



PALM-TREES

**A Pan African and Transdisciplinary Lens on the Margins:
Tackling the Risks of Extreme Events (PALM-TREES)**

MANAGING HEAT RISK IN LAGOS: PROTECTING VULNERABLE COMMUNITIES FROM EXTREME HEAT

POLICY BRIEF

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EXECUTIVE SUMMARY

Extreme heat is an important and increasingly persistent climate risk in Lagos. Evidence from the PALM-TREES project shows widespread heat stress across the study locations, with none recording heat stress below 35°C. High temperature combined with high humidity substantially increases heat discomfort, particularly during the dry season. March recorded the highest average Humidex values and the greatest frequency of heat-stress days. Heat exposure is also spatially differentiated. Heat hotspots are particularly prominent in the southern portion and city centre, while Urban Heat Island effects were identified in the city centre. The vulnerability is not evenly distributed. Approximately 75.5% of respondents work outdoors, while 46.3% of households experience high thermal housing vulnerability and a further 47.2% experience moderate vulnerability. In addition, 91.3% of households depend on a single income source, constraining their capacity to absorb the economic effects of prolonged heat. The lived experience of heat is substantial. Approximately 95% of weather-diary participants reported feeling hot during February and early March, with persistent discomfort reported during the February–April observation period. The study also indicates increasing heatwave severity and duration, with heat conditions extending across two to four months during the dry season. These findings are particularly relevant to Lagos's existing climate policy architecture. The State's Climate Action Plan 2020–2025, Lagos Resilience Strategy, and more recent Lagos Climate Adaptation and Resilience Plan (LCARP) already establish a policy basis for climate resilience. LCARP specifically identifies extreme heat as a major climate impact driver and includes proposed investments in cool surfaces, green building envelopes, cool pavements, and the planting of 50,000 climate-resilient trees annually to reduce extreme-heat impacts. The policy challenge is therefore not the absence of a policy framework, but ensuring that existing commitments target the communities and population groups experiencing the greatest heat exposure and vulnerability.

KEY RECOMMENDATIONS

1. The Lagos State Ministry of Environment and Water Resources, working with the Lagos State Resilience Office (LASRO), Ministry of Economic Planning and Budget and Local Government Councils, should use PALM-TREES heat-risk evidence to strengthen implementation and targeting of LCARP heat-adaptation interventions.
2. The Ministry of Environment and Water Resources, LASRO and the Nigerian Meteorological Agency (NiMet) should strengthen heat-risk monitoring, interpretation and communication, particularly for communities and groups with high exposure.
3. The Ministry of Physical Planning and Urban Development and relevant building-control institutions should incorporate heat vulnerability into urban development, building and neighbourhood improvement interventions, building on LCARP's proposed cool-surface, green-envelope and cool-pavement measures.
4. The Lagos State Water Corporation and Local Government Councils should strengthen reliable access to water in highly heat-vulnerable communities, recognising hydration as a key existing coping strategy.
5. The Ministry of Health, Ministry of Environment and Water Resources and relevant livelihood-support institutions should strengthen protection of heat-exposed populations, particularly outdoor workers and households whose livelihoods depend on informal or unstable income.

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6. LASRO, Local Government Councils and the Ministry of Women Affairs and Poverty Alleviation should ensure that heat adaptation is community-based, gender-responsive and inclusive, with vulnerable groups participating in the identification and implementation of local adaptation measures.

7. Ministry of Health should develop health-related health risk surveillance for data capturing, sharing and integration into heat stress management.

METHODOLOGY

The policy brief is based primarily on the PALM-TREES project, “A Pan-African and Transdisciplinary Lens on the Margins: Tackling the Risks of Extreme Events – Dimensions of Risks and Vulnerability Associated with Flooding and Heat Stress among the Margins in Lagos, Nigeria.” The study adopted a mixed-methods, transdisciplinary approach that combined physical and social science methods. The physical component included heat vulnerability analysis using the Weather Research and Forecasting (WRF) model, while the social component included quantitative surveys, iButton installations, weather diaries, key informant interviews, focus group discussions, community needs assessments, and stakeholder engagement. Quantitative data covered 918 communities and 377 wards across the 20 LGAs of Lagos, generating 1,166 data points. Community-level engagement subsequently included locations such as Apapa, Ajegunle, Mile 12 and Agboyi-Ketu. The brief focuses specifically on evidence concerning heat exposure, heat stress, thermal housing vulnerability, livelihoods, access to water and cooling, and community coping.

POLICY CONTEXT OF EXTREME HEAT IN LAGOS

Lagos is a rapidly urbanizing coastal megacity in which climate risk interacts with population density, land-use change, infrastructure deficits and socioeconomic inequality. The Lagos Resilience Strategy recognizes that rapid urbanization and population growth have outpaced sustainable urban planning and created interconnected environmental, infrastructural and social stresses. It consequently calls for an integrated approach to building an efficient, inclusive and resilient city. The climate dimensions of this challenge are increasingly well established. Research on Lagos has documented the growth of the urban heat island alongside rapid urbanization. Bassett et al. (2020) found that nighttime urban heat island intensity increased between 1984 and 2016, while the spatial extent of areas experiencing elevated urban heat increased substantially. More recent modeling found generally high heat-stress conditions in highly urbanized areas, with the most socioeconomically disadvantaged urban form particularly affected. Obe et al. (2024) conclude that urban morphology is an important determinant of the spatial and temporal distribution of heat stress in Lagos.

Other research reinforces the importance of land use and urban form. A study of Lagos using long-term MODIS land-surface-temperature data found that both urbanization and global climate change contributed to increasing urban land-surface temperature, with urbanization responsible for approximately 61% of the observed urban warming in the study period. The implications are important for policy because heat vulnerability is not determined by temperature alone. Housing characteristics, socioeconomic status and access to adaptive resources influence people's ability to cope. Research on heat vulnerability more generally shows that excluding housing characteristics can produce an incomplete assessment of heat-related vulnerability and health risk (Sera et al., 2020).

Existing Lagos climate and environmental policy framework

Lagos already has several instruments relevant to managing extreme heat.

First, the Lagos Climate Action Plan (CAP) 2020–2025 established a state-level framework for reducing emissions while strengthening climate resilience. The plan succeeded the earlier 2015 Climate Change Policy and Action Plan and covers climate adaptation and resilience alongside energy, transport and waste. Second, the Lagos Resilience Strategy provides an integrated framework for addressing shocks and chronic stresses. Importantly for heat adaptation, it includes goals relating to land-use planning, affordable housing, access to clean water, information management and disaster preparedness, as well as strengthening the health system.

Third, the Lagos State Climate Adaptation and Resilience Plan (LCARP) provides the most direct policy entry point for the PALM-TREES findings. LCARP identifies extreme heat, extreme rainfall and sea-level rise as the three major climate impact drivers facing Lagos. Its proposed adaptation portfolio includes specific heat-related interventions, including retrofitting manufacturing plants with cool surfaces, green building envelopes, and cooling systems; retrofitting roads with cool pavement; and planting 50,000 climate-resilient trees annually to reduce the impacts of extreme heat on health and productivity. Fourth, the Lagos State Environmental Management and Protection Law 2017 provides the broader legal

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framework for environmental management and protection in the State. The Law establishes the Lagos State Environmental Protection Agency and brings together responsibilities concerning environmental protection, pollution and public health. Its broad definition of pollution includes alteration of the thermal properties of the environment where this adversely affects human health, welfare or environmental quality.

Fifth, Lagos's urban planning and development-control framework provides an additional entry point. LASBCA's current planning resources include the Lagos State Urban and Regional Planning and Development (Amendment) Law 2019 and associated development-control regulations. These instruments

KEY ISSUES AND EVIDENCE FROM THE PALM-TREES PROJECT

1. Extreme heat is persistent and widespread

The study found generally high heat-stress conditions across Lagos. None of the study locations recorded heat stress below 35°C. High humidity combined with elevated temperatures further intensifies heat stress, particularly during the dry season. March recorded the highest average Humidex values, ranging from approximately 39.49°C to 41.28°C. The study estimates an annual pattern involving 360 days of "Some Discomfort", 120 days of "Great Discomfort" and six days of "Dangerous Heat Stress". This reinforces the need to treat heat as a recurring climate risk rather than occasional weather anomaly.

2. Heat risk is spatially concentrated

WRF simulations identified Urban Heat Island effects in the city centre, while heat hotspots were particularly prominent in the southern portion and city centre. Population density is particularly high in these areas. This is consistent with wider Lagos research showing that highly urbanized local climate zones experience particularly high heat stress. This implies that adaptation investments should be spatially targeted, particularly where high exposure overlaps with high vulnerability.

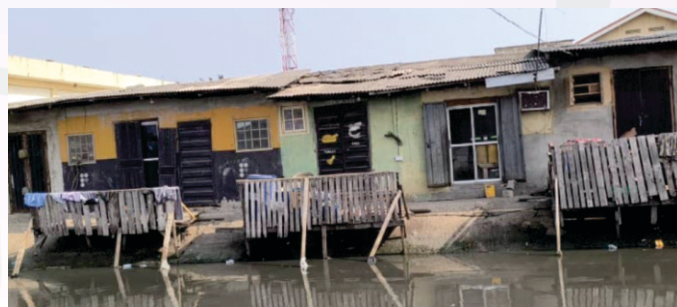
3. Outdoor livelihoods increase exposure

Approximately 75.5% of respondents work outdoors, while informal or casual employment is the leading livelihood category. For these workers, avoiding extreme heat can mean losing income. Heat adaptation therefore needs to recognise the relationship between climate exposure and livelihood security.

4. Housing conditions increase heat vulnerability

The Thermal Housing Quality Vulnerability Index indicates that 46.3% of households have high thermal housing vulnerability, while another 47.2% have moderate vulnerability. Only 6.5% fall within the low-vulnerability category. This finding is consistent with

are relevant because heat exposure is closely connected to urban form, building characteristics, density and the availability of vegetation and open space. The policy significance of the PALM-TREES findings is therefore clear: Lagos already has relevant climate, resilience, environmental and planning instruments, but the evidence indicates a need to make their implementation more spatially targeted and socially differentiated. The PALM-TREES findings add value by identifying how heat exposure intersects with housing conditions, livelihoods, water and cooling access and lived experience at community level. They can therefore help government move from broad policy commitments towards more targeted implementation.



wider literature showing that housing is a critical determinant of heat vulnerability and that housing characteristics should be incorporated into heat-risk assessment and intervention design.

5. Access to cooling and water is unequal

Fans are the devmost reported cooling facility, available to 71.8% of respondents, while only 6.1% reported access to air conditioning. The findings also show reliance on different water sources, with boreholes being the most common. Access to reliable water is particularly important because increased water intake is one of the main coping strategies reported by communities. This is directly relevant to the Lagos Resilience Strategy, which already identifies expanding and protecting water sources as part of improving Lagos's resilience.

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6. Communities are already experiencing prolonged heat discomfort

Approximately 95% of weather-diary participants reported feeling hot during February and early March. Many participants consistently reported feeling very uncomfortable and excessively hot during the

POLICY IMPLICATIONS

The PALM-TREES evidence suggests that Lagos does not need a completely new institutional framework for heat adaptation. Rather, the immediate priority is to strengthen implementation of existing climate and resilience commitments using more granular evidence about where and among whom heat vulnerability is greatest.

1. Existing climate commitments should become more spatially targeted

LCARP already proposes cool surfaces, green building envelopes, cool pavements and large-scale tree planting. PALM-TREES evidence can help identify where such interventions are likely to have the greatest benefit.

2. Heat adaptation should combine physical exposure with social vulnerability

The study demonstrates that high heat exposure intersects with outdoor livelihoods, vulnerable housing and limited access to cooling. This means that heat interventions should not be based solely on temperature maps.

3. Urban planning is central to heat-risk reduction

Research shows that urban morphology and land-use change are important drivers of heat exposure in Lagos. Existing planning and development-control mechanisms should therefore become part of the heat adaptation response.

4. Water and basic services should be treated as adaptation measures

Access to water and cooling determines whether households can translate knowledge of heat risk into effective action. This provides a direct connection between the PALM-TREES findings and the Lagos Resilience Strategy's emphasis on water access.

5. Implementation should be inclusive

Lagos's resilience strategy explicitly adopts an inclusive approach involving government, communities, academia, business and civil society. PALM-TREES similarly emphasizes gender, inclusion and marginalized populations. Heat adaptation should therefore involve affected communities in identifying and implementing appropriate responses.

PRIORITY POLICY RECOMMENDATIONS

1. Use PALM-TREES evidence to target implementation of LCARP heat interventions

Responsible institutions:

February–April observation period. The study also reports increasing heatwave severity and duration over the previous five years, with heat conditions extending approximately two to four months during the dry season.

Lagos State Ministry of Environment and Water Resources; Lagos State Resilience Office (LASRO); Ministry of Economic Planning and Budget; Local Government Councils.

LCARP already identifies investments in cool surfaces, green building envelopes, cool pavements and climate-resilient tree planting.

Specific actions

- ♦ Overlay PALM-TREES heat hotspots and vulnerability evidence with existing LCARP project locations.
- ♦ Prioritize high-density communities where heat exposure coincides with high social or housing vulnerability.
- ♦ Use LCARP implementation and investment planning to direct heat interventions towards these priority locations.
- ♦ Establish community-level indicators for monitoring whether interventions are reaching vulnerable populations.

2. Integrate heat risk into urban planning and building interventions

Responsible institutions:

Lagos State Ministry of Physical Planning and Urban Development; Lagos State Building Control Agency (LASBCA); Lagos State Planning and Environmental Monitoring Authority (LASPEMA); Local Government Councils.

The evidence demonstrates the importance of urban morphology and housing conditions in determining heat exposure.

Specific actions

- ♦ Incorporate heat-risk evidence into relevant local development and neighbourhood planning.
- ♦ Prioritise heat-vulnerable areas for cool-surface and cool-pavement interventions.
- ♦ Promote heat-sensitive building and neighbourhood design.
- ♦ Use existing development-control processes to encourage measures that improve thermal conditions.
- ♦ Integrate green infrastructure and tree planting into appropriate urban development interventions.

3. Strengthen heat-risk monitoring and communication

Responsible institutions:

Lagos State Ministry of Environment and Water Resources; LASRO; Lagos State Emergency Management Agency (LASEMA); NiMet.

Specific actions

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- ◆ Strengthen arrangements for accessing and interpreting meteorological heat information.
- ◆ Develop locally understandable heat-risk messages.
- ◆ Communicate periods of elevated heat stress through accessible community channels.
- ◆ Prioritise outdoor workers and communities identified as highly vulnerable.
- ◆ Incorporate community observations and lived experience into heat-risk communication and monitoring.

4. Strengthen access to water and basic cooling resources

Responsible institutions:

Lagos State Water Corporation; Lagos State Ministry of Environment and Water Resources; Local Government Councils.

The PALM-TREES findings show that water intake is an important coping strategy while access to cooling remains highly unequal.

Specific actions

- ◆ Identify heat-vulnerable communities where inadequate water access compounds heat exposure.
- ◆ Prioritise reliable water supply interventions in these locations.
- ◆ Incorporate water access into community-level climate adaptation planning.
- ◆ Promote affordable and locally appropriate cooling options for vulnerable households.

This recommendation is consistent with the Lagos Resilience Strategy's existing objective of expanding and protecting water sources to improve Lagos's water supply.

5. Protect heat-exposed workers and vulnerable livelihoods

Responsible institutions:

Lagos State Ministry of Economic Planning and Budget; Ministry of Women Affairs and Poverty Alleviation; relevant livelihood-support institutions; Local Government Councils.

With approximately 75.5% of respondents working outdoors, livelihood exposure is a major component of heat vulnerability.

Specific actions

- ◆ Incorporate heat exposure into livelihood-support programmes.
- ◆ Develop practical heat-safety guidance for outdoor workers.
- ◆ Promote measures that enable workers to reduce exposure during peak heat periods without undermining livelihoods.
- ◆ Prioritise households dependent on single or unstable income sources.

6. Establish a heat-health dimension within climate-risk management

Responsible institutions:

Lagos State Ministry of Health; Lagos State Ministry of Environment and Water Resources; LASEMA; Local Government health authorities.

The PALM-TREES findings demonstrate widespread heat discomfort and prolonged exposure. The policy response should therefore connect environmental monitoring with health protection.

Specific actions

- ◆ Development of heat-related health risk surveillance across the state and with special attention to the identified heat stress hotspots.
- ◆ Integrate heat-risk information into relevant public-health preparedness activities.
- ◆ Develop public guidance on hydration, heat exposure and appropriate protective measures.
- ◆ Strengthen community awareness of risks associated with prolonged extreme heat.
- ◆ Consider heat exposure in planning for vulnerable populations during periods of elevated heat stress.

7. Strengthen community-based and gender-responsive heat adaptation

Responsible institutions:

LASRO; Ministry of Women Affairs and Poverty Alleviation; Ministry of Youth and Social Development; Local Government Councils; community-based organizations.

The PALM-TREES project explicitly focuses on marginalized populations and intersectional dimensions of vulnerability.

Specific actions

- ◆ Involve communities in identifying locally appropriate heat-adaptation measures.
- ◆ Ensure women and other vulnerable groups participate in adaptation planning.
- ◆ Identify differences in heat exposure, resources



Plate 5: Image of Flood water on the road and a blocked drainage in Ijora Community
Source: Palm-Trees Field work, February 2025.

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CONCLUSION

Extreme heat is no longer a marginal environmental concern for Lagos. The PALM-TREES evidence shows that heat stress is widespread, persistent, and spatially differentiated, with particularly important implications for densely populated communities, outdoor workers, and households living in thermally vulnerable housing. Importantly, Lagos already possesses a substantial policy foundation for responding to this challenge. The Climate Action Plan, Lagos Resilience Strategy, Lagos State Environmental Management and Protection Law and LCARP provide complementary foundations for climate resilience, environmental management, urban planning, water access and adaptation. LCARP goes further by identifying concrete heat-related investments, including cool surfaces, cool pavements, green building envelopes and climate-resilient tree planting. The key policy gap is therefore not the absence of policy instruments but the need to connect these instruments more systematically with localized evidence on heat exposure and social vulnerability. The PALM-TREES findings provide an opportunity to do this. By targeting existing adaptation investments toward communities experiencing the greatest combination of heat exposure and vulnerability,

strengthening heat-risk communication, improving access to water and cooling, protecting outdoor livelihoods, and integrating heat into urban and health planning, Lagos can move from broad climate-resilience commitments toward more targeted, equitable, and evidence-based heat-risk management.

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Plate 5: Image of Flood water on the road and a blocked drainage in Ijora Community
Source: Palm-Trees Field work, February 2025.



Image of a Resident at Precious Seeds Community, Oworoshoki.
Source: Palm-Trees Fieldwork, February 2025

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