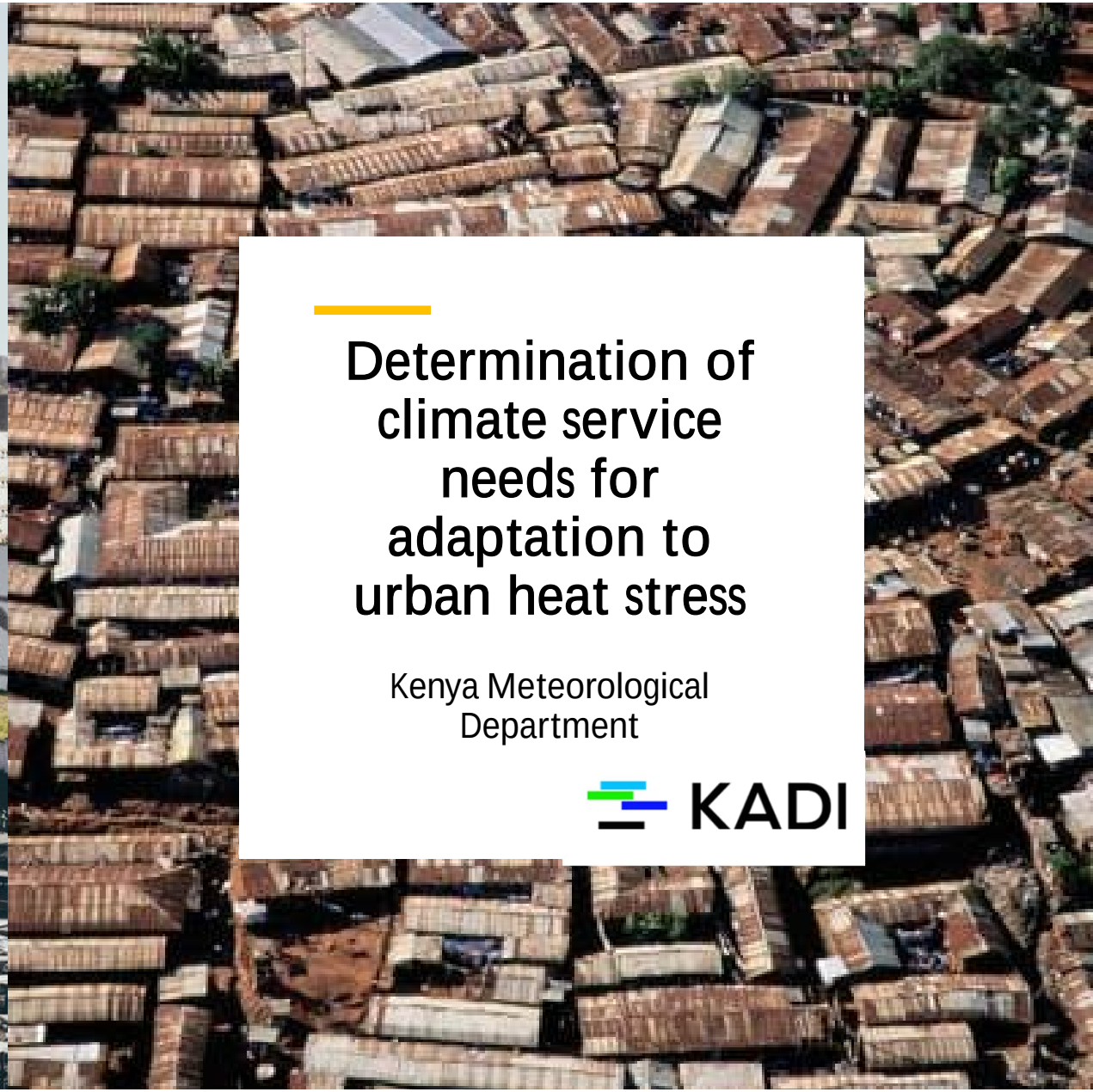

Determination of climate service needs for adaptation to urban heat stress

Kenya Meteorological Department

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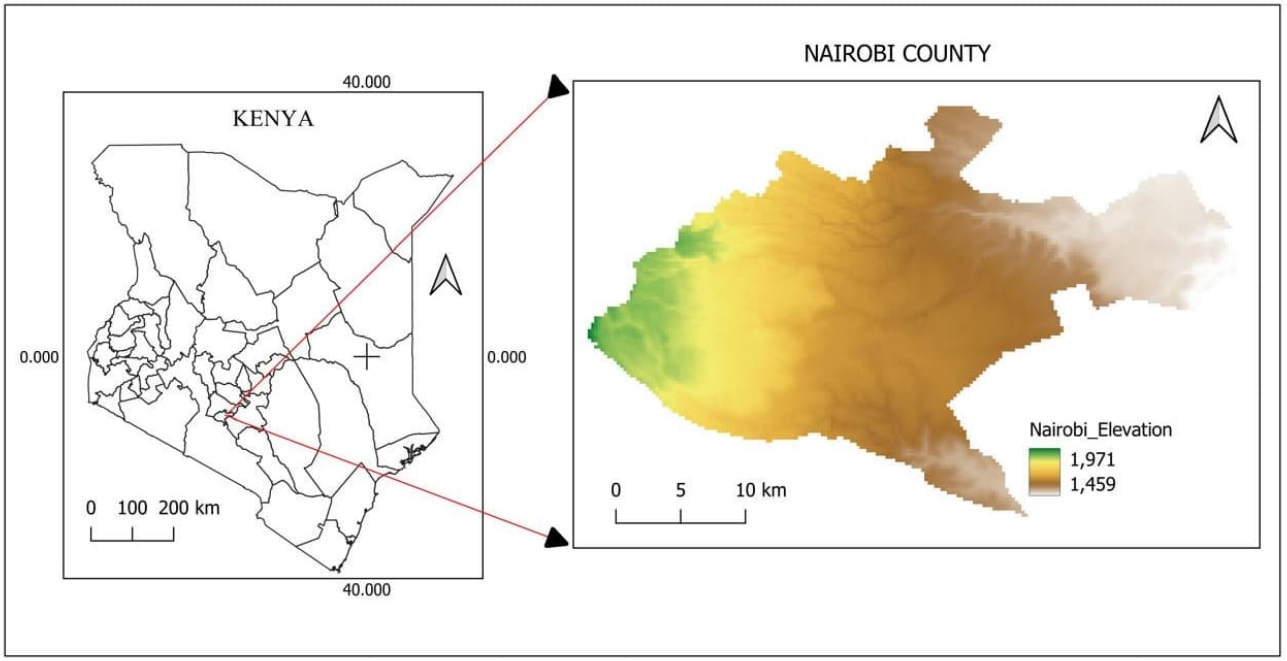
Background: NAIROBI

- Rapidly growing city in EA,
- ~ 5 million inhabitants, a great percentage of whom live in informal settlements
- increasingly impacted by climate change.
- Like many cities in the Global South, Nairobi faces a unique combination of climate-related threats exacerbated by rapid urbanization and existing socio-economic vulnerabilities.



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Nairobi’s Climate Risks

Flooding and extreme rainfall - the most prominent and immediate climate risk for Nairobi amplified by rapid urbanization, unplanned settlements, poor waste management among others

Heat stress –increase in annual average temperatures, greater number of "hot days." Intensified by the urban heat island (UHI) effect. Impacts include heat-related illnesses and exacerbation of existing health conditions, expansion of the geographic range of climate-sensitive vector-borne diseases.

Drought and water scarcity – from prolonged dry spells and droughts impacting the city’s water supply, creating food insecurity and impacting energy availability.

Air Pollution – intertwined with the climate risks

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Demographic Distribution

1

Stark illustration of extreme socio-economic inequality, directly shaping the city's vulnerability to climate risks. The urban landscape is physically and demographically segregated, with a small number of affluent, low-density areas contrasting sharply with a vast network of overcrowded, high-density informal settlements.

2

Unequal Exposure and Vulnerability: The high population density, lack of green spaces, and heat-absorbing materials (like iron sheets) in informal settlements create intense urban heat islands. This means that the majority of Nairobi's population is living and working in the areas most exposed to extreme heat.

3

Health and Safety Risks: The combination of heat stress and inadequate housing, sanitation, and healthcare makes residents of informal settlements highly vulnerable to heat-related illnesses and outbreaks of diseases.

4

Resource and Service Disparity: Affluent areas have the resources (e.g., air conditioning, private green spaces, reliable electricity) to cope with heat stress. Informal settlements, lacking these resources, have a minimal capacity to adapt, making them disproportionately affected.

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Linkage to Health

- IPCC identifies heatwaves as a climate impact driver for human mortality and morbidity from heat and infectious diseases in all regions of Africa.
- Despite both observations and model projections highlighting heatwaves and their impacts in Kenya and other Sub-Saharan Africa (SSA) countries, these are seldom captured in extreme weather databases.
- Local heatwave thresholds in Kenya and investigate the impacts of exceeding such thresholds on health in Nairobi, Mombasa & Kisumu.

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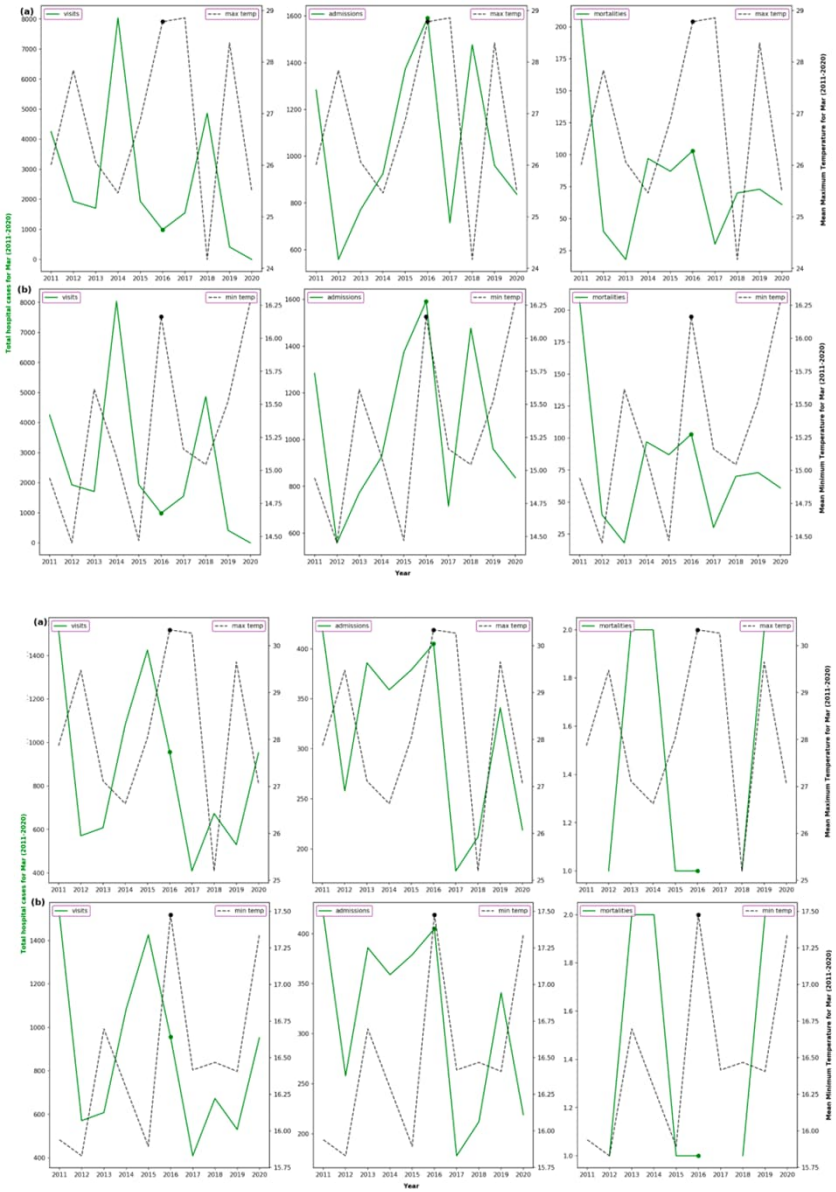

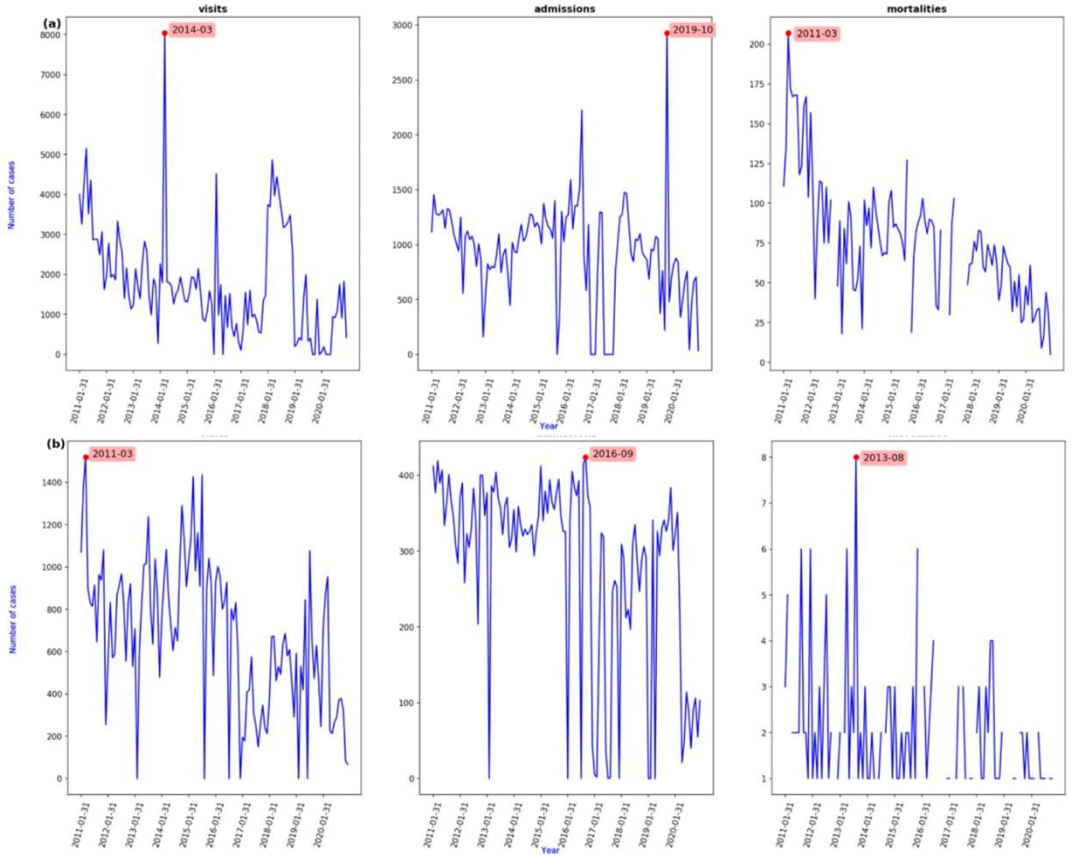

Figure 7. **Total monthly visits, admissions, and mortalities reported in Mbagathi (a) and Mathari (b) hospitals in Nairobi city for the period 2011-2020. The annotation indicates the period (year-month) in which the highest number of cases were reported.**

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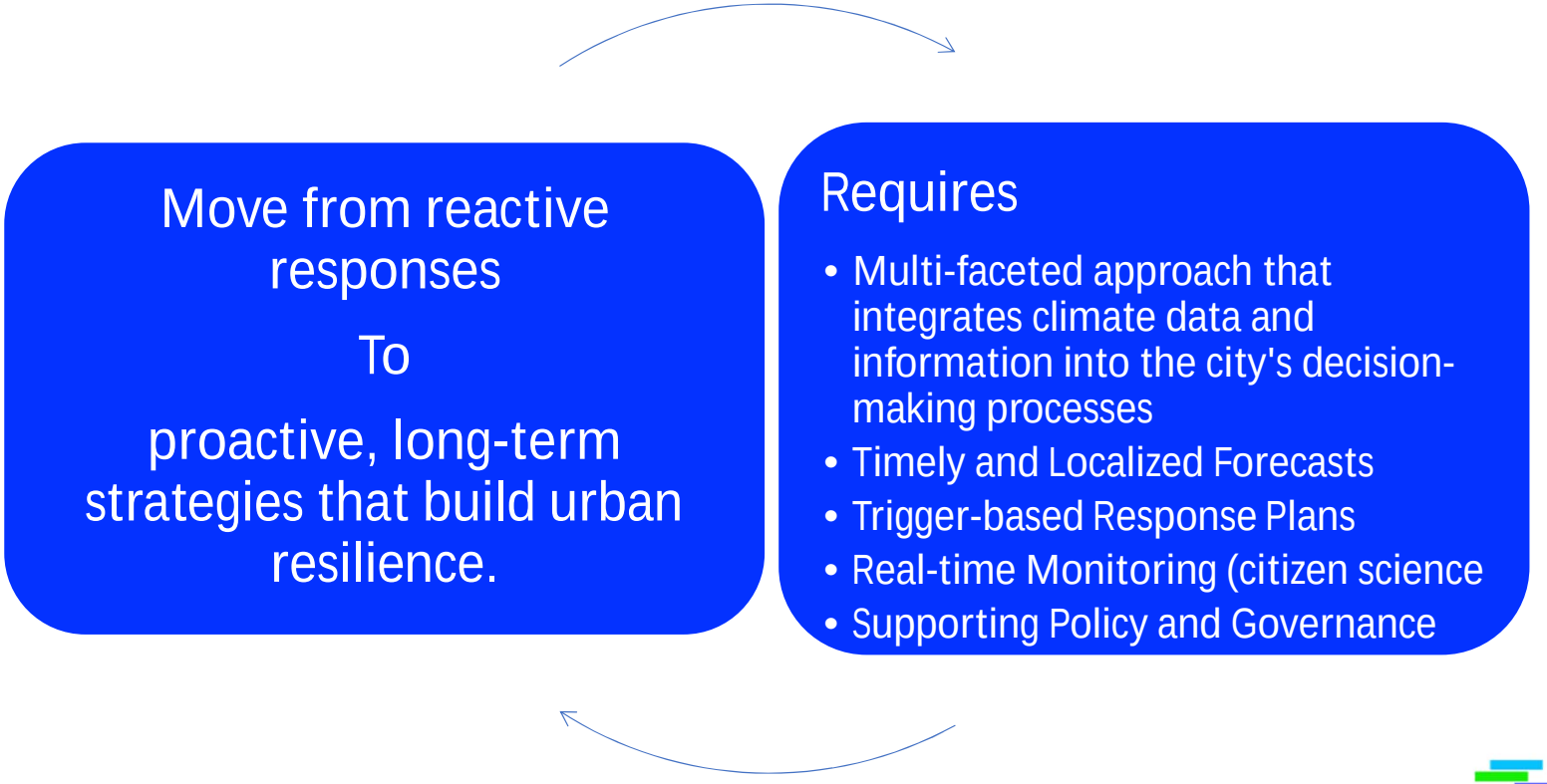
Ultimate Goal



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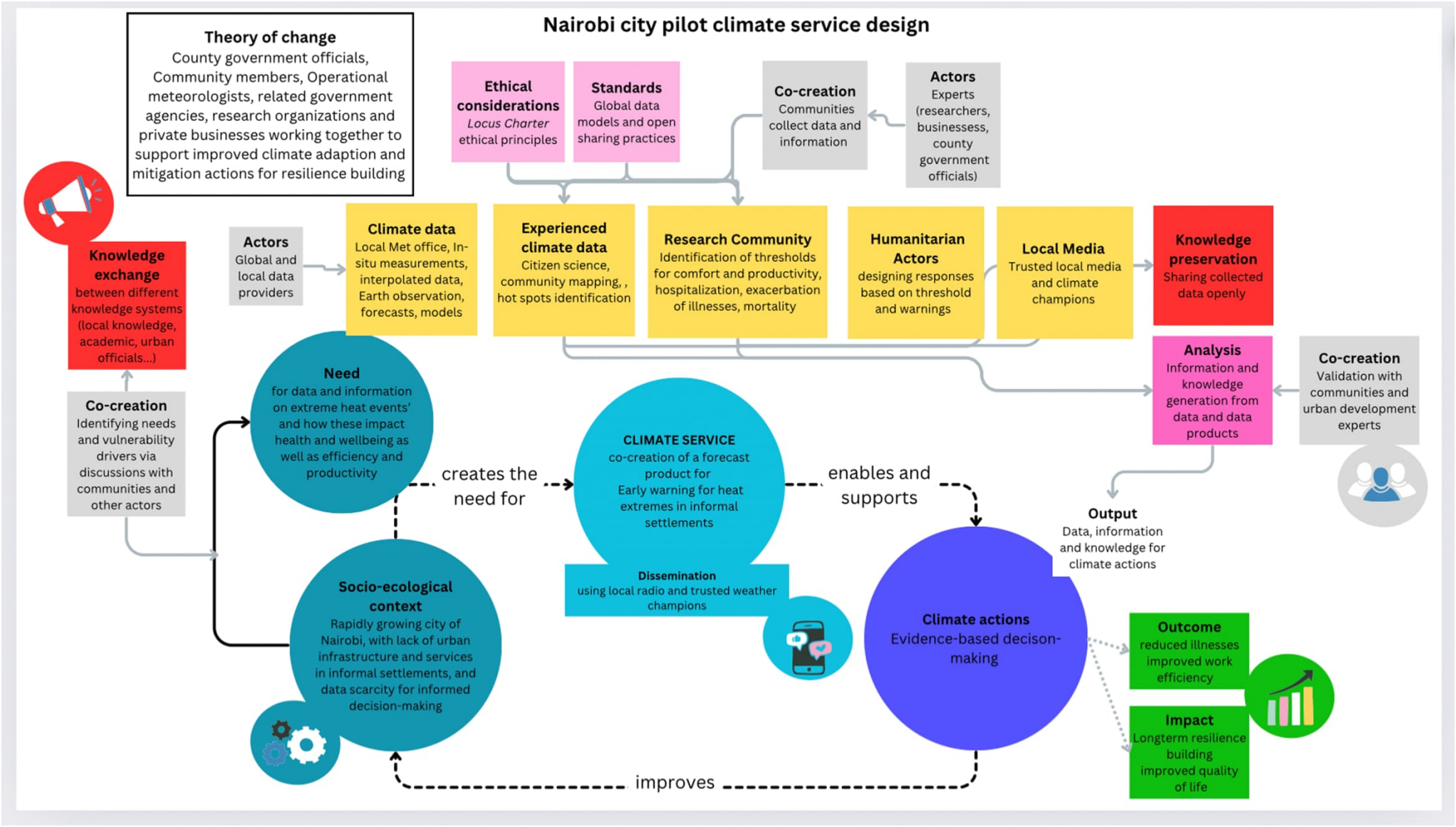
Nairobi city pilot climate service design
Theory of change
County government officials, Community members, Operational meteorologists, related government agencies, research organizations and private businesses working together to support improved climate adaption and mitigation actions for resilience building
Ethical considerations
Locus Charter ethical principles
Standards
Global data models and open sharing practices
Co-creation
Communities collect data and information
Actors
Experts (researchers, businessess, county government officials)
Knowledge exchange
between different knowledge systems (local knowledge, academic, urban officials...)
Actors
Global and local data providers
Climate data
Local Met office, In-situ measurements, interpolated data, Earth observation, forecasts, models
Experienced climate data
Citizen science, community mapping, , hot spots identification
Research Community
Identification of thresholds for comfort and productivity, hospitalization, exacerbation of illnesses, mortality
Humanitarian Actors
designing responses based on threshold and warnings
Local Media
Trusted local media and climate champions
Knowledge preservation
Sharing collected data openly
Analysis
Information and knowledge generation from data and data products
Co-creation
Validation with communities and urban development experts
Co-creation
Identifying needs and vulnerability drivers via discussions with communities and other actors
Need
for data and information on extreme heat events' and how these impact health and wellbeing as well as efficiency and productivity
creates the need for
CLIMATE SERVICE
co-creation of a forecast product for Early warning for heat extremes in informal settlements
Dissemination
using local radio and trusted weather champions
enables and supports
Output
Data, information and knowledge for climate actions
Socio-ecological context
Rapidly growing city of Nairobi, with lack of urban infrastructure and services in informal settlements, and data scarcity for informed decision-making
Climate actions
Evidence-based decison-making
Outcome
reduced illnesses improved work efficiency
Impact
Longterm resilience building improved quality of life
improves

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Stakeholder engagement

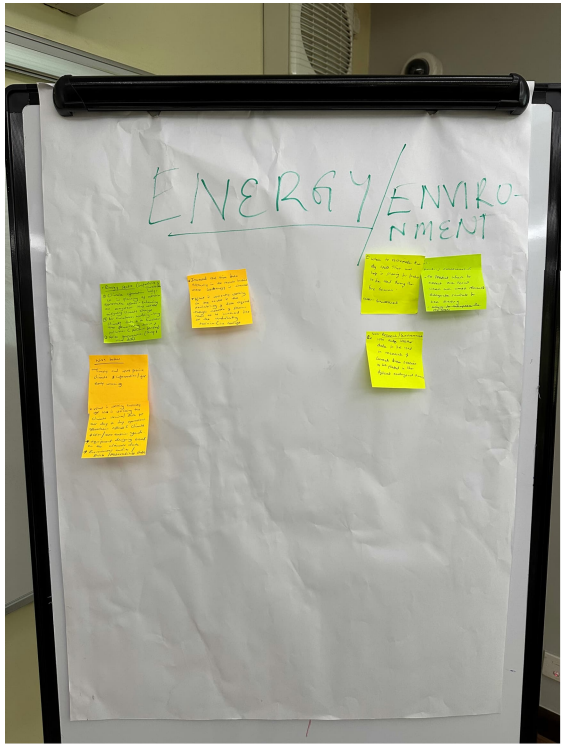

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Table 2: 24-Hour Forecast for Zone 2 (Westlands, Dagoretti South, Dagoretti North, Kibra, Lang'ata)

Time/Date	Saturday 26 July '25	Sunday 27 July '25	Monday 28 July '25	Tuesday 29 July '25	Wednesday 30 July '25	Thursday 31 July '25	Friday 1 Aug '25
Morning 6am – 12pm	Cloudy breaking into sunny intervals.	Cloudy breaking into sunny intervals.	Cloudy.	Cloudy.	Cloudy breaking into sunny intervals.	Cloudy breaking into sunny intervals.	Cloudy breaking into sunny intervals.
Rainfall distribution (Morning)							
Afternoon 12pm – 6pm	Sunny intervals.	Sunny intervals.	Cloudy breaking into sunny intervals.	Cloudy breaking into sunny intervals.	Sunny intervals.	Sunny intervals.	Sunny intervals.
Rainfall distribution (Afternoon)							
Night 6pm – 6am	Partly cloudy.	Partly cloudy.	Cloudy.	Cloudy.	Partly cloudy.	Partly cloudy.	Partly cloudy.
Rainfall distribution (Night)							
Maximum Temperatures	26°C	23°C	23°C	24°C	24°C	25°C	24°C
Minimum Temperatures	11°C	11°C	13°C	11°C	10°C	11°C	13°C
Hazards	No severe weather expected.	No severe weather expected.	No severe weather expected.	No severe weather expected.	No severe weather expected.	No severe weather expected.	No severe weather expected.

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REPUBLIC OF KENYA

MINISTRY OF ENVIRONMENT, CLIMATE CHANGE AND FORESTRY

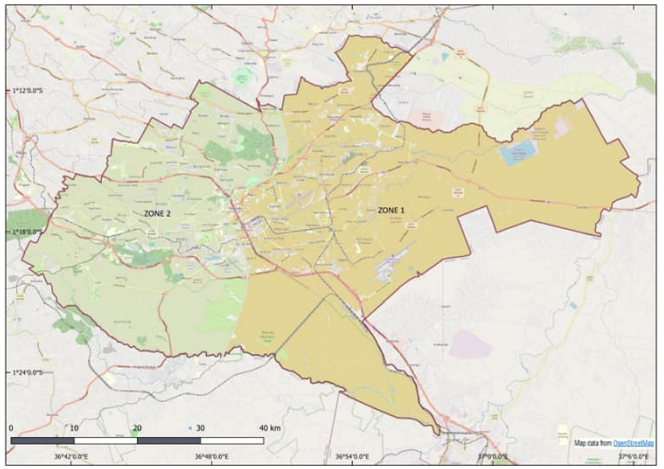
STATE DEPARTMENT FOR ENVIRONMENT AND CLIMATE CHANGE

KENYA METEOROLOGICAL DEPARTMENT

WEEKLY WEATHER FORECAST FOR NAIROBI COUNTY

VALIDITY: 26TH JULY TO 1ST AUGUST 2025

FORECAST ISSUED ON: 25TH JULY 2025



SUMMARY:

- ***The County is likely to be generally dry with intermittent cold and cloudy conditions.***
- ***Day-time highs are expected to be between 23°C and 26°C while night-time lows are likely to range from 10°C to 14°C.***

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Contribution to RI for Climate Services for African Cities

Data and Monitoring Infrastructure: demonstrates viability of a hybrid data collection model, blending formal and informal systems.

- Low-Cost Sensor Networks
- Citizen Science
- Diverse Data Streams

Highlights challenges for a Sustainable Research Infrastructure (technological, funding, scalability)

Demonstrates the necessity of a research infrastructure that prioritizes two-way knowledge exchange,

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Lessons Learnt

Value of a ‘people-centered’ approach, where scientific expertise is integrated with local knowledge and needs

- Increased Trust and Ownership: crucial for ensuring that warnings are heeded and that people take the recommended actions. Creates a sense of ownership.
- Context-Specific and Usable Information: Communities possess unique knowledge about their environment and how it responds to climatic changes, social structures, and existing coping mechanisms. Co-development allows for the translation of complex scientific data into locally understandable language and culturally appropriate messages. (IBF)
- Identification of Vulnerable Populations: ensures that the warning system is targeted and reaches those who need it most, rather than relying on broad, less effective public messaging.
- Leveraging Existing Networks: Communities already have established and trusted communication channels, like community leaders, local chiefs, and social networks. Best to identify and utilize these existing networks to disseminate warnings quickly and effectively.
- Leverage Citizen Science – for data collection

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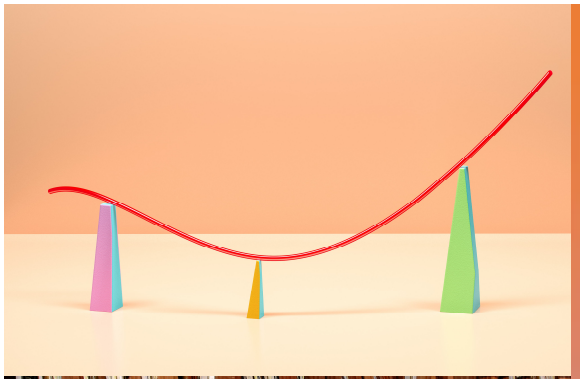
Challenges

- Power Imbalances: ensuring the co-development process is genuinely collaborative and not just a consultation where experts retain all the decision-making power.
- Resource Constraints: Developing and sustaining a community-based EWS requires significant financial and human resources. A lack of dedicated personnel to manage the system at the community level and develop tailored forecasts at the NHMS.
- Scalability and Transferability: beyond the small communities we worked in due to different social dynamics and environmental conditions.
- Sustaining Engagement: Initial enthusiasm for a project tends to wane over time. Both for the researchers and the community and other stakeholders.
- Integrating with Formal Systems: particularly with the broader city and national early warning infrastructure. There usually exists a disconnect between the community-level warnings and the official city-wide response. This is where we are at!!
- Multiple Siloed Approaches: from various projects duplicating the work and creating stakeholder fatigue



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NEXT STEPS

Development of a Guidance Note for Heat Action Plan for Nairobi

Resilience Academy in Nairobi

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THANK YOU
ASANTE
MERCI

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Funded by
the European Union

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