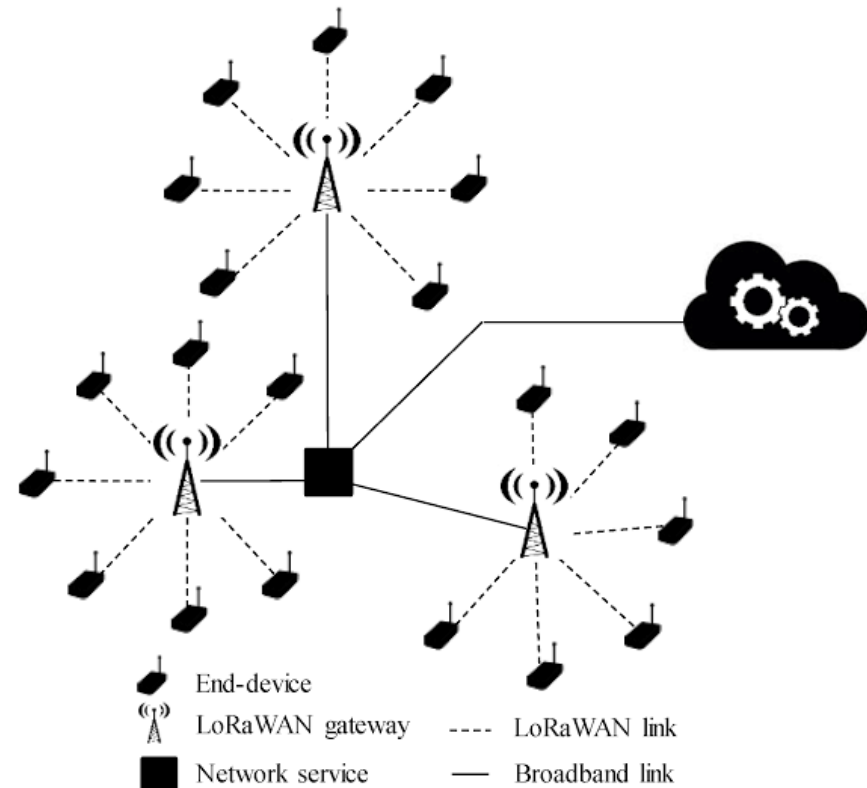
# Building on experience in using IoT and big data in disaster work





# Low cost IoT (Wireless)

- Robust Star topology
- Each data packet has sensor identifier
- Message passing
- Low power usage enables Li-ion batteries to last for months
- “Real time” data visualization







8km

21km



3km







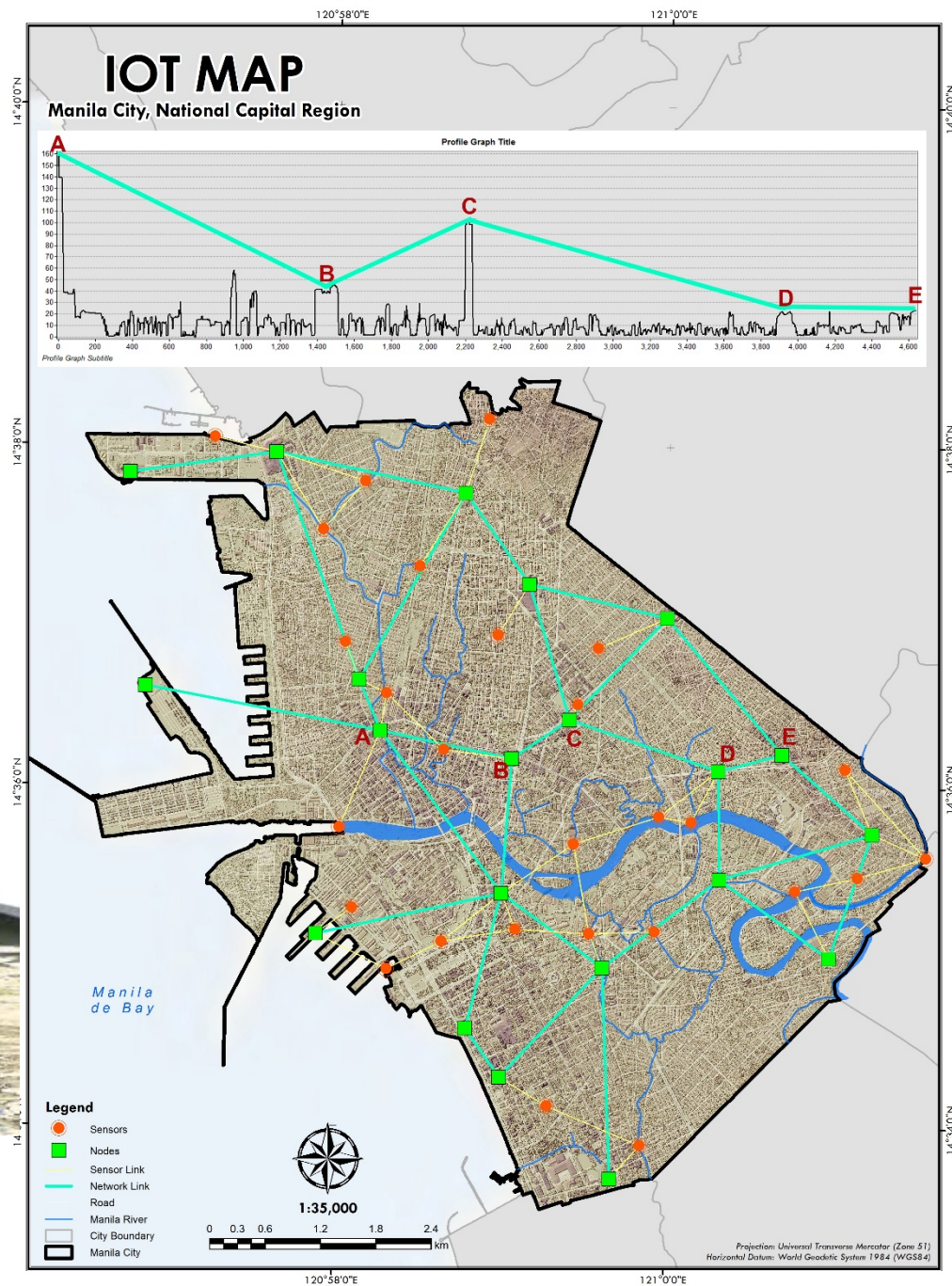
Street Flood Sensor



Rain Gauge



Tide Gauge



Accelerometer

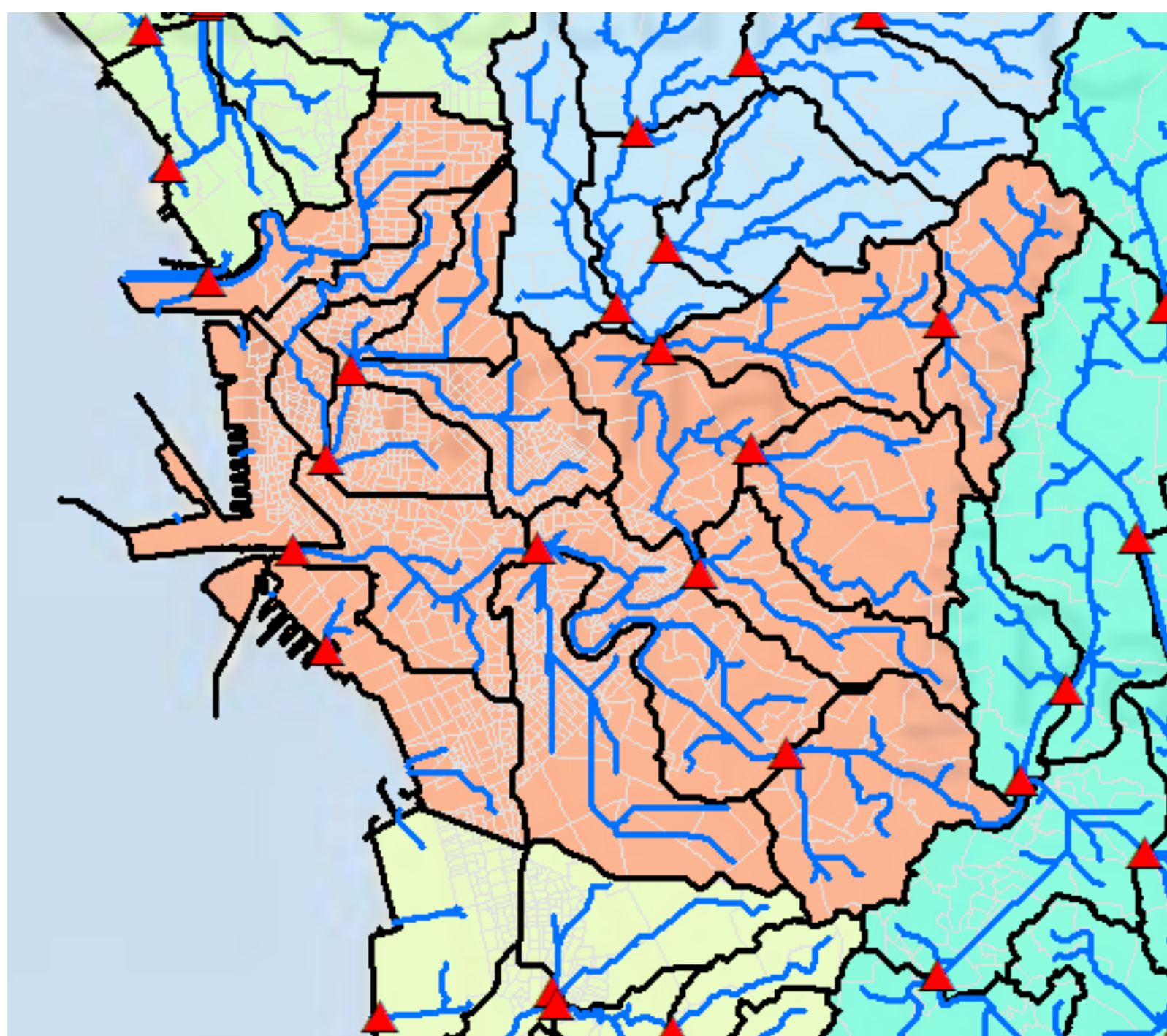


Pollution meter



River water level sensor







6.1

Mindanao, Philippines

2020-09-06 15:23:45 ↓ 133 km



FOLLOWING

4D

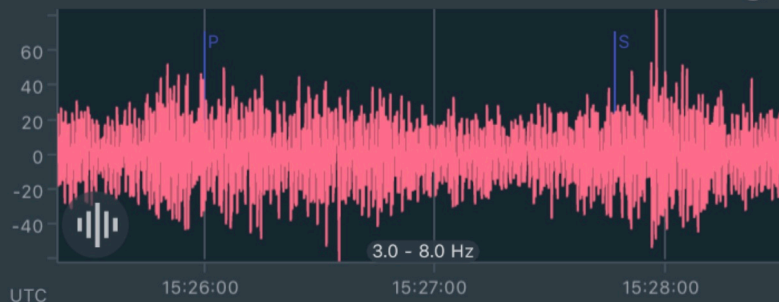
R29BF

4D

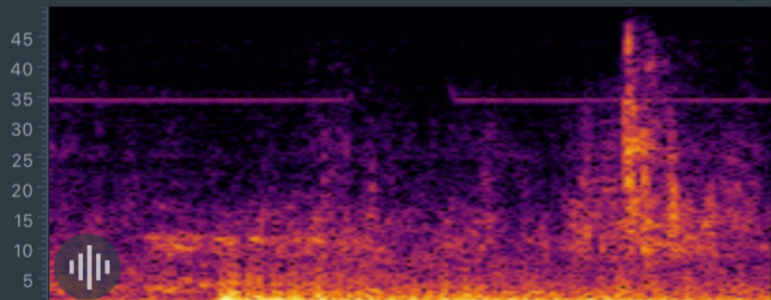
R3B2D

1D

R3D3B

WAVEFORM ( $\mu\text{m/s}$ )

FREQUENCY (Hz)



6.1

Mindanao, Philippines

2020-09-06 15:23:45 ↓ 133 km



FOLLOWING

4D

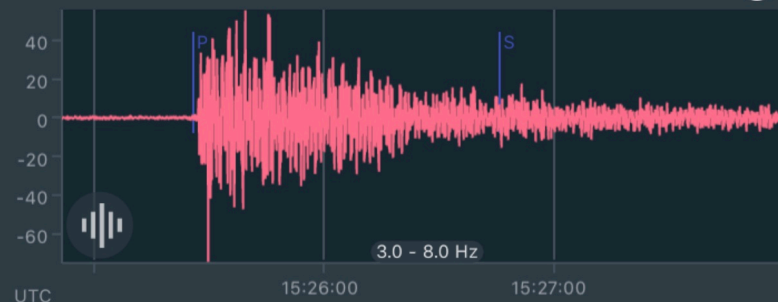
R29BF

4D

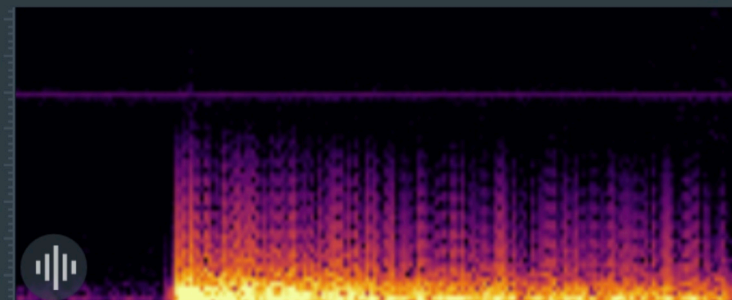
R3B2D

1D

R3D3B

WAVEFORM ( $\mu\text{m/s}$ )

FREQUENCY (Hz)





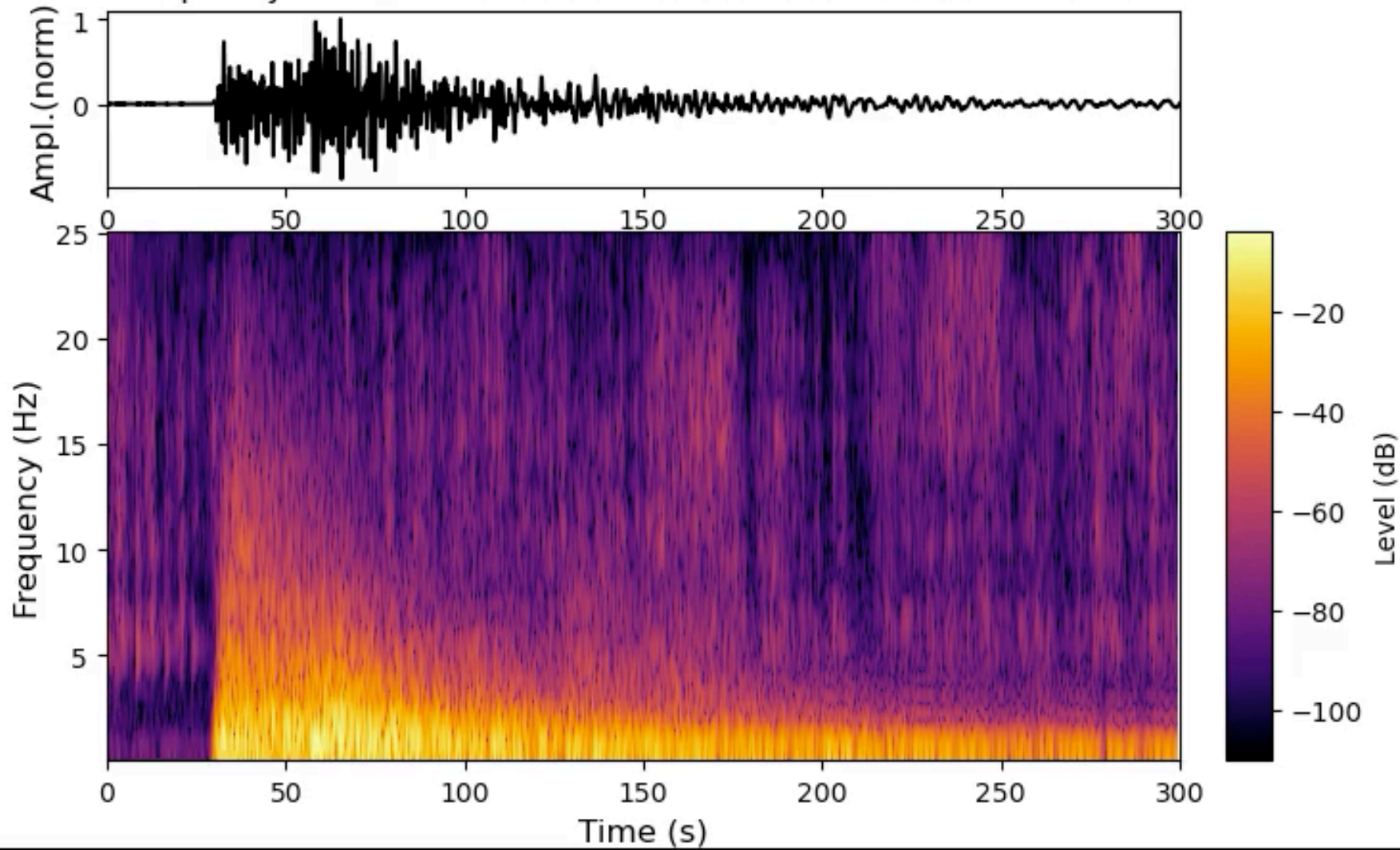


# Raspberry Shake

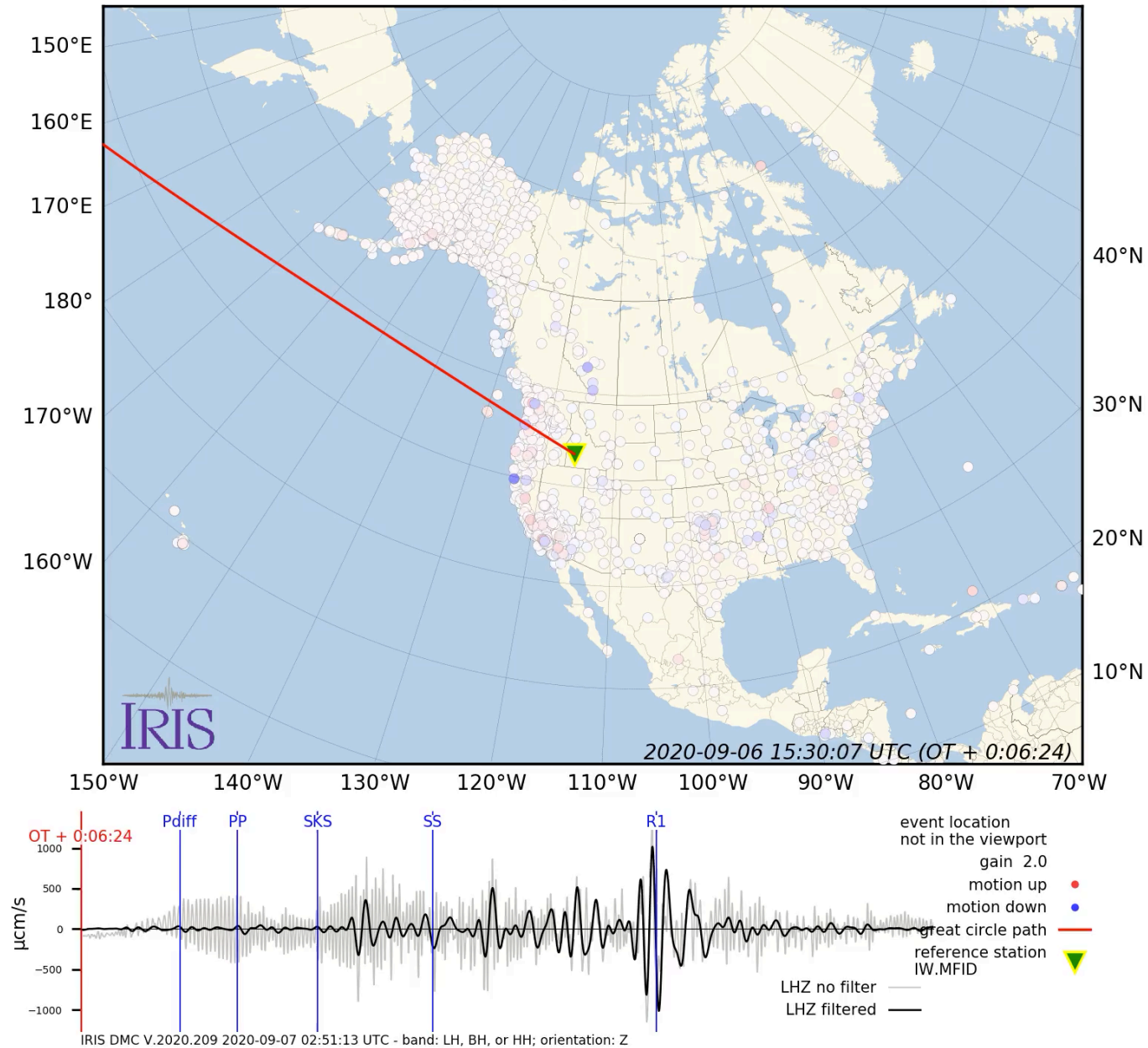
*Your personal seismograph for measuring Earth motion at home*

*This video was created at [sound.raspberrypishake.net](https://sound.raspberrypishake.net). Social media: @raspishake*

Raspberry Shake AM.R3D3B.00.SHZ at 2020-08-18 00:03:50 UTC



September 06, 2020, Mindanao, Philippines, M 6.3  
Origin Time (OT) = 15:23:43 UTC





MARAMING SALAMAT SA PAKIKINIG MAYOR



CONGRATULATIONS DIN!