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URBAN PLUVIAL FLOOD RISK ANALYSIS

Leveraging Data to Build Resilient Cities

THE PROBLEM: URBAN FLOODING IS ON THE RISE



What is it?

- Pluvial flooding occurs when intense rainfall overwhelms urban drainage systems.
- Unlike river flooding, it happens locally – pooling water on city streets and infrastructure.



Why does it matter?

- Rapid urbanization → more concrete and asphalt → less natural absorption.
- Climate change → higher frequency of extreme rainfall events.
- Consequences: traffic paralysis, infrastructure damage, loss of business hours, public health risks (waterborne diseases).



The Big Question:

How can data analytics help identify which urban areas are most vulnerable – and where interventions should be prioritized?



OUR MISSION: FROM DATA TO ACTION

01

Analyze Key Factors

- Perform Exploratory Data Analysis (EDA) on urban flood datasets.
- Study geospatial, land use, drainage, and rainfall intensity.

02

Uncover Insights

- Find correlations (e.g., low drainage density → high flooding).
- Identify the most at-risk zones (residential, commercial, mixed).

03

Visualize the Risk

- Develop an interactive Power BI dashboard.
- Translate raw data into accessible, actionable insights for planners & policymakers.

UNDERSTANDING THE DATASET

| | segment_id | city_name | admistr |
|---|------------|------------------------|-------------|
| 0 | SEG-00001 | Colombo, Sri Lanka | Borough E |
| 1 | SEG-00002 | Chennai, India | Ward D |
| 2 | SEG-00003 | Ahmedabad, India | Sector 12 |
| 3 | SEG-00004 | Hong Kong, China | Sector 14 |
| 4 | SEG-00005 | Durban, South Africa | Sector 5 |
| 5 | SEG-00006 | Bangkok, Thailand | Borough F |
| 6 | SEG-00007 | Nairobi, Kenya | Ward J |
| 7 | SEG-00008 | Bangkok, Thailand | Zone X |
| 8 | SEG-00009 | Washington DC, USA | Sector 12 |
| 9 | SEG-00010 | Vancouver, Canada | Sector 5 |
| 0 | SEG-00011 | Delhi, India | Ward J |
| 1 | SEG-00012 | Athens, Greece | District 18 |
| 2 | SEG-00013 | Sydney, Australia | Zone II |
| 3 | SEG-00014 | Athens, Greece | District 29 |
| 4 | SEG-00015 | Nairobi, Kenya | Borough N |
| 5 | SEG-00016 | Miami, USA | District 20 |
| 6 | SEG-00017 | Lima, Peru | Borough C |
| 7 | SEG-00018 | Miami, USA | District 28 |
| 8 | SEG-00019 | Hong Kong, China | Zone III |
| 9 | SEG-00020 | Kuala Lumpur, Malaysia | Zone VI |
| 0 | SEG-00021 | Singapore, Singapore | District 14 |

Source:

urban_pluvial_flood_risk_dataset.csv

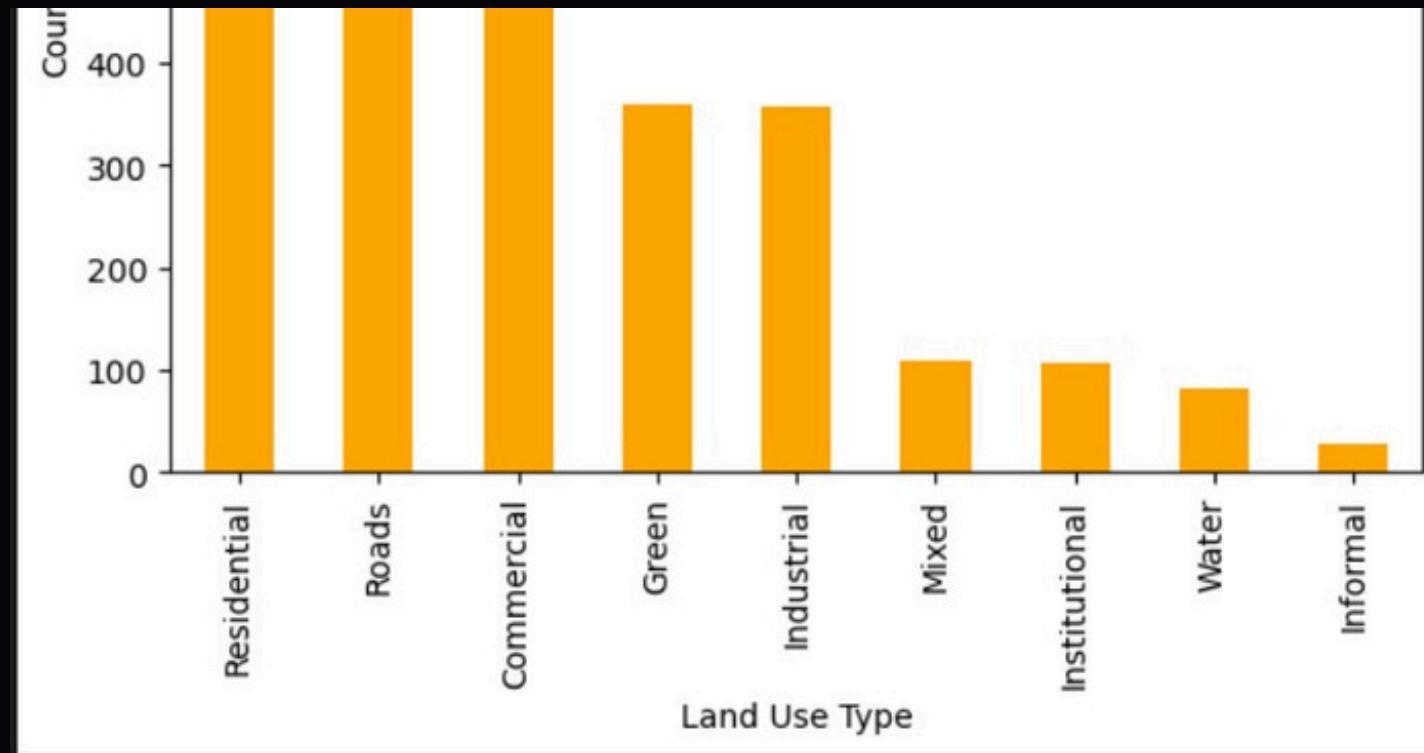
Features Included:

- Geospatial Data: Latitude, Longitude, Elevation (m).
- Urban Infrastructure: Land use type, Drainage density (km/km^2), Storm drain design.
- Environmental Factors: Soil group, DEM source.
- Meteorological Data: Historical rainfall intensity (mm/hr), Return period (years).
- Target Variable: Flood risk labels (ponding_hotspot, monitor, low risk).

Why it matters:

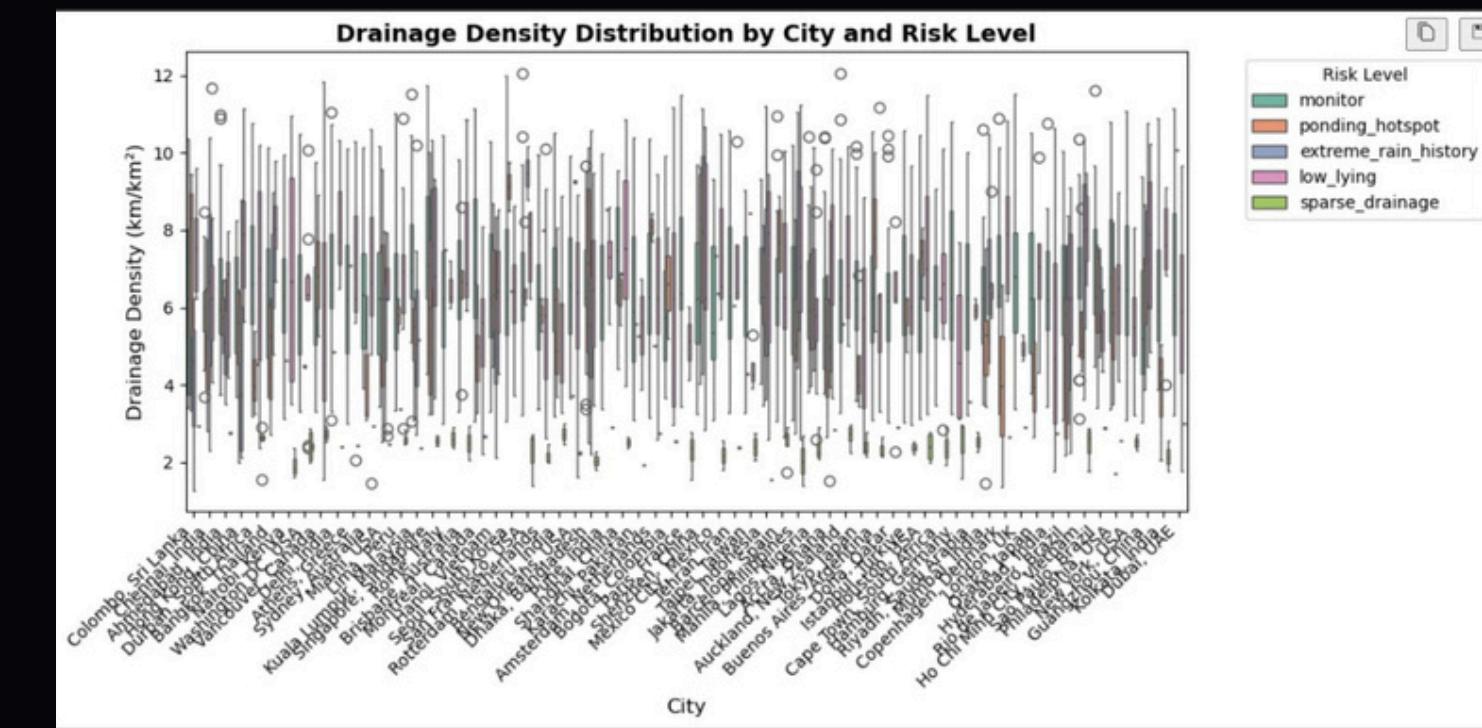
- Each factor contributes differently to urban flooding.
- Combining them provides a holistic view of vulnerability.

WHAT THE DATA TOLD US



Insight 1 – Residential Areas are Prevalent

- Land Use distribution reveals residential areas dominate.
- High vulnerability since these are densely populated living spaces.
- Supports the idea that urban design must account for residential resilience.



Insight 2 – Poor Drainage Increases Risk

- Drainage density strongly correlates with flood risk.
- Ponding hotspot areas have consistently lower drainage density.
- Infrastructure improvements here would reduce vulnerability significantly.

FROM INSIGHTS TO ACTION: DASHBOARD + IMPACT

Interactive Risk Dashboard (Power BI):

- Interactive Map: Drill down to see flood hotspots by city.
- Dynamic Filters: Adjust by land use, risk level, or rainfall data.
- KPIs: Avg rainfall intensity, total high-risk zones, drainage coverage.
- Responsive Charts: Each filter updates visuals in real time.

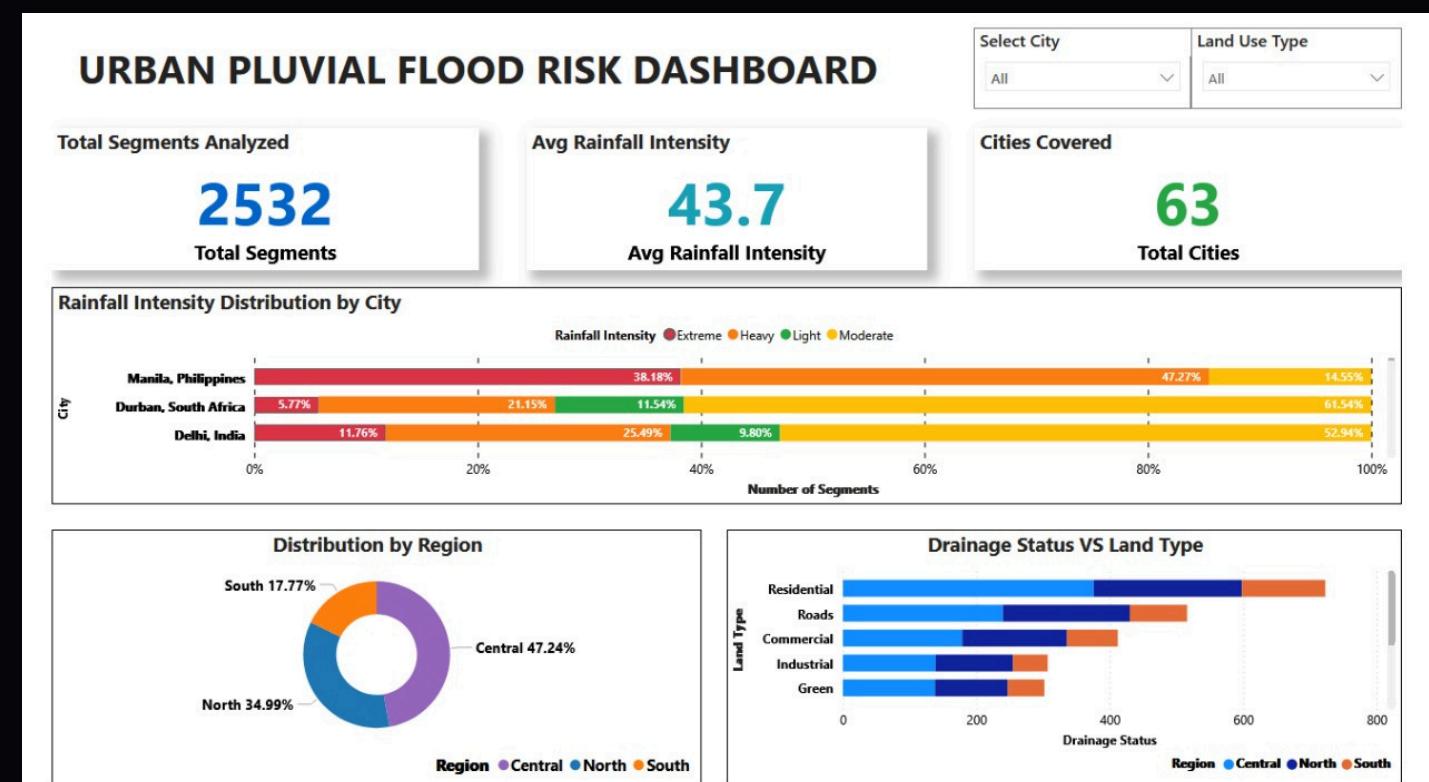
Conclusion & Impact:

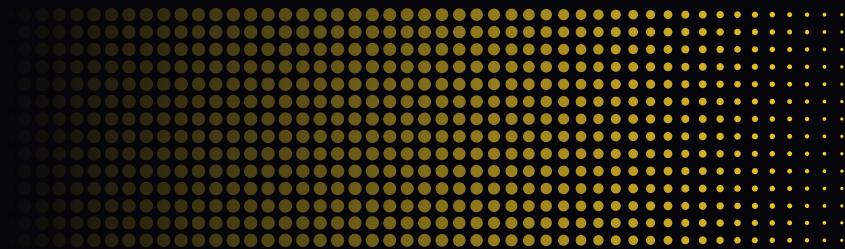
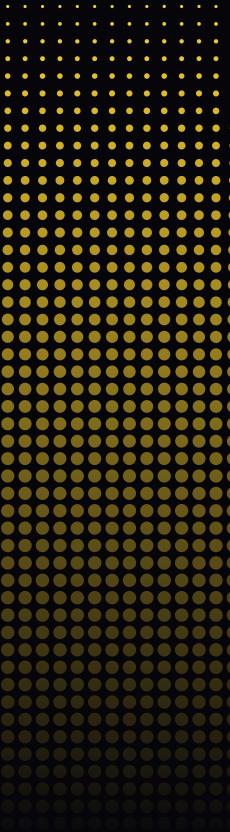
Key Takeaways:

- Residential areas are most vulnerable.
- Drainage density is a critical infrastructure gap.
- Data provides clear evidence for action.

Future Impact:

- Informed Planning: Prioritize drainage & zoning upgrades.
- Emergency Preparedness: Allocate resources efficiently.
- Policy Development: Build evidence-based urban resilience strategies.





THANK YOU
