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Integrated and Multi-Hazard Disaster Management

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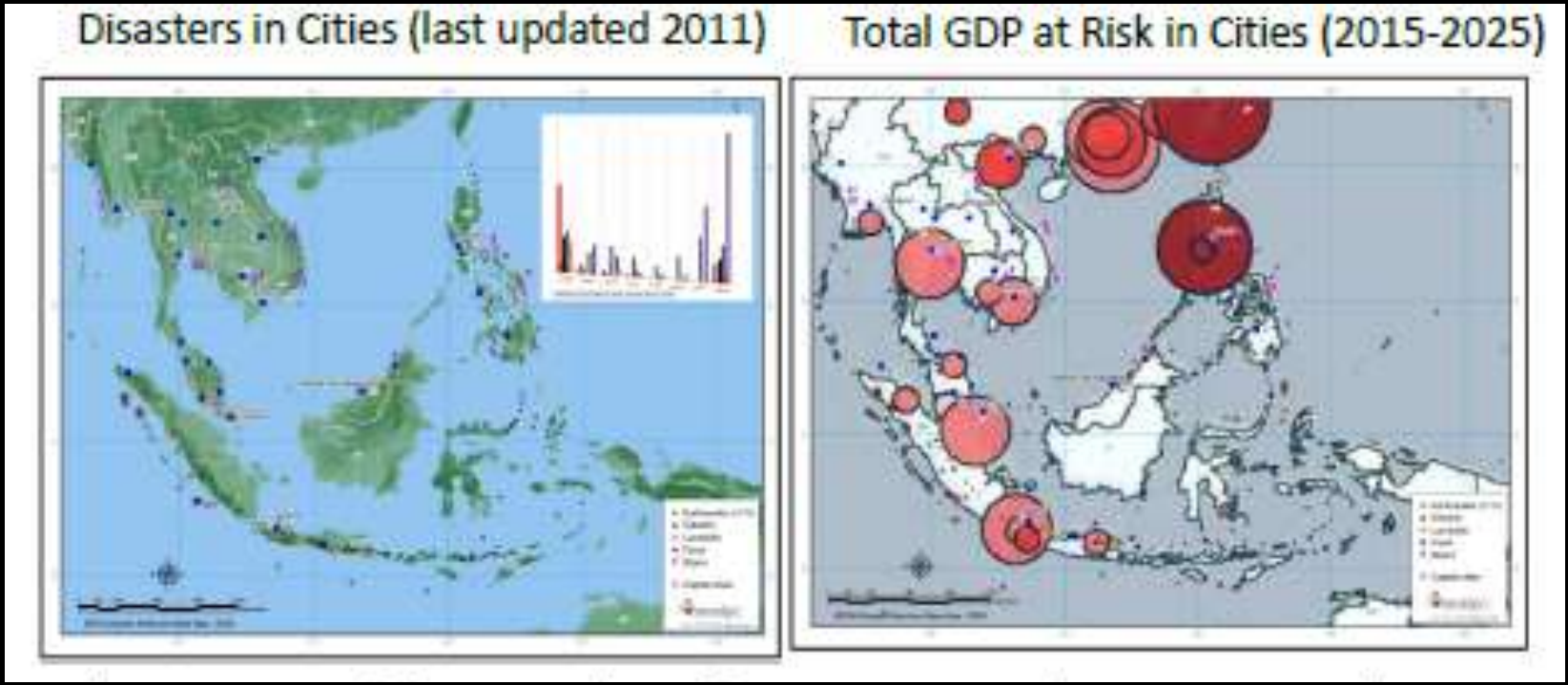
Outline:

1. Introduction
2. Cascading & Climate-driven disasters in Malaysia
3. Examples from SEADPRI

Disaster Risks in Southeast Asia



- The majority of disaster that affect cities in Southeast Asia are climate driven (flood, landslide, storm, drought), except earthquake and volcano
- Climate related threats account for 30% of the total GDP damage across cities in the region, where total GDP at risk can be as high as 5%, higher losses are expected due to climate change (Source: Cambridge Centre for Risk Studies 2015; IPCC 2014)

Earthquake > Tsunami > Nuclear Disasters

- 11th March 2011 Mw=9 earthquake off the Pacific coast of Tohoku
- Tsunami wave, flooding, landslides, fires, building and infrastructure damage, nuclear incidents including radiation releases

Introdution

From Hyogo to Sendai

- Hazard and disaster types
- Disaster reduction to Disaster Risk reduction

Multi-Hazard

- More than just multiple of ‘single-hazard’ approaches
- More than independent analysis of multiple different natural and/or technological hazards
- Multi-hazard approaches are essential; where failing to understand the whole natural system (rather than a small portion of it) can distort management priorities, increase vulnerability to other spatially relevant hazards or underestimate risk

Disaster events

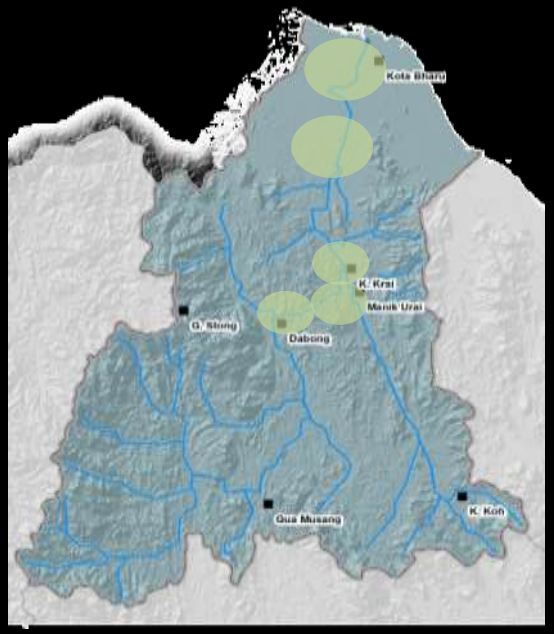
- May occur simultaneously or cumulatively over time, and taking into account the potential interrelated effects that sometimes realizing to Cascading Disasters and Impacts

Typhoon Greg 1996 > Landslides + Floods

- A rare tropical storm Greg landfall in Keningau, Sabah on 26-27 Dec 1996
- The rainstorm caused landslides & mudflood
- In the event 238 peoples died, with another 200–300 are missing, 3,000–4,000 people homeless

Big Flood 2014 > Landslides + Floods

- Major flood including landslides and debris flood
- Geological factor:
  - Basin Geomorphology and river processes
  - Rain-induced landslides and debris flood
- Understanding basin geomorphology and paleo-history of the fluvial system



Source: Joint Project KPM/UMT, JMG, UTM, UMK, UKM, USM 2014

Earthquake 2015 > Landslides > Debris Floods

- 5th June 2015 Mw=6.0 earthquake in Sabah Malaysia
- Geological factor:
  - Slope & Basin Geomorphology
  - Rain-induced landslides and debris flood
- Rockfalls on Mount Kinabalu killed 18 people & loosened rock-soil of mountain slope
- Rainstorm generated landslides & released large volumes of sediment. Flooded several villages and water supply

Source: Ibrahim Komoo & Lim CS 2015

Climate-driven Disasters in Malaysia

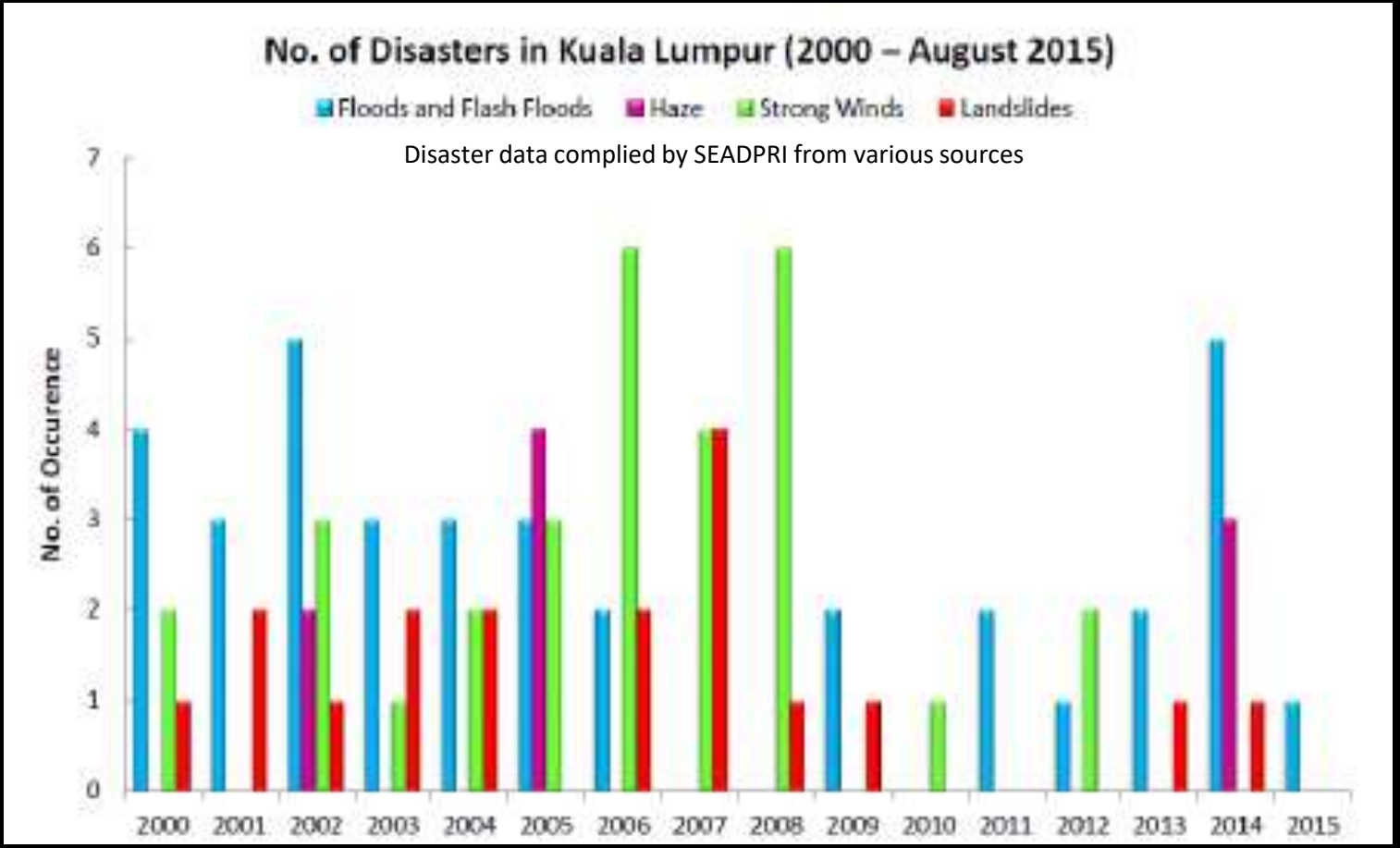
	Event (Year Type Location)	Death*#	Affected People*	Note#
1	1965 Flood	6	300,000	Kelantan, Terengganu
2	1967 Flood	50	125,000	Kelantan, Terengganu, Perak
3	1970/1 Flood	61	243,000	Pahang, Terengganu, Kelantan, Selangor (Kuala Lumpur)
4	1993 Highland Towers, Selangor	48		Landslide after heavy rain
5	1993 Flood	30	20,000	Kelantan, Trengganu, Pahang, Perak, Johor, Sabah
6	1995 Debris Flow, Genting Sempah, Pahang	20		Heavy rain before event
7	1996 Greg Storm, Sabah	270	1,150	Flood, Landslide & Debris Flood
8	1996 Debris Flood, Pos Dipang, Perak	44		Heavy rain before event
9	1999 Landslide, Kg Gelam, Sandakan, Sabah	17		Heavy rain before event
10	2006/7 Flood	52	244,051	Pahang, Terengganu. Kelantan, Johor
11	2011 Landslide, Hulu Langat, Selangor	16		Heavy rain before event
12	2013 Flood	17	220,000	Pahang, Kelantan, Terengganu

Note: *Data from EM-DAT, #Data from supplementary sources

> >> **2014 Big Flood**	25	500,000	Kelantan, Pahang, Perak, Terengganu

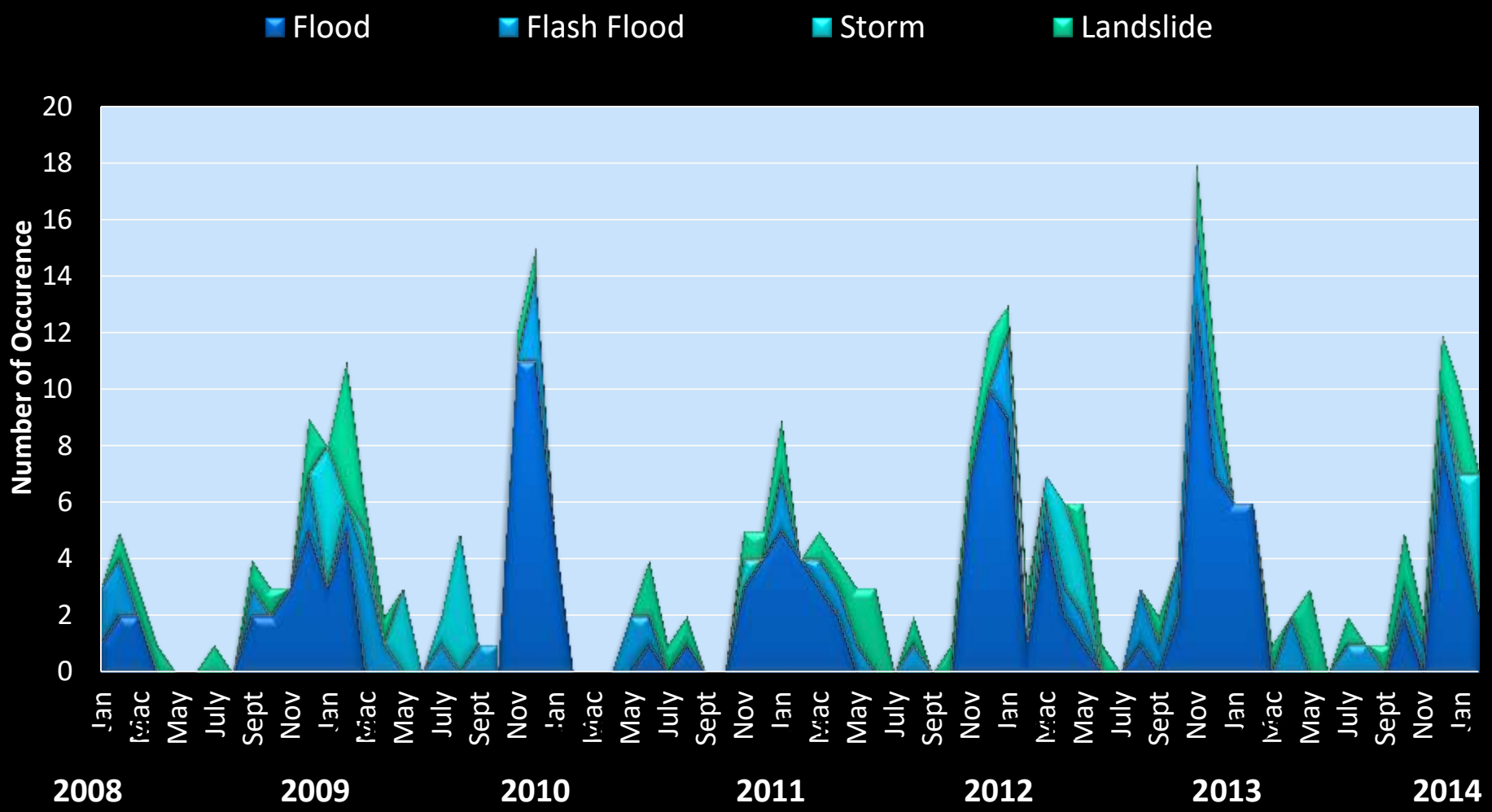
Source: Ibrahim Komoo & Lim CS 2015

Frequency of Disasters in Malaysia



IPCC 2014 (AR5): The First step in Adaptation to future climate change – Reduce Vulnerability and Exposure to present Climate Variability

Frequency of Disasters in Malaysia



Disaster data complied by SEADPRI from various sources

Climate Induced Disasters

- Cameron Highland
- Debris flood 2013 & 2014 (Rain/ Erosion induced?)
- Rain-induced Debris Flow 2011
- Multiple contributing factors given

- Ringlet Nov 2014

- Bertam Valley Oct 2013

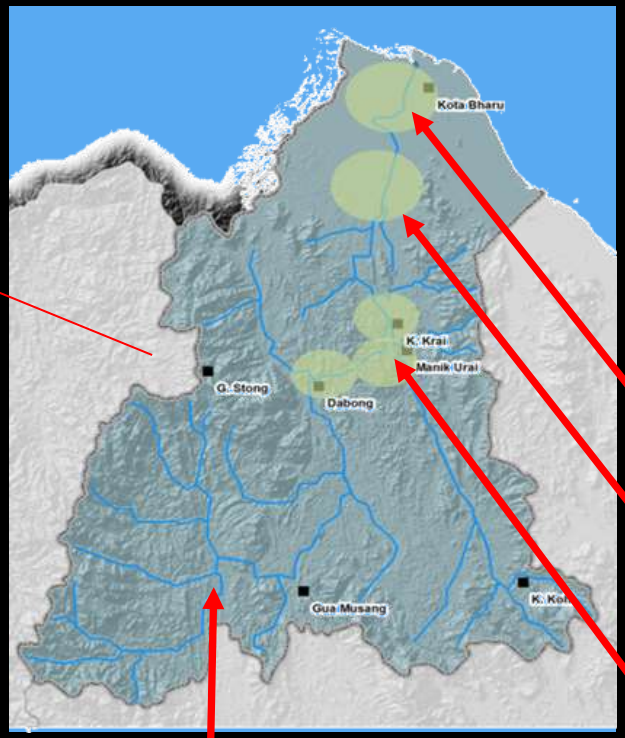
- Sungai Ruil August 2011

Multi Hazard Risk Assessment

Some Examples:

- **Kelantan River Basin**
- **Klang River Basin**
- **Langat River Basin**

Kelantan River Basin

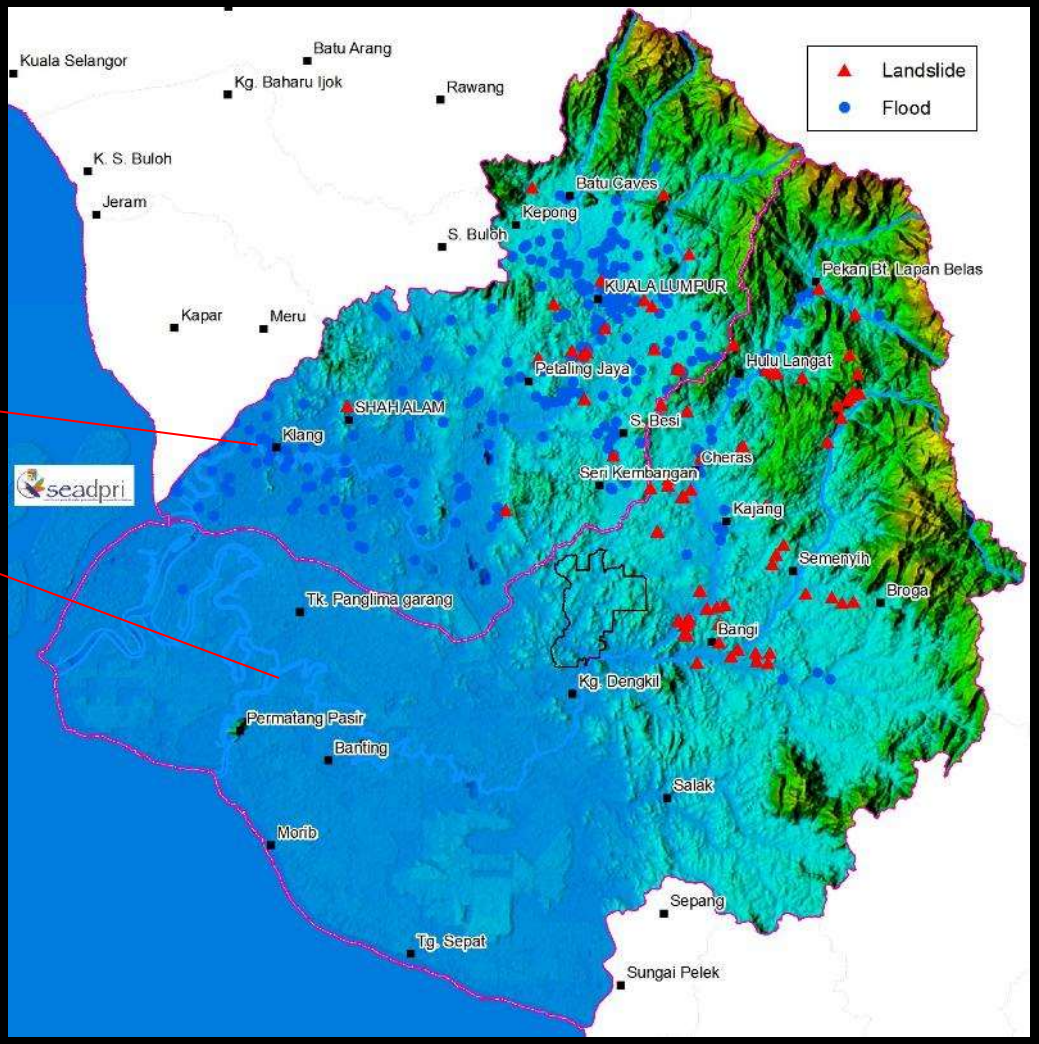


Landslides

Flood

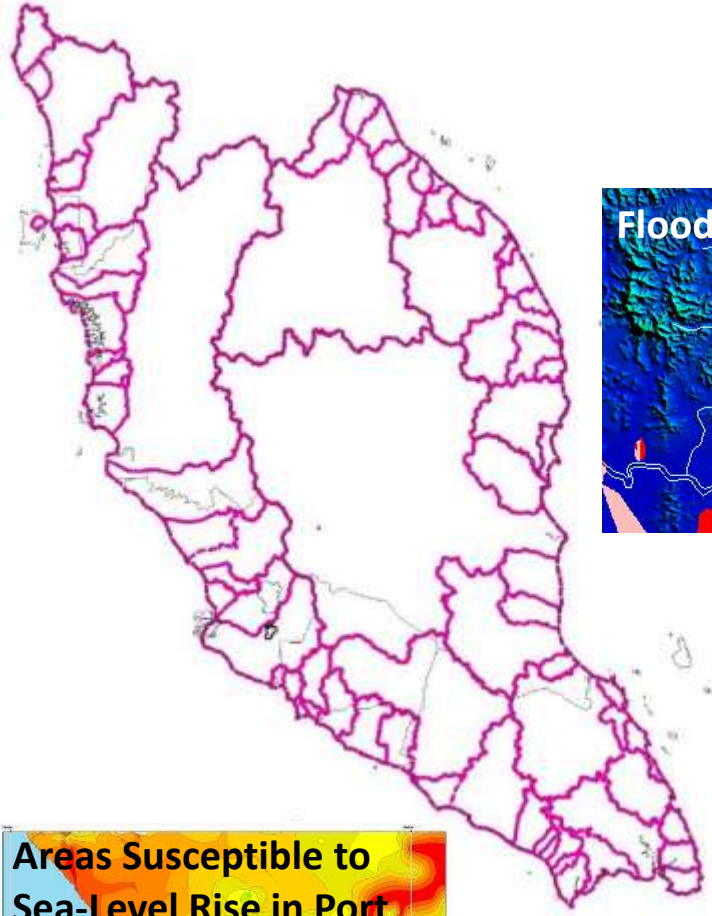
Source: Joint Project KPM/UMT, JMG, UTM, UMK, UKM, USM 2014

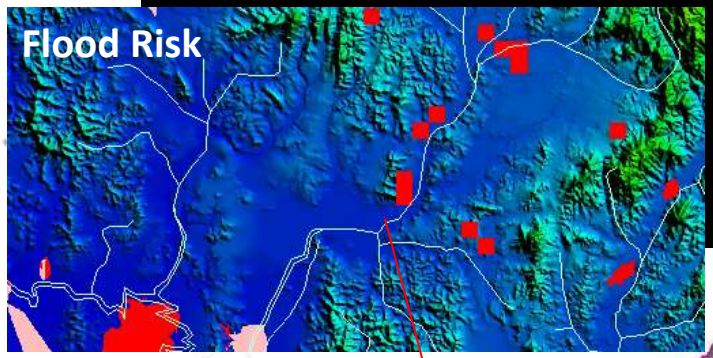
Klang River Basin
Langat River Basin

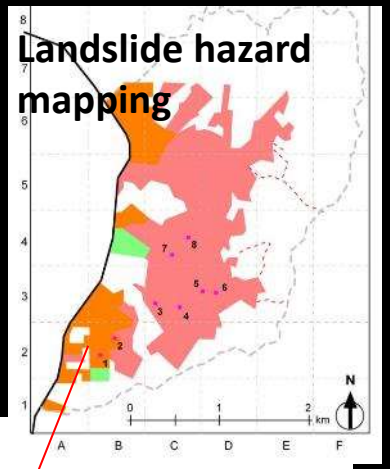


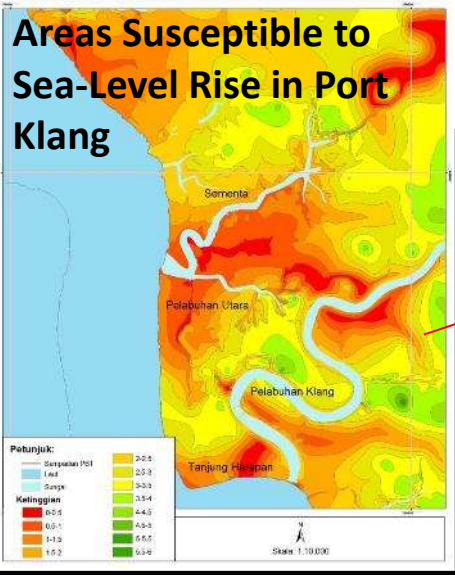
Database: Lim 2013 & SEADPRI

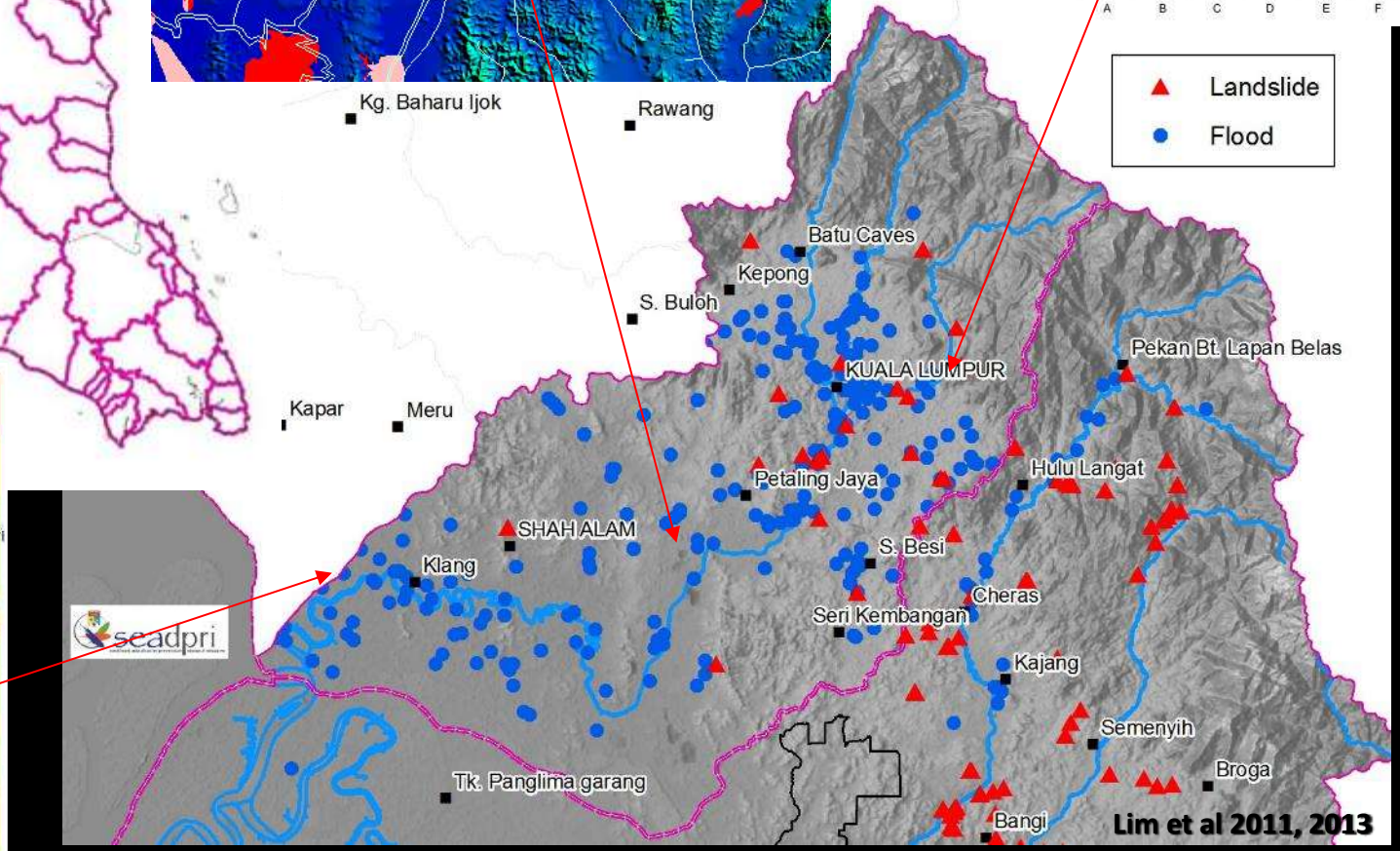
Klang River Basin





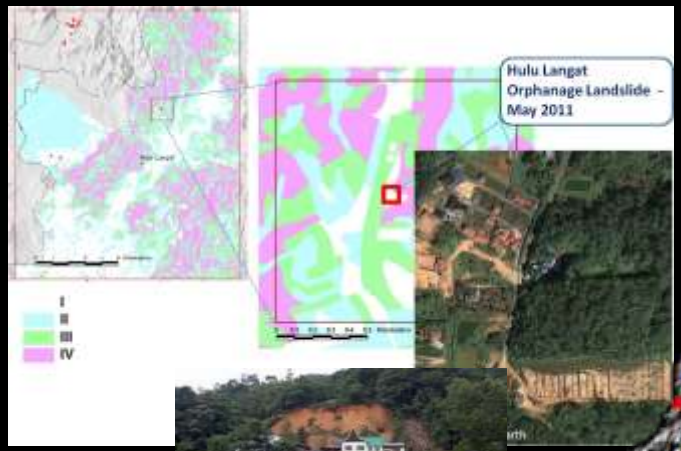


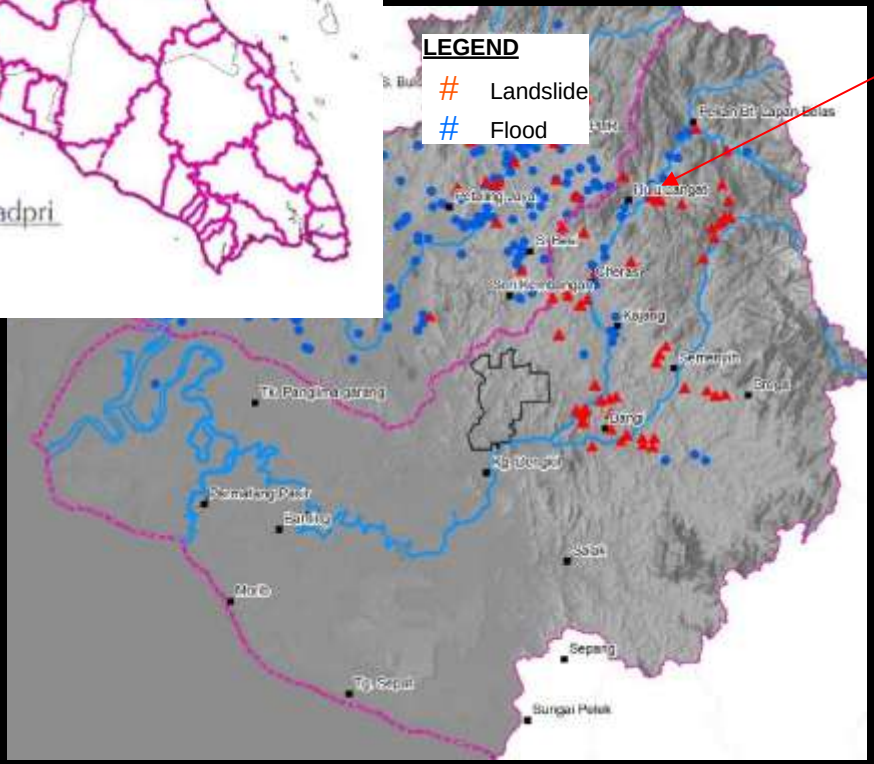




Source: Rasyidah et al., 2012 based on data from JPBD Selangor

Langat River Basin





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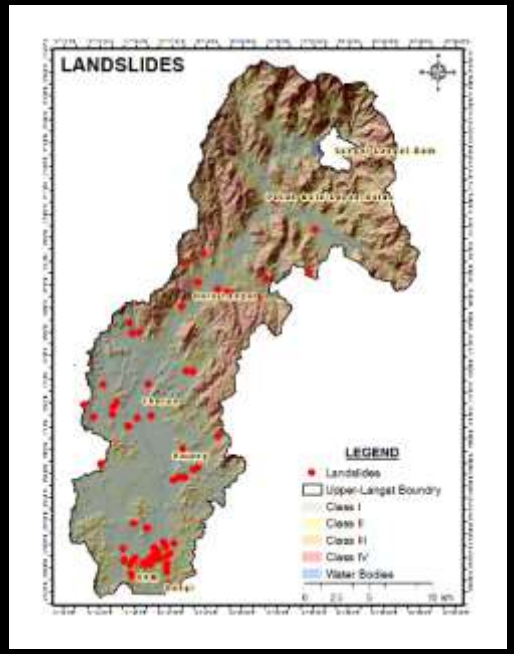
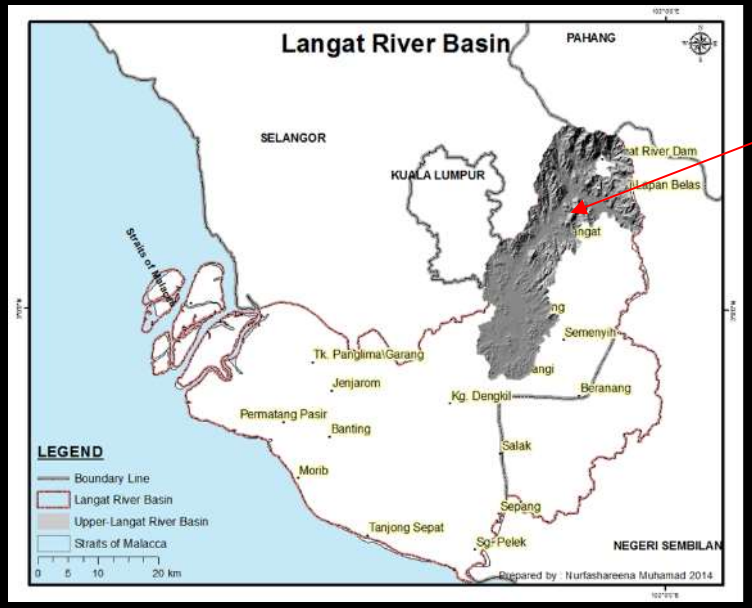
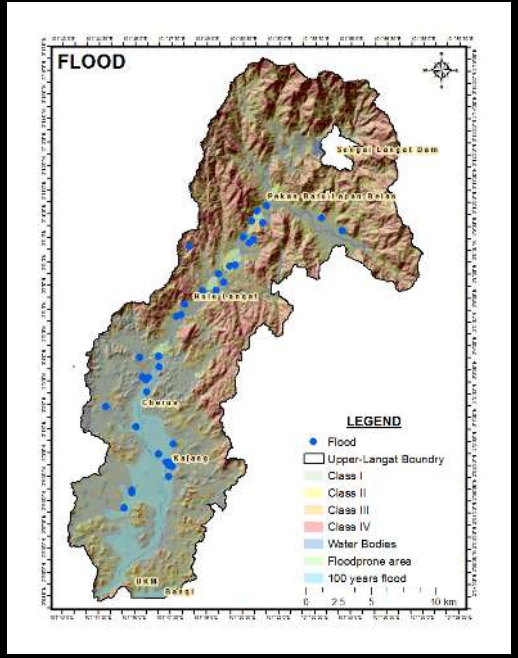
Local Scale Mapping

- Multidisciplinary and technical data derived from various sources & can be categorized into several categories; **a) inventory, b) predisposing criteria, c) triggering factors, d) element at risk**
- Main methods:
  - **Development of inventory & High-res Data**
  - **Content & Statistical Analysis**
  - **Spatial Modeling**





Susceptibility maps



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Concluding Remarks

- Emerging trends of
  - Simultaneous Multi / Cascading Disasters
  - Increasing Climate-Driven Disasters
  - Triggered by Extreme Climate Events
- The need for local and higher resolution mapping and multi-hazard risk assessment
- DRR Cycle
- The importance of systematically analyze and assess risks in integrated manner using multi-hazard, natural systemic or people centered approach i.e. ecological, hydrological, geomorphological

http://www.ukm.my/seadpri

Thank You