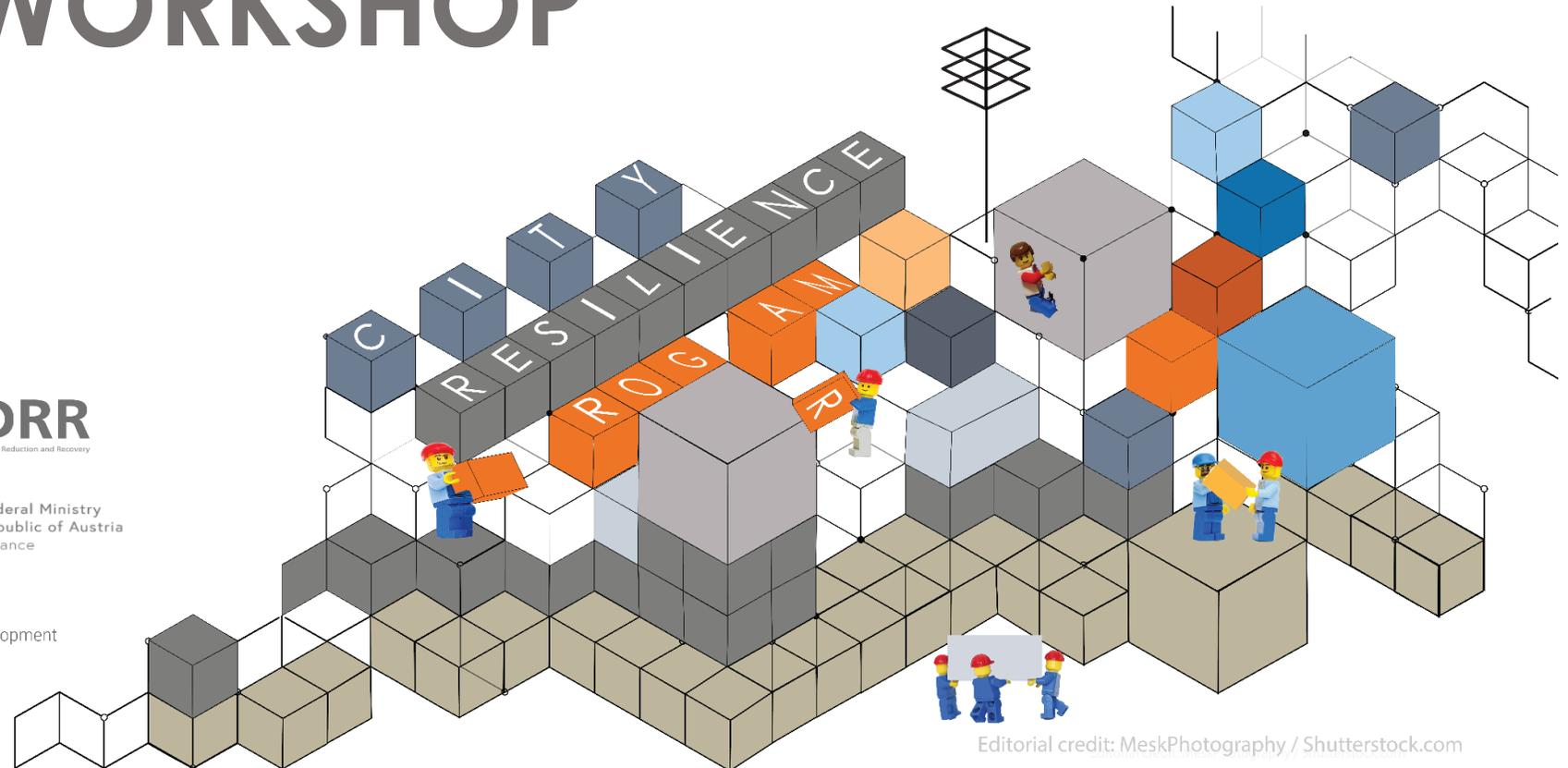


SPATIAL DATA AND RESILIENCE PLANNING WORKSHOP



Swiss Confederation
Federal Department of Economic Affairs FDEA
State Secretariat for Economic Affairs SECO



Editorial credit: MeskPhotography / Shutterstock.com



CITY RESILIENCE PROGRAM

Investing in urban resilience is fundamental to ensuring sustainable development and poverty reduction

- ① Unprecedented urbanization is transforming the planet and the way we live
- ② Most urban expansions occurs near natural hazards, rivers and coastlines, and through informal and unplanned settlements
- ③ Lack of adequate infrastructure and land use planning exacerbate the risks to which urban dwellers are exposed

A DIFFERENT APPROACH

CITY RESILIENCE PROGRAM

- ✓ A fundamental shift from sectoral to spatial combining the built and natural environments
- ✓ Enabled by advances in technology that have increased precision and lowered costs for spatial data to visualize outcomes
- ✓ Understanding the risks of today and tomorrow for a more sustainable future



REACTIVE TO
PROACTIVE

- Design investments with expectations of when and how shocks will occur
- Engineering designs based on future climate scenarios



SILOED TO
MULTIDISCIPLINARY

- Multi-sectoral lens to manage risks within a complex urban system



UNDERSTAND THE
BUILT AND NATURAL
ENVIRONMENT

- Integrate geospatial solutions and innovative technology to maximize land value and resilient urban planning

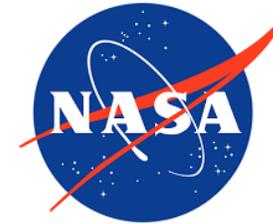
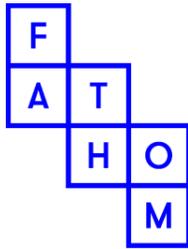
THE CITY SCAN CONCEPT

CITY RESILIENCE PROGRAM

What is a City Scan?

- A rapid assessment of the critical resilience challenges that cities face
- A means for starting conversation on resilience and infrastructure needs, rather than a specific decision-making tool
- A package of geospatial solutions, maps, and data visualizations that integrate features of the built and natural environments





OpenStreetMap





**POLLER ACTIVITY:
How well do you know your city?**

QUESTION 1

CITY RESILIENCE PROGRAM

What are your city's critical development challenges?

QUESTION 2

CITY RESILIENCE PROGRAM

How much of your city do you think was built before 1975?

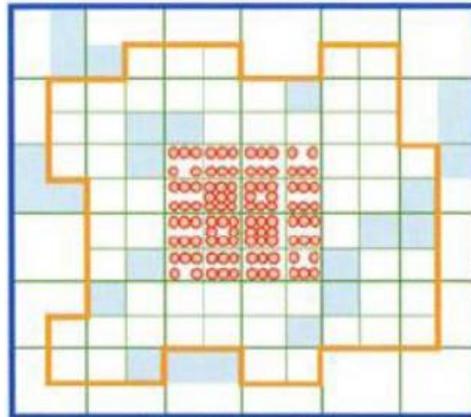
- A. Less than 25%
- B. 25%-50%
- C. 50%-75%
- D. 75%-100%

QUESTION 3

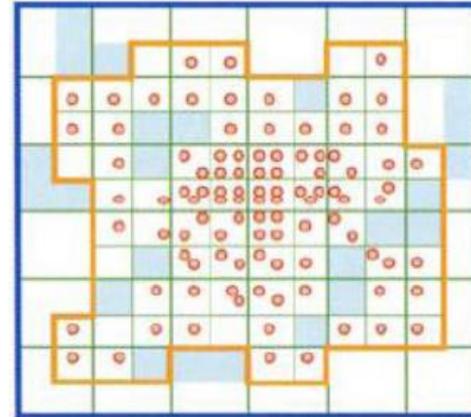
CITY RESILIENCE PROGRAM

How do you think is your city growing? (select only one from the following images)

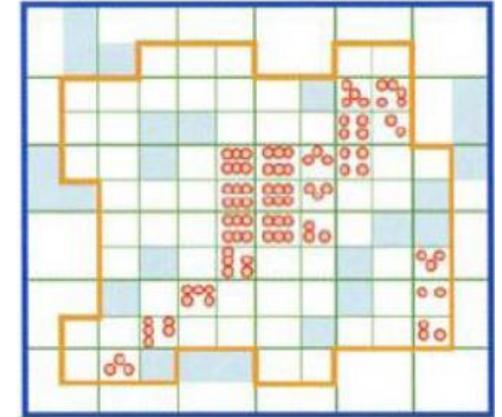
Compact



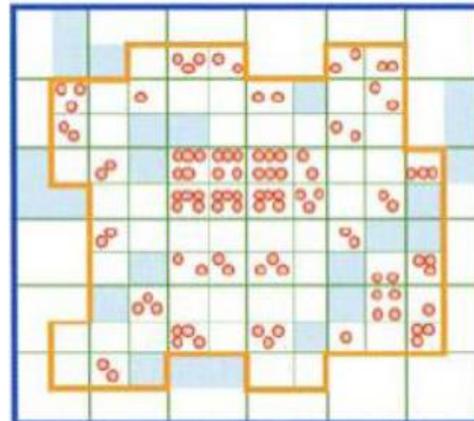
Scattered



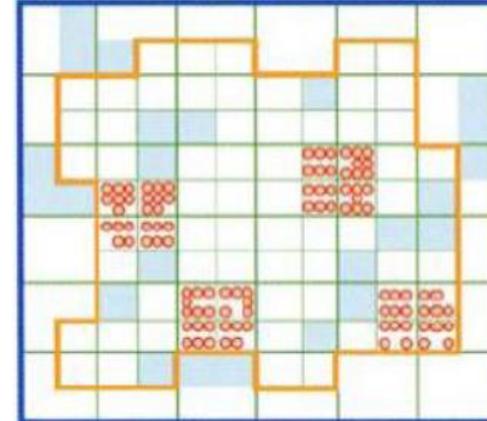
Linear strip



Leapfrogging



Clusters



QUESTION 4

CITY RESILIENCE PROGRAM

What are your city's top 3 hazards? (Select up to 3)

- Cyclone (e.g. hurricane, storm, typhoon)
- Drought
- Floods
- Earthquakes
- Volcanoes
- Landslides
- Others

QUESTION 5

CITY RESILIENCE PROGRAM

What type of flood are you most concerned about?

- A. River (or fluvial)
- B. Flash floods
- C. Overland, rainfall (or pluvial)
- D. Storm surge or coastal
- E. Groundwater floods
- F. Semi-permanent floods
- G. Not applicable to my city

QUESTION 6

CITY RESILIENCE PROGRAM

How much of your city (built-up area) do you think is exposed to urban flooding?

- A. Less than 10%
- B. 10%-30%
- C. 30%-50%
- D. More than 50%
- E. Not applicable to my city

QUESTION 7

CITY RESILIENCE PROGRAM

Does your city have master plan, land use plan, development plan or structural plan currently enforced?

Yes

No

Not applicable to my city or I don't know

QUESTION 8

CITY RESILIENCE PROGRAM

What sources of information does your city use to make investment decisions? (e.g. census data, household surveys, cadasters, GIS, scholarly journals, government reports, etc.)



TRANSPARENCIES EXERCISE

TRANSPARENCIES EXERCISE

CITY RESILIENCE PROGRAM

14-15 spatial layers, which can be overlaid to reveal information

1. Administrative boundaries
2. Background
3. Built-up area, pre-1975
4. Built-up area, 1975-1990
5. Built-up area, 1990-2000
6. Built-up area, 2000-2014
7. Population distribution
8. Land cover
9. Road network criticality
10. Infrastructure assets (schools, hospitals, fire stations, police stations)
11. Economic hotspots
12. River (or fluvial) flood
13. Rainfall (or pluvial) flood
14. Coastal erosion
15. Terrain deformation

QUESTION 1

CITY RESILIENCE PROGRAM

Overlay layers 1, 2 and 3.

What does this show?

Is the city center already defined?

How would you characterize its shape?

QUESTION 2

CITY RESILIENCE PROGRAM

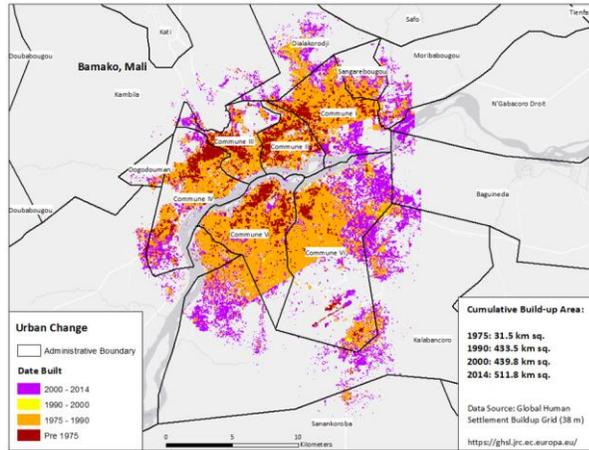
Add layer 4, then 5, then 6.

How has your city grown since 1975?

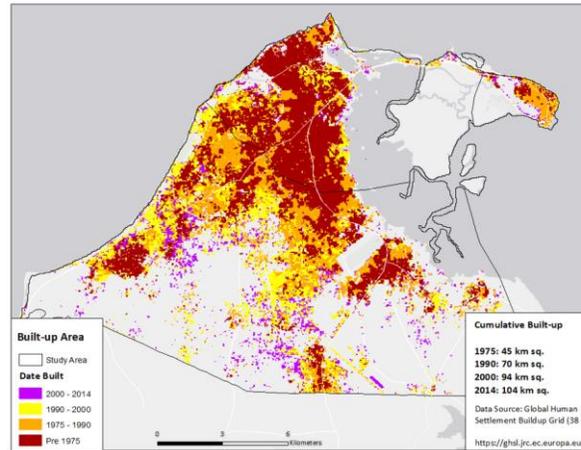
Where will it grow moving forward?

BUILT-UP AREA

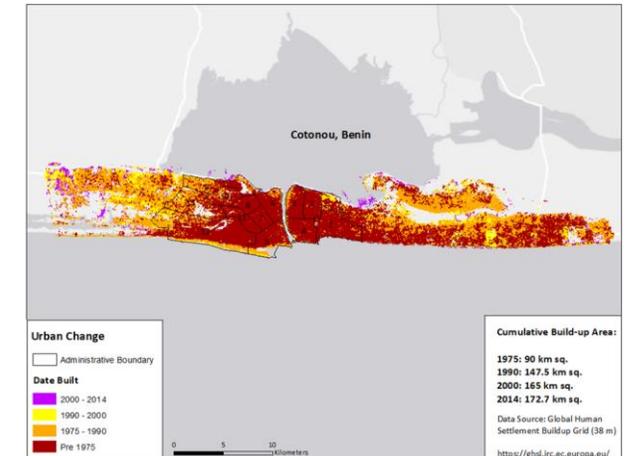
CITY RESILIENCE PROGRAM



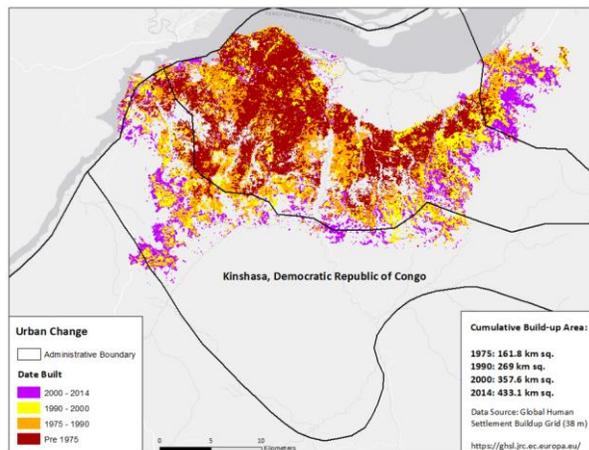
Bamako, Mali



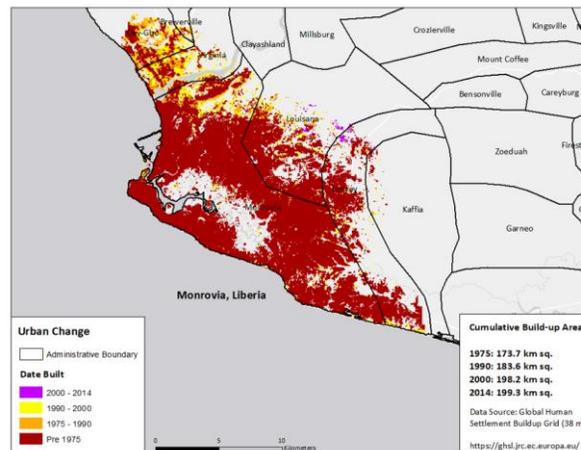
Banjul, The Gambia



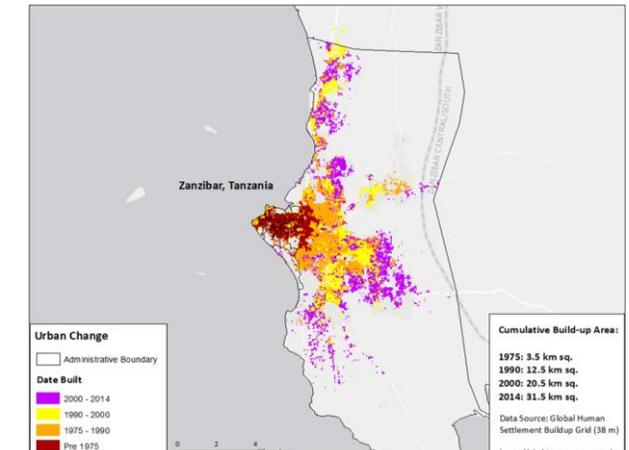
Cotonou, Benin



Kinshasa, Democratic Republic of Congo



Monrovia, Liberia



Zanzibar Town, Tanzania

QUESTION 3

CITY RESILIENCE PROGRAM

Overlay layers 1, 2, and 11.

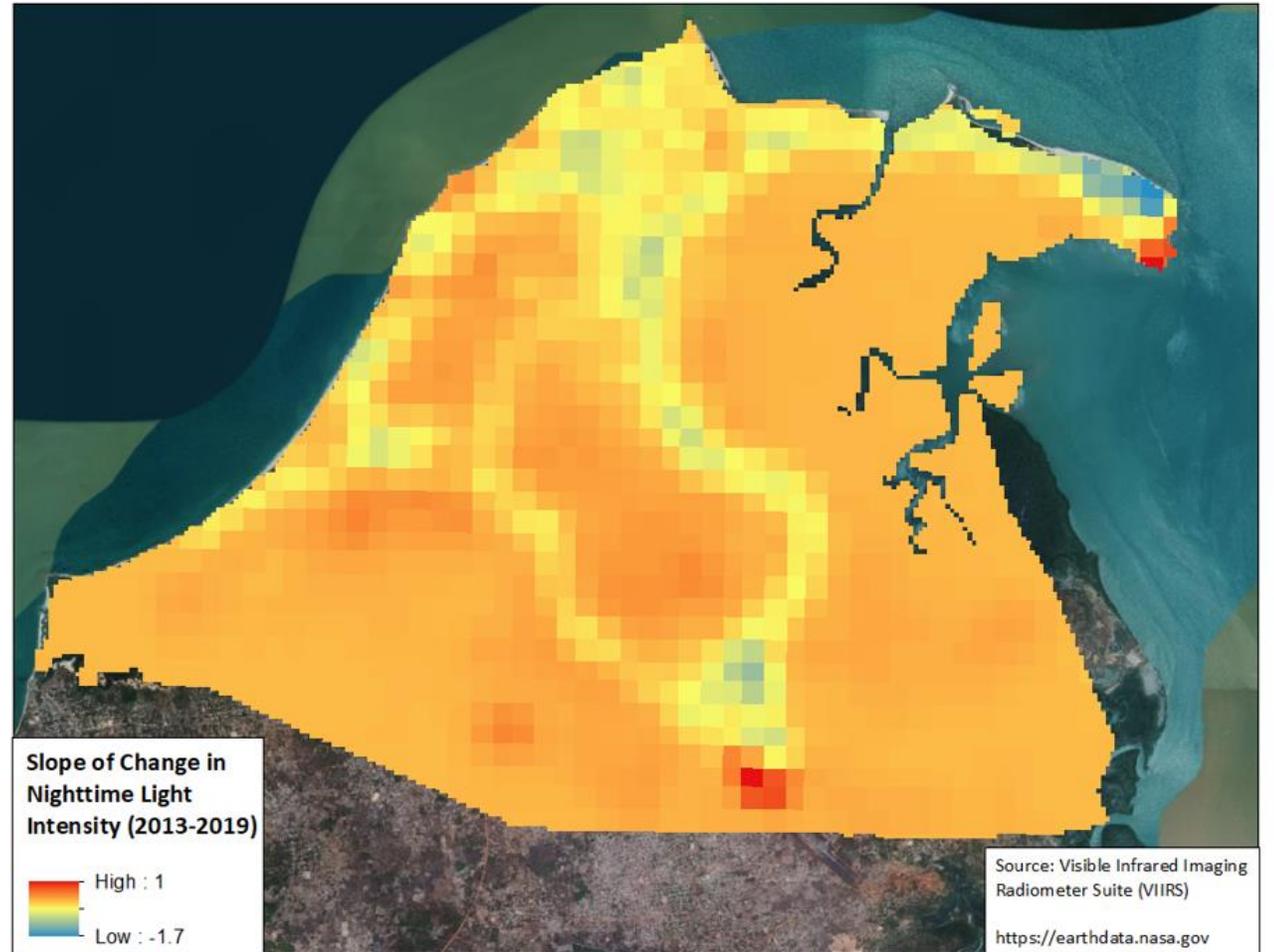
Are there areas (in **red**) observed in your city? Where are they located?

ECONOMIC HOTSPOTS

CITY RESILIENCE PROGRAM

Red areas represent a positive slope – an increase in the intensity of nighttime light emissions.

A proxy or indication of changes in economic activity



Banjul, The Gambia

QUESTION 4

CITY RESILIENCE PROGRAM

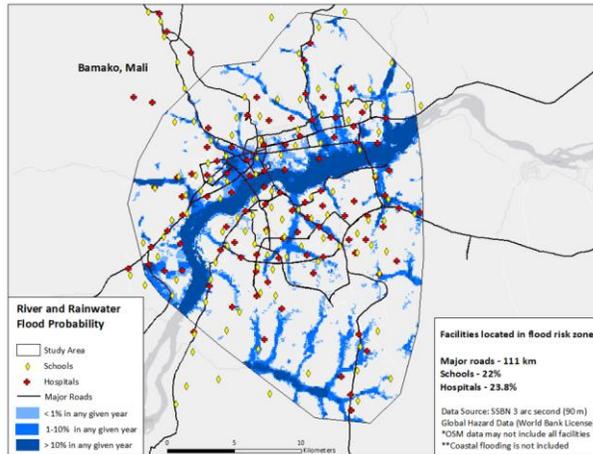
Overlay layers 1, 2, and 12.

Remove layer 12, and replace with 13.

Add layer 12 to 1, 2 and 13. Is river flooding or rainwater flooding more of a challenge in your city?

PLUVIAL AND FLUVIAL FLOODING

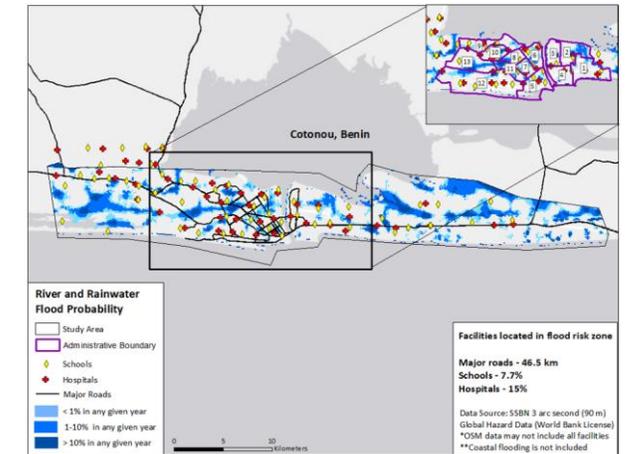
CITY RESILIENCE PROGRAM



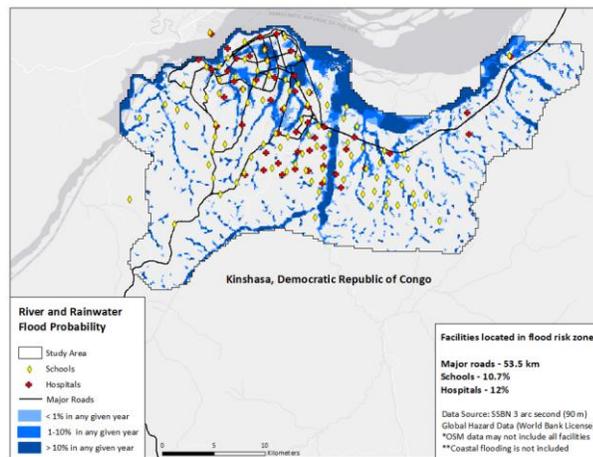
Bamako, Mali



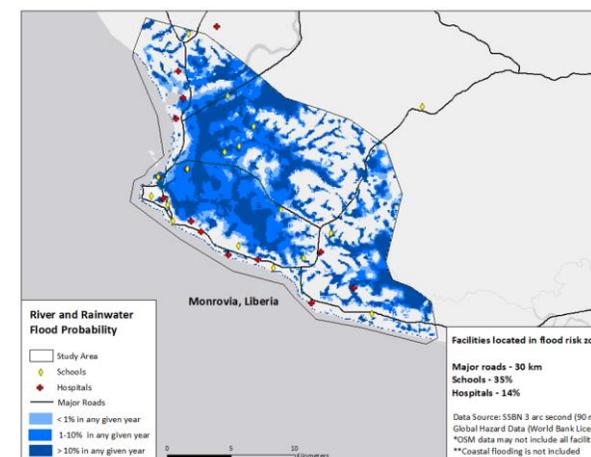
Banjul, The Gambia



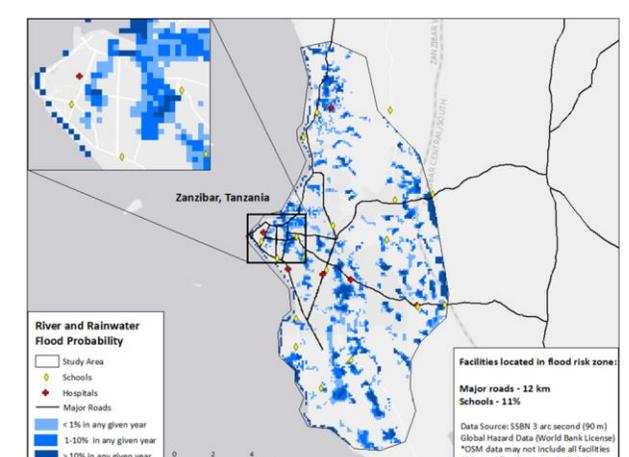
Cotonou, Benin



Kinshasa, Democratic Republic of Congo



Monrovia, Liberia



Zanzibar Town, Tanzania

QUESTION 5

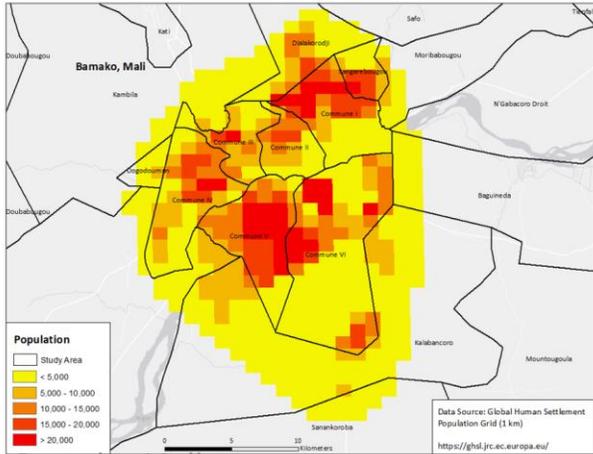
CITY RESILIENCE PROGRAM

Overlay layers 1, 2, 7, 12 and 13 in order.

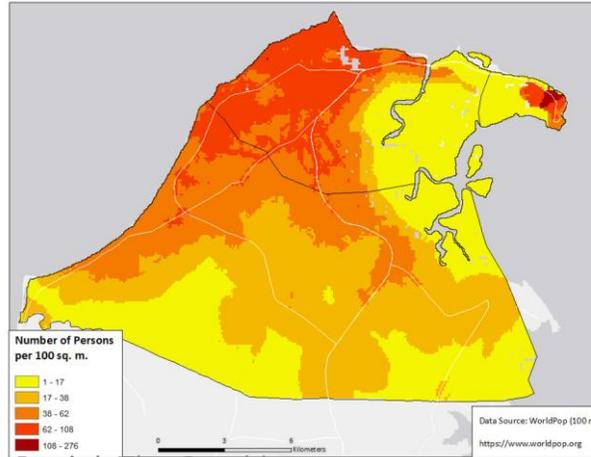
Where is your population most exposed to flooding?

POPULATION

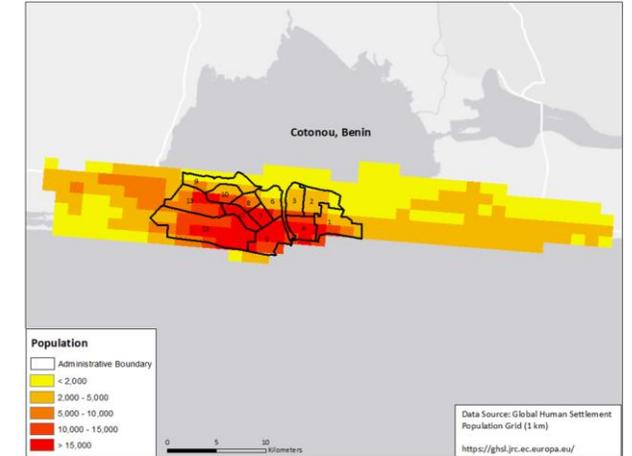
CITY RESILIENCE PROGRAM



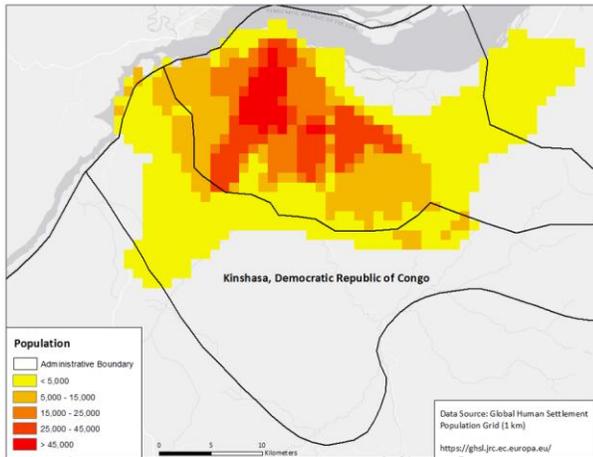
Bamako, Mali



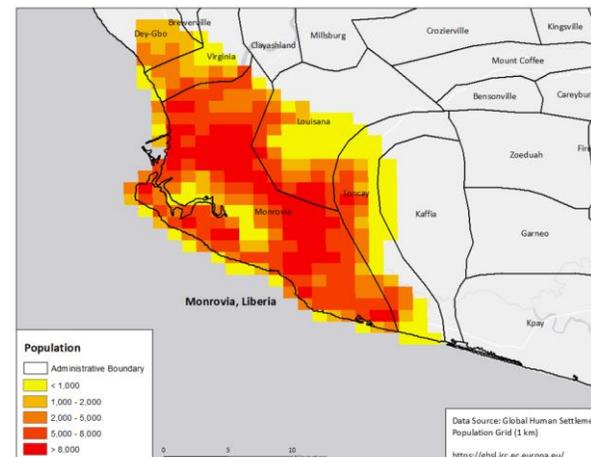
Banjul, The Gambia



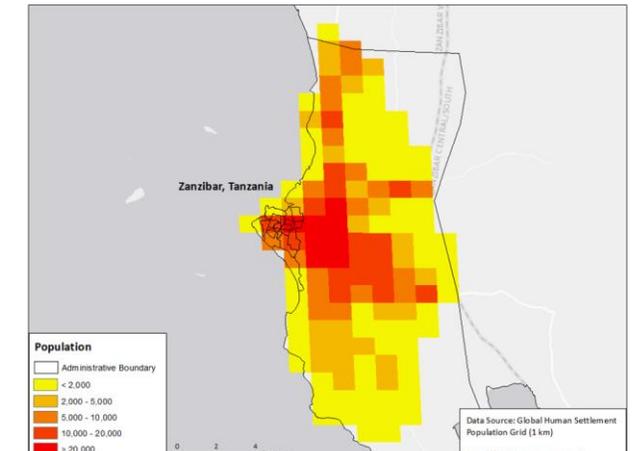
Cotonou, Benin



Kinshasa, Democratic Republic of Congo



Monrovia, Liberia



Zanzibar Town, Tanzania

QUESTION 6

CITY RESILIENCE PROGRAM

Overlay layers 1, 2, 8, 12 and 13 in order.

Which land cover types are most exposed to rainwater and river flooding?

Extra credit: If built-up area is exposed, which time period was most of the exposed built-up area built?

QUESTION 7

CITY RESILIENCE PROGRAM

Overlay 1, 2, 9, 12 and 13 in order.

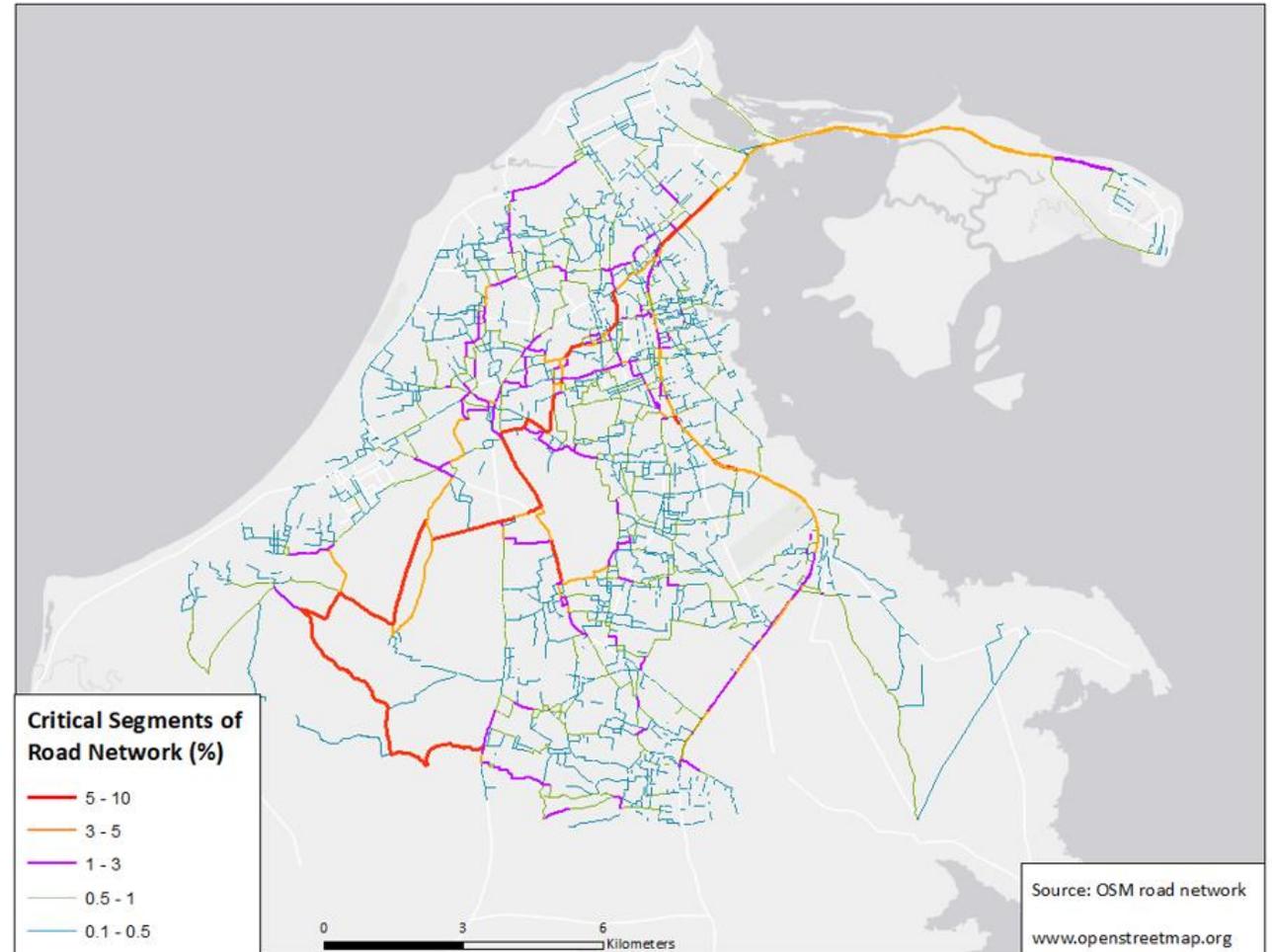
How many road segments (in **red**) are exposed to river and rainwater flooding?

ROAD CRITICALITY

CITY RESILIENCE PROGRAM

Road network criticality highlights segments in a road network that, if blocked due to flooding, protests, or other natural or political reasons, would cause a higher degree of disruption in cross-city travel.

Red segments are the most critical for overall city connectivity.



Banjul, The Gambia

QUESTION 8

CITY RESILIENCE PROGRAM

Add layer 10 (Note: 1, 2, 9, 10, 12 and 13 in order)

Are your roads, schools, hospitals, fire stations and police stations exposed to flooding?

In the event of a disaster, how will your lifeline and critical infrastructure perform?

QUESTION 9

CITY RESILIENCE PROGRAM

Overlay layers 1, 2, 8 and 14 in order

What major land cover classes are along the coast?

What shoreline impacts are taking place along the coast?
Accretion (in **green**) or erosion (in **red**)

COASTAL EROSION

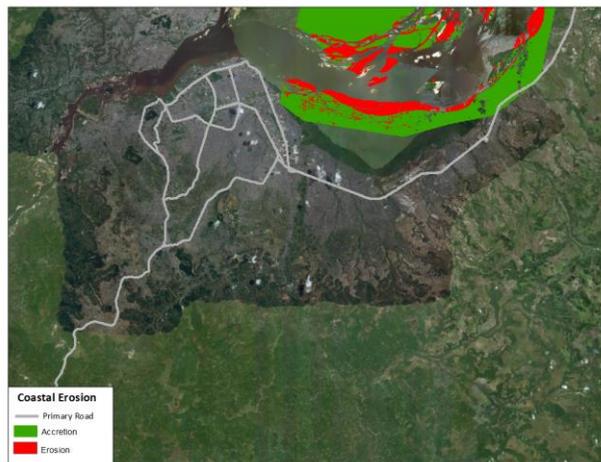
CITY RESILIENCE PROGRAM



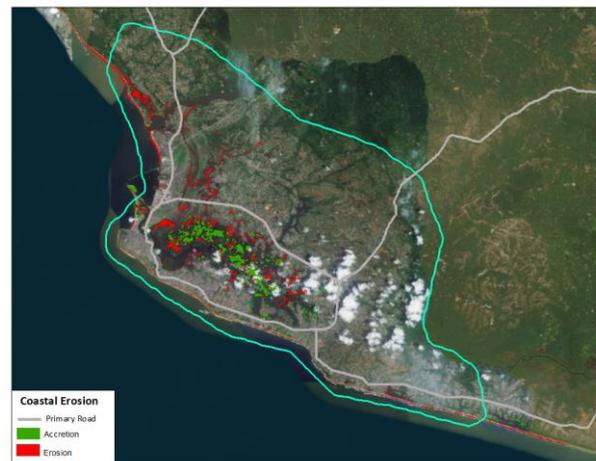
Banjul, The Gambia



Cotonou, Benin



Kinshasa, Democratic Republic of Congo



Monrovia, Liberia



Zanzibar Town, Tanzania

QUESTION 10

CITY RESILIENCE PROGRAM

Overlay layers 1, 2, 15, 3, 4, 5, and 6 in order

Where are the hotspots (or points) of observed land deformation concentrated in your city?

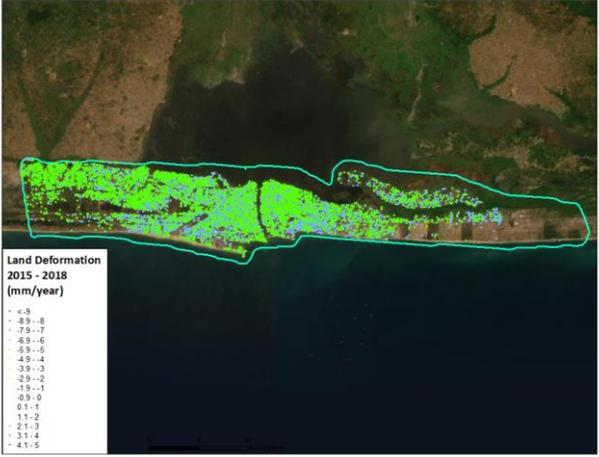
Have these areas experienced considerable development in recent years?

TERRAIN DEFORMATION

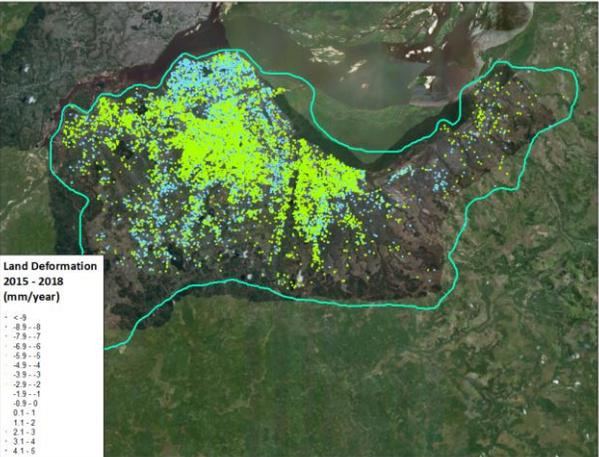
CITY RESILIENCE PROGRAM



Banjul, The Gambia



Cotonou, Benin



Kinshasa, Democratic Republic of Congo



Monrovia, Liberia

QUESTION 11

CITY RESILIENCE PROGRAM

Play around with the layers.

What other information or spatial relationships can you derive from the layers?

GROUP DISCUSSION

CITY RESILIENCE PROGRAM

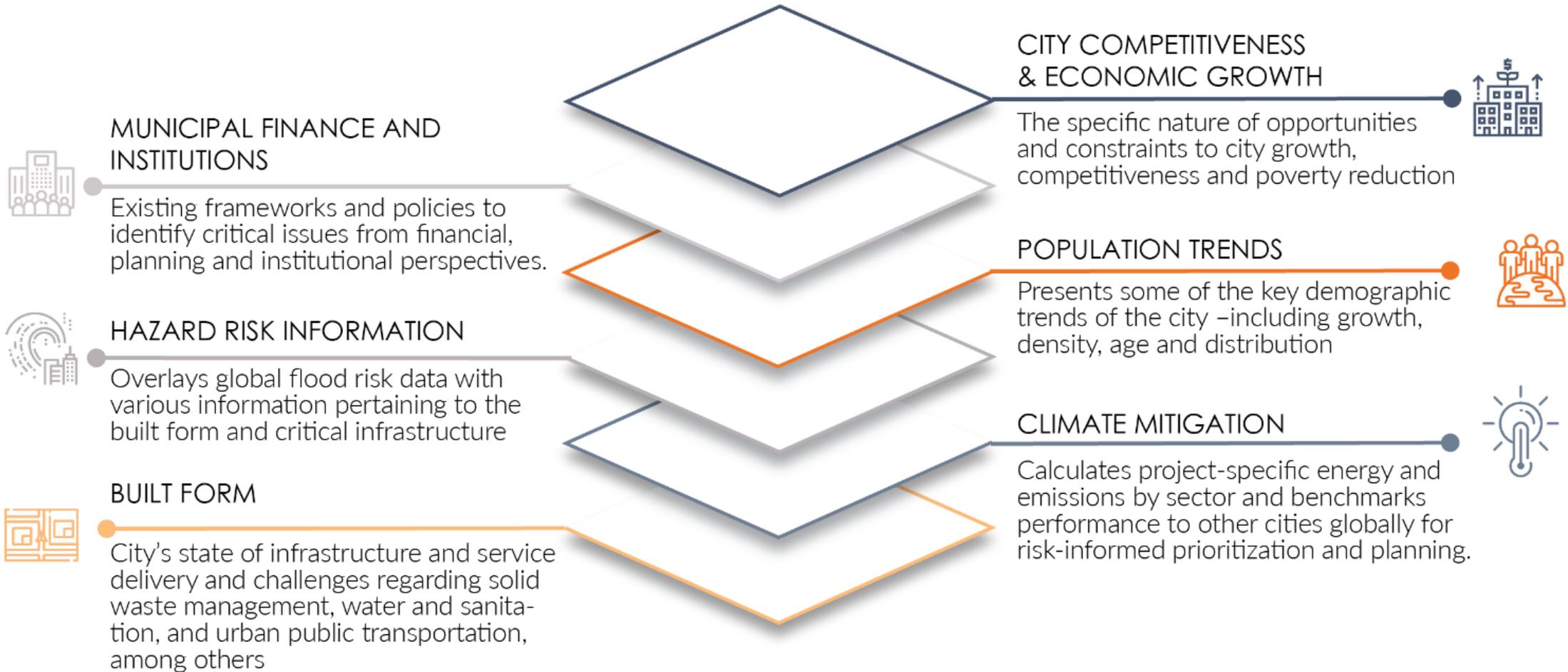
1. What was the most surprising result for you from this transparencies exercise? What are your city's critical development challenges?
2. What other information do you need in order to validate or amplify the information presented?
3. What investments need to be prioritized or coordinated?



CITY SCAN

CITY SCAN

CITY RESILIENCE PROGRAM

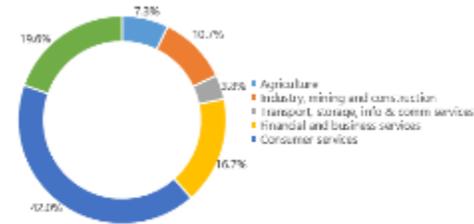


4. CITY COMPETITIVENESS AND ECONOMIC GROWTH

4.8. Share of employment by sector

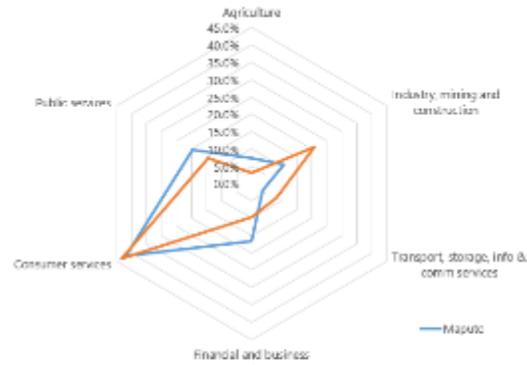
This indicator provides information on the relative importance of different economic activities with regard to employment. Information by sector of economic activity is particularly useful in identifying broad shifts in employment and stages of development.

In Maputo, more than 42% of the city's working population is employed in the consumer services sector.



Source: Global Knowledge Database

Maputo, Mozambique



Note: Cities included in the calculations for the global average are Abidjan, Addis Ababa, Dakar, Derg, Salento, Johannesburg, Kinshasa, Lagos, Luanda and Nairobi.

Benchmarking

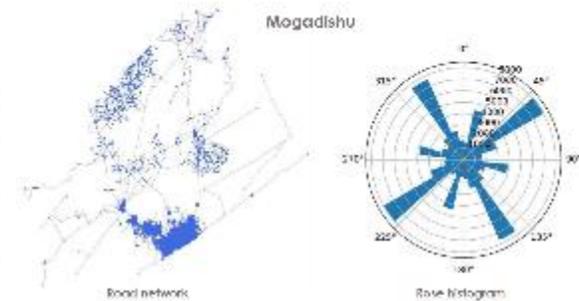
In terms of employment, non-traded sectors (e.g. coffee shops, shopping malls, hairdressers and maintenance services) in selected cities in the region almost always make up the bulk of a city's economy. They can be used as tools of spatial income redistribution within a city and as a means to create jobs in the underserved areas.

5. BUILT FORM

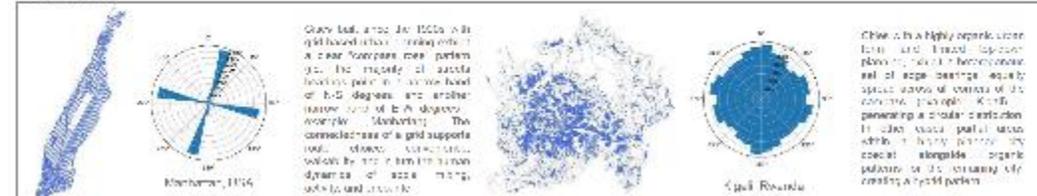
5.6. Urban form and street orientations

This layer visualizes the geometric orientation of the city's streets, specifically the proportion of streets (line pairs: east-west, north-south, or in any point on the compass). Street edge bearings can help understand local habitats of urban forms or transportation planning, and morphology evaluate existing transportation system patterns and configurations; and explore new planning proposals and alternatives. The rose histogram visualizes the distribution of city streets by compass bearing.

The total length of Mogadishu's road network is 10,721,585.4 km. There are 80,058 road segments and 29,195 intersections.



Benchmarking



Mogadishu, Somalia

6. CLIMATE MITIGATION

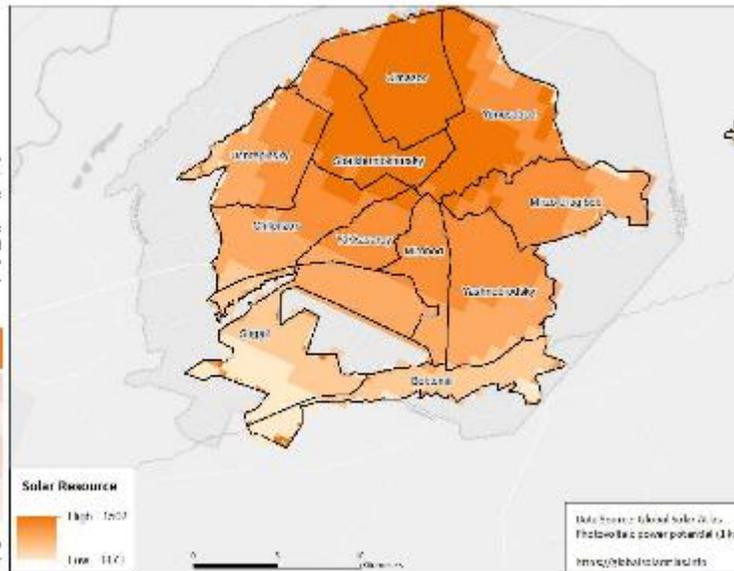
6.1. Solar PV potential

Photovoltaics (PV) is the most widely applied and versatile technology for solar power. This map displays an indicative estimate of yearly average PV power generation values (kW/m²/yr) in the case of Tashkent, the city can produce an annual PV output of 1,788 kWh/m², thereby creating an opportunity to invest in small-scale residential rooftop systems.

PV power calculator

Type of PV system	Small, residential	Medium, commercial	Ground-mounted, large
System size (kWp)	5	30	100+
Annual electricity output (kWh)	130	130	100
Annual electricity output (MWh)	0.13	0.13	0.1
Max PV capacity (kWp)	1-10	1-500	1-1000+

Note: The Global Solar Atlas uses generalized database settings for a global assessment of PV power potential for the selected site. An optimum layout of PV modules and CSP2 modules layout should be used for detailed analysis.



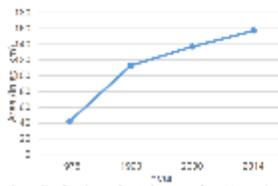
Tashkent, Uzbekistan

7. RISK INFORMATION

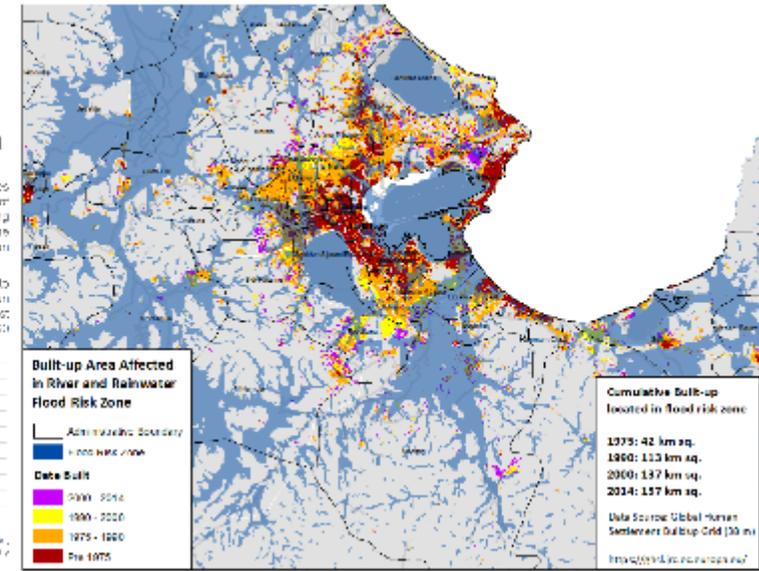
7.8. Urban built-up area exposed to combined river and rainwater flooding

Increased rainfall in urban areas often generates high flood flooding due to the limited capacity of drainage systems, as well as urban flooding caused by debris from rain drains. The combination of elevated and heavy flooding can aggravate their individual potential damages.

Temporally, built-up area in Tunis exposed to both river and rainwater flooding grew at an annual rate of 7% from 1975 to 2014. The largest expansion taking place between 1975 and 1990 throughout the city's built-up area.



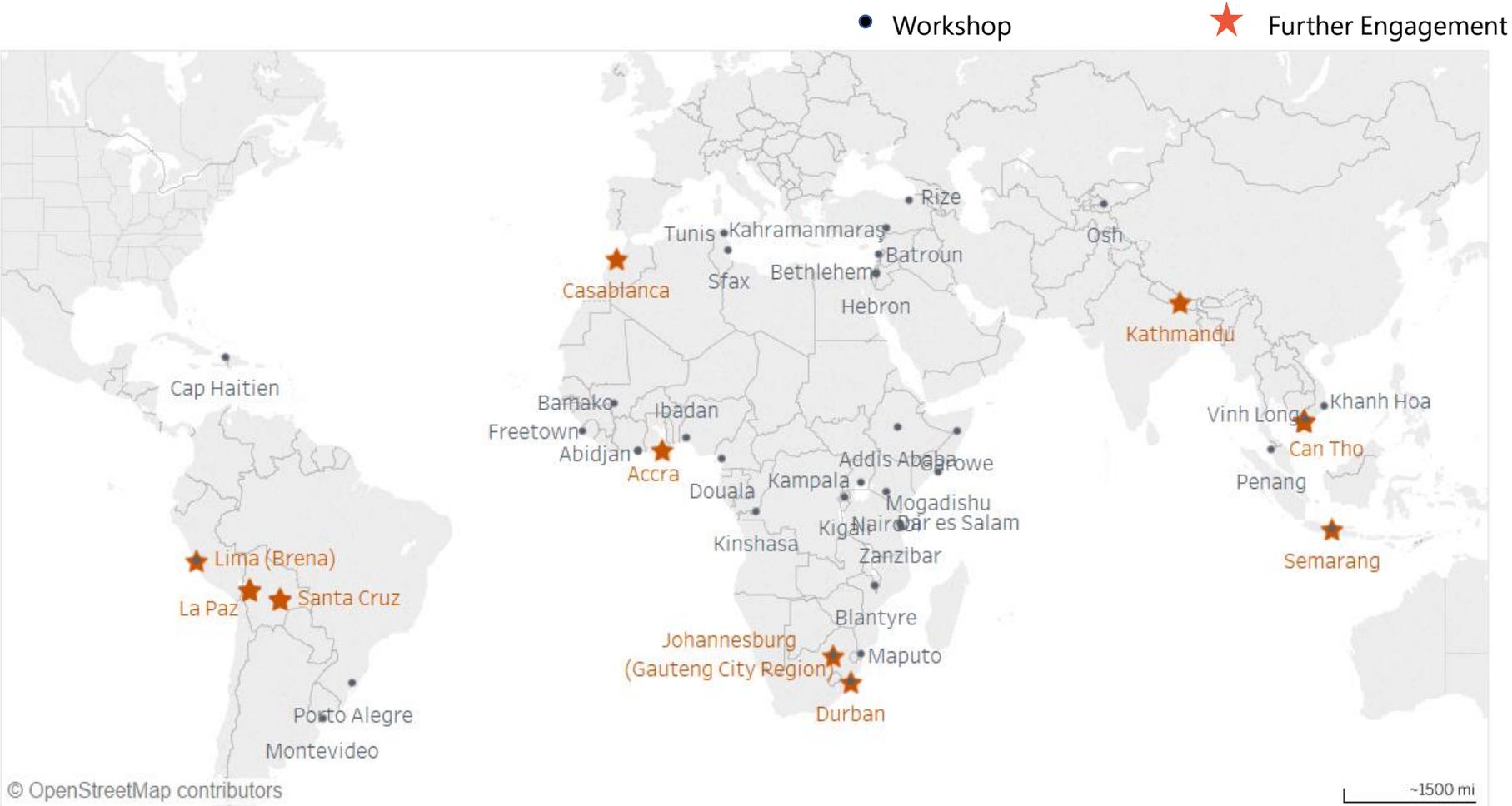
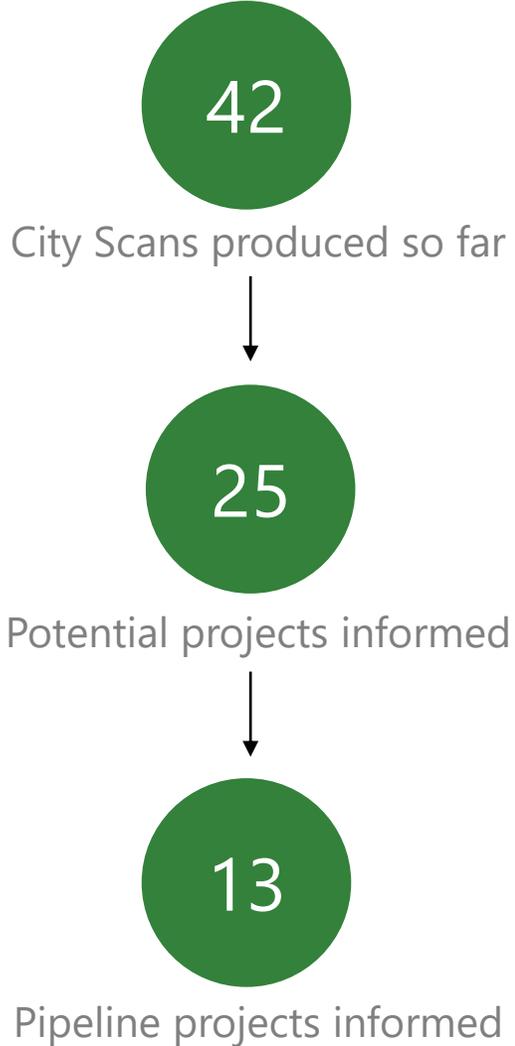
Data Source: Global Human Settlements Database (2014)



Tunis, Tunisia

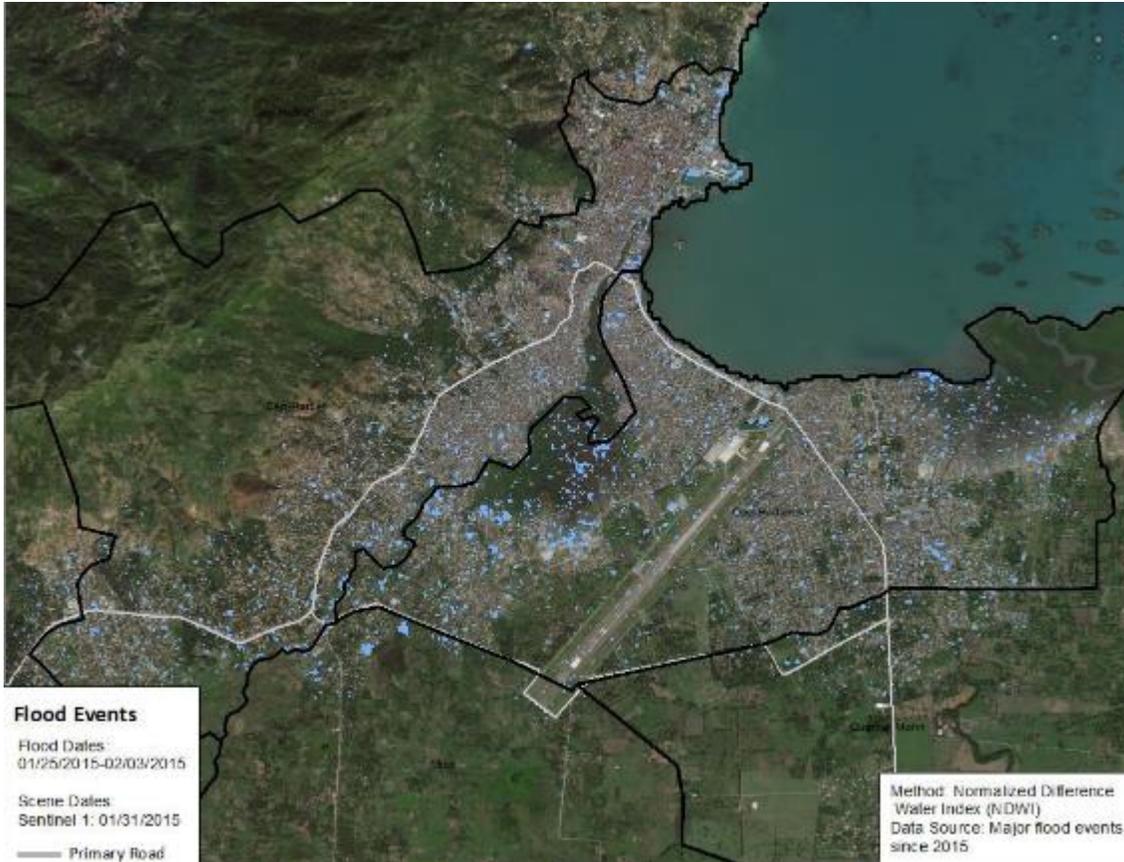
WHERE WE WORK

CITY RESILIENCE PROGRAM



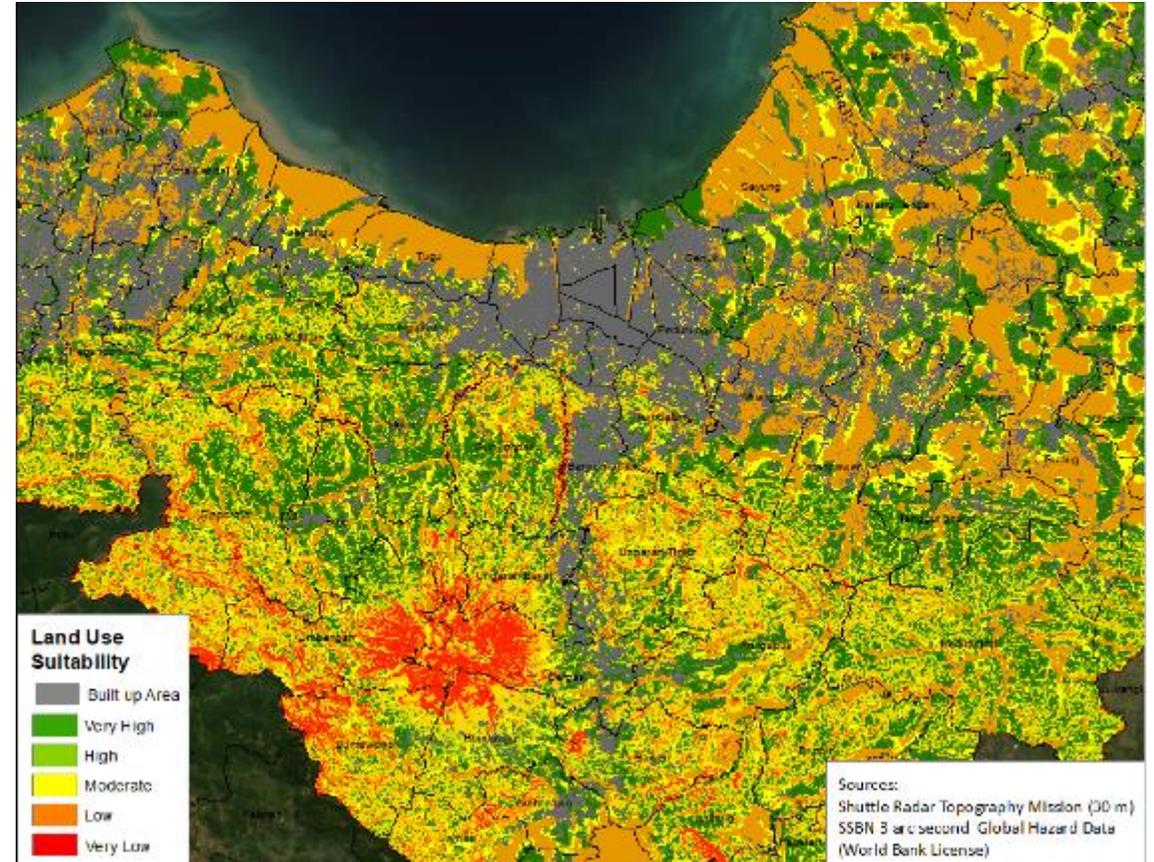
NEW PRODUCT DEVELOPMENT

CITY RESILIENCE PROGRAM



Cap Haitien, Haiti

Flood event layer pinpointing streets, parks and urban areas flooded



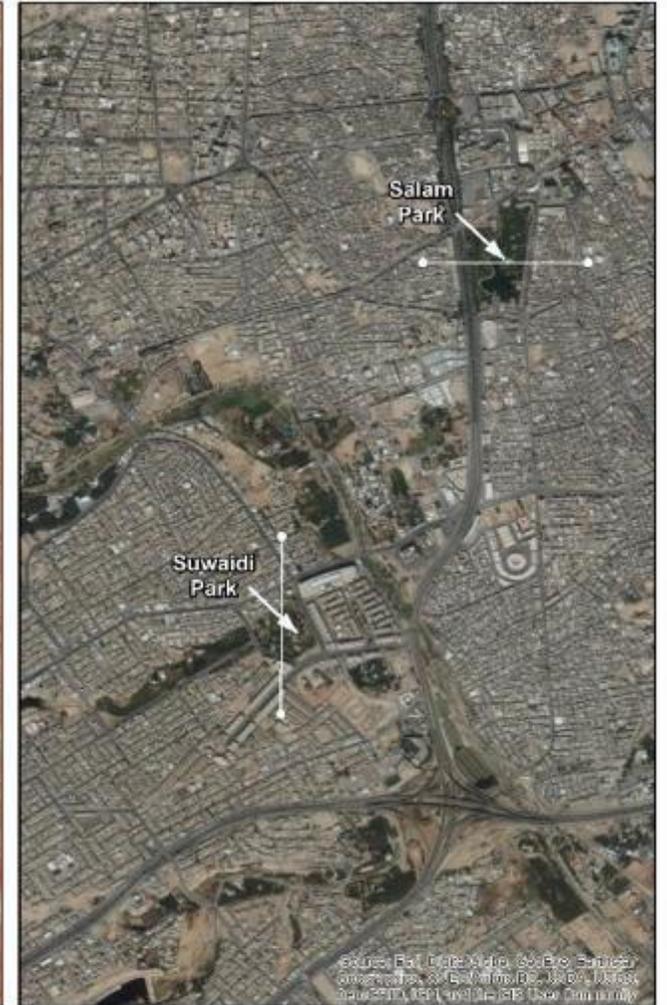
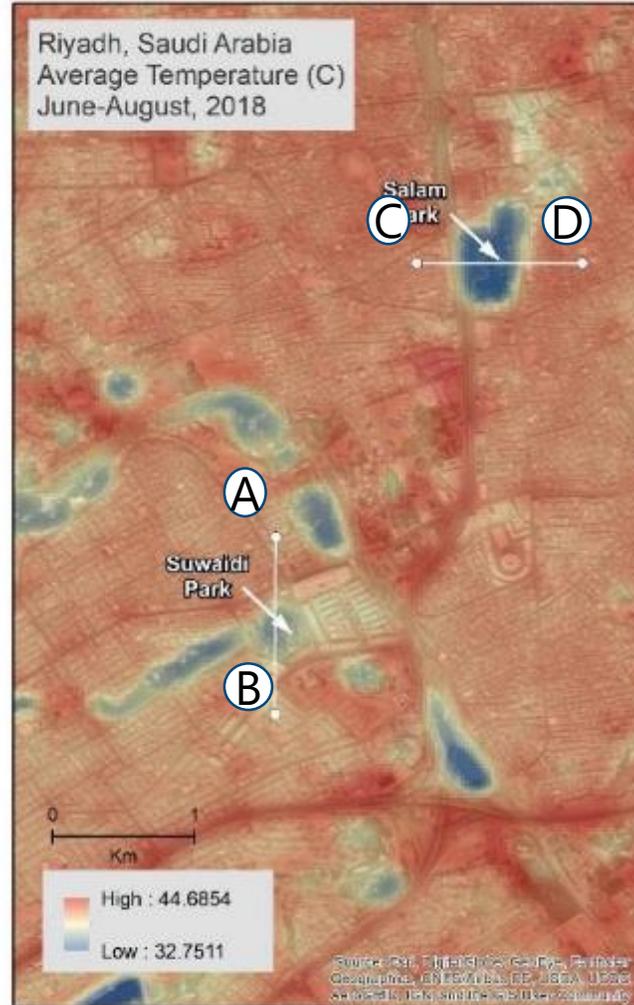
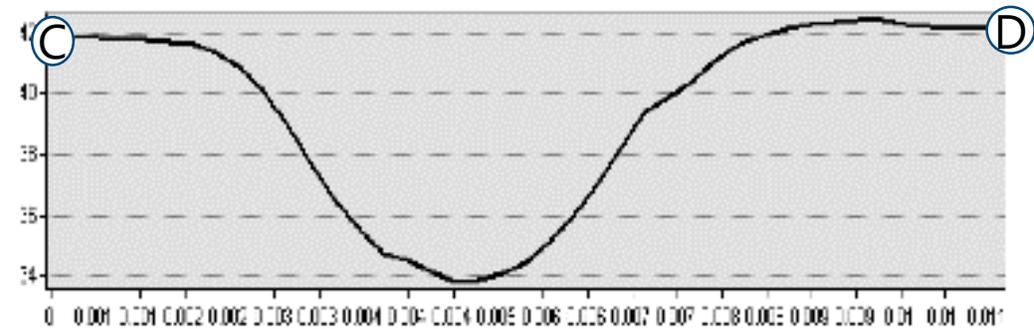
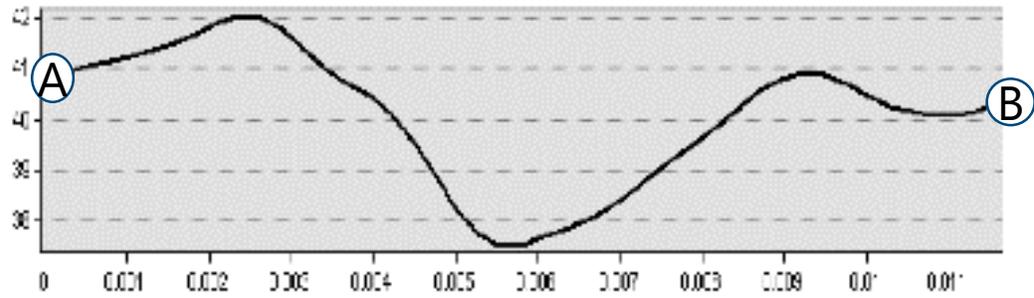
Semarang, Indonesia

Greenfield development suitability highlighting the most and least appropriate areas for development

NEW PRODUCT DEVELOPMENT

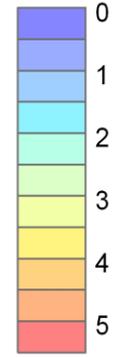
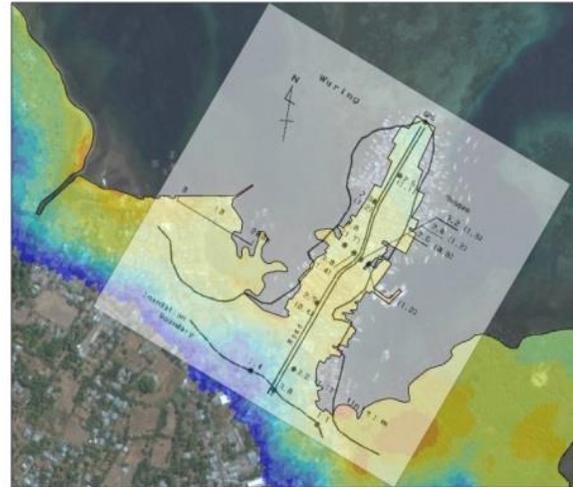
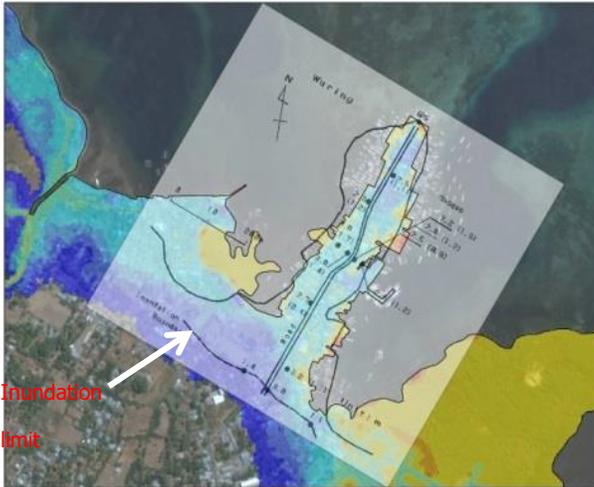
CITY RESILIENCE PROGRAM

The graphs below trace localized temperature changes along the lines drawn between two points in the city that pass through cooler areas

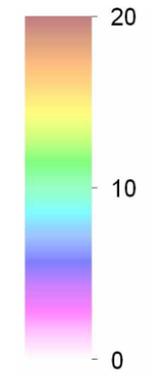
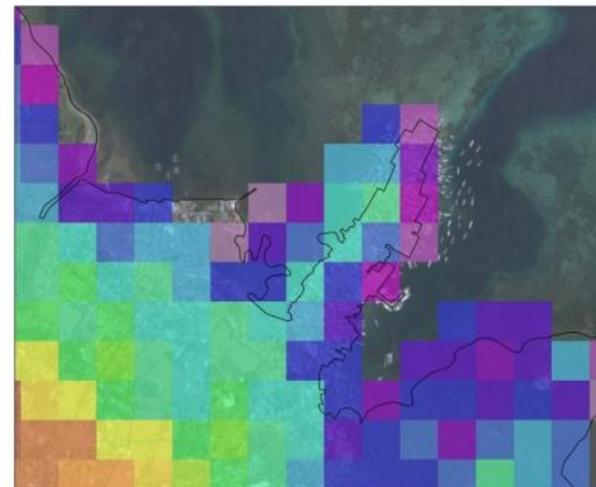
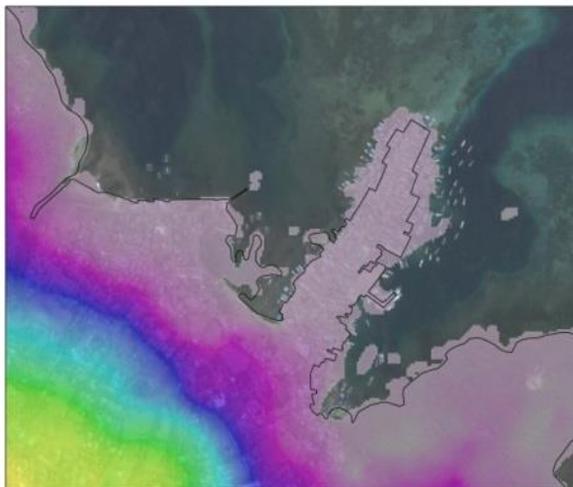


MOVING FORWARD

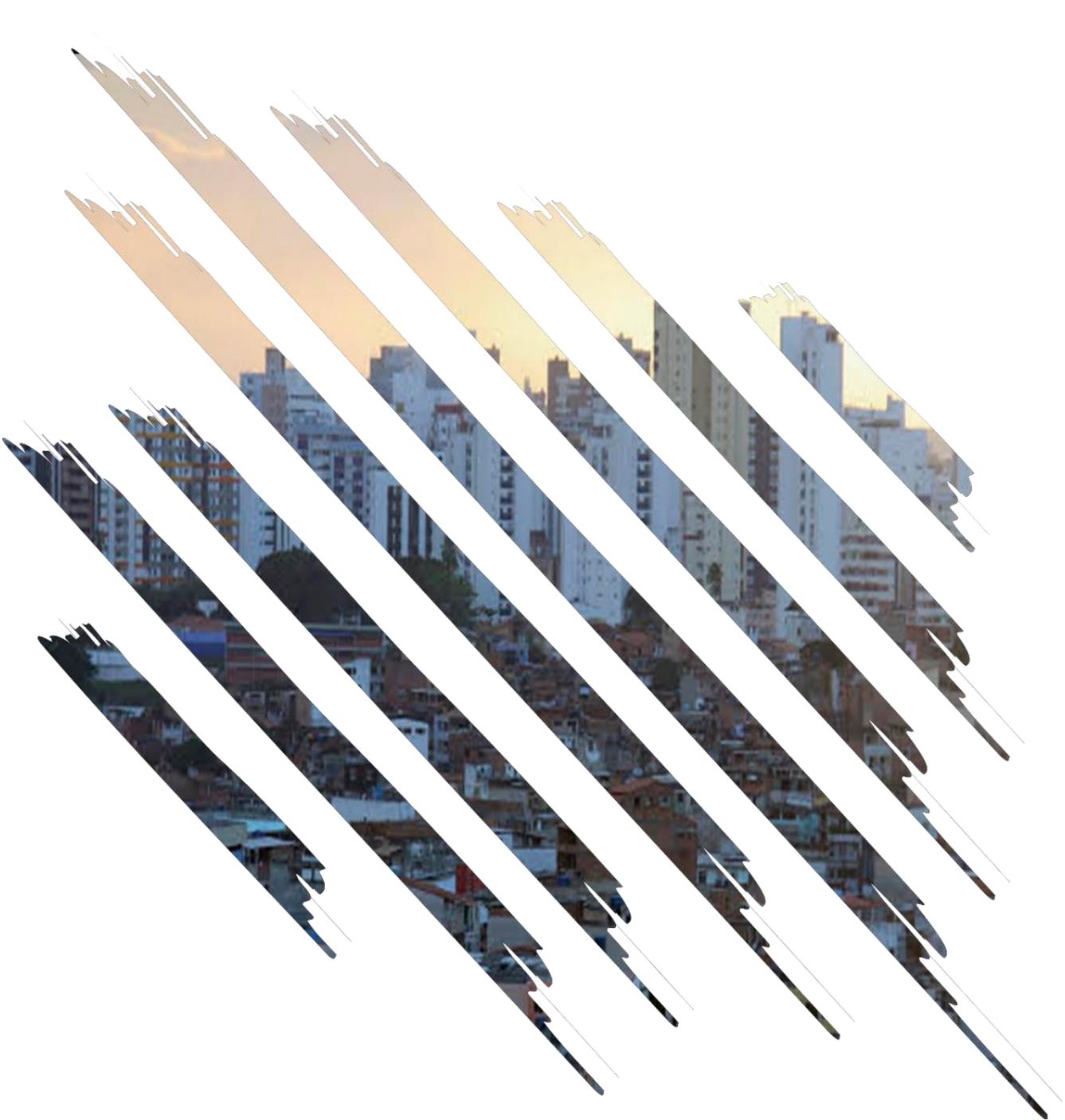
CITY RESILIENCE PROGRAM



Depth (m)



Elevation (m)



Thank you!

For more details, please visit:

<https://www.gfdrr.org/en/crp>