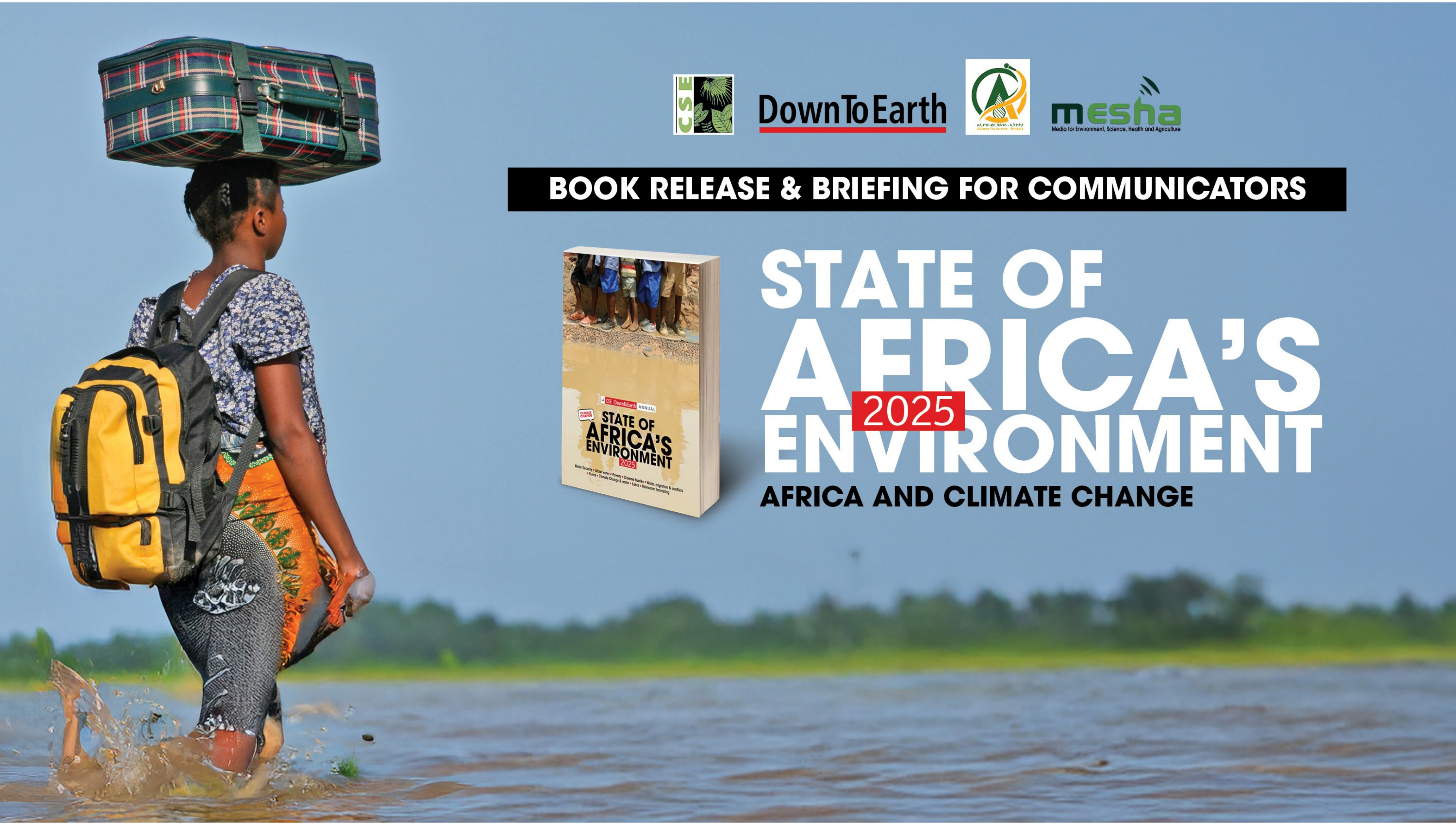

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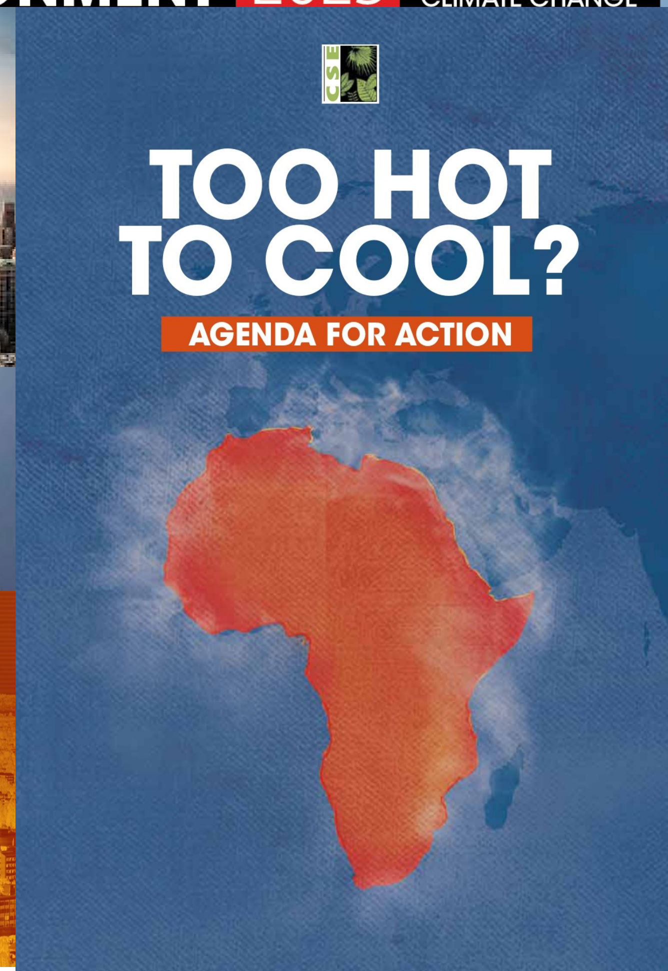
STATE OF AFRICA'S ENVIRONMENT 2025

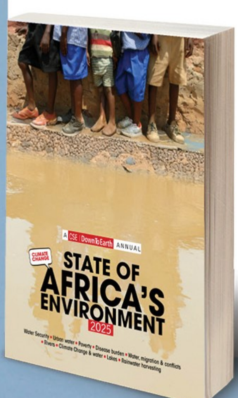
AFRICA AND CLIMATE CHANGE

Anumita Roychowdhury
Sharanjeet Kaur
Centre for Science and Environment

The 2025 Africa Science Journalist Congress
State of Africa's Environment Report – Climate Change, 2025

Addis Ababa, September 18-19, 2025





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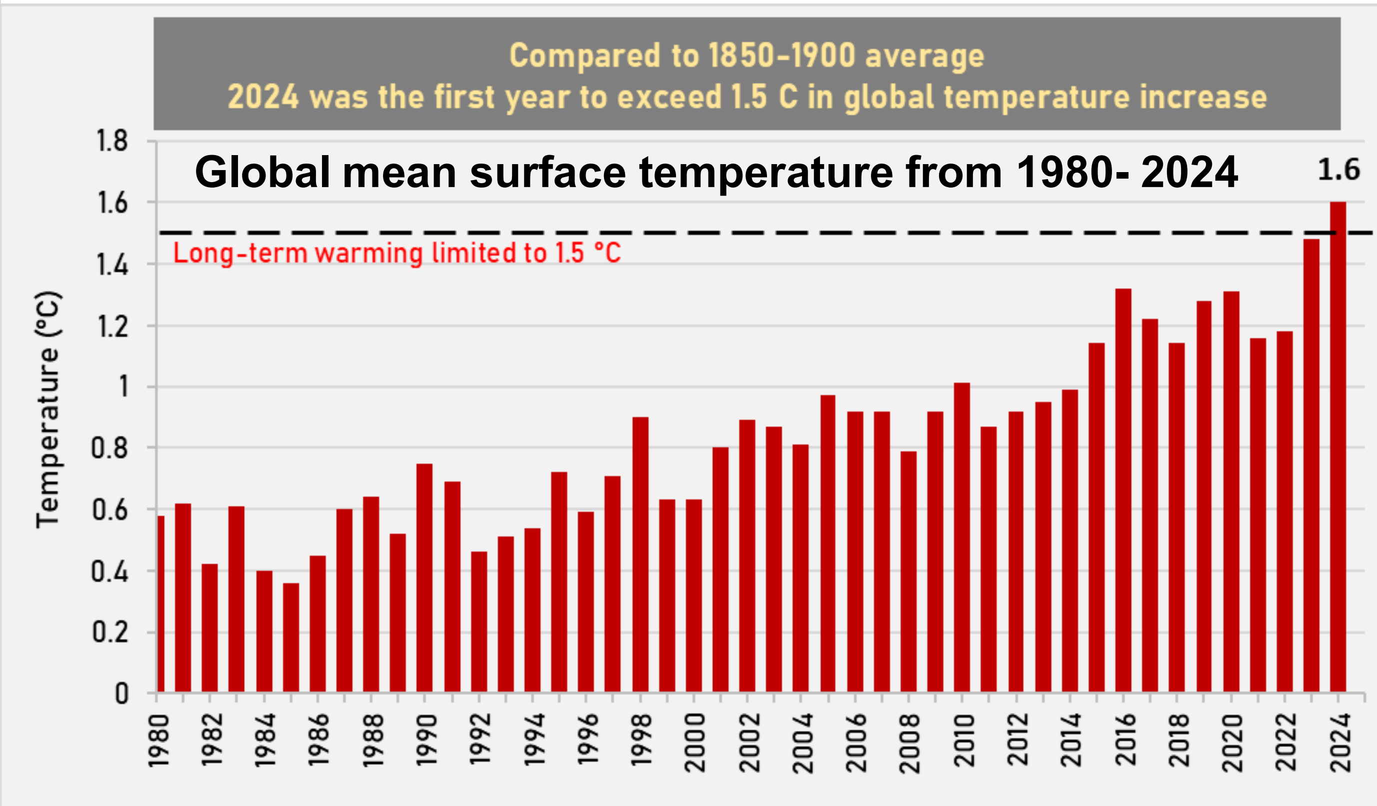
STATE OF AFRICA'S ENVIRONMENT 2025 AFRICA AND CLIMATE CHANGE

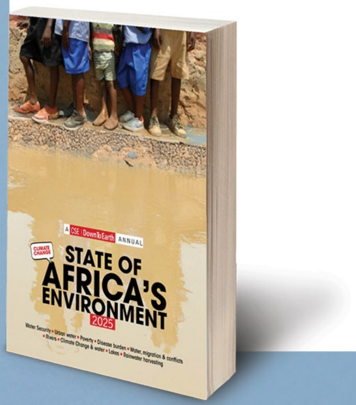
Rising heat – a global challenge



Source: Copernicus Climate Change Service

- The world is experiencing record breaking temperatures.
- **2024, the hottest year** ever observed, +1.6°C above pre-industrial baselines.
- The decade from **2015 to 2024 is the warmest** on record.
- Land areas (especially tropics & subtropics) are heating faster than oceans.
- By 2100, up to 74% of the world's population could face deadly heat (under high emissions scenario), up from ~30% today.
- Air pollution clean up and heat

Africa’s vulnerability



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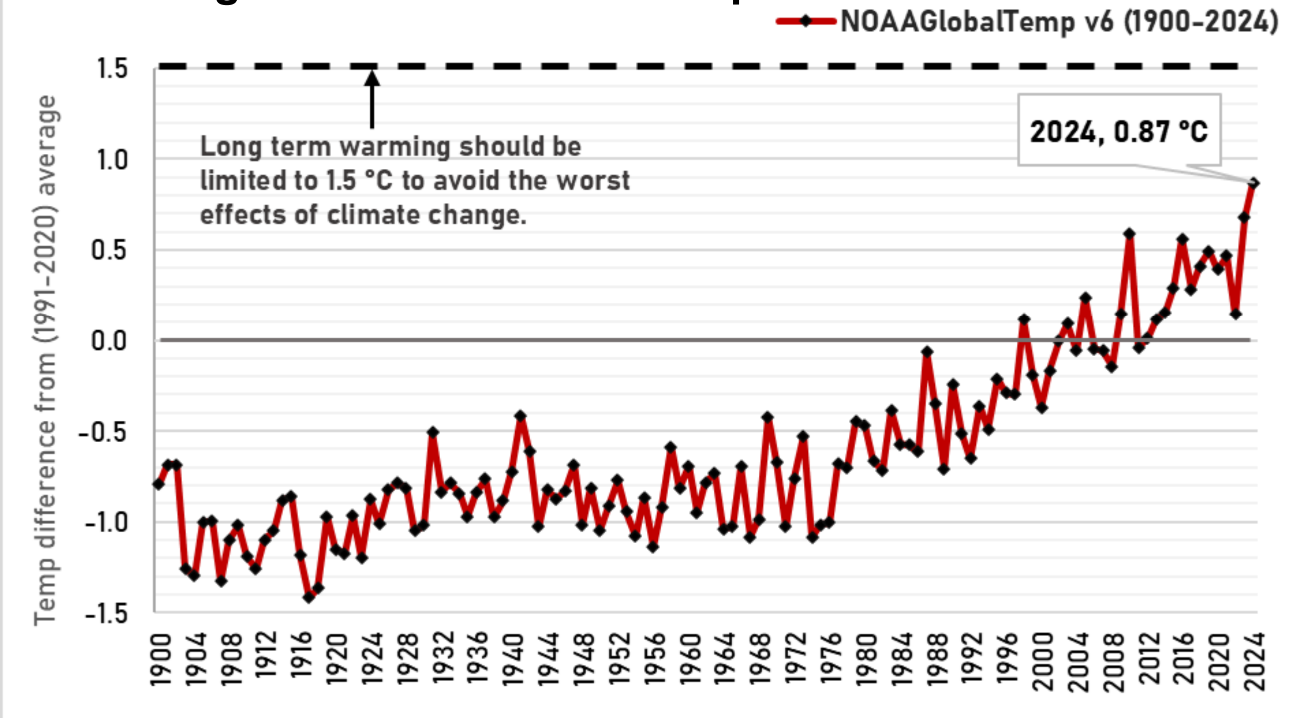
STATE OF AFRICA'S ENVIRONMENT 2025

AFRICA AND CLIMATE CHANGE

Rising heat in Africa continent

Annual regional mean surface temperature from 1900- 2024 in Africa



- **Africa is warming at ~0.3°C per decade**, faster than the **global average of 0.2°C** for the 1991–2023 period.
- **2024,** Africa recorded an average temperature anomaly of 0.87°C above the 1991–2020 baseline.
- Mean annual warming to exceed 2°C by the end of the century. Some regions reaching 3–6°C under high-emission scenarios.(IPCC 5th Assessment report).
- By late 21st century, heat exposure could rise 12-fold – with 10–30% more dangerous hot days and 6–20% greater intensity in West, Central & NE Africa.

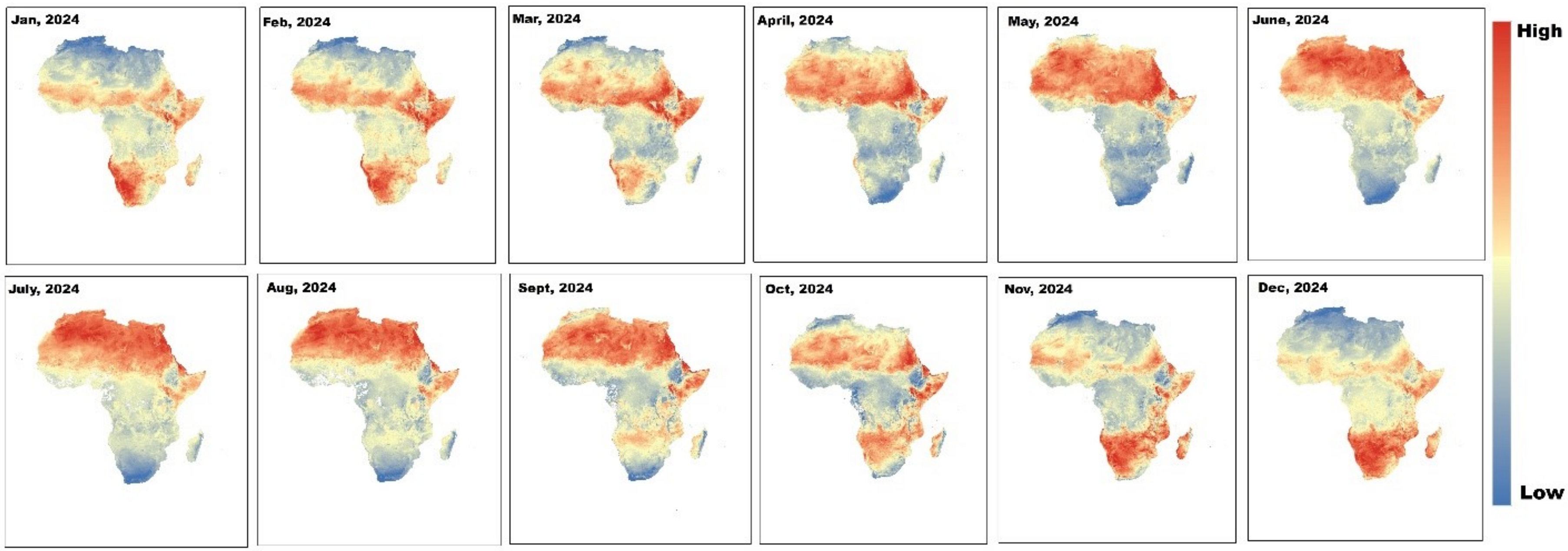
Note: Temperature difference calculated from 1991 – 2020 average.

Source: NOAA Global Surface Temperature Dataset (NOAAGlobalTemp), Version 6.0

WMO.2023.State of the Climate in Africa.

Seasonality of temperature variation in Africa

Seasonal variation in Land surface Temperature

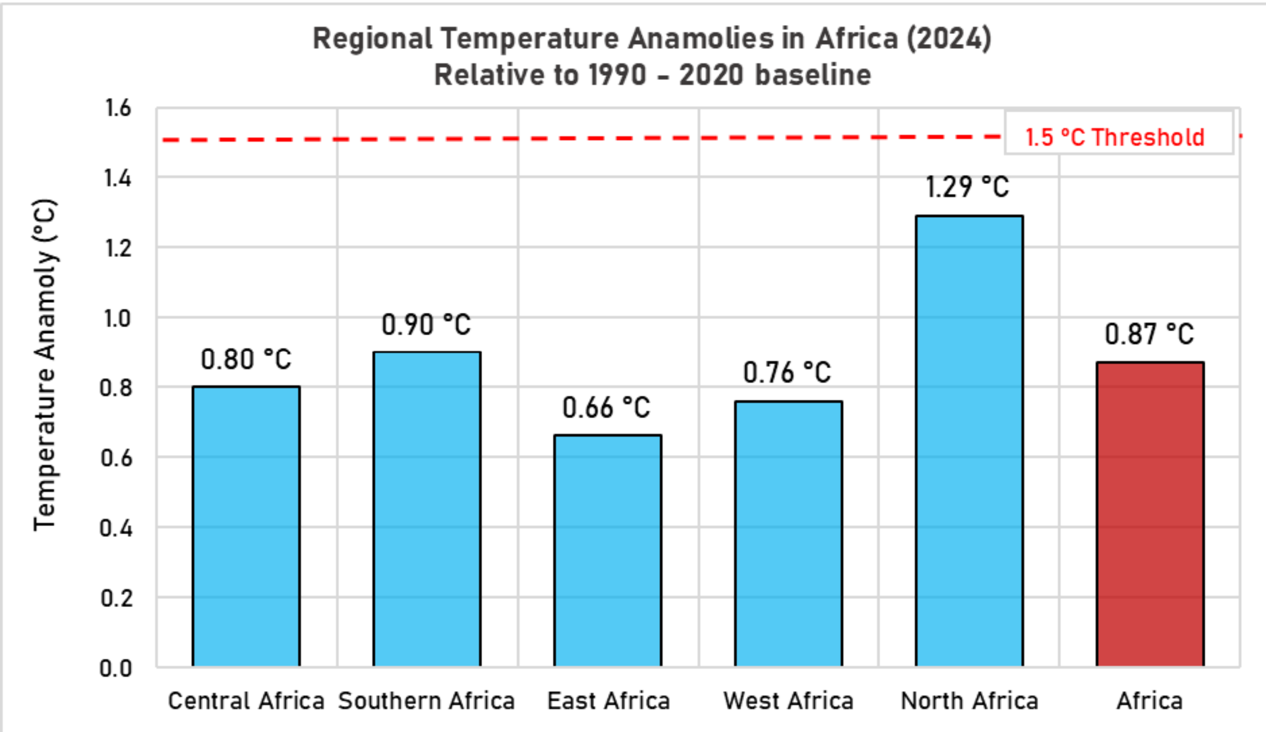


Source: CSE analysis of MODIS data.

- Strong seasonal temperature contrasts
- **Northern Africa:** Highest temperatures from May to September with extreme heat.
- **Southern Africa:** Warmest from December to February; cooler winters (June–August).
- **Equatorial & Central Africa:** Consistently high temperatures year-round with less seasonal variation.
- Coastal areas (West Africa, Eastern Madagascar) experience moderate temperatures

Uneven regional trends

Near-surface air temperature anomalies for 2024



Note: Anomalies for the whole African continent and for each of the African subregions have been calculated using NOAAGlobalTemp v6.

Source: WMO

North Africa: **Warming rate has doubled**, rising to +0.4°C per decade between 1991 and 2023, compared with +0.2°C per decade during 1961–1990. Heatwaves more **frequent and intense in Cairo and Algiers**.

Southern & Central Africa nearing 1 °C warming. Heat stress is rising, **especially in Johannesburg and Cape Town**.

West Africa: Heat stress is **rapidly worsening in Lagos, Accra, and Dakar. Urban areas are increasingly vulnerable.**

Central Africa: Heat stressed areas expanding, **especially in Kinshasa and Douala.**

East Africa: Dangerous heat events are **more frequent in Nairobi and Addis Ababa**.

Urban Heat islands and heat stress: High temperature and humidity – a double whammy

•**Wet bulb temperature (heat + humidity) is critical for assessing heat stress**.
The danger threshold: 35°C

•**Urban Heat Island Effect:** Lagos, Nairobi, Addis Ababa, and Lusaka show UHI effects with urban areas 3–4°C hotter than peri-urban zones.

•**Nighttime UHI is stronger** in informal settlements, increasing heat exposure and health risks for vulnerable populations.

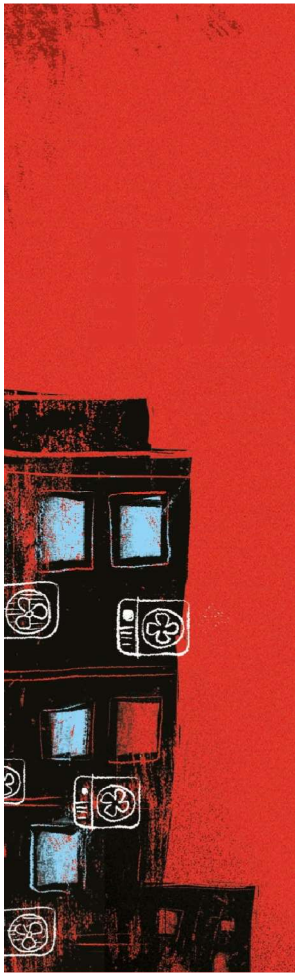
Key urban heat drivers and city-specific evidence from African UHI studies.

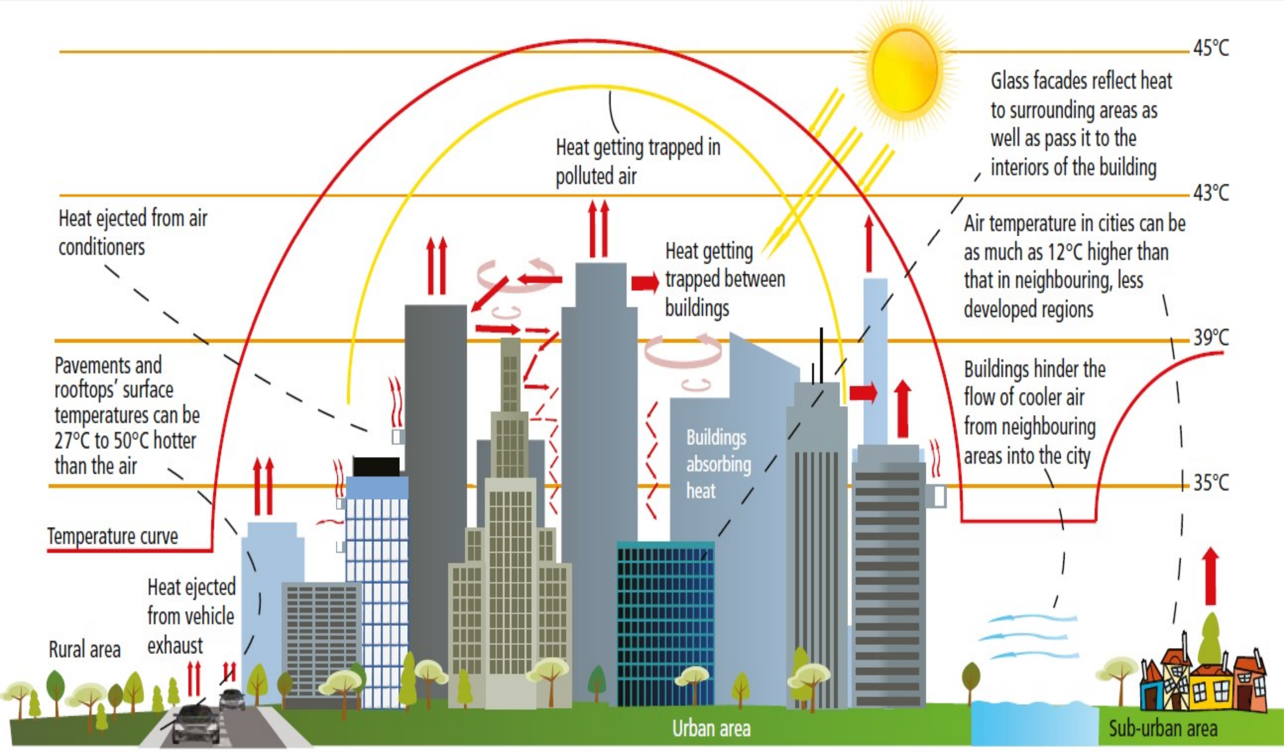
Urban Heat Driver	Mechanism/Impact	African City Evidence
Loss of green cover	Reduces cooling, increases LST	Lagos, Nairobi, Addis Ababa
Dense settlements	Trap heat, poor ventilation, high night-time temperature	Johannesburg, Lagos
Rapid urban expansion	Increases impervious surfaces, amplifies UHI	Lagos, Kampala ,
High humidity (wet bulb temp)	Increases heat stress, limits sweat-based cooling	Coastal West African cities

Combination of high heat and humidity can compromise the human body's main cooling mechanism: sweating. The evaporation of sweat cools our bodies, but higher humidity levels limit this natural cooling.

People can suffer heat stress and illness with fatal consequences even at much lower ambient temperatures -- if humidity is high.

Cities simmering in their own waste heat (includes waste heat from vehicles)





Worse --- cities are not cooling down at night at the rate they used

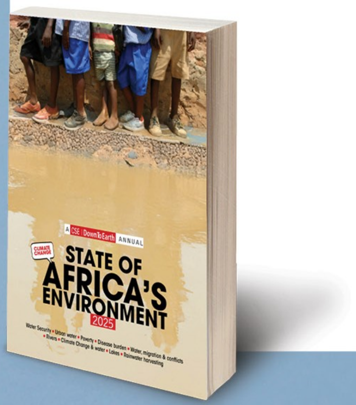
- Significant upward trend in night time land surface temperature across most regions of Africa between 2000 and 2014. (Source: Scientific Reports journal in 2019)
- Some areas in southern, central, and eastern Africa have also recorded localized decreases.
- Rapidly urbanizing areas are more vulnerable urban heat island effect
- East Africa: 31% of the region experienced significant night time LST rise, – even outpacing daytime warming.
- North Africa: Greater Cairo's average night time LST increased from 24.94°C in 2000 to 27.22°C in 2019 (Source: Remote sensing journal 2021).
- Night time heatwaves more frequent and intense across African urban clusters.

Lancet Planetary Health* noted that *the risk of death from excessively hot nights would increase nearly six-fold.

Note: Summer is defined as the period from March to August. A city's weather profile is based on average of all IMD weather stations located in the city. Heat index has been calculated using the U.S. National Oceanic and Atmospheric Administration formula. * Data up till 30 August 2023.
Source: CSE analysis of climatological data from IMD

Source: CSE Urban

Case study of Lagos and Johannesburg: What did we find?



How did we do this study?

- **Analyzed land surface temperature and land=use pattern** for Lagos & Johannesburg to assess urban heat island effect
- Used freely accessible satellite data from the United States Geological Survey (USGS) Earth Explorer platform were used (Landsat 8 OLI/TIRS). Analysis have been made using ArcGIS mapping software.
- **South Africa:** summer heat time: **Nov–Mar** (Data used for Jan and Dec months)
- **West Africa:** summer heat time: **Feb–Apr** (Data used for Dec months - limited cloud-free imagery during Feb - Apr).

Spatial & temporal variations in LST; Changes in LULC patterns. Relationship between LULC changes & LST (urban expansion → more heat).

Heatwave Criteria: No single continent-wide threshold for severe heat - varies by region & climate zone.

- **Common criteria:**
  - **≥35°C absolute temperature threshold.**
  - **≥90th/97th percentile of historical maximum** for 2–3 consecutive days.
- **South African Weather Service criteria:**
  - Heatwave = **3+ days with max temp ≥5°C above average mean maximum** for hottest month.
- **Expert Team on Climate Change Detection and Indices (ETCCDI) Indices:**

a) Defines heatwaves using percentile thresholds (90th or 97th percentile for 2–3 consecutive days) -- Widely applied in climate research and monitoring across Africa.

- These considered for analyzing heatwave events for consistent assessment of extreme heat exposure

Lagos

Lagos is a coastal megacity characterized by high humidity and extensive dense housing

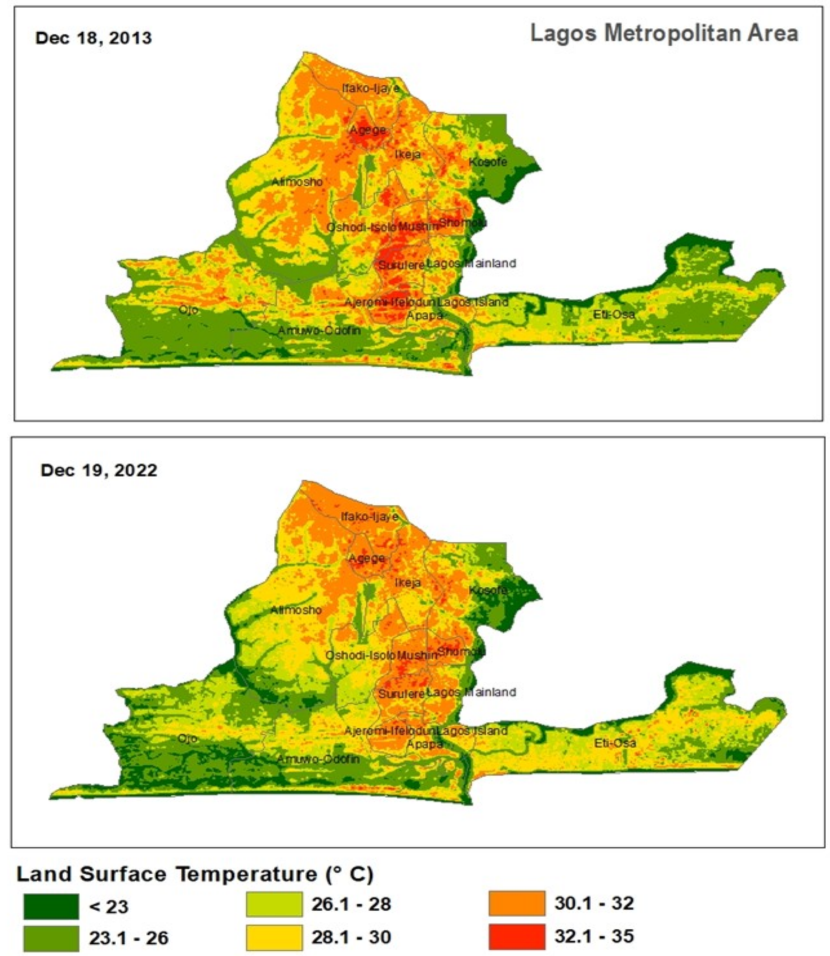
Land Surface Temperature Variations (2013 vs 2022)

- **32–34 °C zone expanded to new areas due to rapid land-use changes** including Ifako-Ijaiye and Eti-Osa,
- 2022: Ikeja, Mushin, Surulere observed peak heat of 33.92°C.

- **Consistently Hot LGAs (30–34 °C)** in both years: Ifako-Ijaiye, Ajeromi-Ifelodun, Mushin, Surulere, and Agege.

- **Peak LST**: Stable
- ***2013:*** 34.43 °C in Ikeja (industrial zone)
- ***2022:*** 33.92 °C in Ikeja, Mushin, Surulere

- **Lowest LST (both years):** 21.5 °C near Lagos Lagoon (Eti-Osa).

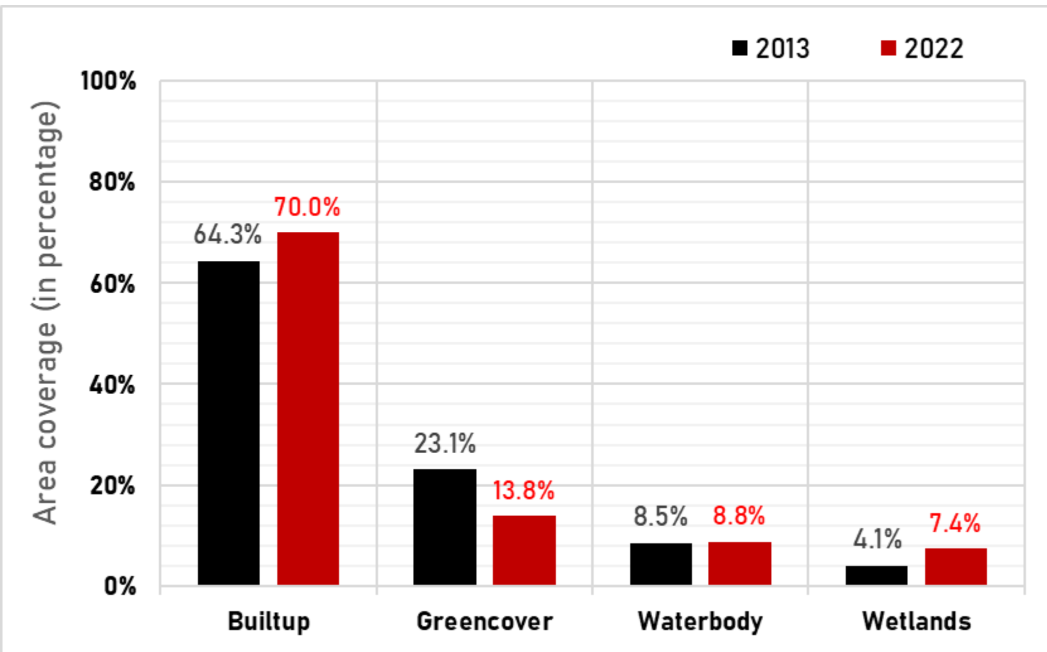


Note: Heatwave months (Dec-Jan) are chosen to analyze the Land Surface Temperature (LST). The respective date of acquisition of the images are Dec 18, 2013, and Dec 19, 2022.

Source: CSE analysis of Landsat 8 satellite images from United States Geological Survey (USGS) Earth

Lagos: Changing land-use and heat

Land Use Land Cover Change – Lagos 2013 vs 2022



Source: CSE analysis of Landsat 8 satellite images from United States Geological Survey (USGS) Earth Explorer.

Surface Temperature by Land Cover

Land Cover	Land Surface Temperature (°C)		Change (°C)
	2013	2022	
Built-up	34.4	33.9	-0.5
Green cover	32.0	32.7	0.8
Wetland	30.9	31.5	0.6
Waterbody	27.4	27.4	0.0

Built-up areas grew from 64% in 2019 to nearly 70% in 2022: LST increased by about 0.5°C.

Growth has occurred within already urbanized cores with high baseline heat, while open spaces, scattered vegetation, roads, and proximity to coastal areas helped moderate temperatures.

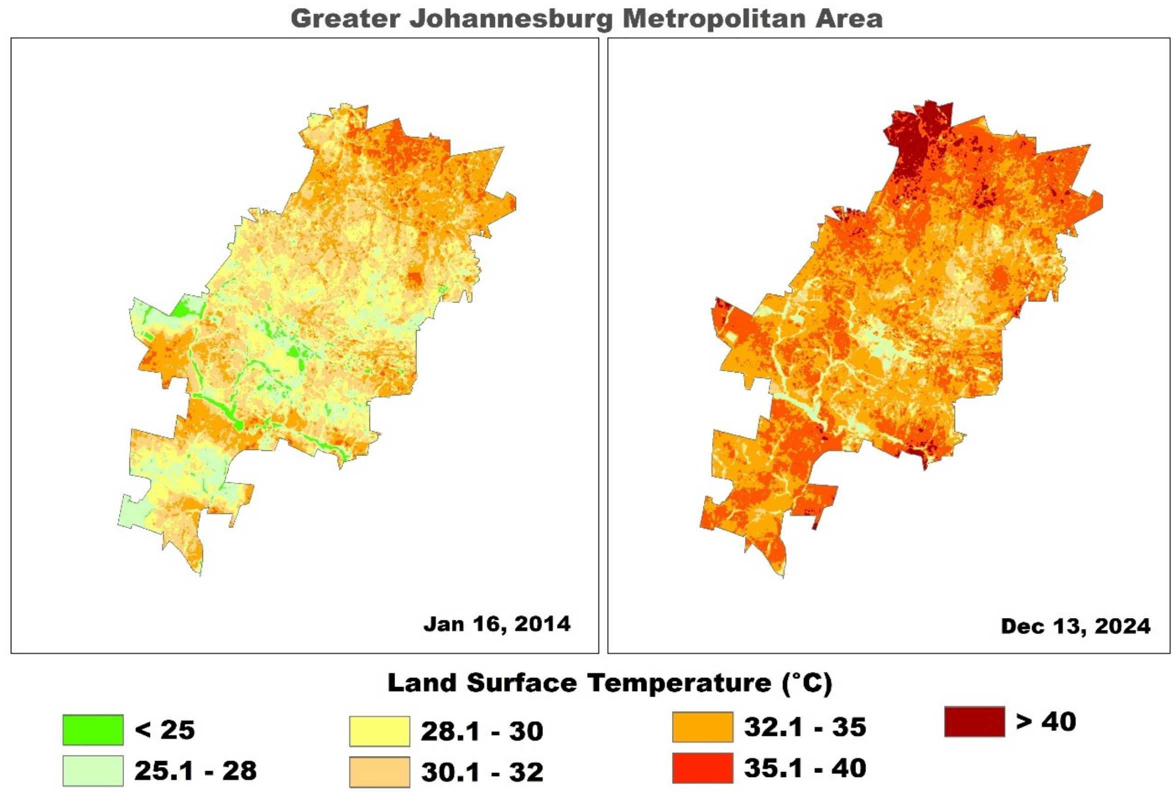
Thus, LST remains relatively consistent, masking smaller-scale thermal variations.

Johannesburg

Johannesburg experienced rapid urban expansion, with significant land cover changes influencing the city's heat profile

Land Surface Temperature Variations (2014 vs 2024)

- **Substantial temperature increases between 2014-2024**, **Hotspots 2024:** Highest LST (35 – 50 °C) in built-up zones like **Alexandra (East), Southern Johannesburg, and NW near Lanseria Airport**.
- **Consistently Higher Temperature Zones:** Lanseria Airport in the northwest and Stone Ridge Center in the eastern region.
- **Extreme hotspots (45 – 51 °C)** in **Lanseria Airport** and **Stone Ridge Center** (Eastern Johannesburg) in 2024.
- **Peak LST Values:**
- **2024 Peak:** 51 °C near Lanseria & Stone Ridge
- **2014 Peak:** Above 32 °C in northern built-up zones
- **Cooler zones** observed near **water bodies and dense vegetation**, showing their **natural cooling effect**.
- **Sharp rise in LST across all land cover categories,-- built-up areas saw the steepest jump by +9.7°C.**

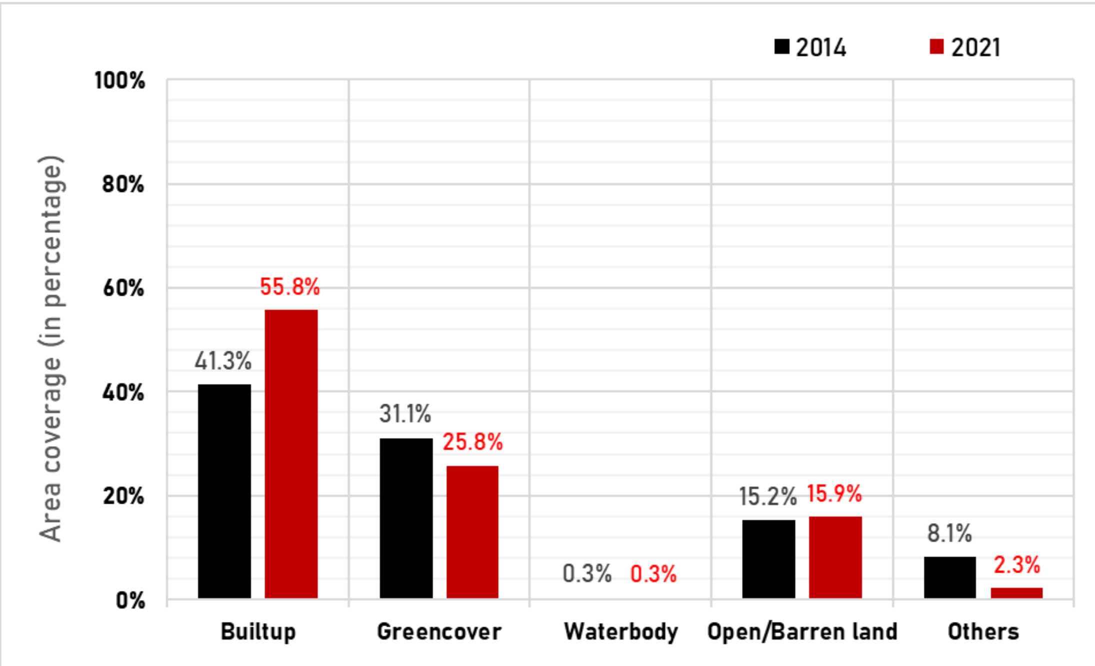


Note: Heatwave months (Dec-Jan) are chosen to analyze the Land Surface Temperature (LST). The respective date of acquisition of the images are Jan 16, 2014, and Dec 13, 2024.

Source: CSE analysis of Landsat 8 satellite images from United States Geological Survey (USGS) Earth Explorer.

Johannesburg: Heat and changing land-use

Land Use Land Cover Change – Johannesburg 2014 vs 2021



Surface Temperature by Land Cover

Land Cover	Land Surface Temperature (°C)		Change (°C)
	2014	2024	
Built-up	41.5	51.2	9.7
Green cover	38.8	48.7	7.8
Waterbody	35.0	41.4	6.5
Open/Barren Land	42.2	50.9	8.7
Others	41.3	47.0	5.7

Built-up area has increased by 15% in a decade,

An increase **of 9.7 °C from 2014 to 2024 in built up areas**.

•Expansion of impervious surfaces is **strongly linked to rising land surface temperatures**

•Even, water bodies recorded an increase of +6.5 °C,

Source: CSE analysis of Landsat 8 satellite images from United States Geological Survey (USGS) Earth Explorer.

Why is Africa more vulnerable?

Growing vulnerability: Heat-related illnesses; food insecurity; loss of labor productivity; Cooling needs rising. Urban heat island effects worsening discomfort.

Population by country at high risk due to a lack of access to cooling

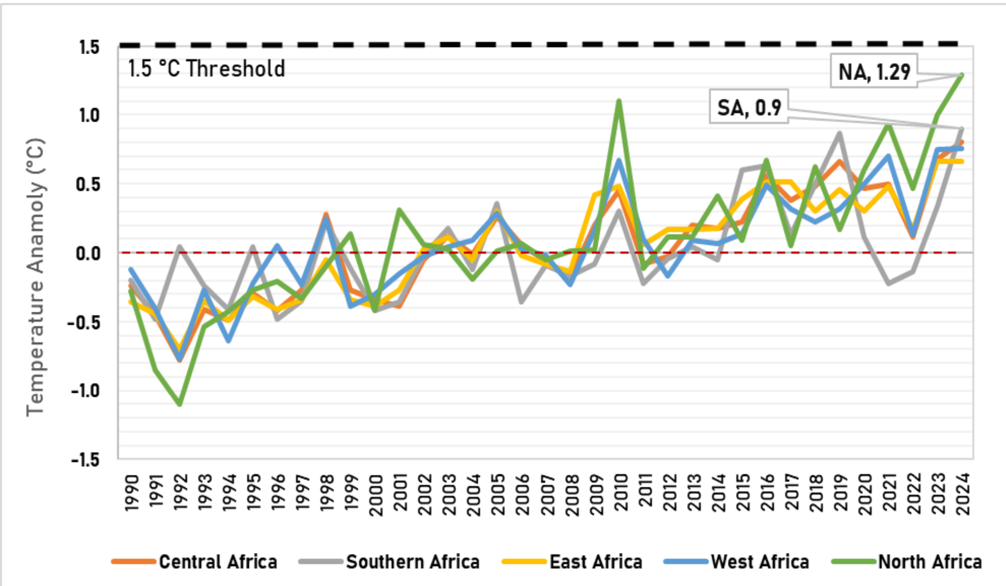
Source: Chilling Prospects 2022, SE4All

More than half of African nations are at a high risk from growing heat.

- Guinea-Bissau and Somalia: More than 90% of their total populations at a high risk.
- Angola, Benin, Liberia, and Mozambique have over 80 percent of their populations classified as high risk.
- **+34% perinatal mortality risk** linked to modest temperature rise (Sub-Saharan Africa).
- **Outdoor Workforce at Risk:** Agriculture, construction, mining workers face productivity loss & health risks; up to 5% of working hours lost annually by 2030.
- **Agricultural productivity declines** expected, with **Western Africa hardest hit**.

Growing risks

Annual region-wise surface temperature (1900–2024)



Note: Temperature difference calculated from 1991 – 2020 average. NA –North Africa; SA- South Africa.

Source: NOAA Global Surface Temperature Dataset (NOAAGlobalTemp), Version 6.0; WMO

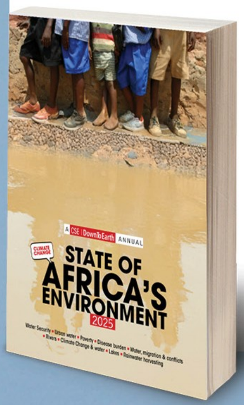
- **Ethiopia: 5–10% agricultural GDP loss** from climate-driven yield decline.

- **Southern Africa's hydropower at risk** from higher heat + reduced rainfall.
- Zambezi Basin: Reduced inflows during hot, dry spells causing repeated **power shortages at peak demand.**

- **Low Adaptive Capacity:** 600 millions Africans lack electricity (43% of population). 970 million without clean cooking access; LPG unaffordable for 30 million.
- **Urban Poor Most Exposed:** Informal settlements with corrugated metal/concrete trap heat indoors, often hotter than outside.
- Informal housing faces 6–10 hrs/day of extreme heat in summer. Vulnerable groups face high exposure + high sensitivity + low adaptive capacity.

- **Cooling is Unaffordable:** High cost of appliances & weak public health systems leave cities ill-prepared.
- Lagos & Johannesburg show how rapid urban growth and local geography shape heat risks differently

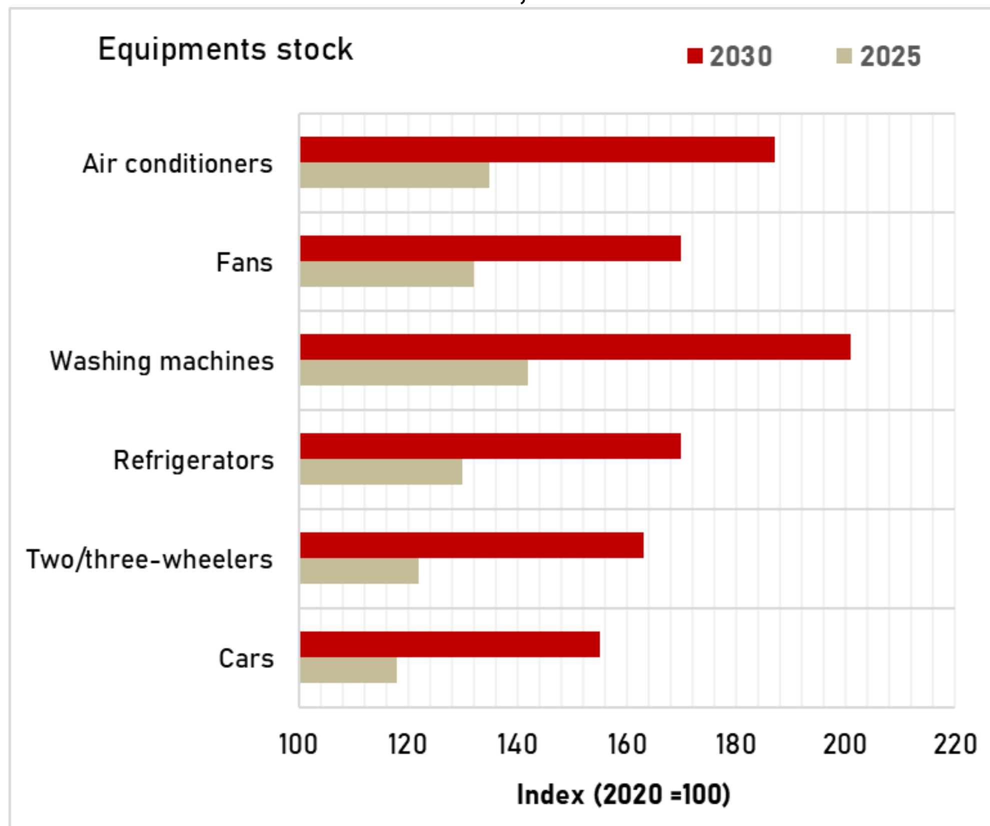
Heat an cooling demand and need for thermal comfort



Impact of growing heat on cooling and electricity demand

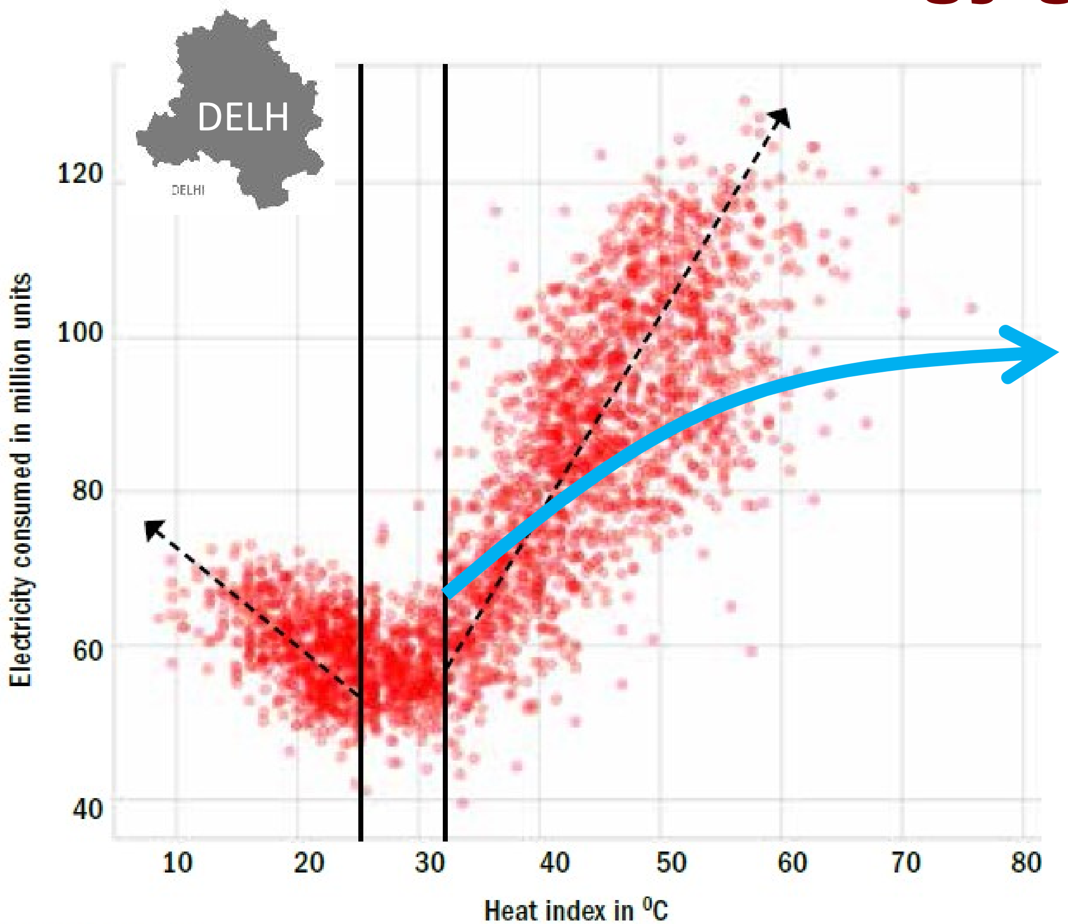
- **World's lowest per capita use of modern energy**, but demand is set to **grow rapidly due to rising heat & cooling needs.**
- **Household electricity demand to more than double** from **160 TWh to 350 TWh by 2030**.
- **Sub-Saharan Africa (excl. South Africa)** - fastest growth, electricity use for appliances set to **quadruple by 2030**.
- **Global contrast:** AC ownership in Africa = **0.08 units/household** today → rising to **0.10 by 2030** & **0.25 by 2050**, compared to **0.7 global average** and **2.2 in the US**.

Growth in selected energy-related economic activities in Africa in the SAS, 2020-2030



Source: International Energy Agency 2022, Africa Energy Outlook

Example from Delhi: link between thermal discomfort energy guzzling



Energy demand shoots up dramatically beyond 32 °C **ambient temperature.**

Source: CSE analysis

Global dumping of old and used appliances locking in high electricity demand

Massive dumping of old and second hand air conditioners; more energy inefficient; use ozone depleting refrigerants.

- **Old air conditioners consume two to three times more electricity** than new models. (Yale Environment)
- **35% of new room air conditioners sold in Africa's 10 largest countries in 2018 were low-efficiency units** that could not be sold legally in the countries of origin, including the United States, Japan, South Korea and China. (CLASP and IGSD)
- **More efficient appliances cost two to three times as much as used ones, but consume a third as much electricity.**
- **Energy Savings Potential (IEA, 2022):** Banning lowest-efficiency appliances → save **40 TWh** of electricity demand **by 2030** in Sub-Saharan Africa (~ one-third of today's appliance demand). More stringent MEPS & cooling design → avoid **~20 TWh by 2030, equal** to **4,400 MW gas power capacity** (~USD 2.7 bn construction cost). **By 2030 -** Efficiency of refrigerators & ACs could rise by **~50 per cent.**

Combating global dumping

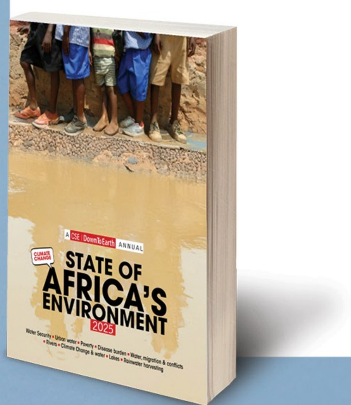
- **Several African countries joined a United Nations working group to stop this trade**. Such dumping can be illegal under Basel Convention, international treaty governing hazardous waste, and the European Union's Waste Shipment Directive

- **Casablanca Declaration (2022):** Union of African Associations of Refrigeration and Air Conditioning Stakeholders (U-3ARC) pledged to end dumping of obsolete air conditioners in Africa. Supports Kigali Amendment goals - Promotes low-global warming potential (GWP) refrigerants & energy-efficient cooling.

- **Ghana's Leadership (Cooling Efficiency)** 2008: **Ghana banned imports of used ACs & refrigerators** under Energy Efficiency Regulation (LI 1932). Full enforcement from Jan 2012. Old appliances wasted ~30% electricity & used CFC gases.

- **African Regional Action:** Countries with mandatory **minimum energy performance standards (MEPS)** for cooling devices: ECOWAS members, Benin, Ghana, Nigeria, Senegal Algeria, Egypt, Kenya, Rwanda, South Africa, Uganda.

Need heat management and thermal comfort in buildings as regions are urbanizing and construction industry is growing rapidly



Africa in grip of rapid construction

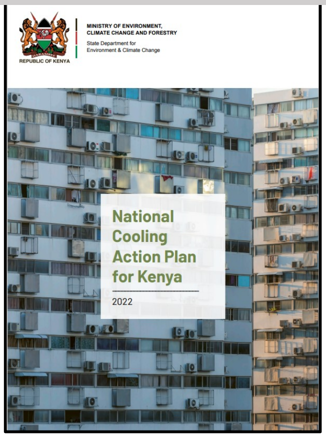
- **UNEP: 80% of new floor area growth in low-income countries without stringent building codes by 2030**. ***But a large share of the future building stock are yet to be built. This is an opportunity.***
- **Africa's building floorspace to quadruple by 2070** (90% residential) (Source: Science Direct, 2024). Total building floorspace in Africa will increase at a CAGR of 3.0% between 2000 and 2070. Infrastructure to advance at a 9.4% CAGR through 2030.
- **Conventional on-site construction dominates (85.7%), but prefabricated & modular methods growing fastest** (10% CAGR by 2030).
- **New buildings are 71.6%** of the Africa construction market share in 2024,-- **Renovation to expand at a 9.5%** CAGR to 2030. (Source: Africa Construction Market Analysis by Mordor Intelligence)
- Egypt leads Africa's construction market (37.8%), while Kenya is the fastest-growing (9.1% CAGR to 2030).
- **Sector share:** Residential = 38.6%; Infrastructure = 9.4% CAGR growth.
- **Massive affordable housing unit shortfall. Nigeria:** 28 million units; **DRC:** 3.9 million; **South Africa:** 3.7 million deficit**Kenya:** ~2 million deficit..
- **Need climate-responsive, passive building design** to improve thermal comfort

Towards National Cooling strategies

- **40% of African countries** have/are planning **mandatory cooling equipment standards**; ~20% for refrigeration.
- **Central focus is on cooling technologies, energy efficiency and refrigerants.** Energy efficiency standards and labelling of energy efficient appliances.
- **Only a few countries have added passive architecture and material for heat management in buildings.** green and blue infrastructure.
- **Green-certified buildings** are also expanding across Africa
- Countries are addressing climate extremes through **adaptation plans, NDCs, and green building codes**—e.g., **Ethiopia's CRGE Strategy** promotes sustainable, climate-resilient construction.
- **Need national and sub-national action plans and action** on building regulations and capacity building for passive cooling, and, heat resilient city planning to mitigate UHIE. Upgrading housing with cool roofs, insulation, and passive design strategies reduces indoor heat exposure and lowers energy demand for cooling.

Africa: National Cooling Action Plan: Focus areas

Kenya



Targets:

- Efficient cooling appliances
- Natural, low Global-Warming-Potential (GWP) refrigerants.

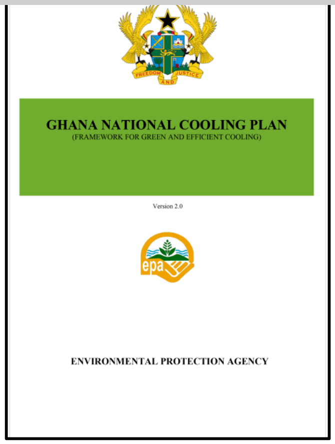
Mentions:

- Passive cooling in building codes, cool roofs, standards & labelling for ACs/refrigerators.

Not in focus

- Thermal Comfort

Ghana



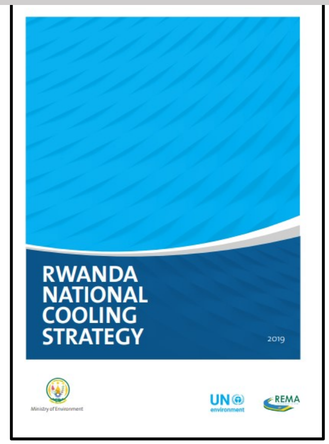
Targets:

- Minimum Energy Performance Standards
- efficient cooling appliances; Natural, low GWP refrigerants.
- Cool roofs, shading, efficient appliances, ECOFRIDGE program to replace outdated units.

Not in focus

- Thermal Comfort
- Passive cooling

Rwanda



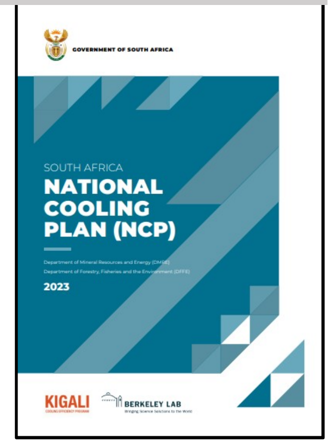
Targets:

- MEPs, Energy efficiency codes, subsidies for efficient appliances, bulk procurement strategies for lighting; Low-energy building standards to cut energy use by up to 80%.
- ment.

Not in focus

- Thermal Comfort
- Passive cooling

South Africa



Targets:

- Energy-efficient cooling products to support refrigerant transition under the Montreal Protocol & Kigali Amendment.
- MEPs
- Building codes
- Cool roofs

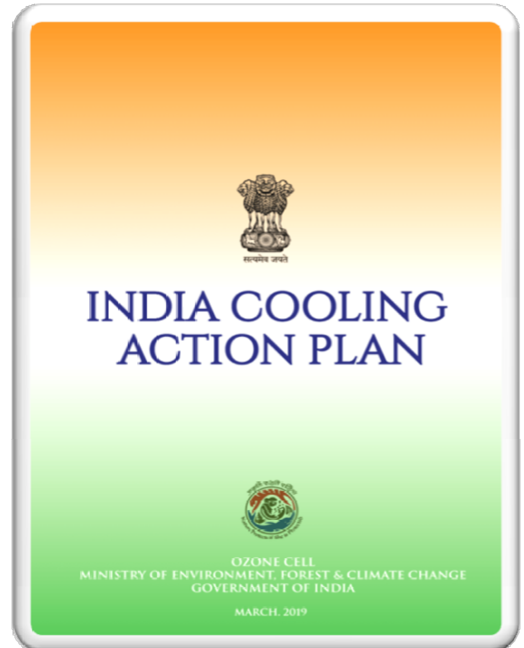
Not in focus

- Thermal comfort strategies

India National Cooling Action Plan

The India Cooling Action Plan (ICAP) was launched in March 2019

- Thermal comfort for all
- Sustainable Cooling
- Reduce cooling demand across sectors by **20% to 25%** by 2037-38.
- Decrease refrigerant demand by **25% to 30%** by 2037-38.
- Cut cooling energy requirements by **25% to 40%** by 2037-38.



Aims to achieve this by:

- Passively-cooled building design
- Adoption of adaptive thermal comfort standards
- Promoting the use of energy-efficient appliances
- Promoting non refrigerant and not-in-kind technologies
- Training and certification for RAC service technicians
- Deployment of low-GWP refrigerant alternatives

Passive Design / Buildings

- Building energy codes.
- Adaptive thermal comfort standards.

Equipments

- Increased energy efficiency of equipments
- eco-labelling

Space cooling

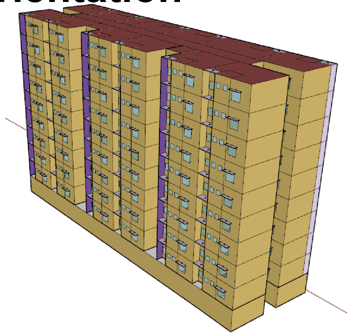
- Non refrigerant cooling
- Not-in-kind cooling

Skill building and Research

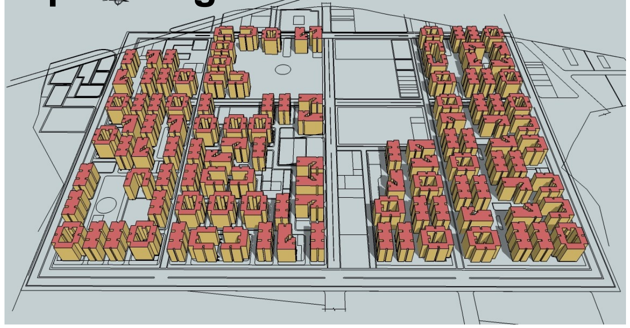
- R&D innovation ecosystem
- Training and certification

Changing building design, orientation and material impact energy intensity – examples from India

Unfavourable orientation



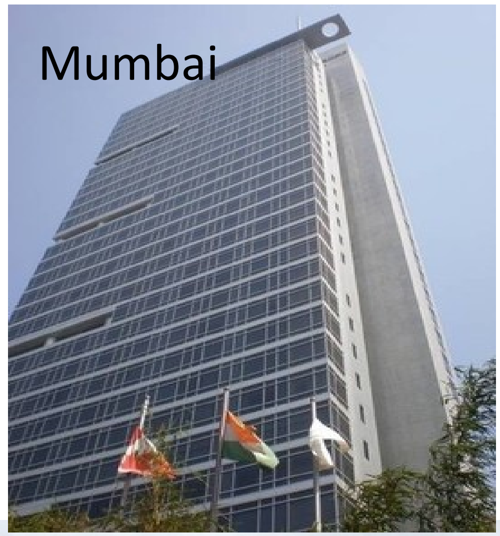
Climate Non-responsive master planning



Energy inefficient construction materials.

Losing connect with local material, design and climate: Creating heat trapping glass façade and air conditioned spaces


Addis Ababa


Mumbai


Kolkata


Chennai


Bangalore


Noida

ANIL AGARWAL ENVIRONMENT TRAINING INSTITUTE, Neemli

TOTAL SITE AREA **11 Acres**	CLIMATE ZONE **Composite**
ESTABLISHED IN **2017**	LOCATION **Neemli, Rajasathan**

PASSIVE MEASURES APPLIED

Reduced cooling demand through passive measures employed

Microclimate enhancement
- Plantation on site
- Permeable pavement

Building form
- Courtyard
- Mutual shading
- Orientation

Envelope/Material
- Shaded windows
- Insulation
- Buffer zones
- Insulated and Cool roofs
- Minimal fenestrations in East/West

ACTIVE COOLING TECHNOLOGIES APPLIED

Low impact cooling

Indirect-Direct-Evaporative Cooliing

Campus employs a three stage cooling system

Refrigerant based cooling

HVAC System

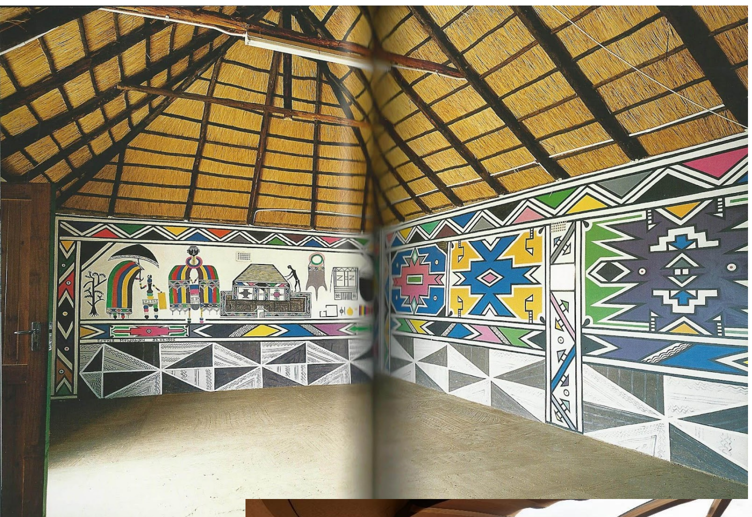
- Heat recovery for hot water generation
- Use of natural refrigerant R 290

R 290

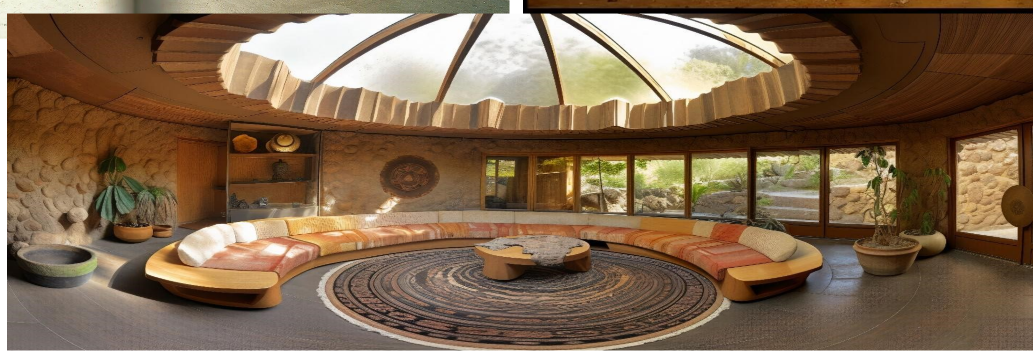
Fusion of tradition and modern architecture

Traditional techniques and material can be adapted in modern buildings to reduce energy and material intensity of the structures

Ndebele houses in South Africa



The Great Mosque of Djenné:
Made of sun baked bricks



Earth architecture, using materials like mud, clay, sand, and straw, bamboo, timber, natural stones, rammed earth,- adapting to modern buildings

Source: Safiya Yahaya, 2024

Need climate sensitive buildings
Drawing lessons from our local wisdom









Create opportunities – more creative use of building orientation, positioning of interior spaces according to direction, variation in glazed area according to orientation of façade, combination of appropriate building material etc

Practitioners and architects are integrating local techniques and materials with modern construction

Need roadmap for heat management for co-benefits

Go beyond the technocentric focus on energy efficiency to address vulnerability, equity and heat resilience at building and city level -- Need heat management plan

- **Cooling Action Plans (CAPs):** Mostly align with Montreal Protocol, focus on refrigerants and energy efficiency; some integrate passive design, greening, and water bodies. Most African countries have Cooling Action Plan (**CAPs) but Heat action Plan (HAPs) lagging behind**.

Towards Heat Action Plans

- Only **Sierra Leone (2025)** has adopted a **Heat Action Plan:** Cooling corridors and green spaces to reduce heat exposure, infrastructure improvements to adapt urban areas to rising temperatures; protective measures for vulnerable groups, including women, children and the elderly. Public awareness campaigns on heat-related risks and solutions.

Heat Action Plans are needed to address:

- **Local context of climate impacts** → adopt urban planning, buildings design, material approaches to reduce heat load and address differentiated vulnerabilities of groups
- Early warning systems, disaster preparedness, emergency health infrastructure.
- Urban resilience of built structures and housing, reliable energy, greening, and inclusive planning.

Green and blue infrastructure

Green and blue infrastructure is critical for mitigating urban and regional heat. **Can lower surface temp by up to 2°C and enhance thermal comfort by 10°C. --** Added benefits: better air, biodiversity, storm water control, carbon storage.

Water bodies recording increase in surface tempertaure

- **Lake Tanganyika:** surface temperature risen by about 1.3°C, -- deep waters have warmed by 0.2°C;
- **Lake Malawi's** deep waters have warmed by ~0.7°C over the past six decades.
- **Lake Chad:** Declining depth accelerated summer warming and altered regional temperature gradients,
- **Egypt's Toshka Lakes:** exposed bare soil and salt crusts heat more quickly.

Reduced water volumes, surface heating, drought, evaporation, water abstraction, land use changes, and altered hydrological cycles are the factors. (South African journal of Geomatics in 2019)

- **East African rift lakes**. Warmer air and increased long-wave radiation from the atmosphere add to this heating, while stratification reduces mixing and traps heat in deeper layers.

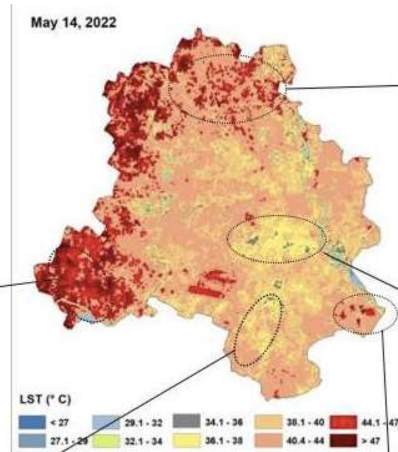
Green areas recording rises in surface temperature

Green areas recording rises in surface temperature due to fragmentation, reduced patch size, irregular shapes, and increased edge density, -- weakening their cooling capacity. Policy and regulations on green and blue infrastructure is developing in Africa.

Strengthened regulations at the municipal and regional levels.

Lesson from Delhi

Hotspot: Jaffarpur Kalan, Daulatpur, Daryapur Khurd



Hotspot: Narela, Alipur, Bawana, Khera Kalan

Coldspot: Civil Lines, Raj Ghat, Jhandewalan

Coldspot: Munirka, Sultanpur

Hotspot: Badarpur, Jaitpur

Type, quality and spread of vegetation matter

Unshaded region	Shading due to palm tree	Shading due to large canopy tree
LST > 40.0°C	LST = 35.9°C	LST = 29.7°C

Effective vegetation cover can be responsible for decrease by as much as ~ 5°C - 10°C

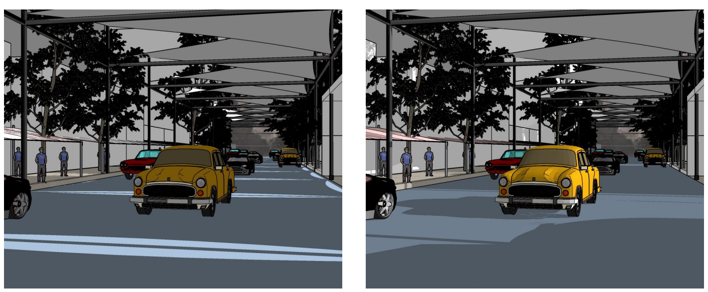
Source: CSE Urban Habitat

Tackling heat at street-scale: Potential solutions

Shading

Shading with help of tree placement.

Shading with help of tensile membranes.



Microclimate

Microclimate enhancement through trees, vertical greens and swales; Quality of green, distribution of green foliage matter. Strategic placement of trees offers numerous benefits above artificial shading devices. Trees facilitate evapotranspiration through their leaves, which helps cool

Source: CSE Urban Habitat

What is needed for heat management plans?

Implement Heat Management Action Plan to reduce urban heat load through infrastructure development; Integrate climate indicators into urban and regional planning & infrastructure development. Expand green & blue spaces to cut urban heat.

Vulnerability assessment – special focus on the vulnerable groups -elderly, children, women & low income groups

Strengthen Health & Early Warning: Establish early warning systems & health surveillance networks.

Implement Thermal Comfort measures in Buildings

- Implement thermal comfort standards; Enforce design & material guidelines for heat resilience –(passive cooling, orientation, shading & ventilation)
- Upgrade informal housing with building design for ventilation and day lighting, cool roofs & appropriate material and insulation; Retrofit infrastructure & informal housing for thermal comfort.
- Energy efficiency codes & labelling for buildings and appliances;
- Integrate locally available sustainable and low cost material to reduce energy and material intensity of structures .

Stop dumping of old and energy inefficient appliances and air conditioners: Adopt stringent regulations, and energy efficiency standards; Leverage domestic policy and international treaties on waste to stop dumping

What is needed for heat management plans?

Build energy resilience in built structures

- Affordable renewable-powered cooling innovations. Reliable, clean energy access for cooling.
- Rooftop solar + efficient buildings to cut peak demand
- Address energy poverty → fans, refrigeration, AC access for vulnerable groups.

Expand Green & Blue Infrastructure

- Urban planning guidelines for **material use, greening, and water bodies** Strengthen **municipal-level regulations**
- Nature-based solutions: urban forests, wetlands, agroforestry.

Financing & Governance

- Make heat a core adaptation priority in policies to enable convergence funding across sectors
- Mobilize **r**egional & international funding (AU, AfDB, climate funds)
- Strengthen governance & cross-sectoral planning

Build regional collaboration (AU, AfDB, UNEP) → harmonization, standards, building codes, financing.

Data & Research Gaps

The warning: IPCC, Working Group-I, Sixth Assessment Report (AR6 WG-I): -- It is almost certain that the frequency and intensity of heat extremes and duration of heat waves have increased since 1950 and this will keep increasing even if global warming is stabilized at 1.5°C.