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# Early Warning System and Flood Management in Pangkalpinang

CRIC Meeting

# Tools Early Warning Systems (EWS) Pangkalpinang

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Pilot4DEV

**Prof. Youssef Diab**
youssef.diab@univ-eiffel.fr

**Dr. Pascaline Gaborit**
pascaline.gaborit@pilot4dev.com

**Zoé Thouvenot**
zoe.thouvenot@pilot4dev.com

https://www.univ-gustave-eiffel.fr/en/
www.pilot4dev.com
www.resilient-cities.com

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# Pangkalpinang

October 2021

# Summary - Assessement on scope of EWS development - Pangkalpinang

## 01 Availability and efficiency of tools (data, map...)

- A localisation map based on field surveys and a prediction map based on historical events data are available, but it does not incorporate climate change information.
- There is a lack of real time communication, whether it is about weather data that is communicated manually or EWS information from BMKG transmitted through WhatsApp or again community reports to BPBD transmitted by phone.

## 02 Community's involvement (knowledge and capacity-building)

- There is a weak engagement with community. Community is not involved in the preparation to disaster and capacity-building activities are internal to the BPBD only.

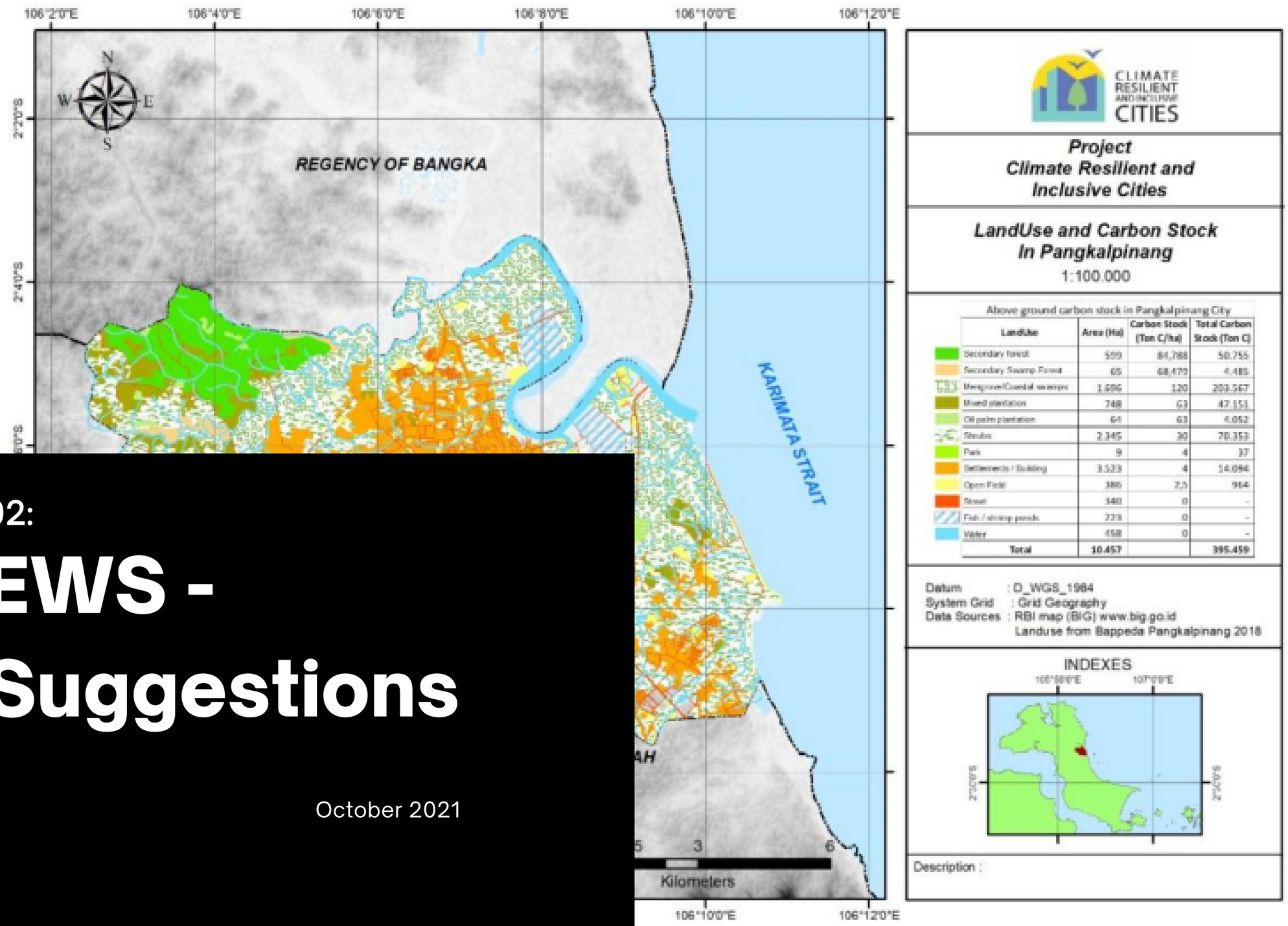
## 03 Governance/institutional preparedness

- There is no institutional arrangements for evacuation as well as no fixed procedures for inundation and flooding. The study notices evacuation routes in flood-prone locations, but sometimes only warnings when it rains. There are communication channels via WhatsApp between officials, but a weak communication with the community.

02:

# EWS - Suggestions

October 2021



# Case study 1 - EWS Floods, Siragjang, Bangladesh (2014)

*Source: Lydia Cumiskey UN Water 2015*

## Introduction

***"A people-centred early warning system comprises four key elements: knowledge of the risks; monitoring, analysis and forecasting of the hazards; communication or dissemination of alerts and warnings; and local capabilities to respond to the warnings received (Basher, 2006)"***

Ultimately an early warning system will only be effective if all components are effective. Communication and dissemination component has been recognised as the component which lacks sufficient attention and results in a huge gap between the information produced by national level forecasting agencies and the information that is actually received and acted upon by the flood affected communities. This case focuses on this gap.

# Case study 1 - EWS Floods, Siragjang, Bangladesh (2014)

*Source: Lydia Cumiskey UN Water 2015*

## The project

### 01 Governance

- Strengthening the existing DRR structure for warning dissemination (creating connections)
- Using volunteers as communication agents to spead information.
- Using local information centres by training them to disaster management

### 02 Tool/technology

- Mobile Services technology (SMS) and Voice Message Broadcast (VMB)
- VMB was used to communicate flood forecast information to 300 people including the most vulnerable, govt. officials, NGOs and selected volunteers.
- Water level data was collected and disseminated by trained local people to the national flood warning center using SMS.

### 03 Capacity Development

- Technical forecasting and early warning training for NGO partners and selected community volunteers.
- The training focused on the current early warning system and how to receive, interpret and respond to the warnings.

# Case study 1 - EWS Floods, Siragjang, Bangladesh (2014)

*Source: Lydia Cumiskey UN Water 2015*

## Lessons learnt

- **Benefits** - overall the project highlighted a need for better communication of national level information to the local level. They also identified that it is a useful tool to spread information. Finally, youth can serve as liaison agents - they quickly disseminate information.

- **Barriers** - there were institutional challenges (the national forecasting agency is under a different ministry to the disaster management department creating a gap between their efforts in early warning) as well as a limited capacity (human and financial) at the national level agencies and the local level agencies mandated for early warning dissemination.

- **What has worked well?** The trained volunteers and gauge readers were very successful in building trust and awareness in the community about the new warning communication system. The messages were sent immediately to the local level from the national level (no time lag). The warnings were very understandable for the illiterate members of the community.

- **What can be improved?** Further adjustments to the message length, frequency, volunteer group (include more students and teachers).

# Case study 2 - Ultrasonic Sensors, The Philippines, around the Cagayan River (2017)

*Source: J G Natividad and J M Mendez (2018)*

## Introduction

- Ultrasonic sensing has the capability to probe inside objects non-destructively because ultrasound can propagate through any kinds of media including solids, liquids and gases.
- This study focuses only on the water level detection and early warning system (via website and/or SMS) that alerts concerned agencies and individuals. The study includes an inquiry system - individuals in the community could inquire the actual water level and status of the desired area or location affected by flood through SMS keyword.
- The ultimate aim is to build a water level detection using ultrasonic sensor and develop a web and SMS application as an early warning system that provides essential information to the local communities and concerned agencies.

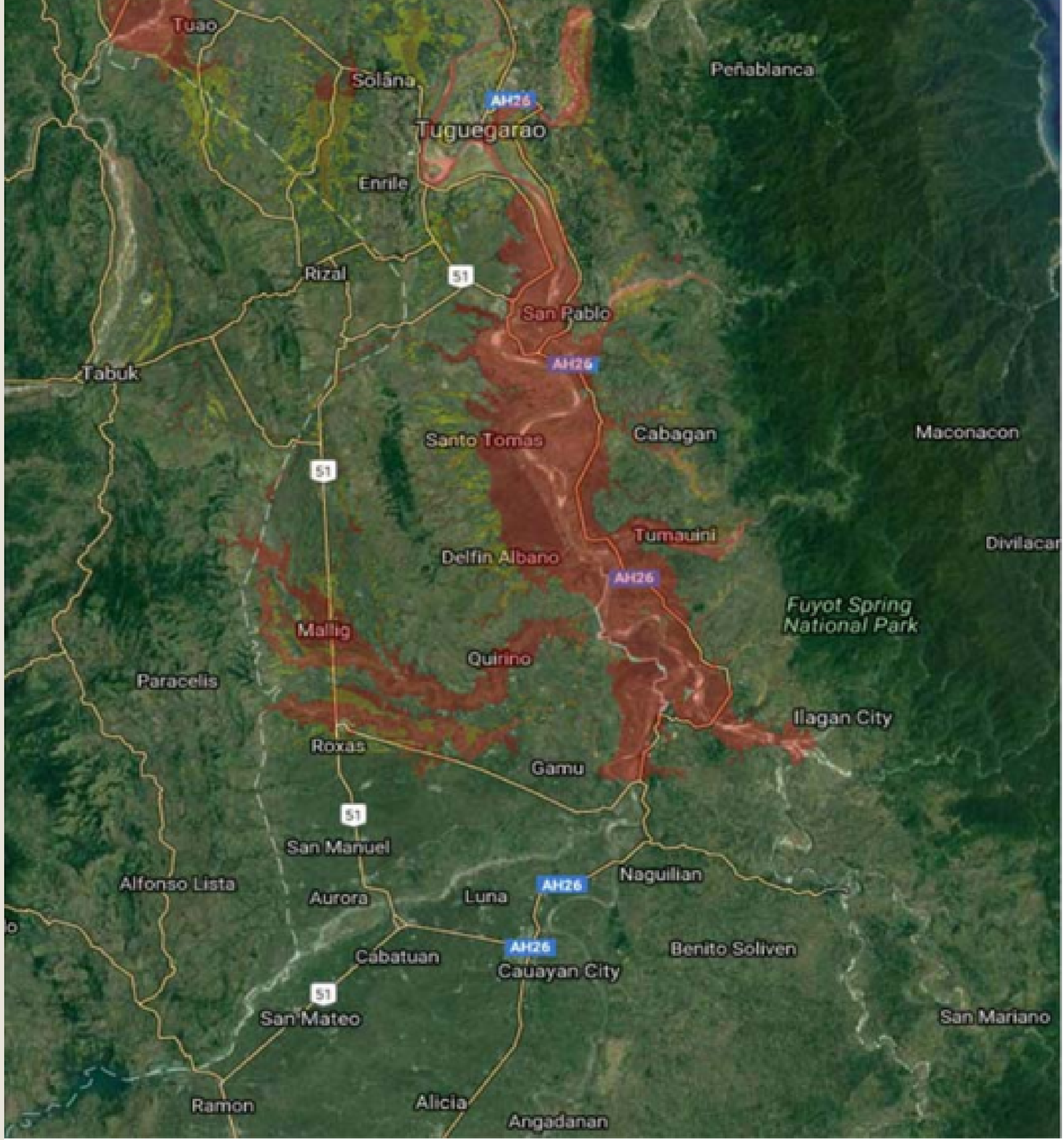
- The project is taking place in the Philippines, in the Northern portion of the province of Isabela, particularly in the municipalities near Cagayan River.

- Some technologies have been installed - Automated Rain Gauges (ARG) and Water Level Monitoring Stations (WLMS) along the country's major river basins (RBs).

- But these technologies are using one-way communication.

- Also, local communities need to access the website/information - usually through computers and/or phones that they can hardly afford. We must also consider that individuals are busy with their daily routine, and monitoring activity cannot be their priority.

- The unawareness led to the overflow of the watercourses of the river waterway and the subsequent inundation of various localities causing extensive damages to properties and human life.



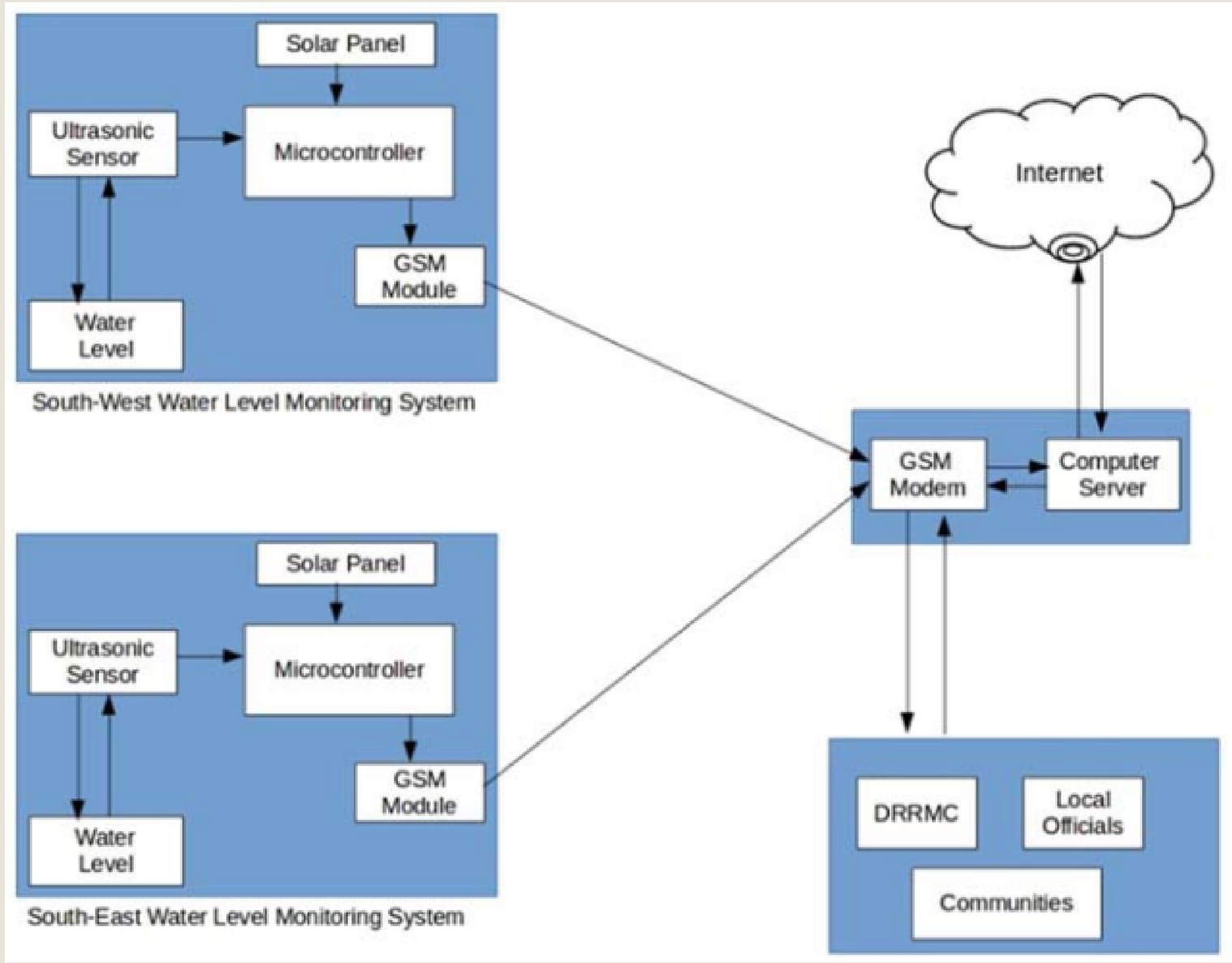

*@ Map of Flooded Areas in the Northern Protion of Isabela*

# The project

**The devices used** - an ultrasonic sensor to measure the water level, Arduino micro-controller that process the signal from the sensor, GSM module to send the data or information from the micro-controller to the computer server and a power source using Solar Panel, Regulator and Battery.

Once a sensor is triggered, a signal will be relayed to the micro-controller which serves as a switch that triggers the connected GSM module to send an alert message or water level status to another GSM modem connected to a computer server. Then, the developed program installed in the computer server will interpret and analyze the message received and automatically send a text message to the concerned agencies' numbers stored in a database. The program will then automatically relay the alert message or status on the developed website.

Also, concerned agencies, local officials and the local communities could inquire about the current status by sending a message that contains keywords.




*@System Architecture*

# Stages

**01 -**
The SMS application was installed in the computer server to process the received data and make proper action.

The application uses algorithms for decision making. The inputs of the algorithm are the water level status coming from the two monitoring systems sent through SMS.

A threshold value was set in the two monitoring system as basis for the Arduino to trigger the GSM module to send an SMS to the computer server.

*@ Connections of the different components - prototype*

**Table 1.** Threshold Value Set for Prototype Testing

| Water Level (Inches) | Alert Level | SMS Notification Delivery |
|---|---|---|
| 5” and below | Normal | 10 minutes interval |
| 6”-10” | Moderate | 5 minutes interval |
| 11”-15” | Critical | 1 minute interval |
| 16” and above | Emergency | 1 minute interval |

## 02 -

Then the developed program installed in the computer server send an SMS notification to the concerned stakeholders and update the developed web-based monitoring system.

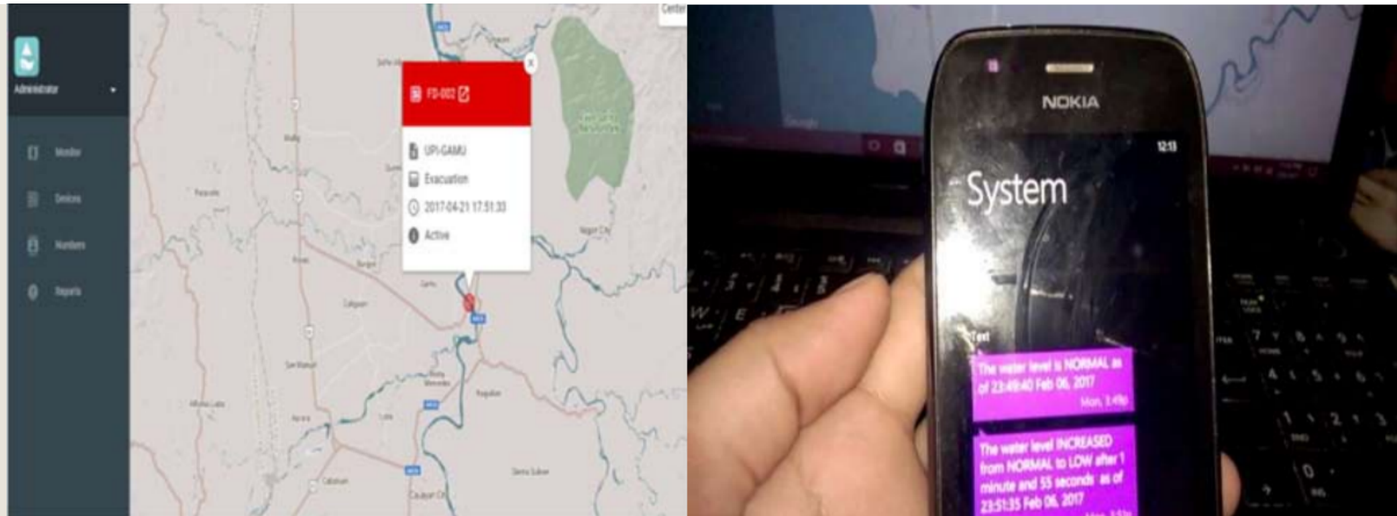
**Table 2.** SMS Application Flood Warning Status

| Alert Level | Flood Warning Status | SMS Notification Delivery |
|---|---|---|
| Normal | Safe | 10 minutes interval |
| Moderate | -Prepare for Evacuation<br>(Area1, Area2, Area3,..)<br>-Standby<br>(Area6, Area7, Area8,...) | 5 minutes interval |
| Critical | -Evacuate<br>(Area1, Area2, Area3,..)<br>-Prepare for Evacuation<br>(Area6, Area7, Area8,...) | 1 minute interval |
| Emergency | -Evacuate<br>(All Flooded Areas) | 1 minute interval |

## 03 -

After the development of the prototype, the model had undergone several tests and experimentations to check the effectiveness of the system.

T**he system was effective in building a two ways communication system.**




*@ SMS alert and Web interface*

# EWS - Additional suggestions

## 01 Work on first responders

Awareness rising campaign on disaster response to empower community leaders to act as first responders as well as the population (trainings, communication...) but also trainings trageted at first aid responders and community organizations (disaster response, smart technologies)

## 02 Work on Disaster Response Plan (vulnerable communities)

Work on a disaster response plan for vulnerable communities - children, elderly, low-income communities, coastal communities.

## 03 Improve Disaster Warning Announcement System

Support the improvement of the media disaster warning announcement system.

## 04 Nature Based Solutions

The use of mangroves (restoration and planting) to fight against floods and water erosion.

## 05 Sustainable building

Work on alternate and sustainable building materials adaptive to flood as well as trainings/workshops to key stakeholders to spread these new methods.

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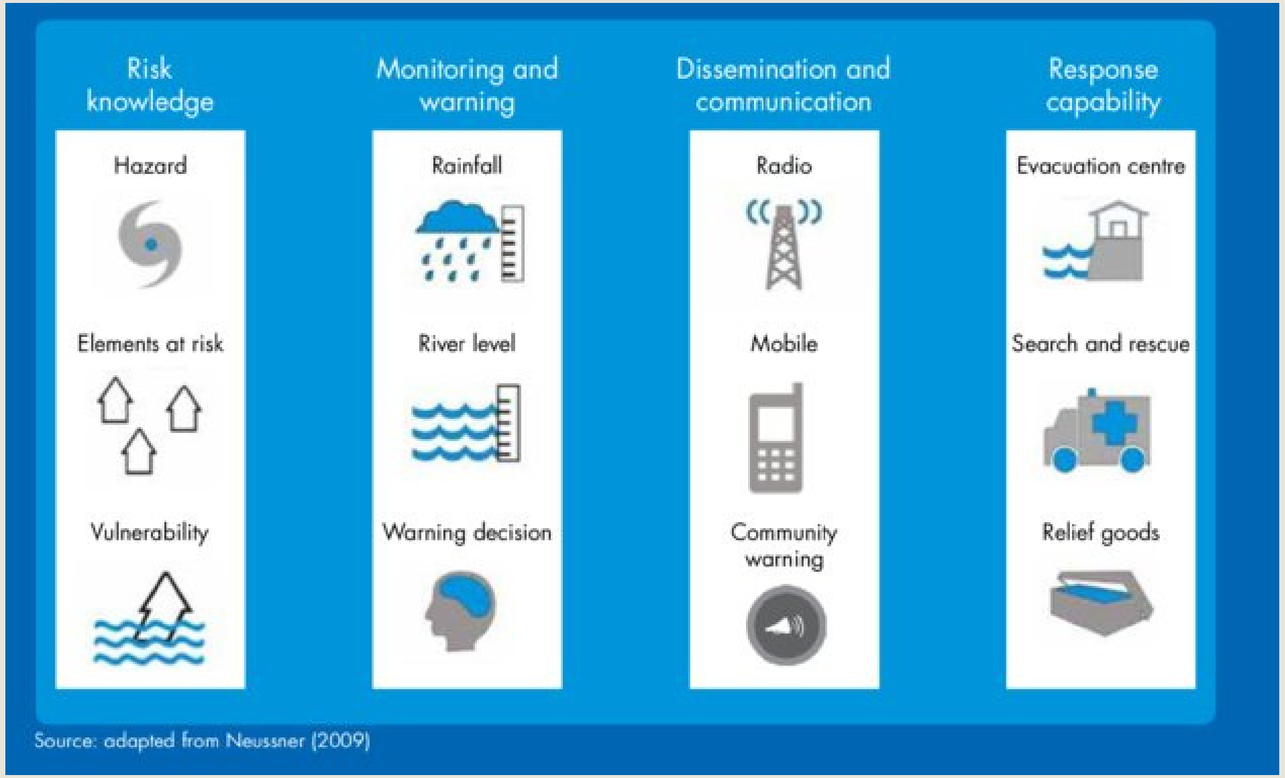
# EWS. UGE - Prof. Youssef Diab



# From laboratories to the real world

Research laboratories and clean rooms

SenseCity

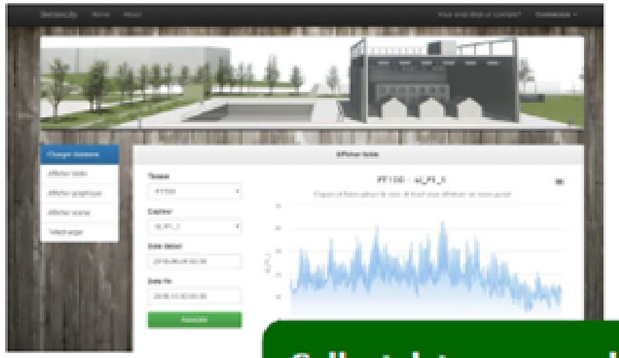

Urban Sensors and infrastructure conception and test

Our approach

Analytics

New solutions & Knowledge for cities

Living lab Experimental field



Collect data , use model and analyze the results

How to implement solutions in real world ?
What are the citizens needs and feedbacks ?

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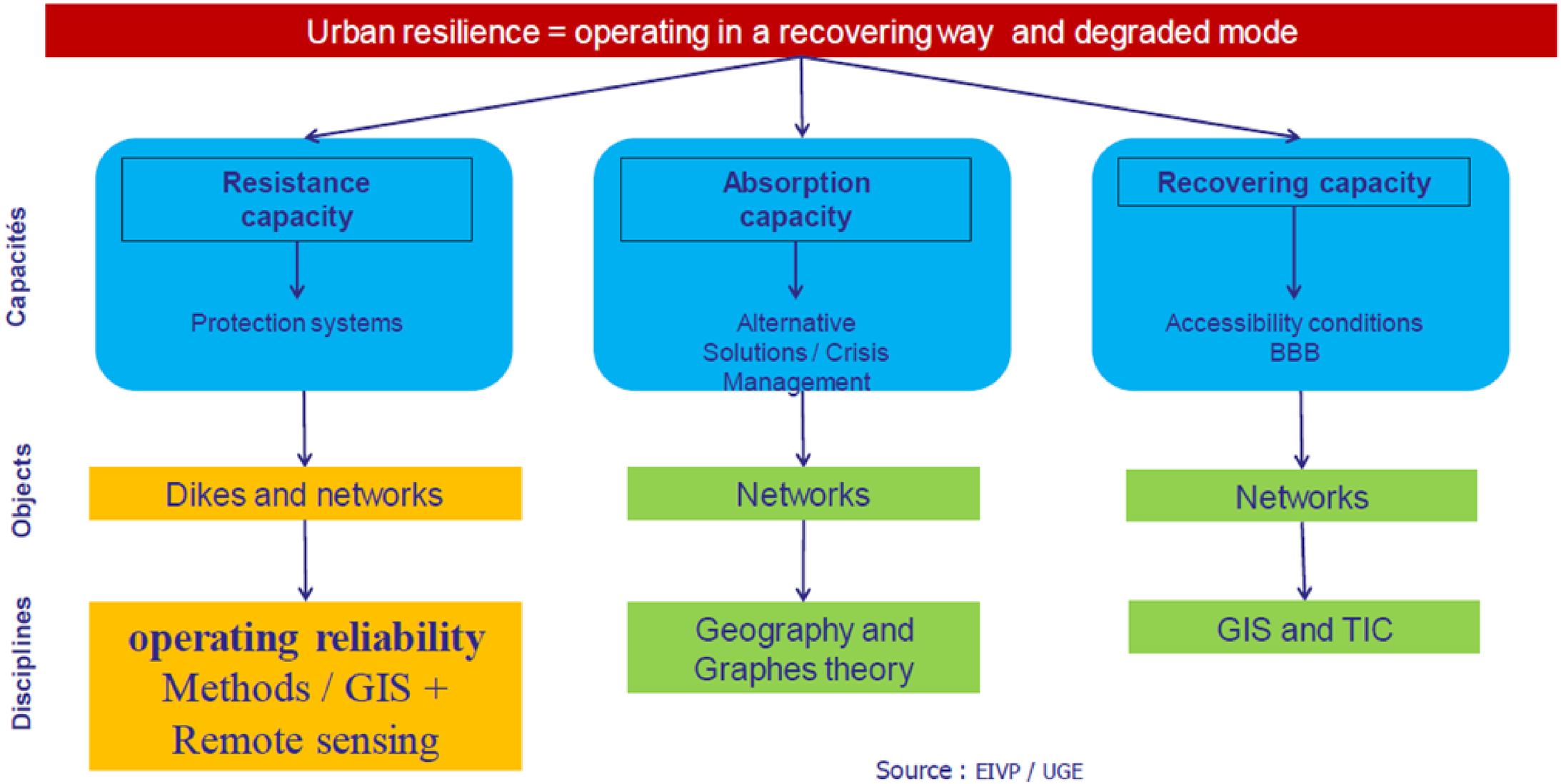
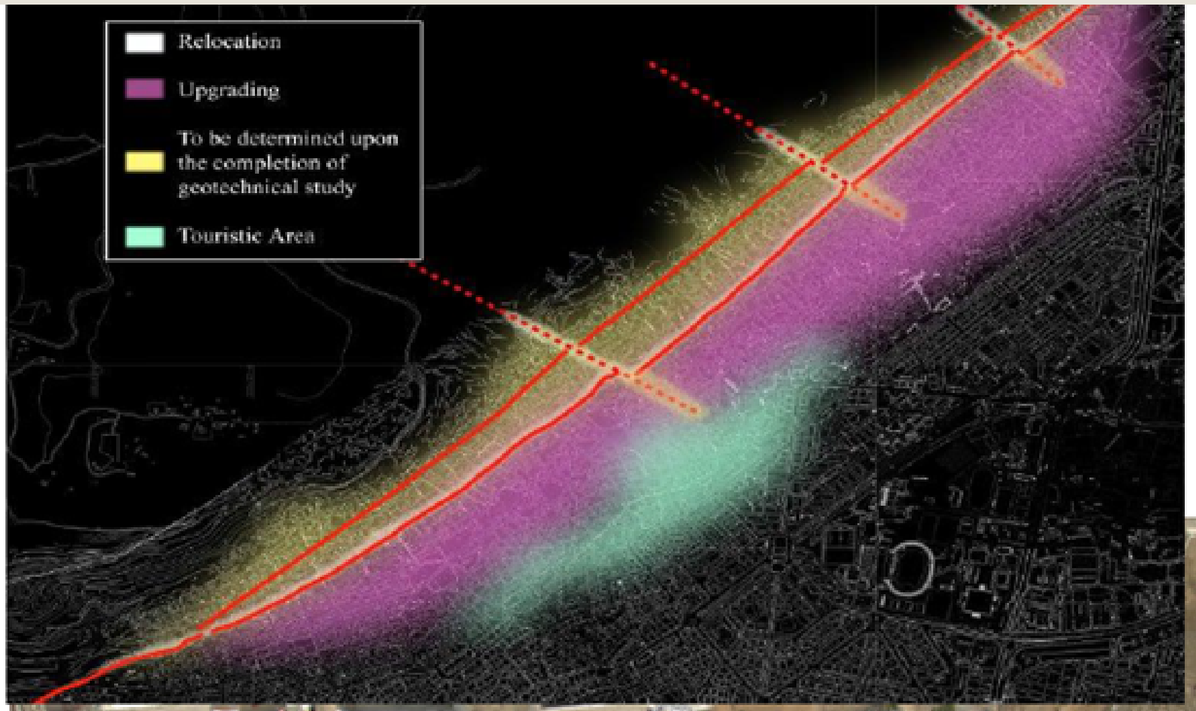
# RESILIENCE.....

## A multidisciplinary concept ...(Lhomme 2012)

# Evaluation of Urban Resilience




Source : EIVP / UGE




Youssef.diab@univ-mlv.fr

# Recommendations

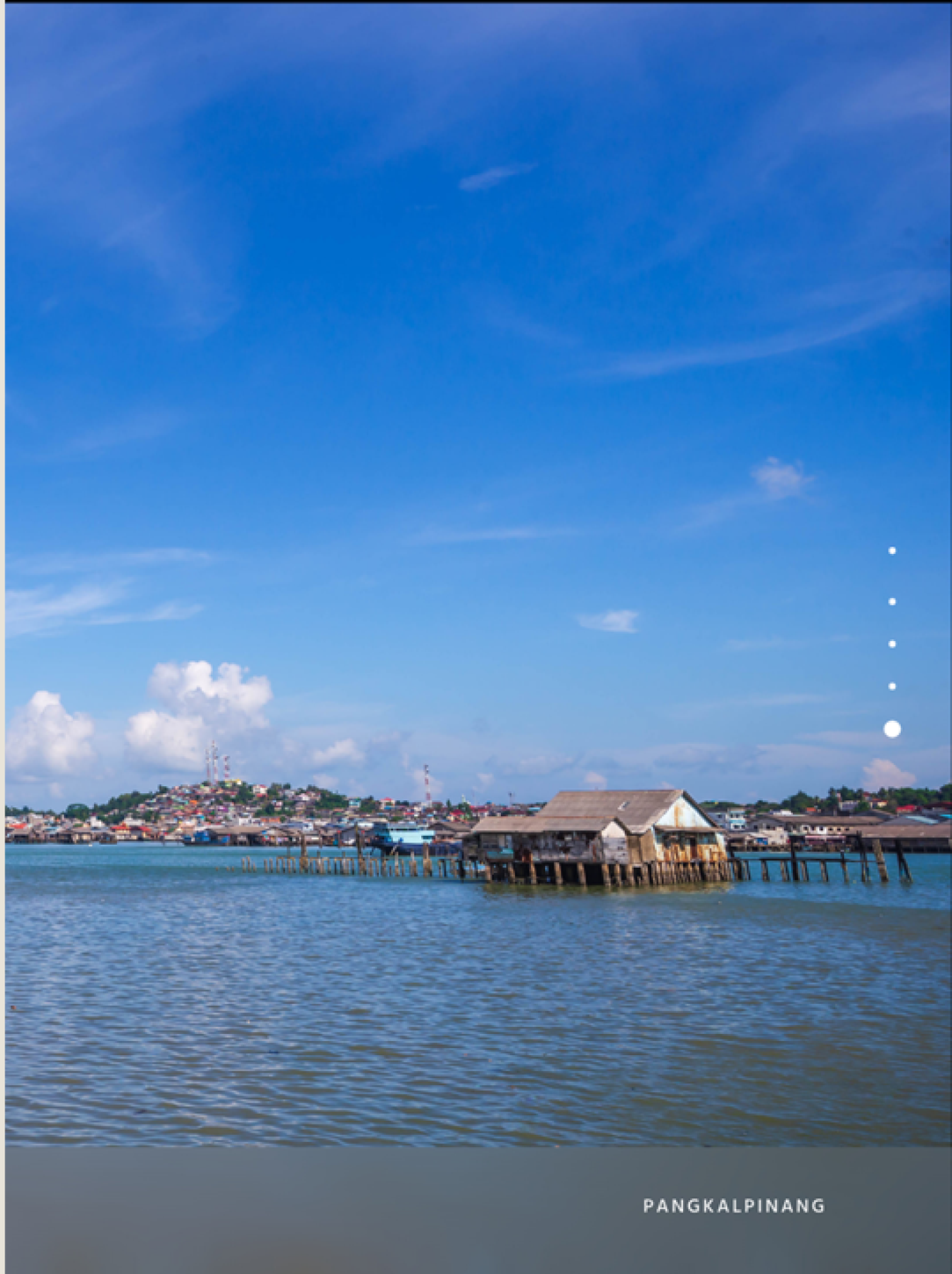
The tools used must be adapted to several factors:

1 - needs of targeted communities,
2 - local specificities,
3 - kinetics of hazards,
4 - risk levels,
5 - risk culture...

**It is mainly the approach to warning that must change.**

Instead of asking people to adapt to one single system, **we must develop shapeshifting systems** that can adapt to the needs of local communities.

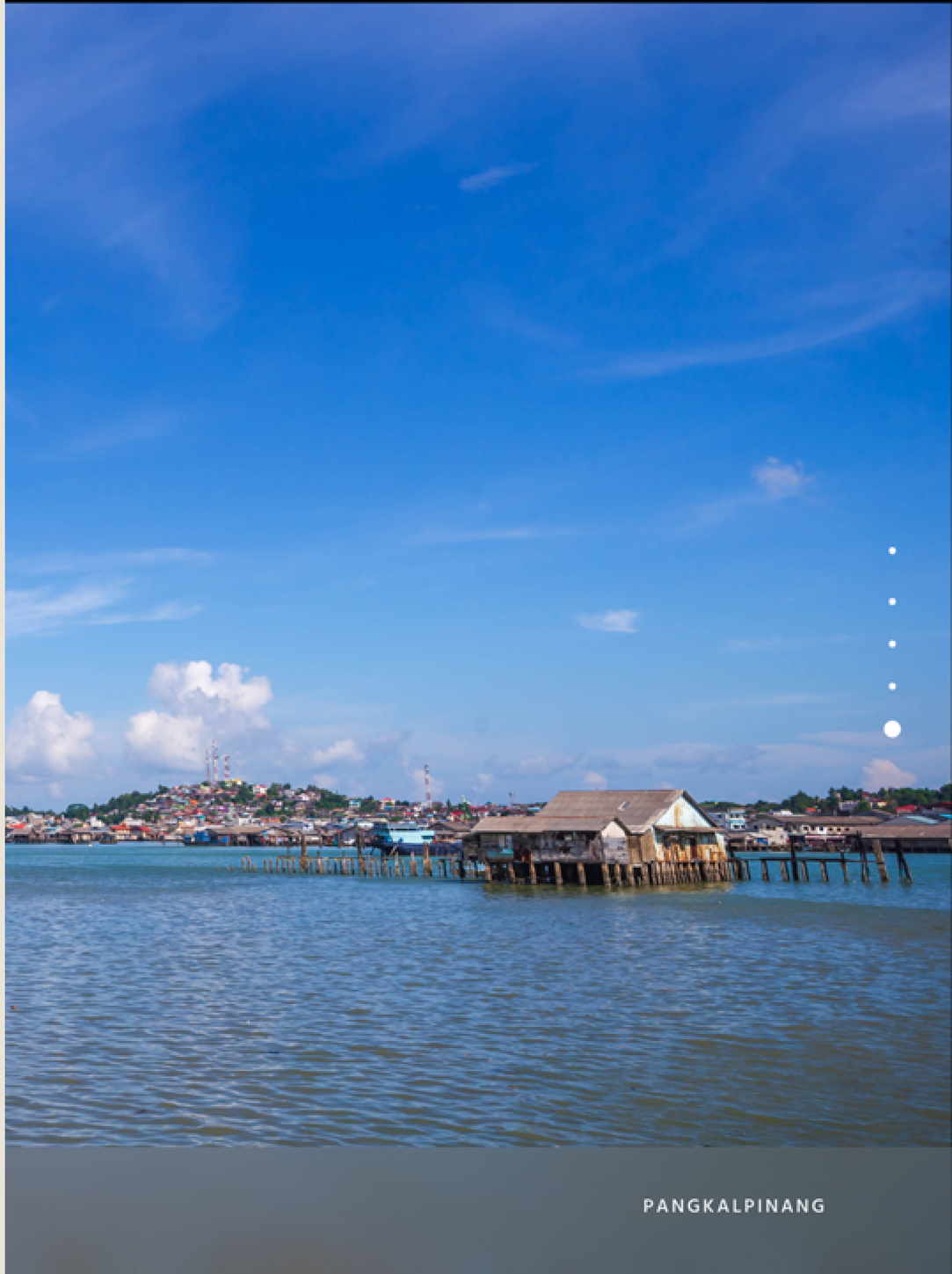
Local authorities may have a major role to play in the choice of warning tools.



# Recommendations

CBC (cell broadcast) is the most efficient tool technically for early warnings and in case of extremely dangerous events (flash floods, landslides, tsunamis, earthquakes).

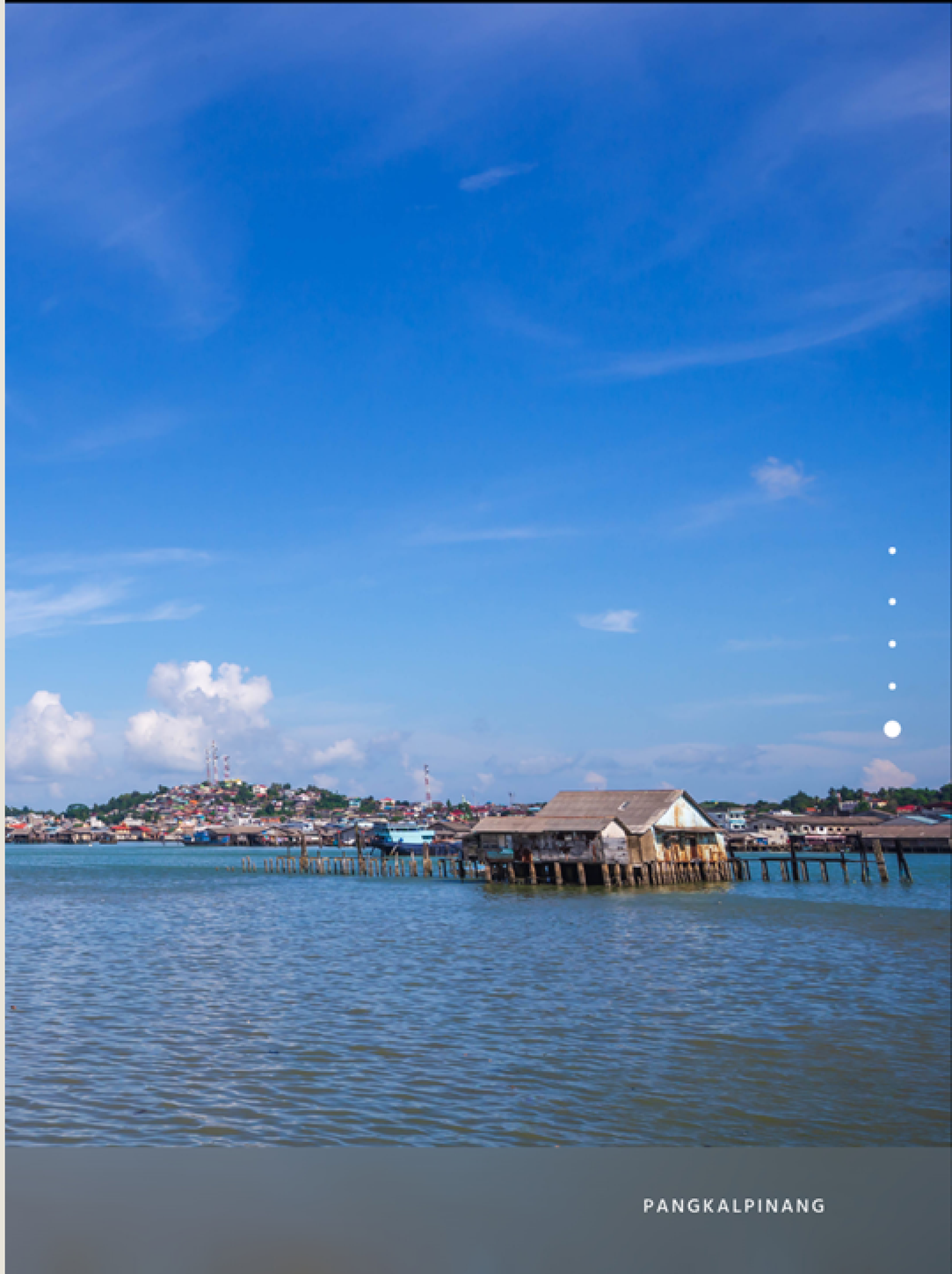
Location-based SMS are however more adapted to communicate preventive measures if the time before the event occurs is sufficient (> 1 hour). However, these tools have inconsistent effects and limited impact in rural areas.



# Recommendations

Our TORs (questionnaire)

- organizational objectives
- structure
- operational objectives
- operational culture
- the optimal warning system



# EWS - Summary of the suggestions

## 01 Technical systems

- At this stage we are very familiar with Urban Heat Island and Flooding hazard. In function of the GIS and available data, a model of interdependencies is possible and indicators could be proposed. Our tool considers: protection systems (dikes, levees….) and all categories of networks and infrastructures. It also considers the Build back better issues.

## 02 A tool dedicated to communities

- The diffusion of brochures and explanations of the potential risks
- The implementation of workshops to enhance companies/industries protection, adaptation, or recovery of their service.

## 03 Governance

- Importance of the implementation of a dialogue with technical managers and political deciders.

# *Thank you for your attention*


**Dr. Pascaline Gaborit**
pascaline.gaborit@pilot4dev.com

**Prof. Youssef Diab**
youssef.diab@univ-eiffel.fr

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