



Cities and Contagion

Rapid Deployment Tool to Identify COVID-19 Exposure Hotspots

GPURL Online Learning Series

April 15, 2020

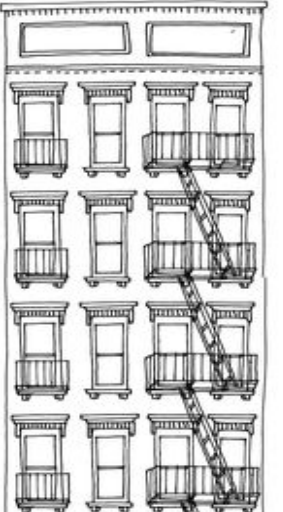
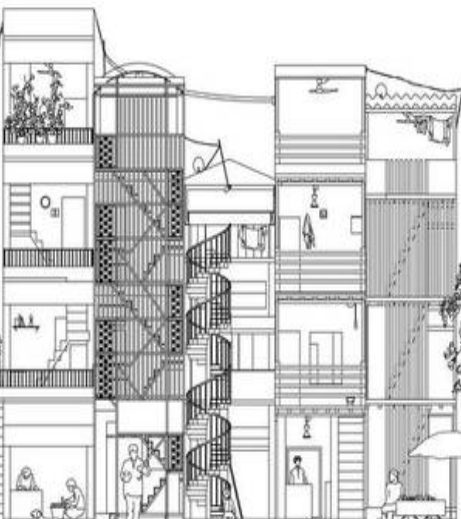
Territorial Development
Global Solutions Group



Cities bring people together

- Social interactions are the hallmark of city life
- However the COVID-19 pandemic calls for seriously limiting social interactions
- Mitigation via social distancing
- Major exposure risk and community contagion when social distancing is challenging

Self-isolation and social distance – is it feasible everywhere?





Anticipating mitigation challenges in developing country cities



To help prioritize limited resources:

Emerging hotspots must be anticipated

Vulnerable groups need to be identified

Nairobi



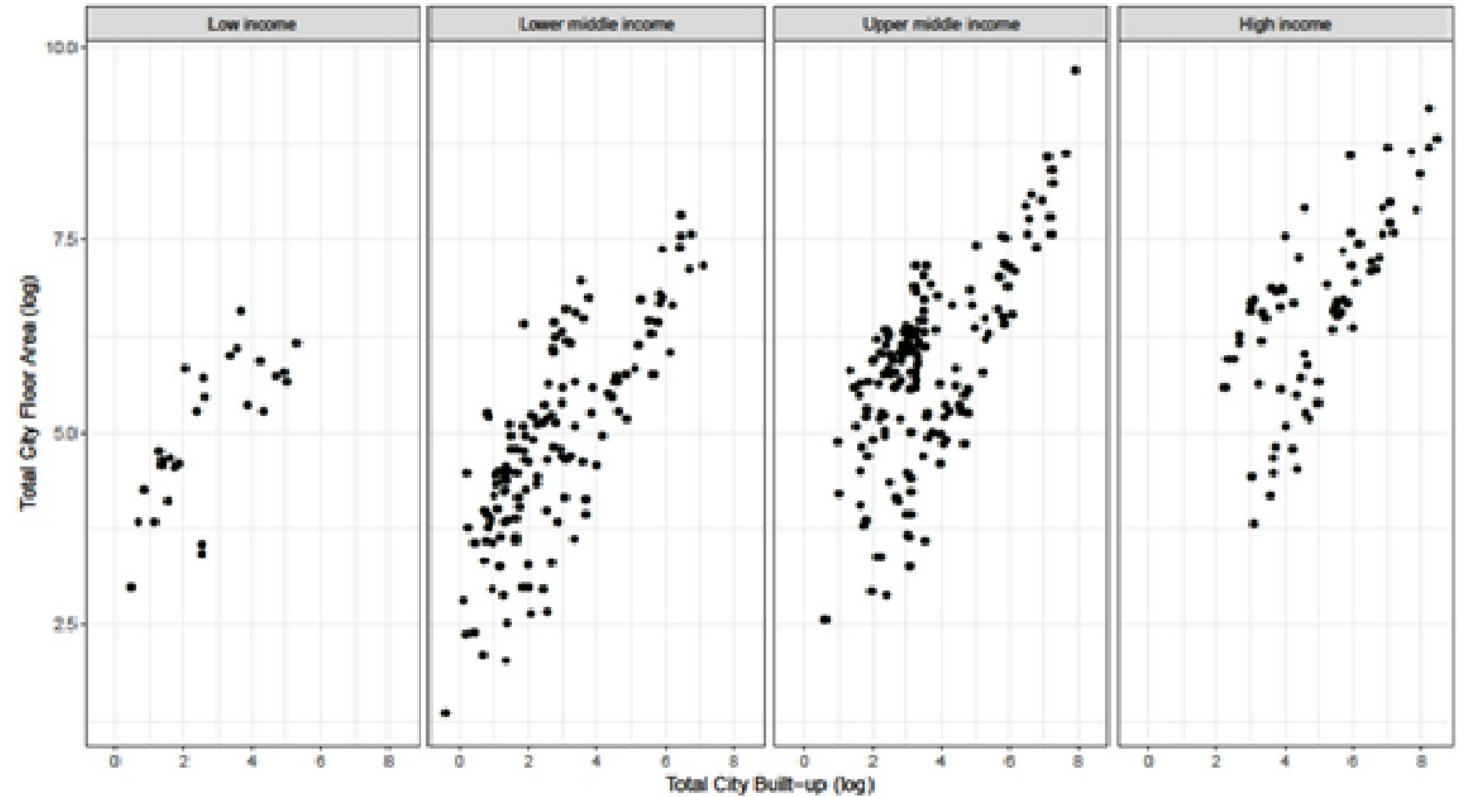
New York



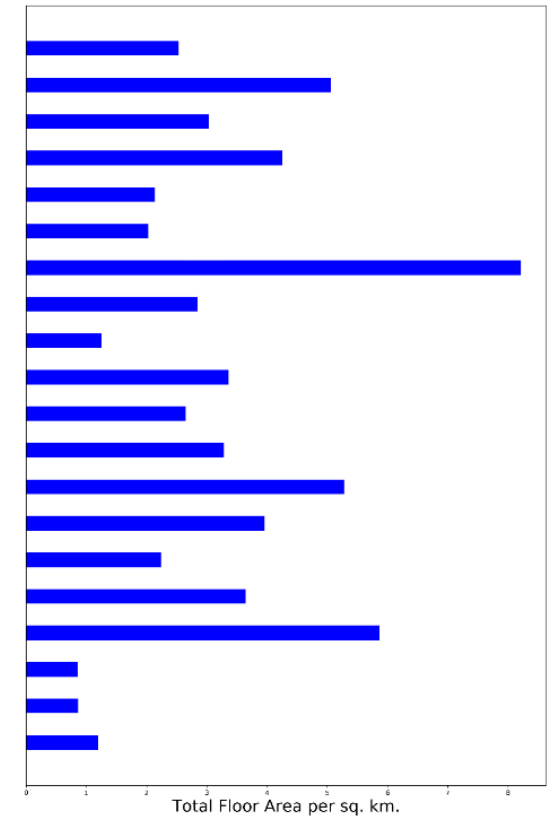
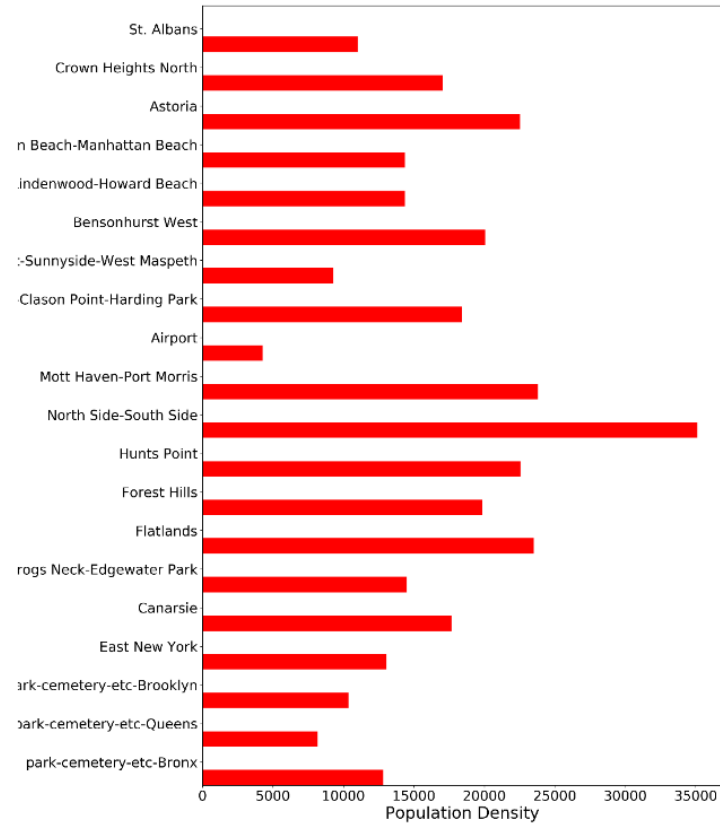
A world map where landmasses are highlighted with a complex network of red and purple lines, representing exposure hotspots for COVID-19. The background is black. The text is overlaid on the left side of the map.

*Rapid Deployment Tool to Identify
COVID-19 Exposure Hotspots*

Important :
data on floor
space to
understand
economic
geography of
cities



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Methodology

To reduce contagion, people need to maintain minimum social distance of 2 meters



Each individual needs a minimum of 3.5 square meters



Density should be at most 0.29 persons per square meter



Areas with density above this threshold can be potential contagion hotspots

Identification of Hotspots

First set of Hotspots

- Accounts for density in the neighboring pixels (queen criterion)

$$D_i = \frac{P_i}{TFA_i} + \sum_{j=1}^8 \frac{P_j}{TFA_j}$$

Second set of Hotspots: accounts for

- Agglomeration of people in the service pixel (when $S_i = 1$)
- Transit through non-service pixels (when $S_i = 0$)

$$D_i = \frac{P_i}{TFA_i} + \sum_{j=1}^8 \frac{P_j}{TFA_j} + S_i \left\{ \sum_{j=9}^N \frac{P_j}{TFA_j} d_j^{-\frac{1}{2}} \right\} + (1 - S_i) \left\{ \frac{1}{8} \sum_{j=1}^N \frac{P_j}{TFA_j} d_j^{-\frac{1}{2}} \right\} d_{i,s}^{-\frac{1}{2}}$$



Hotspots

1. Inability for keeping people apart

Population density per square meter built and minimum mobility

—————> **First set of hotspots**

2. Proximity to places where people may cluster

Location of key services and mobility towards these locations

—————> **Second set of hotspots**



Data

Global data

- WorldPop and Facebook- population dataset
- OpenStreetMap and 'our counterpart' - key services
- DLR (German space agency)- building heights data for low and middle income countries

Local expertise

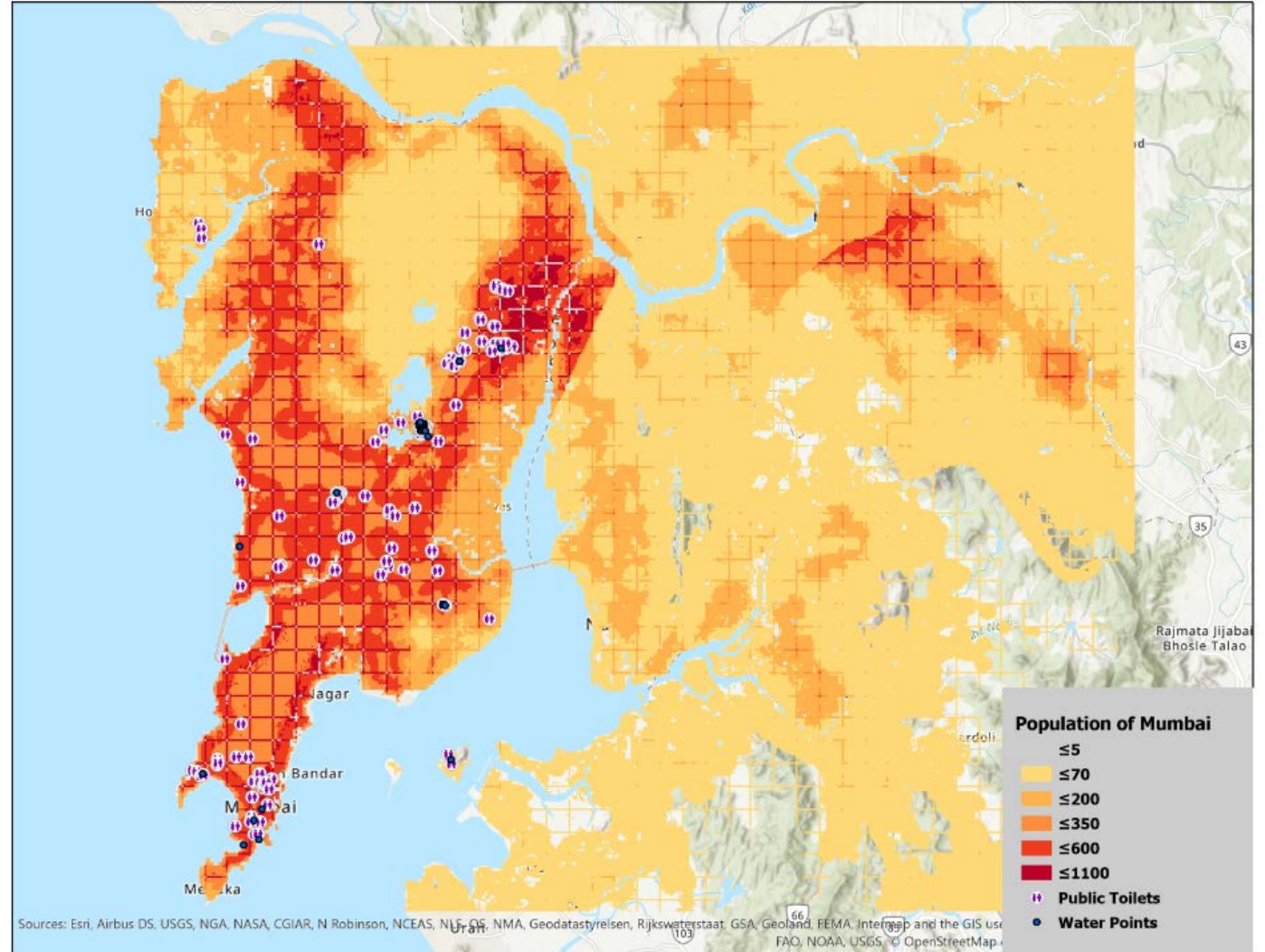
- Focus on rapid scan to support emergency response
- Work closely with WBG country offices and Humanitarian OSM teams
- Draw on staff members with deep knowledge of local conditions
- Supplement global data with local sources (eg. slums mapping)

The image features a dark gray background with a central white horizontal band. Above and below this band are three overlapping circles in shades of blue, creating a decorative, wave-like pattern. The text "Potential hotspots" is centered within the white band.

Potential hotspots

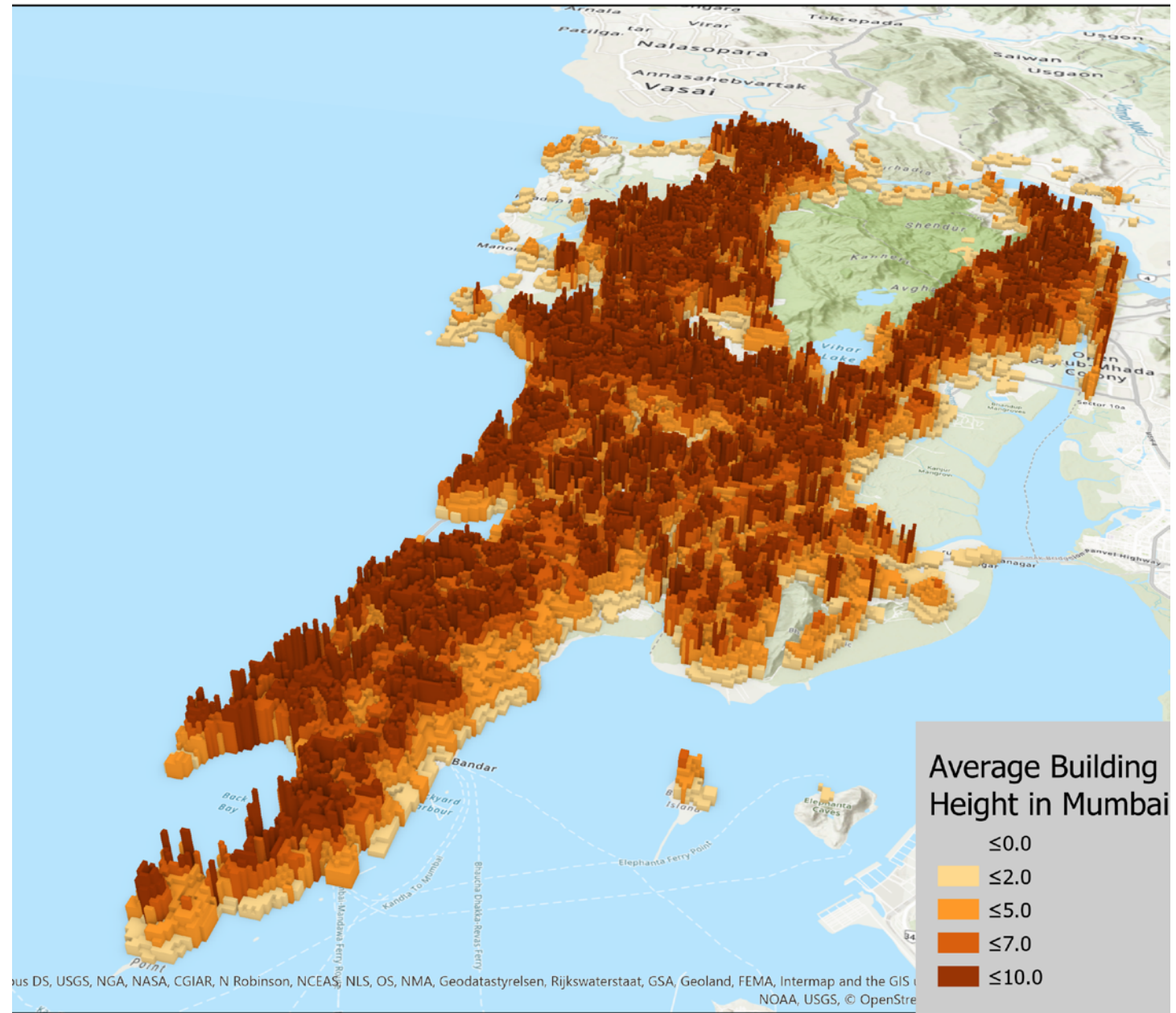
Mumbai

- Population
- Location of Water Kiosks



Mumbai

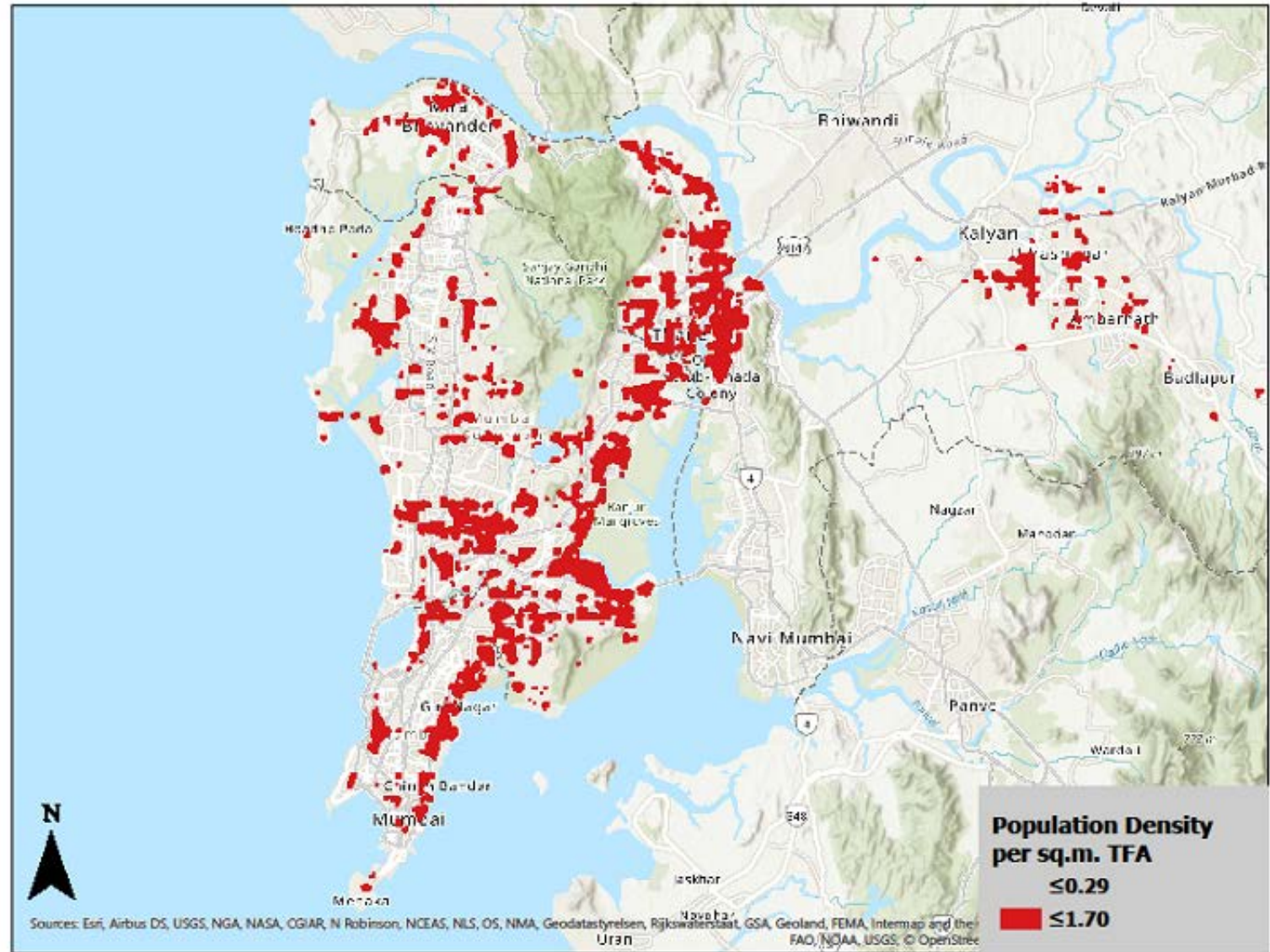
Average Pixel Height



Mumbai

Potential Hotspots

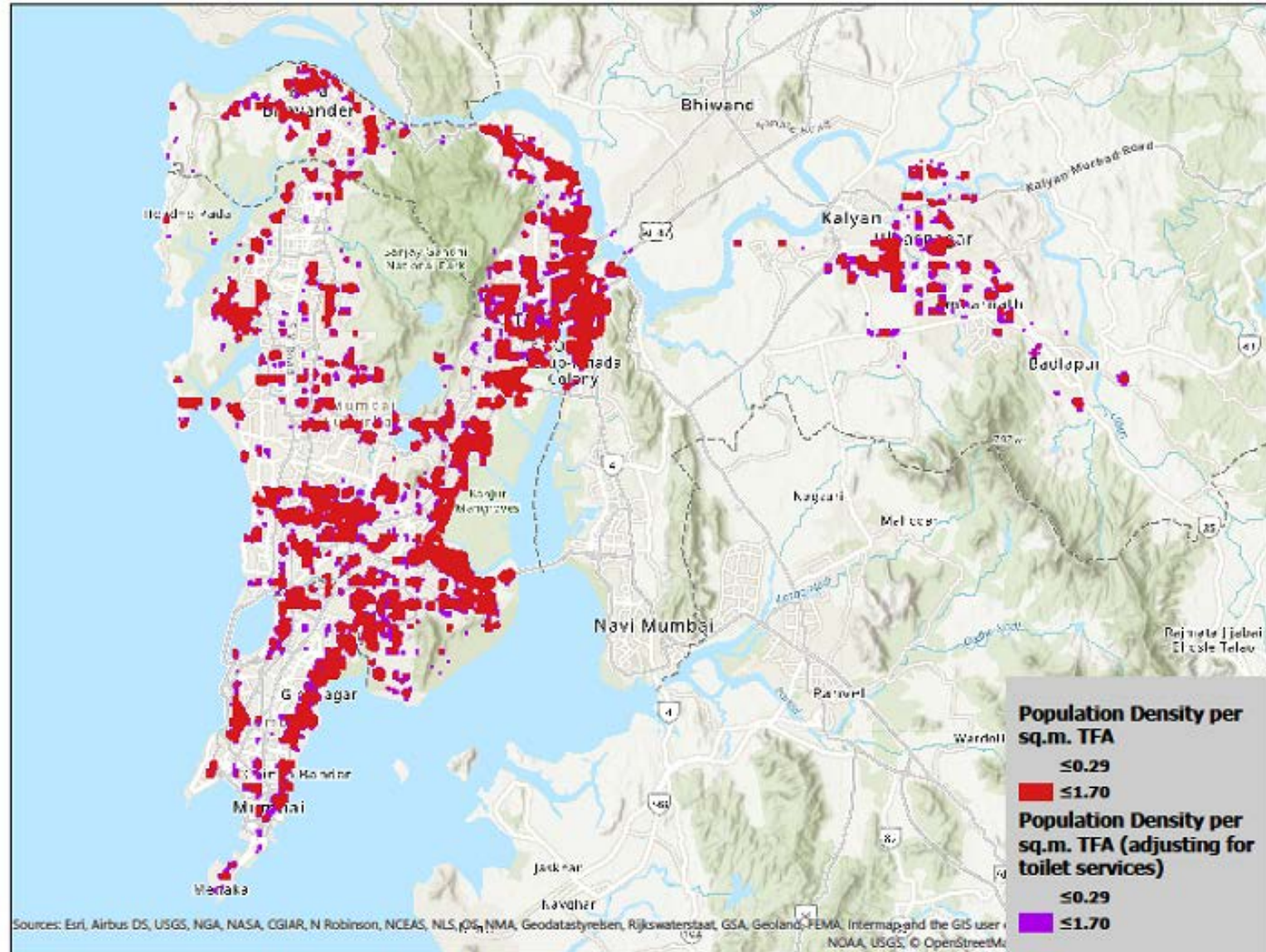
- Hotspots cover 104 km²
- Affected population: 4.5 million
- 20% of the city population affected



Mumbai

Additional Hotspots using Location of toilets

- Hotspots cover 120 km²
- Population affected: 5.2 million
- Population at risk increased 15%

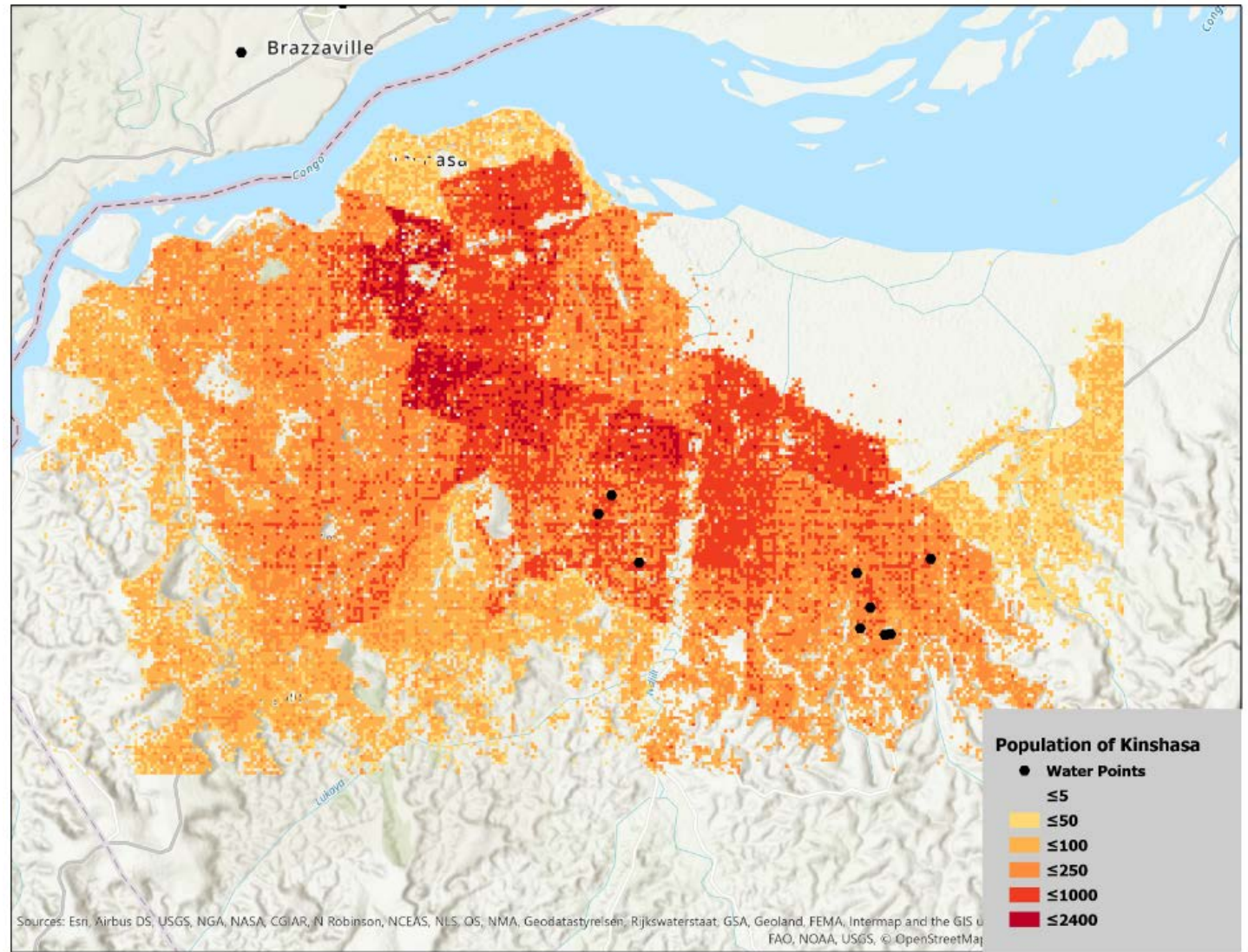




Mumbai:
Highly dense
urban setting

Kinshasa

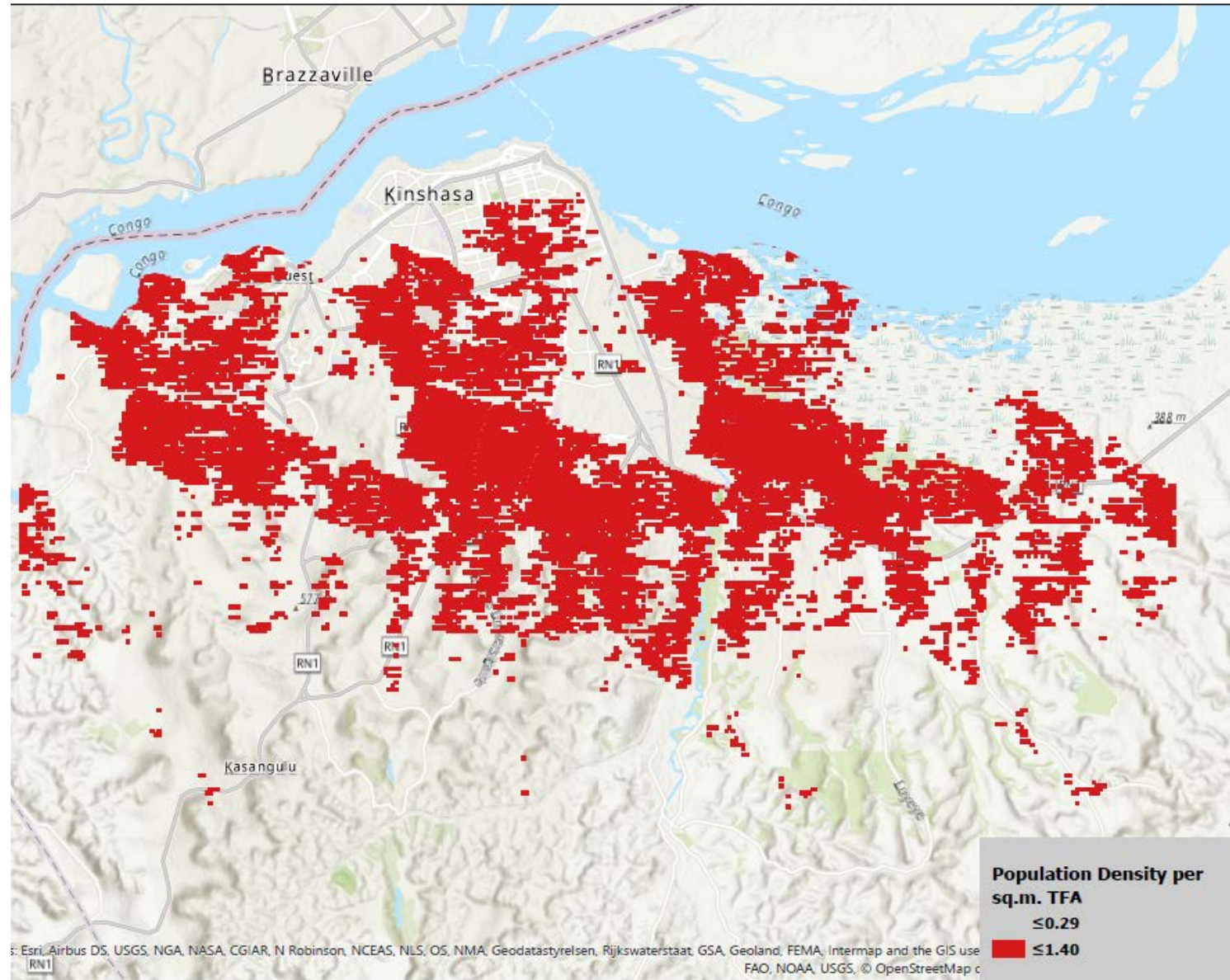
- Population
- Location of Water Kiosks



Kinshasa

Potential Hotspots

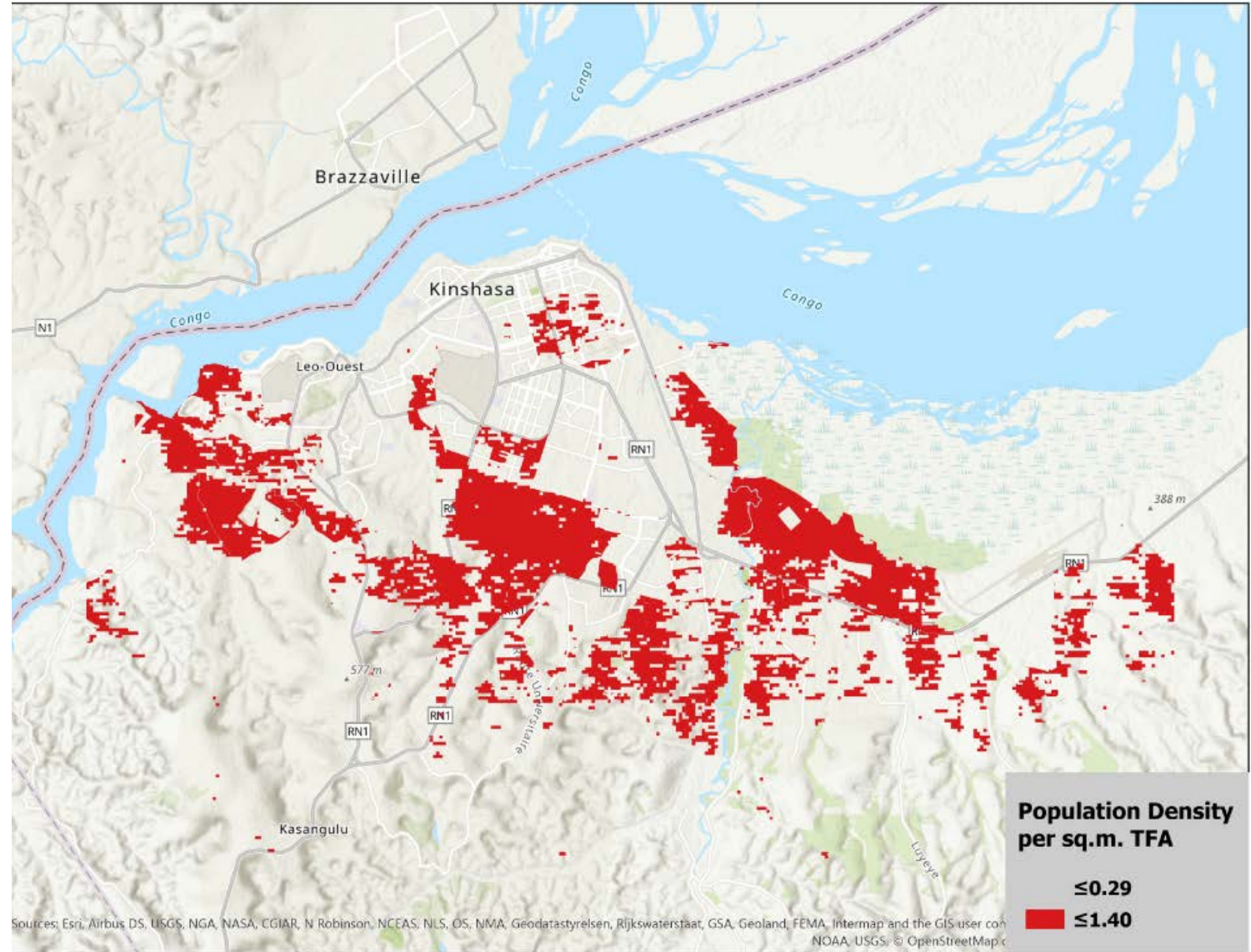
- Hotspot cover 138 km^2
- Affected Population: 5.88 million
- 52% of total population impacted



Kinshasa

Hotspots in Areas where construction is Precarious

- Hotspot cover 88 km^2
- Affected Population: 4.55 million
- 41% of total population impacted

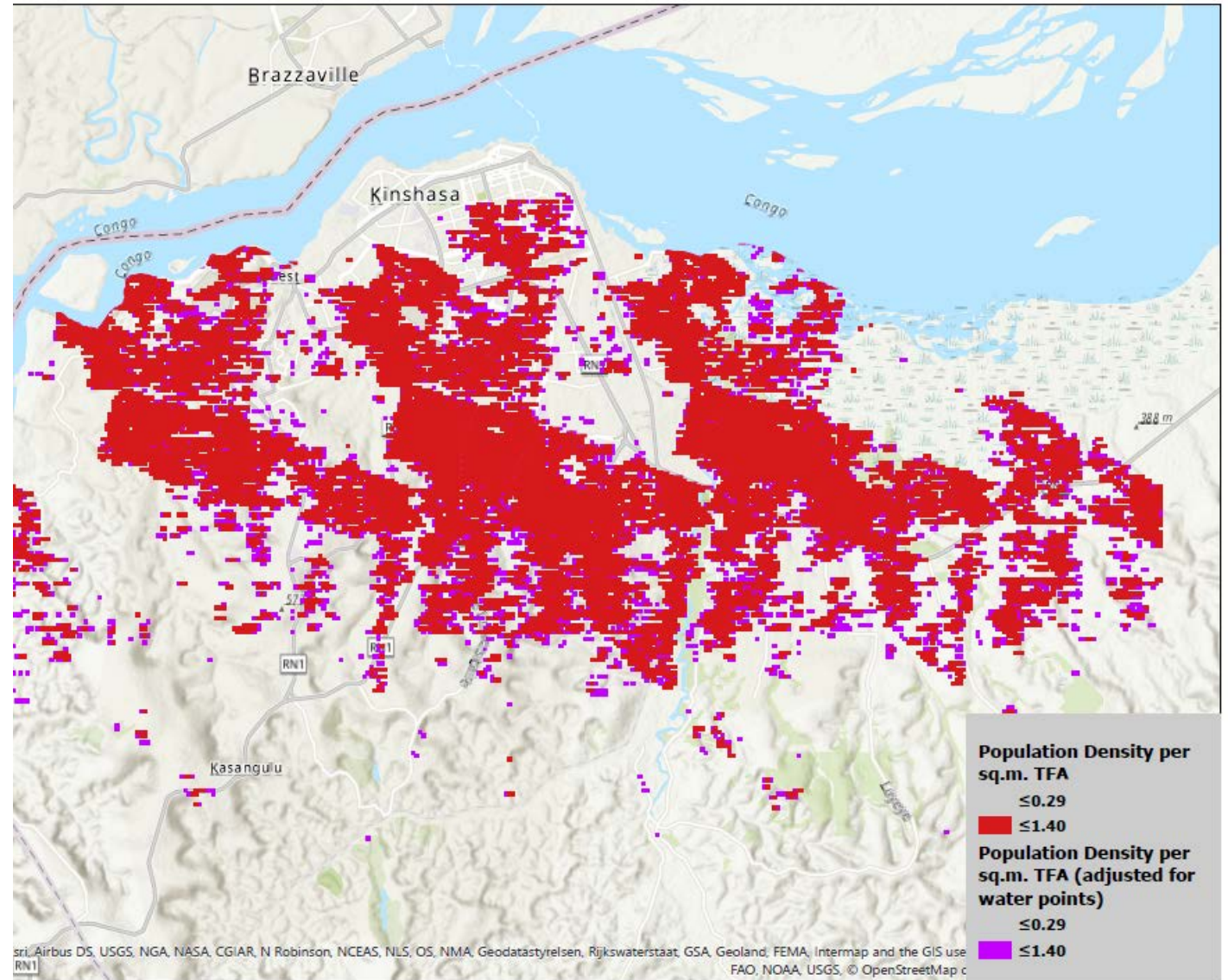


Precarious Layer Data Source: World Bank Policy Note Access to Housing and Services in Kinshasa Province

Kinshasa

Additional Hotspots using Location of water kiosks

- Hotspot cover 170 km^2
- Affected Population: 6.6 million
- Population at risk increased 12%



Kinshasa

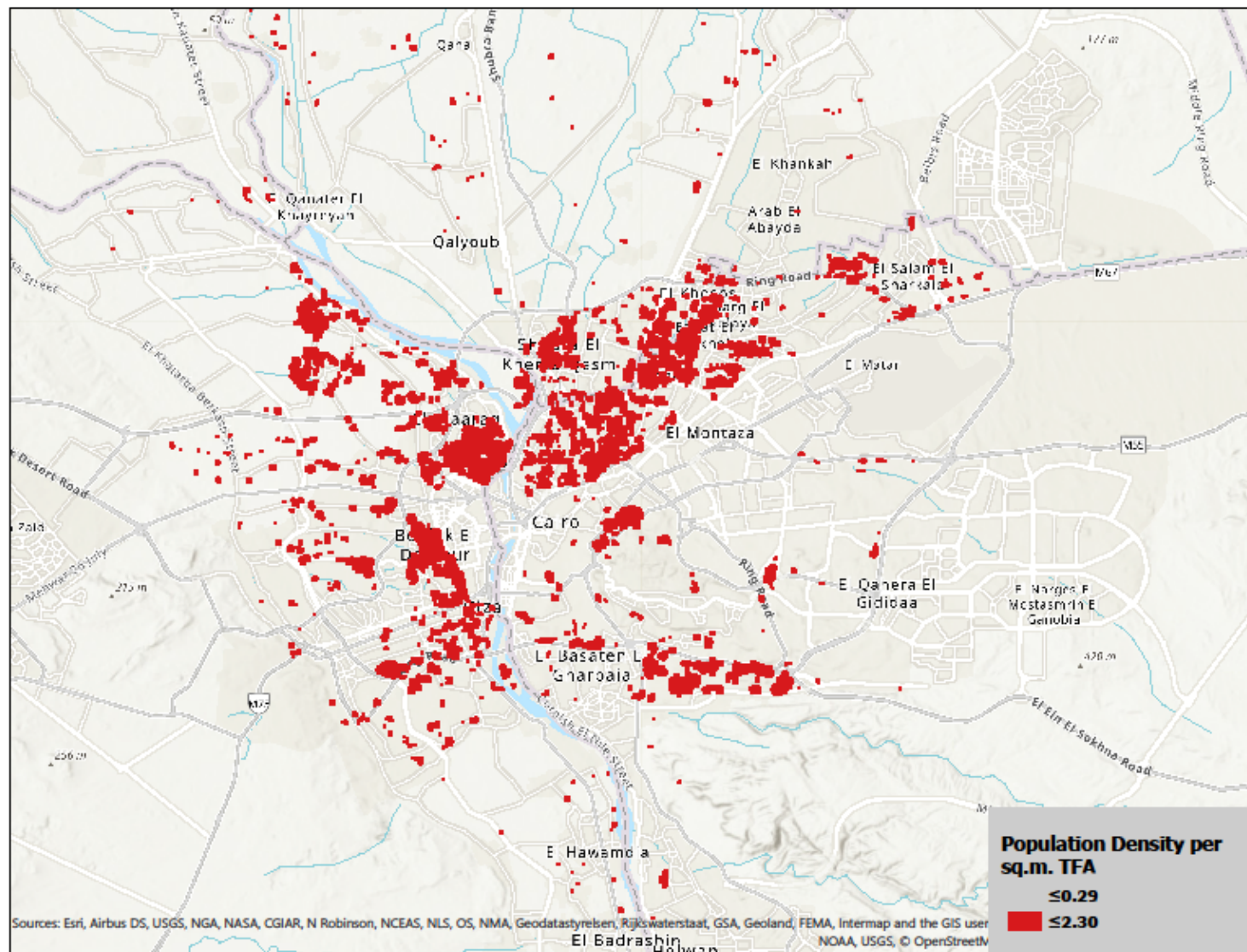
Concentrated hotspots at the periphery



Cairo

Potential Hotspots

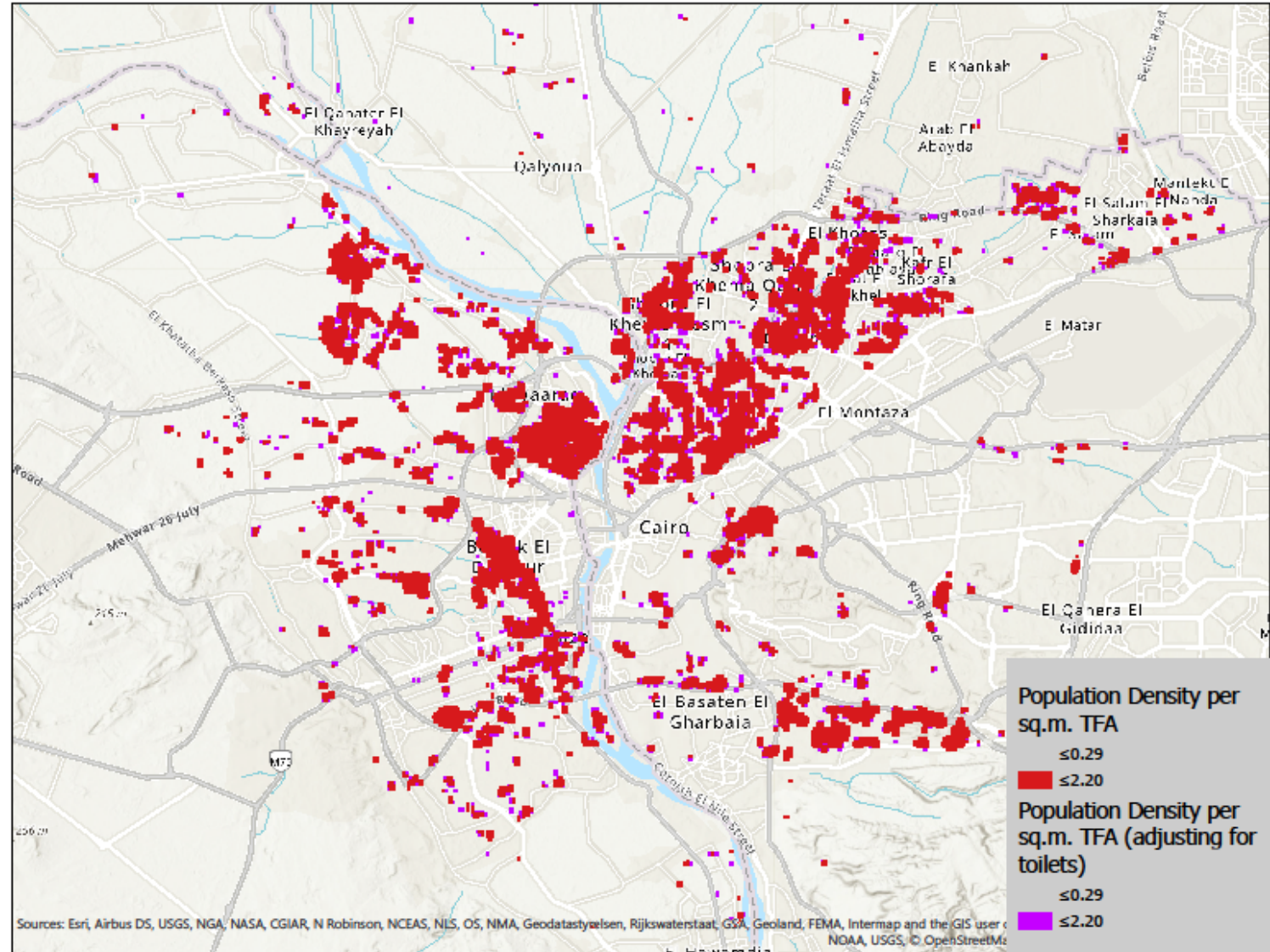
- Hotspot cover 84 km^2
- Affected Population: 5.5 million
- 25% of total population impacted



Cairo

Additional Hotspots using Location of toilets

- Hotspots cover almost 100 km^2
- Population affected: 6.1 million
- Population at risk increased almost 11%



Some final numbers

City	Population	Total People in Hotspots method 1	% Total Population affected Method 1	Total People in Hotspots Method 2	% Total Population affected Method 2
Mumbai	22.7 million	4.5 million	19.8%	5.2 million	22.8%
Kinshasa	11 million	5.8 million	53%	6.6 million	60%
Cairo	21.8 million	5.5 million	25%	6.1 million	28%

Roll out and value added

Benefits city leaders and stakeholders

- Informs timely and accurate responses to rapid viral spread
- Hotspot identification assists understanding of vulnerable areas, informs prioritization and fund allocation
- Can shape the contours of future long-term investments in slum upgrading, shelter upgrading, etc

Engagement with WBG teams

- Working in WBG country teams support CERCs, country teams and local officials
- Major demand in Africa, S. Asia and C. America
- Potential to support 40-50 cities

Benefits to other groups like Slum Dwellers International

- Inform targeting and prioritization in different areas
- Identify hotspots with lack of basic services
- Hotspots require tailored responses