



Building a Resilient City: The Place of Geospatial Science & Technology

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Together we can transform Kampala city



Profile of Kampala City

City Population:

60%

Resident popn is est. at **1.5 million** while day population est. at **4 million**.

5.2%

The current urban population growth rate

The city's contribution to Uganda's GDP.

10 Million

Projected population by 2040 (source: KPDP).

International population statistics:

- **Fertility rate:** 6.9 children per woman cf: Kenya: 4.7, Tz: 5.6, Nigeria: 5.9.
- **Growth rate:** 3.6% per annum; 4th highest in the world cf: Liberia: 3.7%, Emirates: 3.8%, Maldives: 5.6%;... Nigeria: 2.5%.

Kampala's Current Realities

Fastest growing cities on the continent At an urbanization rate of 5.2%

Growing slums juxtaposed with urban affluence

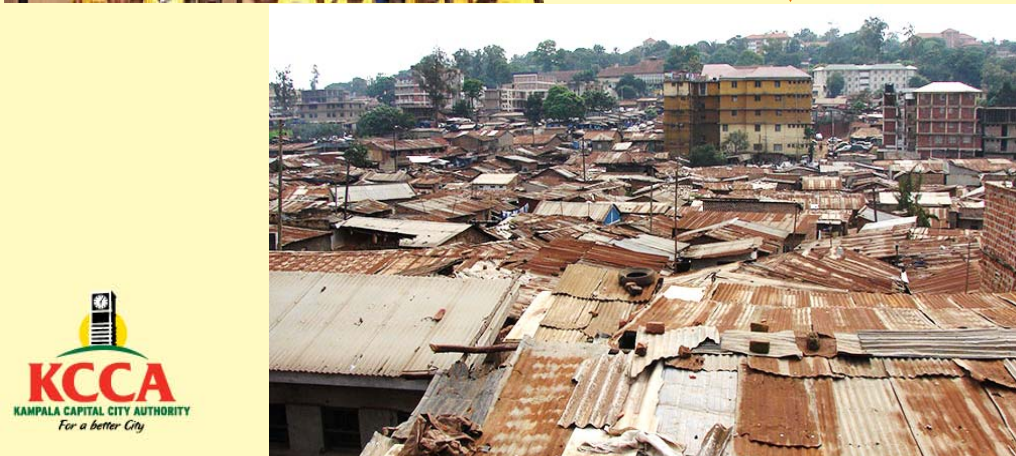


Inadequate City Financing



Current development characterized by **uncontrolled and unplanned settlements**

Insufficient infrastructure



Definitions


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**

Resilient City

A city that is able to absorb, adapt, and **recover from the shocks and stresses** that are likely to happen, transforming itself in a positive way toward sustainability (UN-Habitat)

Kampala City Hazards



HAZARD	HAZARD TYPE	HAZARD LEVEL
Flood	Climatological and Meteorological	HIGH
Human Epidemic	Ecological and Biological	
Environmental Degradation	Human-induced or Technological	
Water Pollution	Human-induced or Technological	
Air Pollution	Human-induced or Technological	
Fire and Built Environment	Human-induced or Technological	
Road Accidents	Human-induced or Technological	MEDIUM
Drought / Dry Spells	Climatological and Meteorological	
Soil Erosion	Geological	
Food Security / Nutrition	Climatological and Meteorological / Human-induced or technological	
Earthquake	Geological	LOW

Notes: Floods dominate Kampala's risk profile affecting more than 170,000 people; the average annual damage from floods is estimated to be US\$49.6 Million

(Source: Kampala Disaster Risk and Climate Change Resilience Strategy, 2020)

Strategies of Building a Resilient City

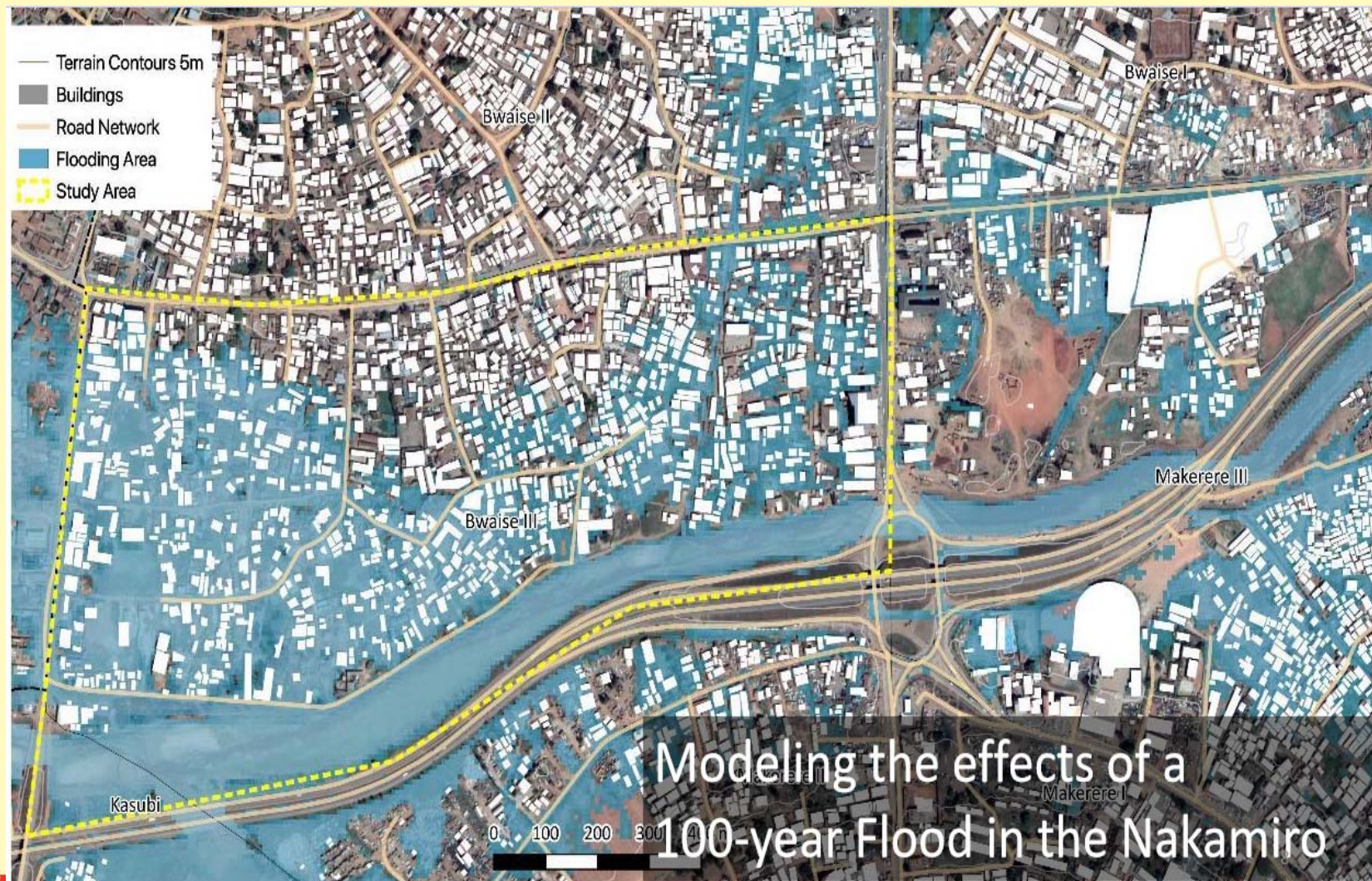
- **Institutional & Governance Strengthening;** improve regulatory and policy framework, inter-institutional coordination for risk mgt., M&E for institutional risk management.
- **Understanding Risk;** surveillance networks, risk audits, community awareness...
- **Invest in Disaster Risk Reduction for Resilience** incl. reducing the vulnerability of key physical infrastructure.

Strategies of Building a Resilient City...

- **Preparedness, Response & Resilient Recovery;** define early warning signs, develop recovery strategy ...
- **Climate Mitigation & Resilience;** improve air quality, reduce emissions and protect green areas
- **Health Resilience & Prevention;** health prevention measures, awareness and emergency preparedness.

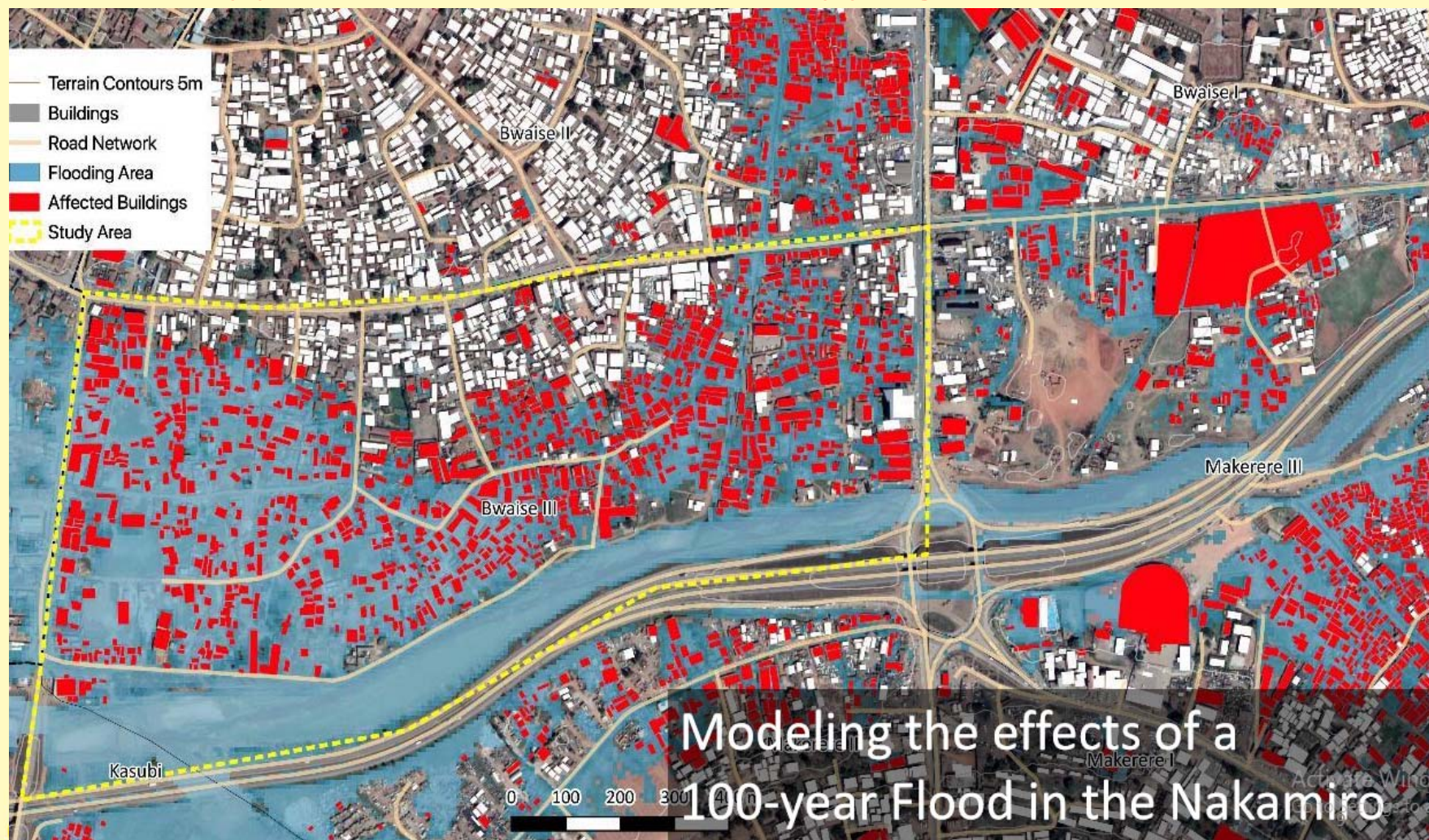
The Role of Geo-Spatial Technologies

Application #1: Flood Risk Mapping



The Role of Geo-Spatial Technologies...

Application #1: Flood Risk Mapping...



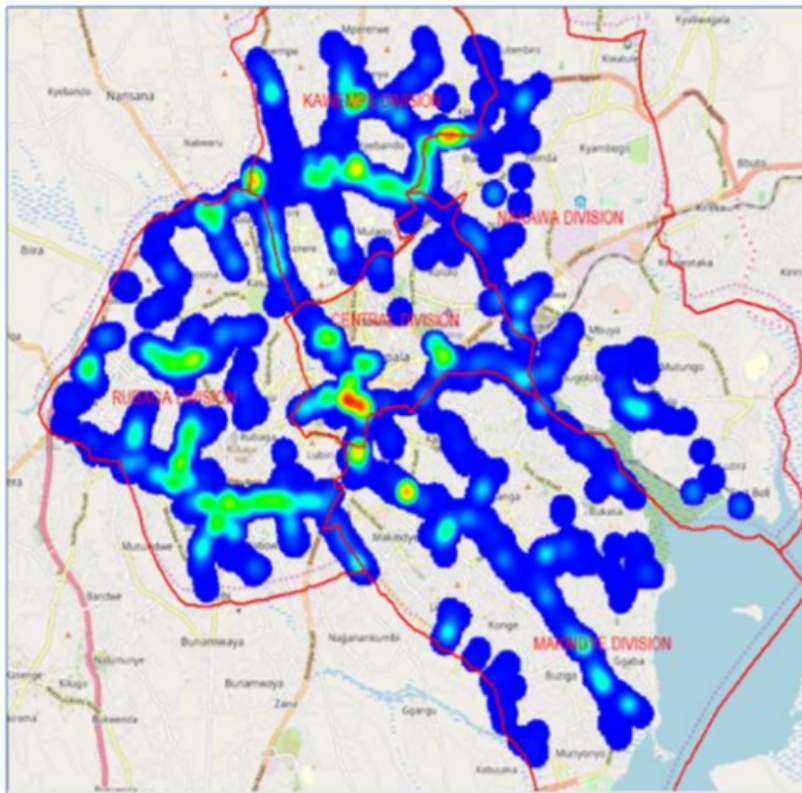
Modeling the effects of a
100-year Flood in the Nakamiro

The Role of Geo-Spatial Technologies...

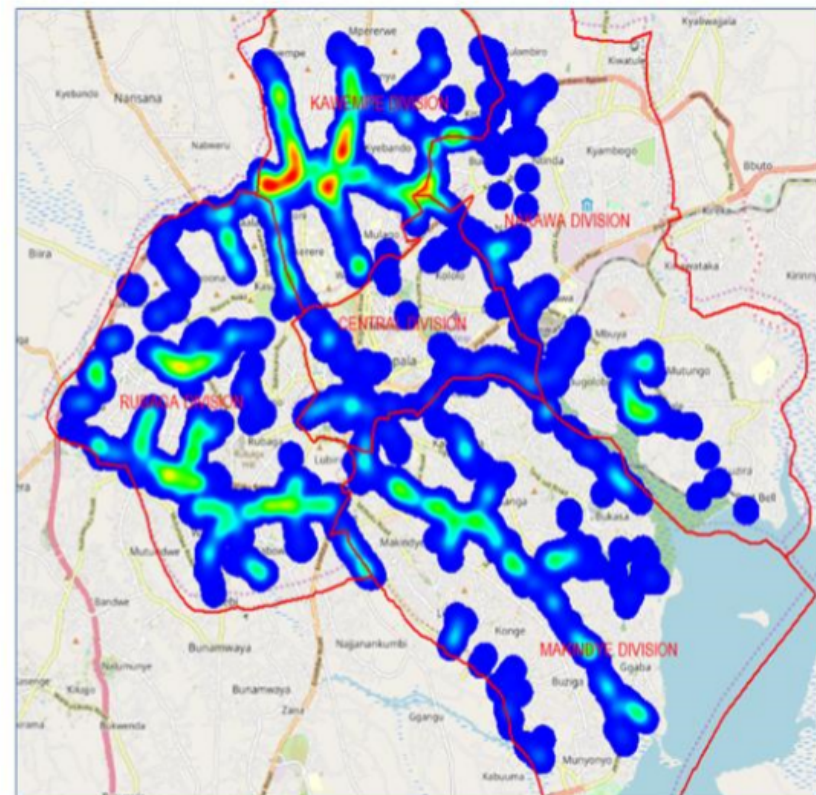
Application #1: Flood Risk Mapping...

Where is Flood Risk Highest?

Spatial variability of Average Annual Losses (AAL)



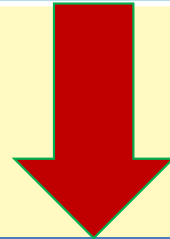
Spatial distribution of people at risk from frequent flooding (10% annual probability)



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Application #2: Disaster Mgt.; the City Address Model

City Address Model (CAM)



A system for:

- Naming all roads and streets
- Assigning numbers to all houses
- Ease navigation, promote economic activities (e.g. tourism), facilitate disaster mgt. (e.g. locate fire incident sites) etc.

The Role of Geo-Spatial Technologies...

Application #3: Earthquake Monitoring using Geodesy/GNSS

- Catastrophic events such as **major earthquakes** and volcanic eruptions result when the **earth's crust fails in response to accumulated deformation**
- Aseismic **deformation of subcrustal rock** is associated with **relative plate motions**, or the ascent of magma through a volcanic plumbing system
- **Geodetic measurements** (space & time domains) document the **crustal deformation** providing unique insights into the physical processes involved.

Reference: Kenneth, W. Hudnut (1995), Earthquake Geodesy and Hazard Monitoring. *Reviews of Geophysics*, **33**(S1) July 1995, pp. 249-255.

The Role of Geo-Spatial Technologies...

Application #4: Mitigating Road Accidents through appropriate Geometric Road Design

- ✓ There is a **significant association** between **road accidents** and **road geometry** (i.e. road curves radii, road gradients, super elevation, lanes number, lane width, sight distance, crest curves, shoulder width etc.).
- ✓ **Road safety** can be enhanced by **improving road geometric design** to mitigate accidents.

Reference: Md Hasibul, I., Teik Hua, L., Hamid, H. and Azarkerdar, A.(2019) Relationship of Accident Rates and Road Geometric Design. *IOP Conference Series: Earth and Environment Science*, **357**(012040).

Final Remarks

- The purpose of the presentation was to enlighten the Surveyors on the subject of **“urban resilience”** and to illustrate the **“applications of Geo-Spatial technologies in urban resilience mgt.”**
- The Geo-spatial applications enumerated in this presentation are just a handful!! **Many more applications can be explored.**



THANK YOU

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