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Community-based climate risk mapping for transformative climate action

Dar es Salaam

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Geographical context

Growing city of Dar es Salaam

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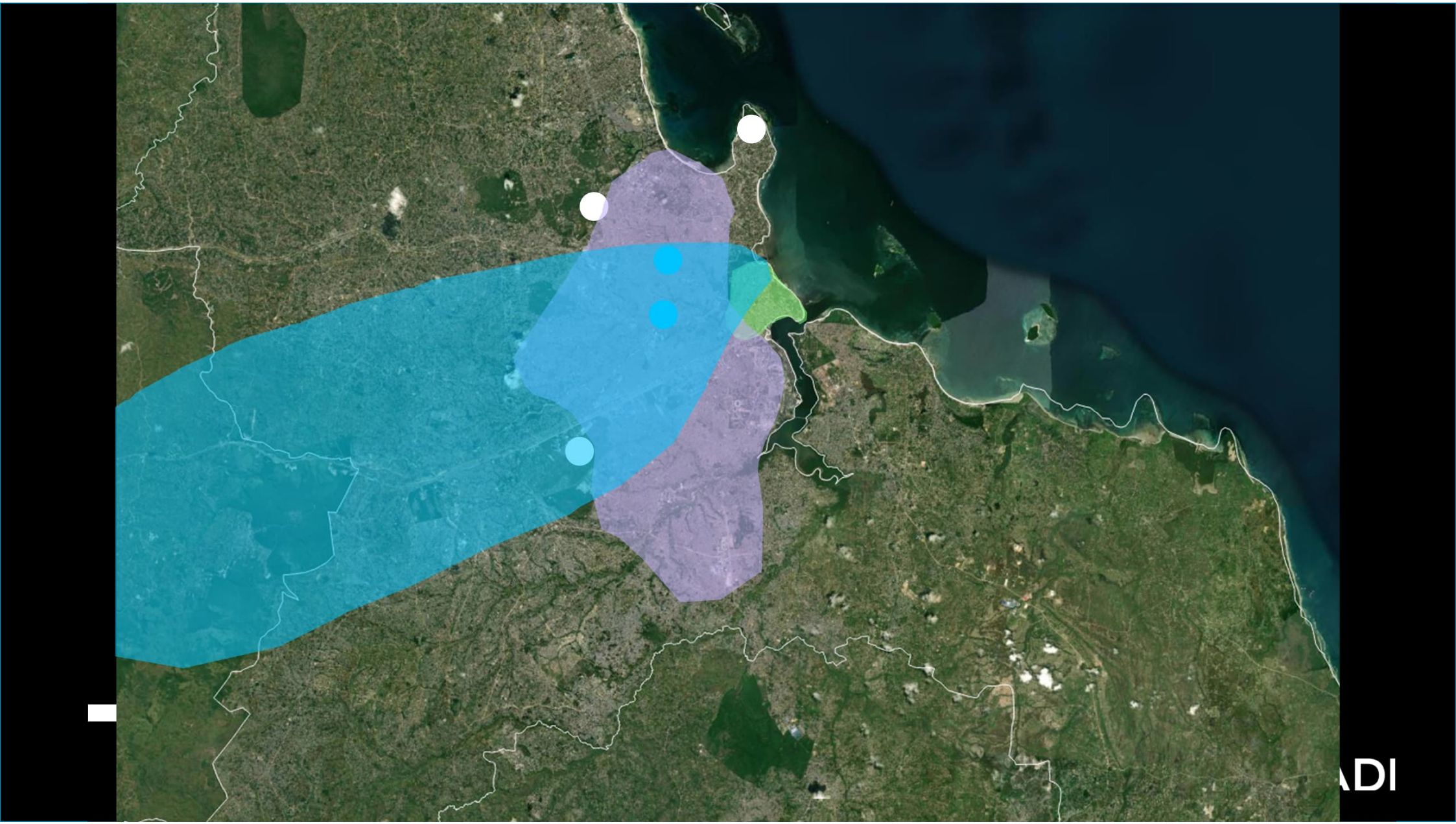
Geographical context (1/4)

Growing city of Dar es Salaam

Geographical context (2/4)

Key climate hazards



Rapid urbanization and settlement densification, riverbanks prone to severe erosion

Peri-urban development transforms land use, rainwater absorption dimishes, and runoff and eroded sediment drains into Msimbazi river

Floodplain covered by Mangrove forests near the sea outlet, wetlands and sandy plains created by sediment deposits after flash floods, roads and bridges, informal settlements over the floodplains

Densely urbanized, informal settlements alongside the Msimbazi river

Msimbazi River catchment
Dar es Salaam, Tanzania

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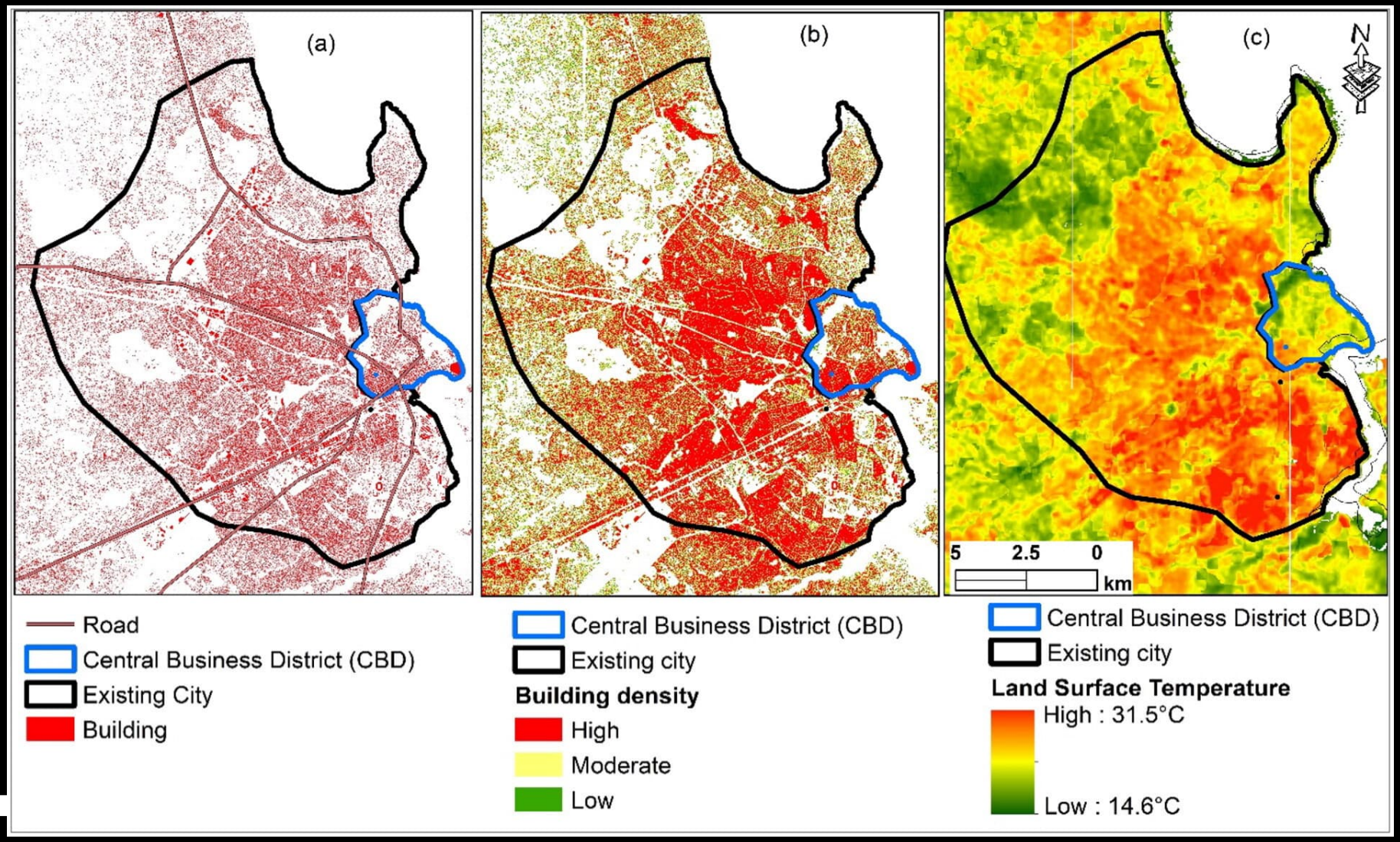

Olipa, S. (2022). Simulating land surface temperature using biophysical variables related to building density and height in Dar Es Salaam, Tanzania

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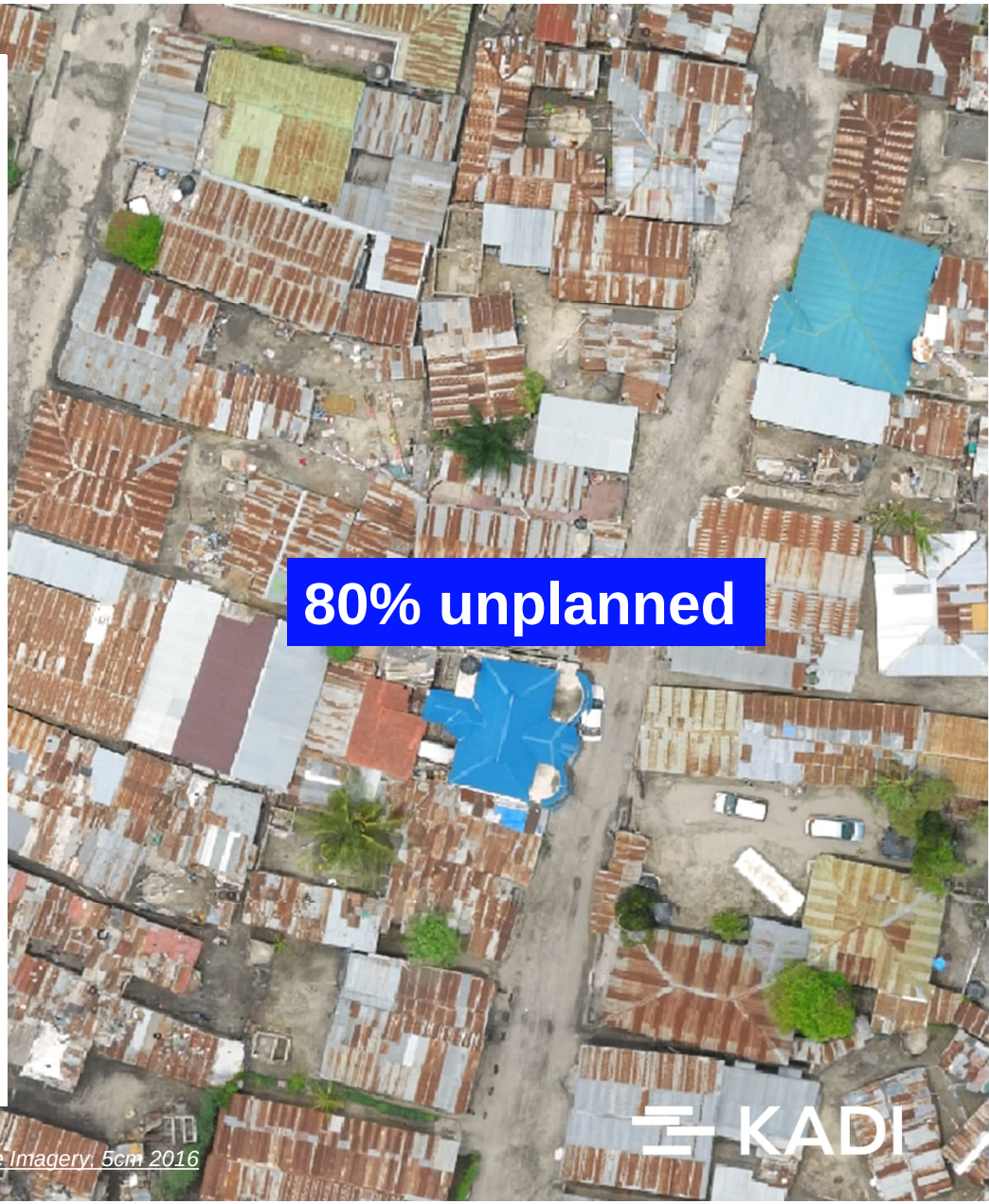
Geographical context (3/4)

Urban fabric as a risk multiplier

Climate induced hazards and their adverse effects on lives, livelihoods and the environment are **exacerbated** by the interplay of both **climate change** and the characteristics of the **urban fabric** itself

Densely built areas Heat-absorbing materials Sparse vegetation	🤝	**Urban heat island**
Deforestation Impervious surfaces	🤝	**Rainfall runoff** **Erosion**
Inadequate infrastructure Insufficient services	🤝	**Blocked drainages** **Solid waste burning**



Data source: Msimbazi Valley Drone Imagery, 5cm 2016

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Geographical context (4/4)

Data gaps and challenges

Barrier to true transformation towards climate resilience is **lack of up-to-date data** on climatic and environmental phenomena and the urban infrastructure

- Limited observation and monitoring network (investment to improve the network in Tanzania)

Alternative ways to close the data gap are needed

- Proxy data (e.g. traffic volumes to estimate air quality)
- Earth Observation (e.g. to generate LSTs)
- Citizen science (e.g. to record urban communities' vast local knowledge of their living surroundings)

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Community-based climate risk mapping for transformative climate action

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Dar es Salaam climate service pilot (1/5)

Description

“Climate service of community-based climate risk mapping for transformative climate action”

- How citizen science can contribute to data gaps regarding climate stressor occurrence in cities in neighborhood-scale?
- Communities’ local knowledge of climate stressor occurrence recorded with mobile tools by digitally skilled youth

Theory of Change: When operational, urban planning officials, local communities, meteorological agency, NGOs and businesses can quickly acquire missing information on neighborhood-scale to plan and execute improved climate adaptation and mitigation actions

Dar es Salaam climate service pilot (2/5)

Participants

Recording **local knowledge** into **digital geospatial data** representing community members' **climate stressor experiences**, compatible with other data sources

400 community members in Tandale and Kigogo wards of Dar es Salaam

- Local knowledge of where floods, extreme heat and air pollution are experienced in the community members' living environments

10 students from ARU with experience of community mapping during RA

- Discussing and mapping with community members using mobile tools and web-based mapping platform

25 urban stakeholders in a round-table

- Identifying solution pathways answering local communities' climate adaptation needs

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Dar es Salaam climate service pilot (3/5)

Implementation

Participatory mapping

Community members' experiences

Floods **Extreme heat** **Air pollution**

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Dar es Salaam climate service pilot (4/5)

Implementation

Focus group discussions

Contextualising mapping results

Identifying climate adaptation needs

10 community members | Kigogo | Tandale

Dar es Salaam climate service pilot (5/5)

Implementation

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Result highlights

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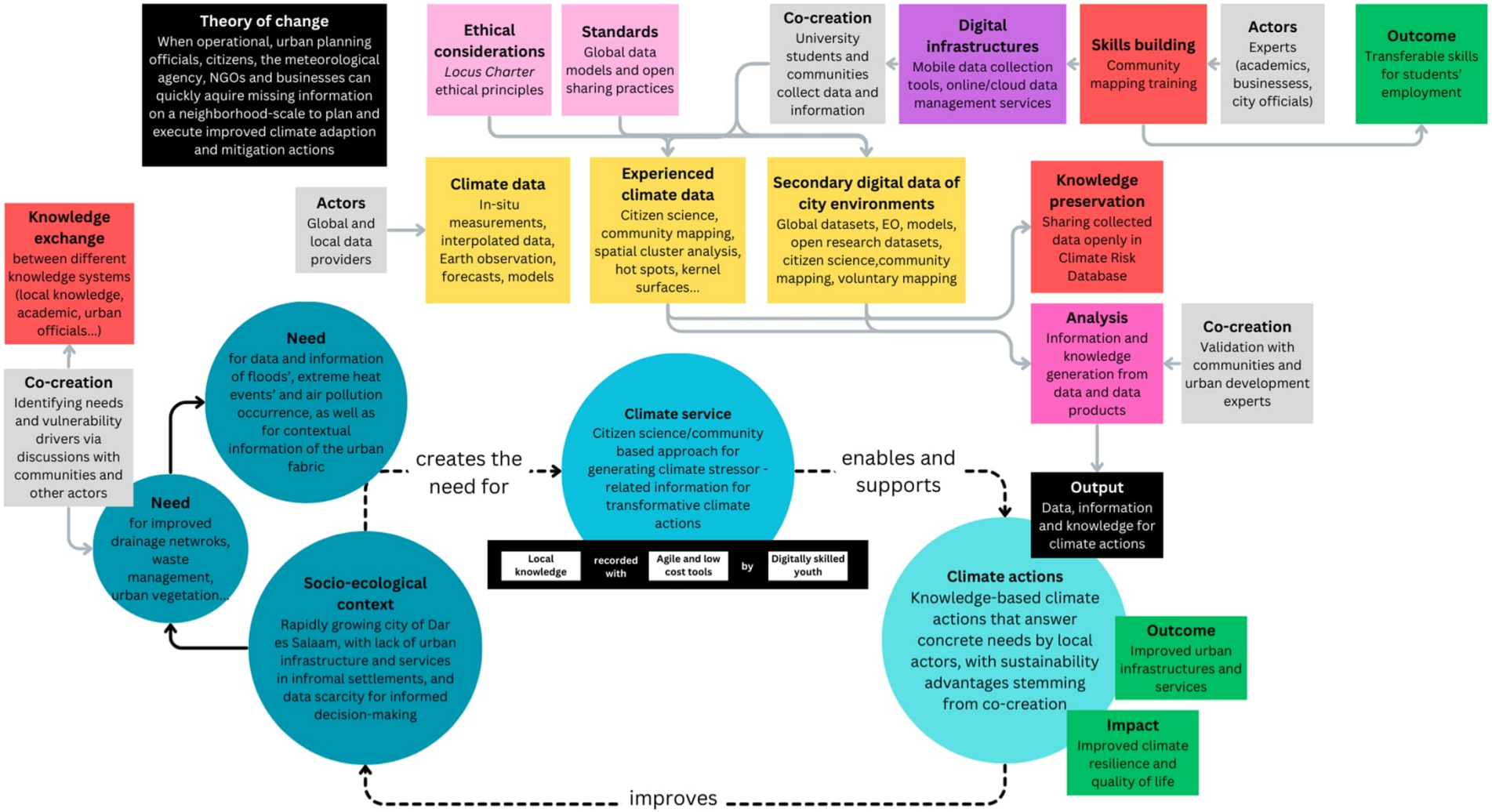
Dar es Salaam city pilot climate service design



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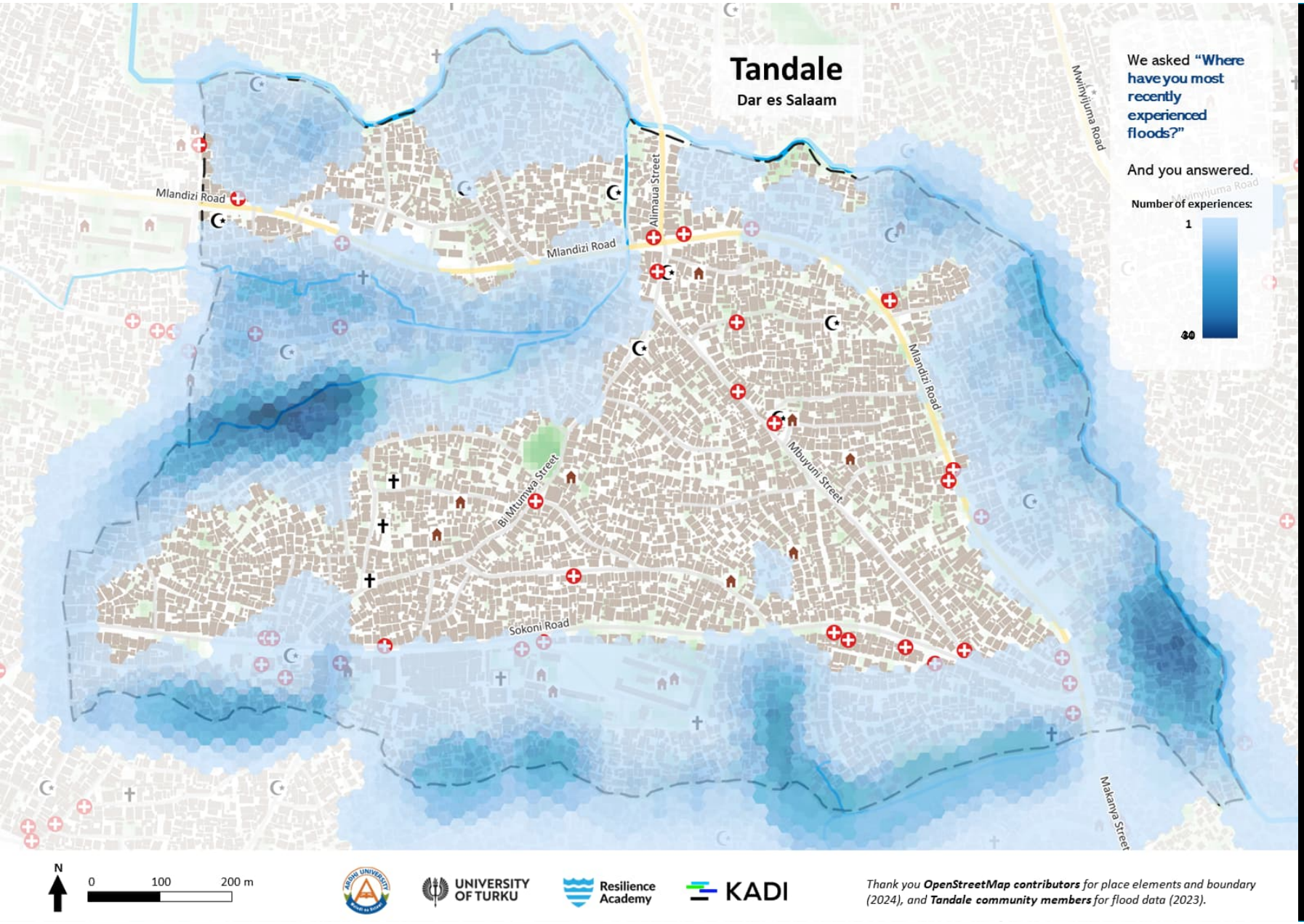

Participatory mapping data analysed, visualised and brought back to communities

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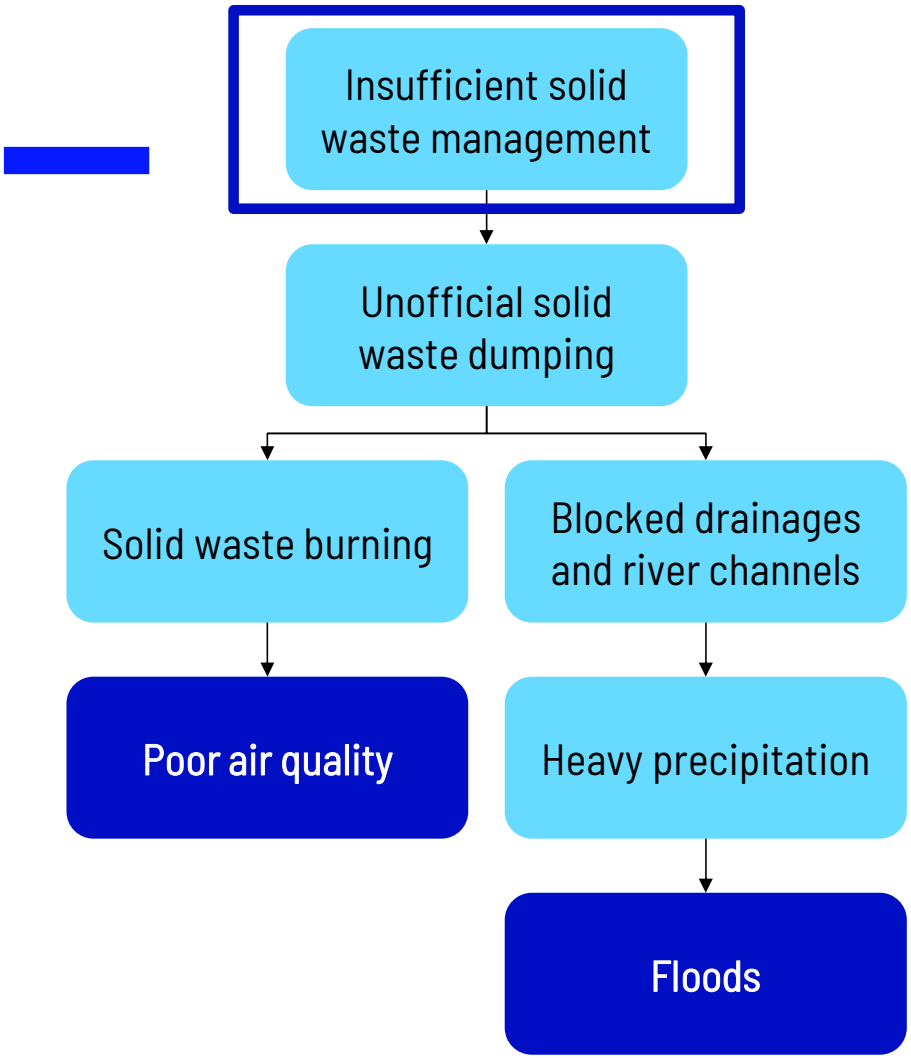
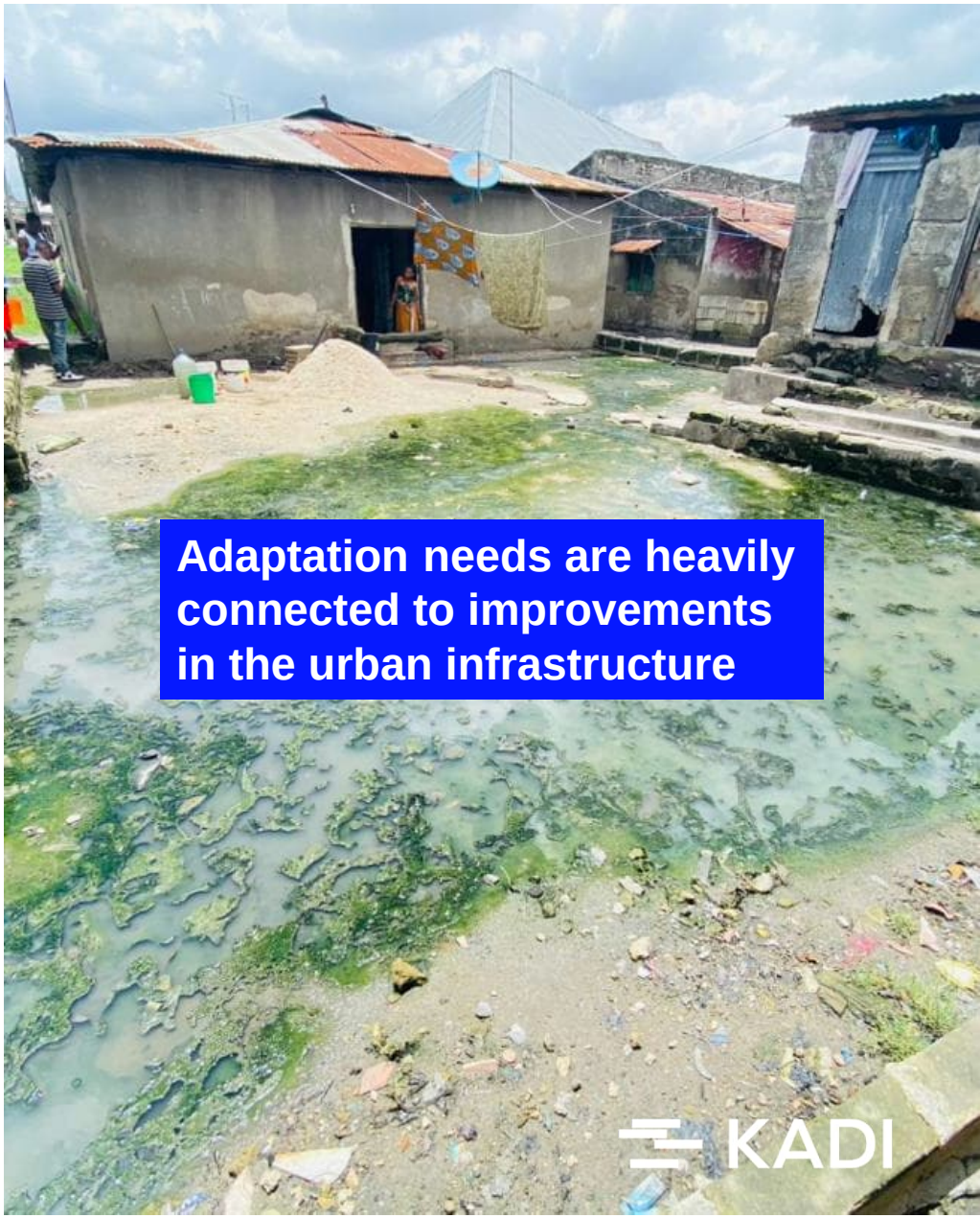

Insufficient solid waste management
Unofficial solid waste dumping
Solid waste burning
Blocked drainages and river channels
Poor air quality
Heavy precipitation
Floods


Adaptation needs are heavily connected to improvements in the urban infrastructure
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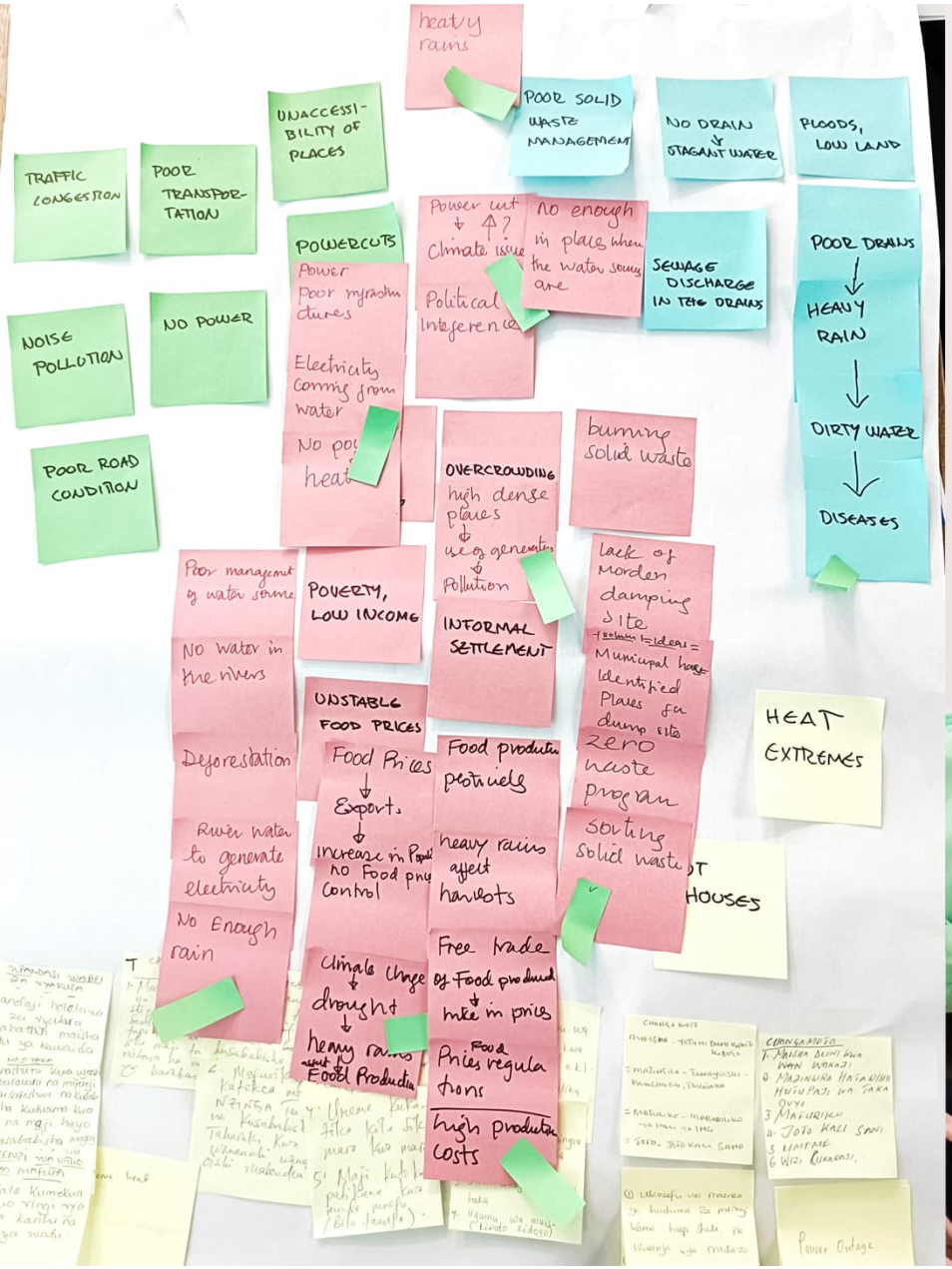
heavy rains
UNACCESSI-BILITY OF PLACES
POOR SOLID WASTE MANAGEMENT
NO DRAIN ↓ STAGANT WATER
FLOODS, LOW LAND
TRAFFIC CONGESTION
POOR TRANSPOR-TATION
POWERCUTS
Power cut ↓ ↑? Climate issue
No enough in places when the water sources are
SEWAGE DISCHARGE IN THE DRAINS
POOR DRAINS ↓ HEAVY RAIN ↓ DIRTY WATER ↓ DISEASES
NOISE POLLUTION
NO POWER
Poor management of water sources
POVERTY, LOW INCOME
OVERCROWDING high dense places ↓ use of generators ↓ Pollution
INFORMAL SETTLEMENT
burning solid waste
lack of modern dumping site
UNSTABLE FOOD PRICES
No water in the rivers
Deforestation
River water to generate electricity
No Enough rain
Food Prices ↓ Export ↓ Increase in Food prices
Food production protests
heavy rains affect harvests
Sorting Solid waste
HEAT EXTREMES
Climate change ↓ drought ↓ heavy rains ↓ Food Production
Free trade of Food products ↓ Increase in prices
Food Prices regulations
high production costs
Power Outage


Result-
Kigoga
Local informants
Construction of drainage and river channels
Waste management ecosystem
Laws and regulations
Community engagement in all processes
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Lessons learned

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Lessons learnt (1/3)
The methodology

Citizen science approaches

- Addressing data scarcity rapidly
- Builds trust and ownership, and highlights often overlooked local knowledge
- Decisions are context-smart, appropriate and long-lasting
- Subjective experiences, offering insights into lived issues
- Most effective when combined with other data sources (measured observations) for validation and complementarity
- Mutual respect, empowering engagement, not extractive

Data, tools and methodology

- Mobile-based tools are accessible and adaptable to low-resource environments
- Resilience Academy approach for efficient data collection and capacity growth for students
- Pre-mapping preparation is essential: understand the local context first to ensure relevance
- Open-source tools are developing fast (ODK Collect, QField, PARTIMAP)
- Ensuring privacy while promoting open science

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Lessons learnt (2/3)

Action and scaling

From data to action

- Goal to generate such data that leads to informed action
- Community-led initiatives AND strong government involvement and political will for large-scale infrastructure upgrades
- Building climate resilience is not just monitoring and collecting data, but transferring the information and knowledge into effective decision-making, resource allocation and action

Scalability and transferability

- Model of community-based data collection of the urban environment is scalable across geographies and themes
- Local tailoring is critical by understanding local needs, geographical context and cultural aspects
- Skilled facilitation team with strong community ties, technical expertise and collaboration with local education institutes

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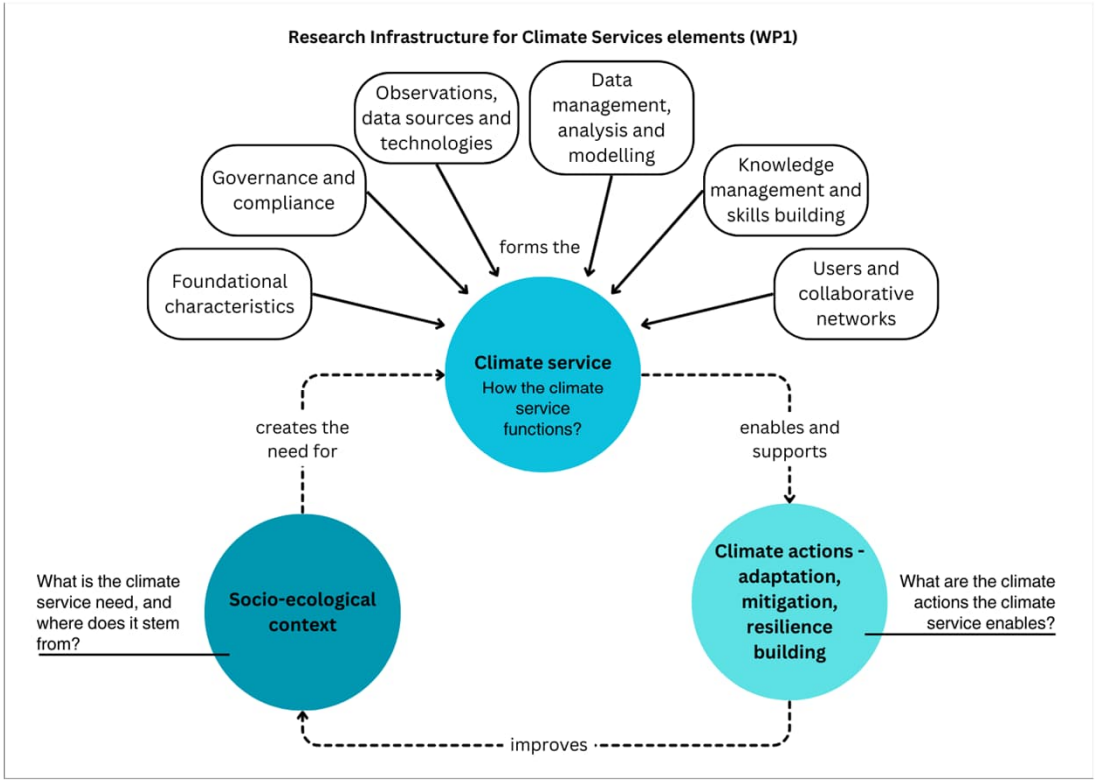
Lessons learnt (3/3)

Integration into RIs

Community-generated data reveals realities **not captured by sensors or satellite data** alone.

Participatory mapping is a valuable layer within **climate and urban research infrastructures** (e.g., KADI RI).

Embedding community participation into RI design helps avoid “ivory tower” approaches, promoting **inclusive science and innovation**.



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Conclusion

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Dar es Salaam climate service pilot

Take-away messages

Urban climate service design: the communities, local knowledge, mobile tools, and skilled youth

- Opportunities of citizen science and community-based approaches
- Urban communities are the experts of their living surroundings
- Co-creation build trust and sustainability
- Skilled youth ready to apply their knowledge for sustainable and climate smart urban development

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