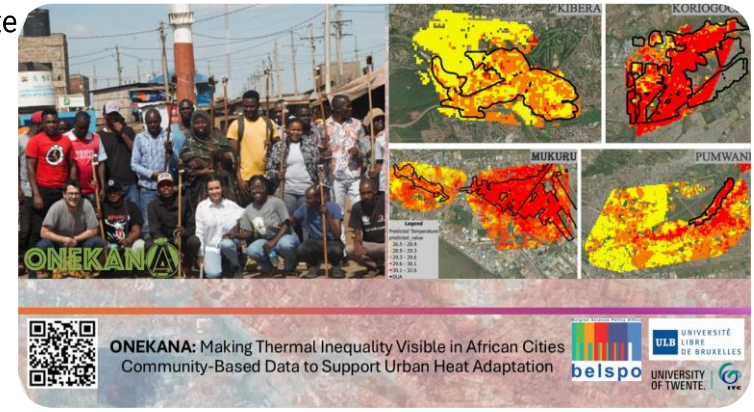
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Thermal Inequalities in Informal Settlements

Submitted By: ITC, University of Twente



Organization Profile

Organization Name: ITC together with CommunityMappers and ULB

Organization Type: University and research institution

Website: https://www.itc.nl/

Practice Details

Country(ies): Kenya, Nigeria, Argentina

City(ies): Nairobi, Lagos, Buenos Aires

Start Year: 2023 **Ongoing:** Yes **End Year:** N/A

Main Adequate Housing Components:



Housing Thematic Areas:

- Housing & Informality
- Housing & Climate Adaptation
- Housing Data & Monitoring
- Technology & Digital Solutions in Housing

Relevant SDGs:



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Problem & Context

In Nairobi's informal settlements, extreme heat is intensified by dense structures, metal roofs, and narrow alleys that trap radiation, creating dangerous thermal corridors. Yet these neighborhoods remain invisible to policy: weather stations are sited far away on open campuses, and satellites measure surface, not air temperature. As a result, the real heat stress felt by residents, particularly children and vulnerable groups, is underestimated, leaving risks underfunded and unaddressed. Existing policy frameworks lack mechanisms to capture localized thermal inequalities, meaning that housing conditions and urban design in informal settlements remain excluded from climate adaptation planning.

Solution Developed

The ONEKANA initiative developed a scalable, community-driven method to measure and address urban heat in informal settlements. Local residents, trained as data collectors, used low-cost sensors along walking routes through critical spaces, open spaces, markets, clinics, and schools. to capture real air temperatures. Micro-surveys recorded housing materials, ventilation, crowding, and access to services, enabling the creation of a heat-risk index. This was conducted together with residents, by making their lived realities visible to decision-makers. The objectives were to document localized heat stress, identify the most at-risk areas, and co-design feasible adaptation measures with communities and stakeholders. Innovations included integrating geospatial data with community data, fostering participatory co-design workshops that translated evidence into practical, low-cost housing and public-space solutions such as roof insulation, shading, ventilation, and community cooling hubs.

Implementation

Implementation began with co-design workshops involving community leaders, guided by our partners from CommunityMappers, a local NGO, to identify priority routes and spaces most affected by heat. Local residents were trained and equipped with low-cost temperature sensors to conduct walking surveys during peak heat hours. Parallel household micro-surveys documented housing conditions, ventilation, and service access. Data were combined with satellite imagery and building footprints in machine-learning models to map air temperature and thermal susceptibility.

Key actors included community groups (data collection and surveys), local leaders (mobilization, co-design), researchers and universities (method development, modelling, analysis), NGOs (facilitation, training, dissemination), and municipal stakeholders (policy linkage). A stakeholder workshop synthesized findings into feasible housing and public-space interventions.

The timeline of the project is 2.5 years, it started from planning and training and selecting study areas (6 months), to community data collection (6 months) in 3 cities, modelling and mapping

(12 months), and stakeholder workshops (3 months). The project is supported by Belspo. The local data collection, together with communities, academia, and NGOs in 3 cities, and workshops to develop adaptation solutions, is the centre of the project.

Enablers & Obstacles

Key enablers included strong community engagement, with residents leading data collection and validating results. The use of low-cost sensors and open data enabled scalability and replication in other settlements. Stakeholder workshops acted as enablers by translating evidence into actionable housing and urban adaptation measures.

Obstacles included the complexity of mapping thermal inequalities in complex urban spaces. These were solved through co-design of surveys to reflect local priorities, capacity-building for residents, and the development of cost-effective methods. Long-term uptake remains a challenge, requiring further advocacy to integrate localized thermal risk mapping into urban planning and housing policy.

Results & Impact

An important result is to make citizens more aware of the impact of high temperatures, in particular for the most vulnerable groups. The initiative produced the first high-resolution maps of air temperature and thermal vulnerability in Nairobi's informal settlements, identifying critical hotspots at the scale of streets and homes. Over 200 households contributed survey data, and dozens of residents participated directly in monitoring, strengthening community skills, and ownership. The analysis revealed strong links between housing materials, the built-up morphology, and reported heat stress, providing evidence for targeted improvements.

For low-income households, especially women, children, and the elderly, the project made visible the disproportionate risks they face, such as a lack of ventilation and reflective metal roofs.

Broader impacts include dialogues between communities, researchers, and city authorities. Proposed solutions, such as cooling hubs, shaded public areas, and roof insulation, were community-validated and low-cost, ensuring local relevance. Longer-term, the approach builds resilience by embedding data-driven planning into settlement upgrading, contributing to healthier living conditions, reduced vulnerability to heat, and more inclusive urban climate policy.

Replication & Scale Up

Lagos and Buenos Aires: the community engagement and low-cost sensor measurements developed in Nairobi were replicated in these two cities.

The practice is highly scalable as it uses low-cost sensors, open data, and community-led surveys adaptable to diverse urban contexts. Training local residents builds capacity for replication, while machine-learning models can be transferred to other settlements or cities.

With modest resources and partnerships, the approach can expand to thousands of households, guiding climate-resilient housing upgrades and informing national urban adaptation policies.

Policy Uptake

This housing practice is a new or innovative practice that is not yet adequately or fully integrated into formal policy frameworks.

To embed this initiative into policy, governments should integrate localized heat-risk mapping into housing and urban upgrading programs, ensuring informal settlements are included in climate adaptation plans. Partnerships with communities and academia should be institutionalized, with funding for low-cost monitoring and incentives for climate-resilient housing materials. Embedding evidence-based approaches in municipal planning can mainstream equity-focused climate action.

Lessons & Takeaways

A key takeaway is the potential to expand this practice into an early warning system for extreme heat, linking community data with real-time monitoring. This could need to be done in collaboration with local authorities to strengthen policy uptake. Future improvements can focus on embedding these tools into governance systems to guide proactive, climate-resilient housing upgrades.