



ASSESSING URBAN HEAT ISLAND IN WEST AFRICA

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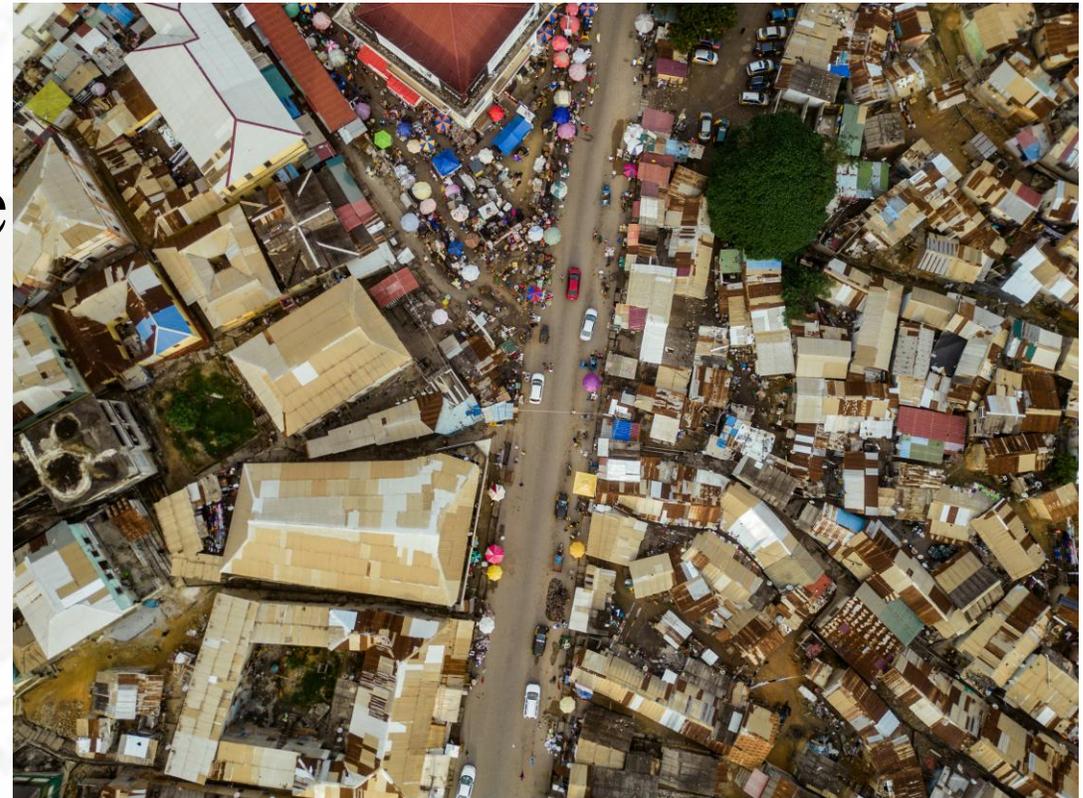




**Climate change is intensifying
extreme heat episodes,
especially in tropical regions.**

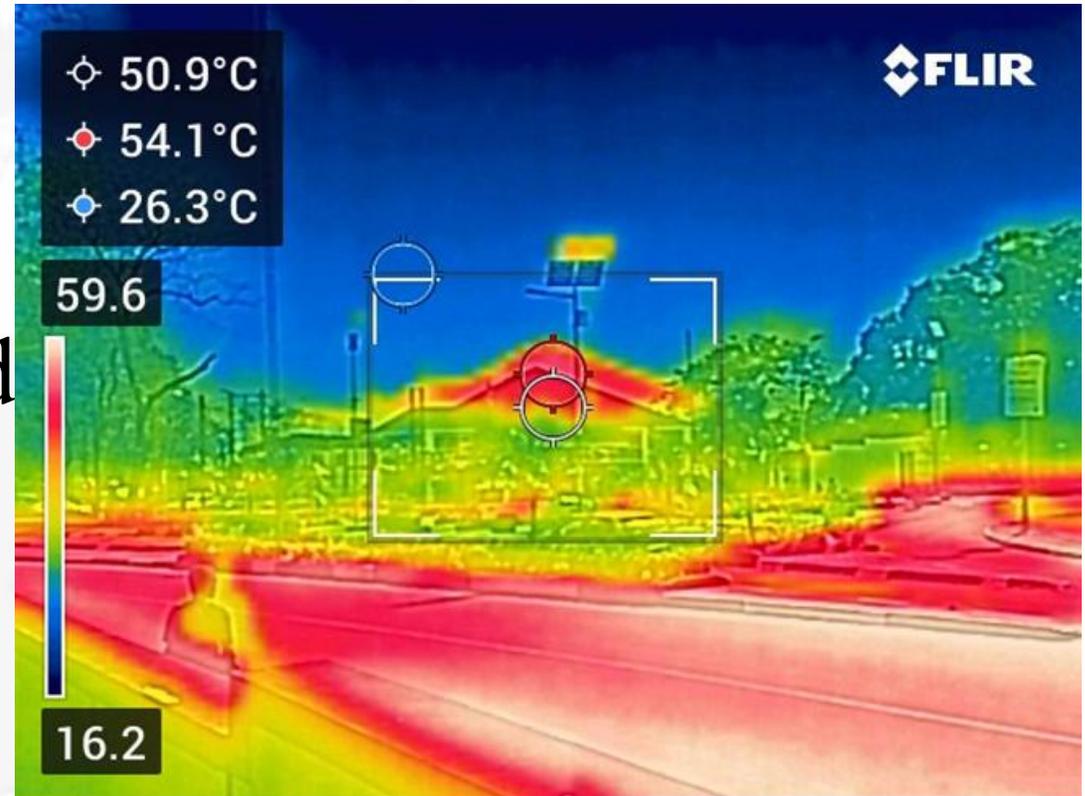


West Africa is rapidly urbanizing
By 2030, over half of West
Africa's population will live
in cities (CDD, 2018)





- There is a critical need
- to understand physical
- drivers of urban heat
- to develop monitoring and
- mitigation strategies.



Urban Heat

What is it?



Definition

Urban heat refers to the phenomenon where urban areas experience significantly **higher temperatures** than their surrounding rural regions, primarily due to **human activities and modifications to the natural landscape**. This effect is widely known as the **urban heat island (UHI) effect**.



Impacts of Urban Heat

- **Health Risks** – Exposure to extreme heat increases risks of heat-related illnesses, including heat strokes and cardiovascular issues (Li & Bou-Zeid, 2013).
- **Higher Energy Consumption** – Increased use of air conditioning leads to greater electricity demand and carbon emissions (Santamouris et al., 2017).



- **Poor Air Quality** – Elevated temperatures accelerate the formation of ground-level ozone and smog, worsening respiratory problems (Stone, 2005).
- **Water Stress** – Higher evaporation rates and increased demand for cooling water put pressure on water resources (Pataki et al., 2011).

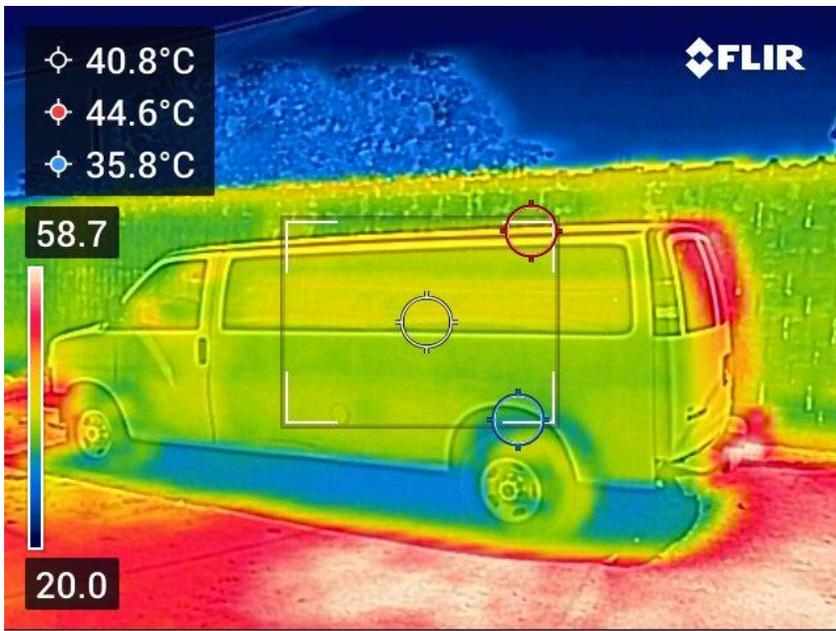


- **Ecosystem Disruptions** – Rising urban temperatures can alter local biodiversity, affecting plant and animal species (Grimm et al., 2008).

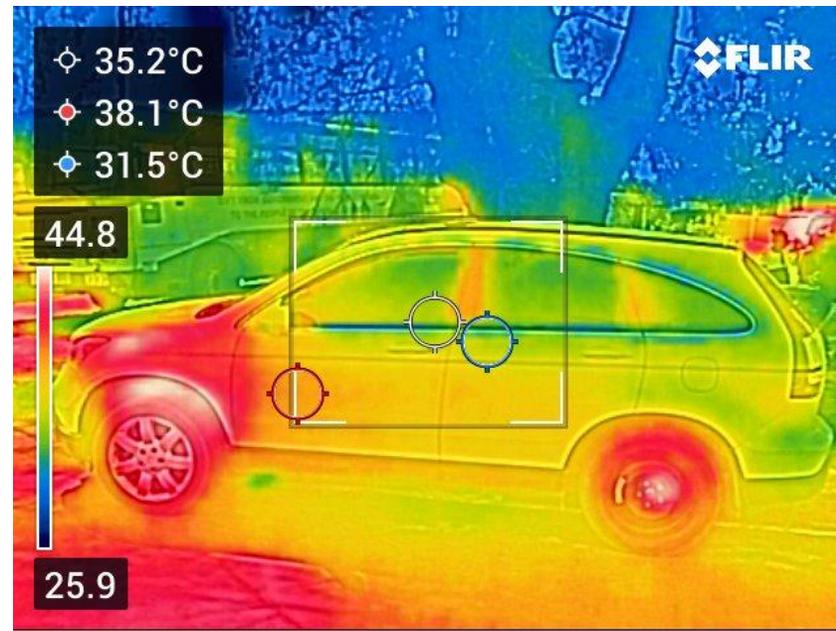




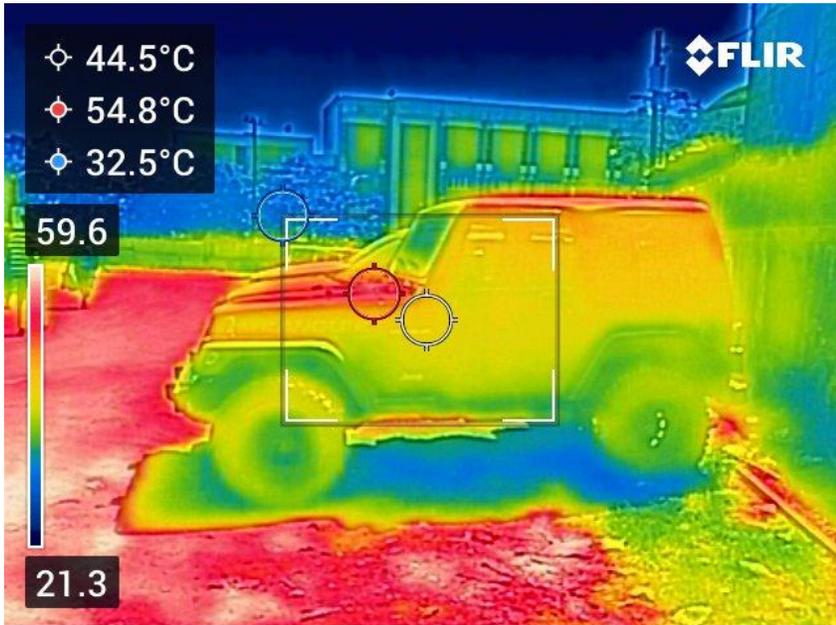




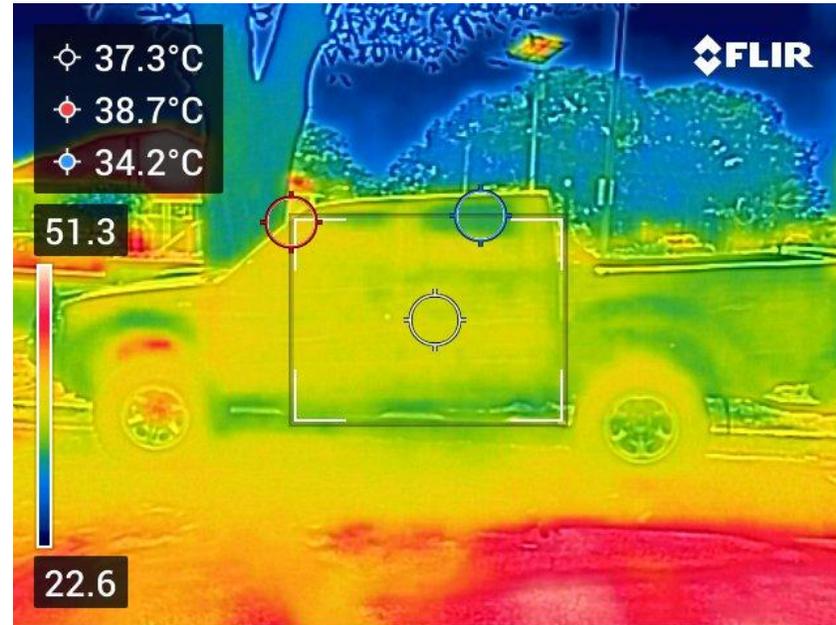
White Car in sun



The Engine area is very hot as compared to the body and glass. The tyre is very hot as well. The rear glass of the bus was identified as experiencing hotness.

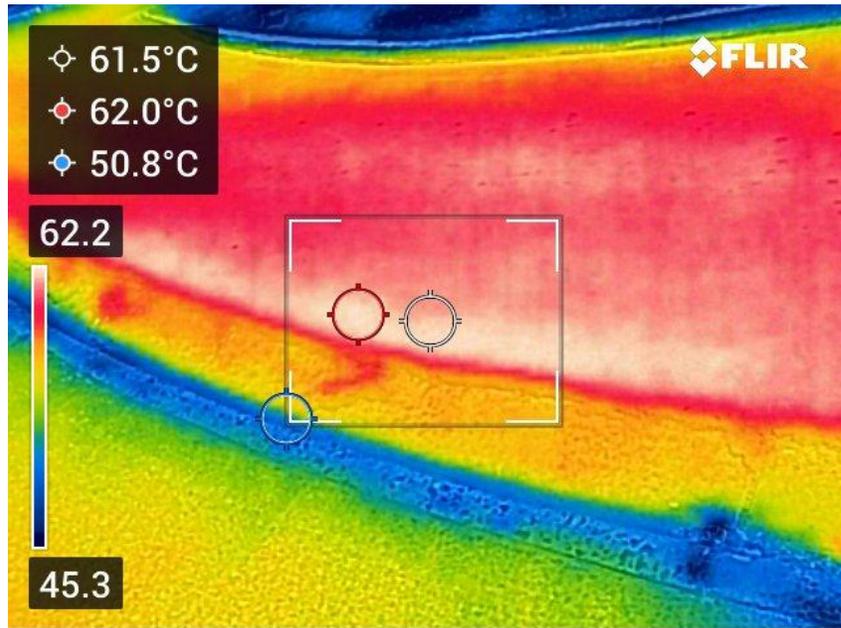


Black Car in sun

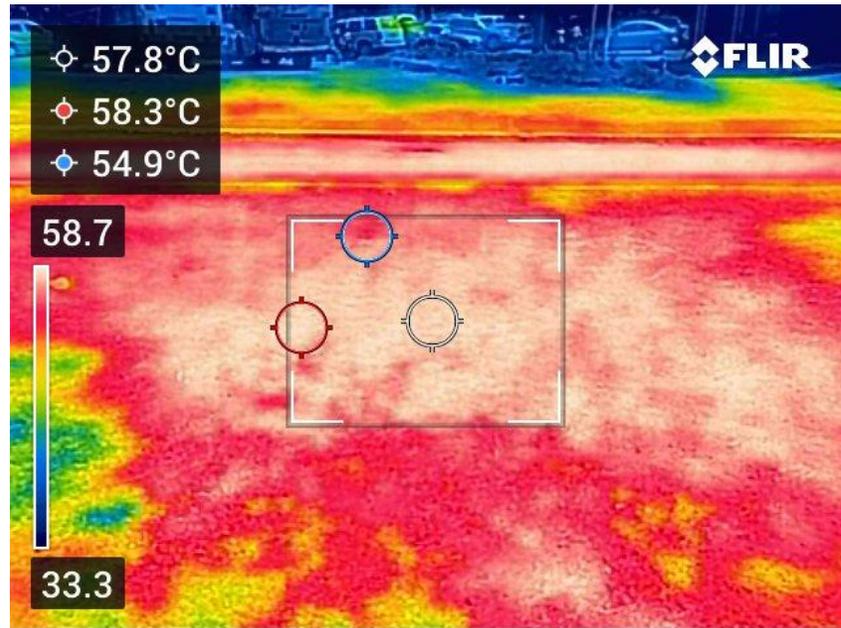


The area that experienced hotness is around the engine. The road is very hot as well. Abeido technique should be adopted.

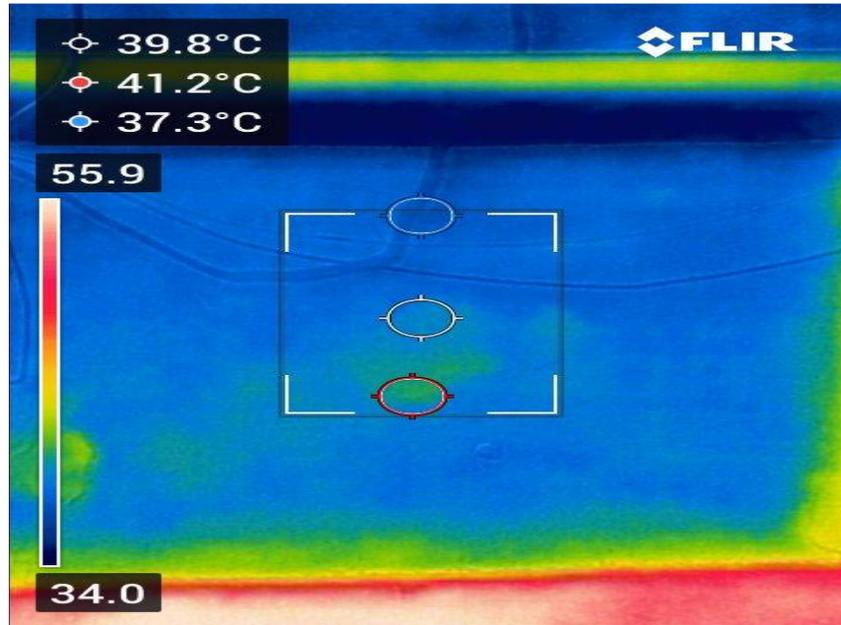
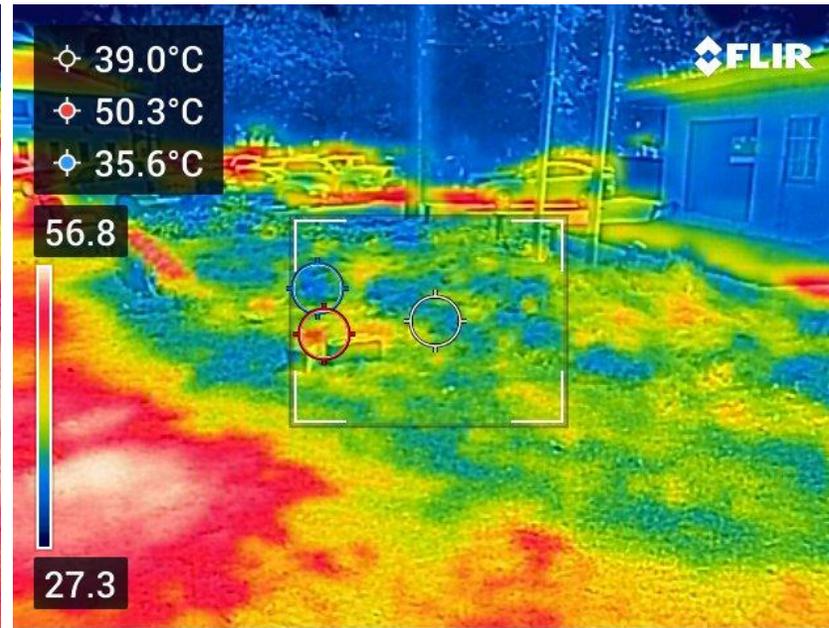
Tarred ground surface



Tarred ground surface



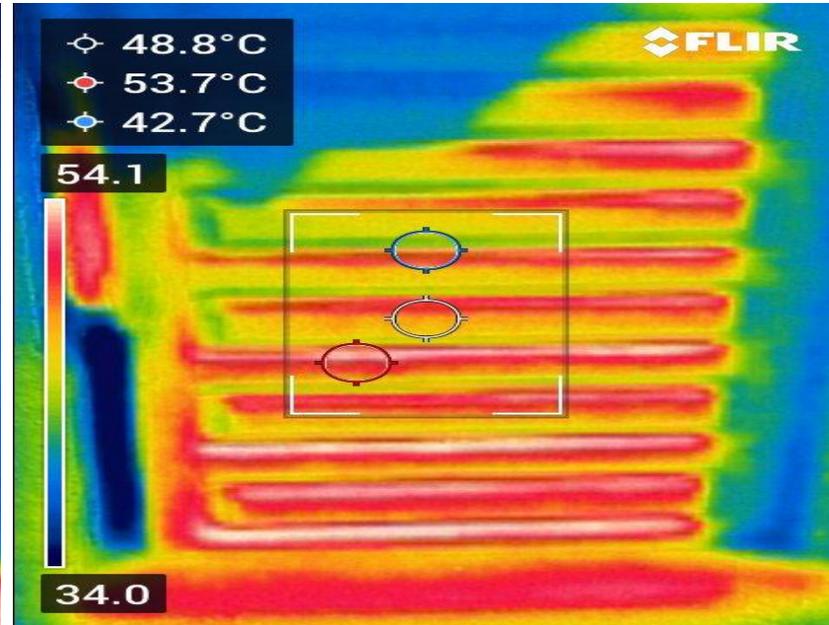
Tarred ground surface



Concrete vertical surface



Metallic vertical surface

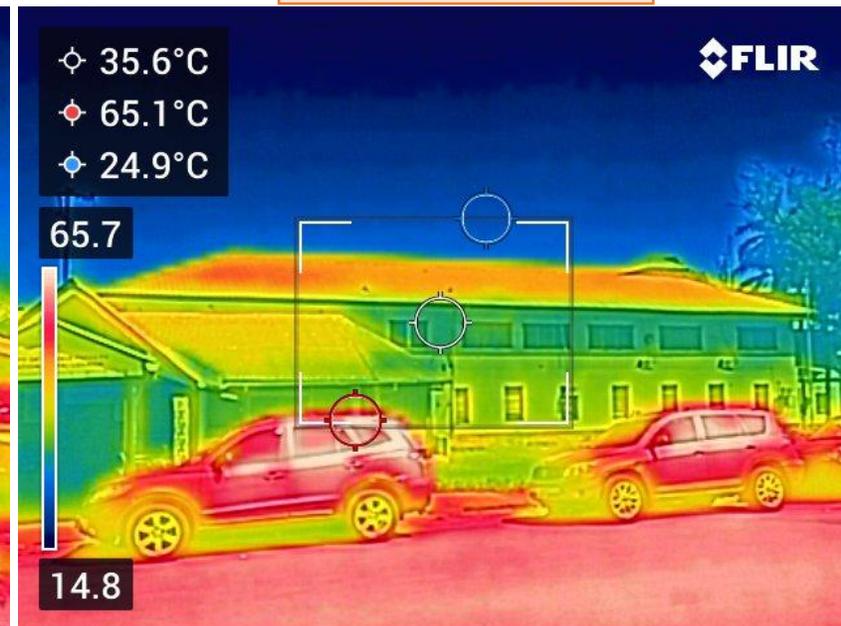


Wood vertical surface

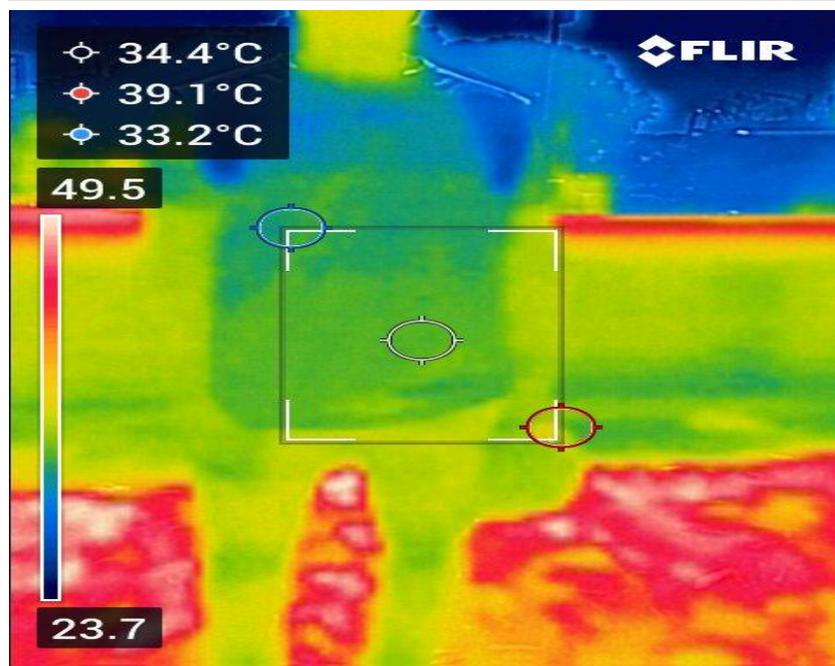
Aluminium roof



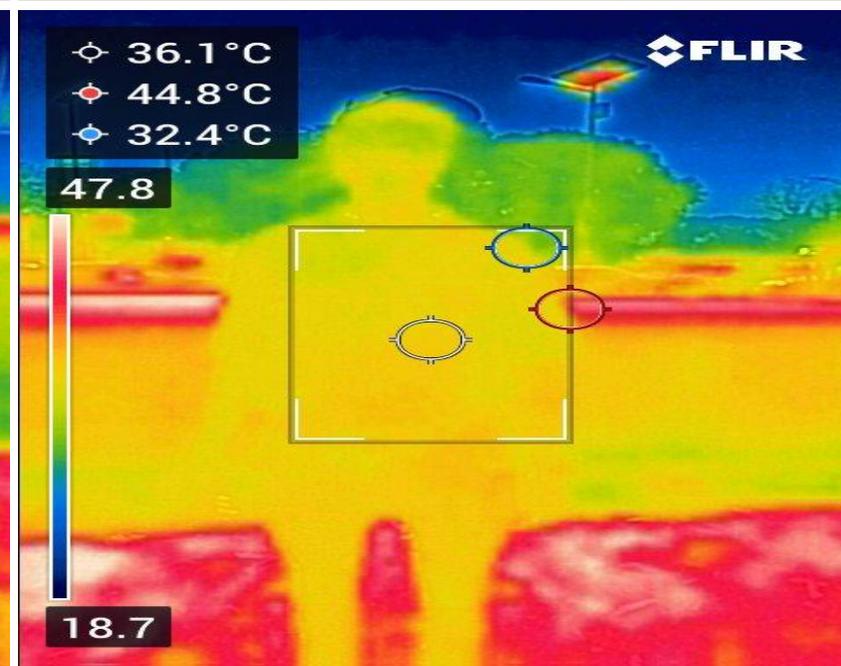
Grey expanded roof



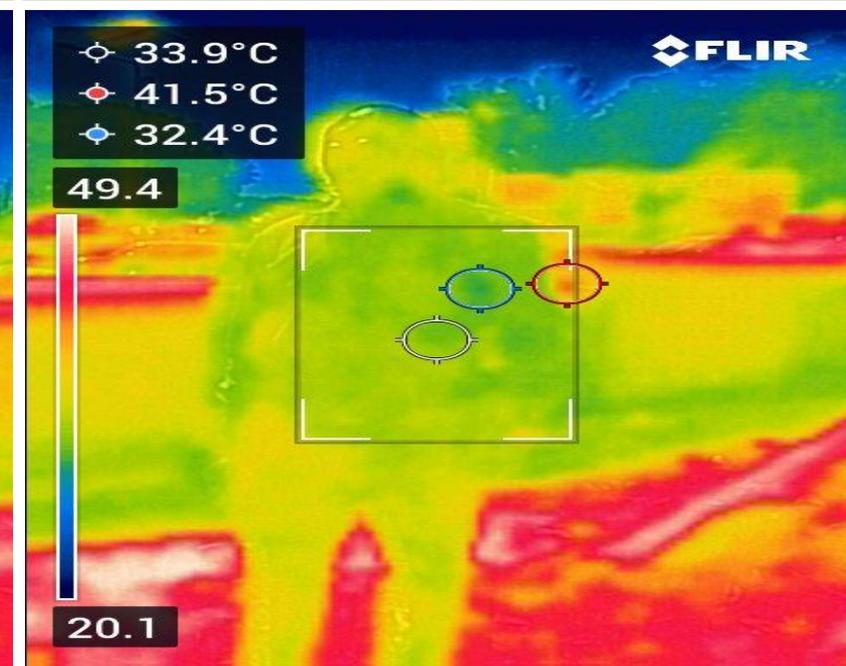
Green expanded roof



Person in white shirt

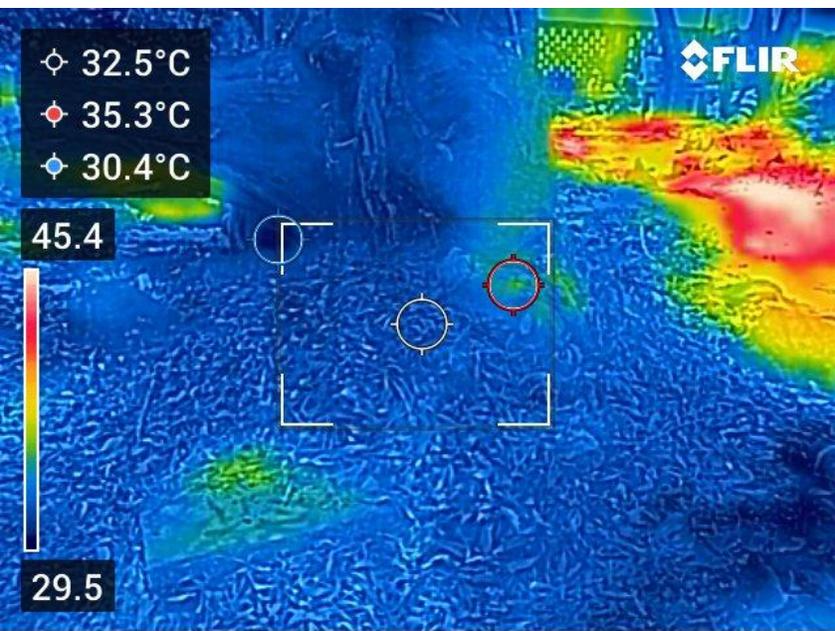
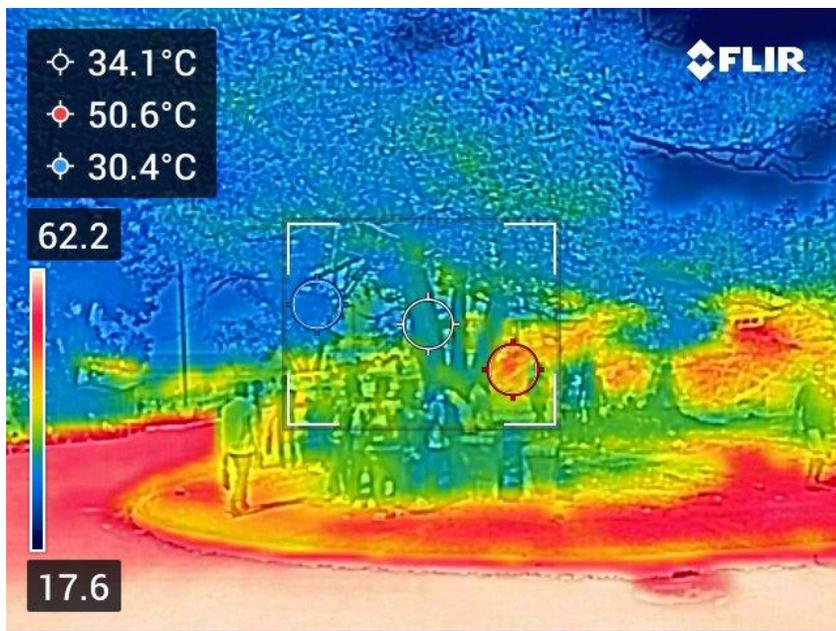


Person in white black



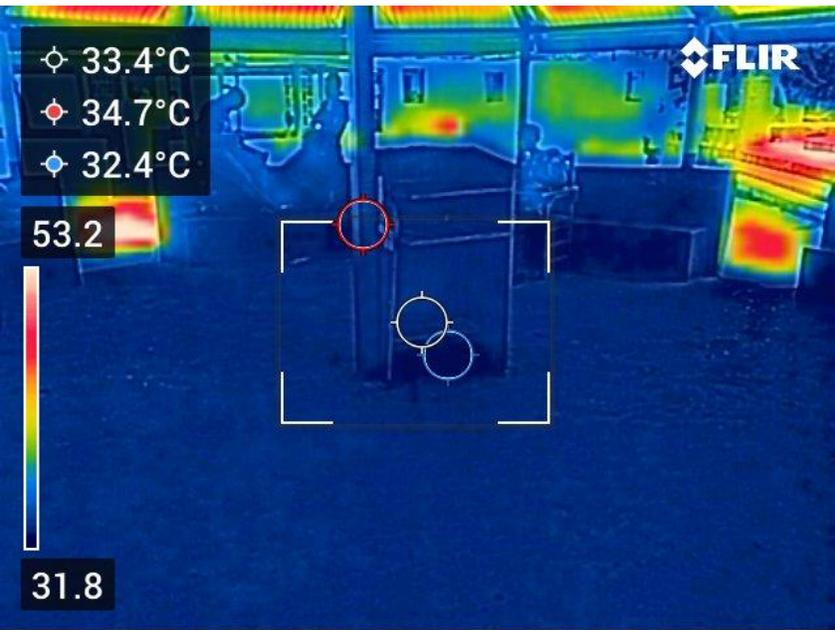
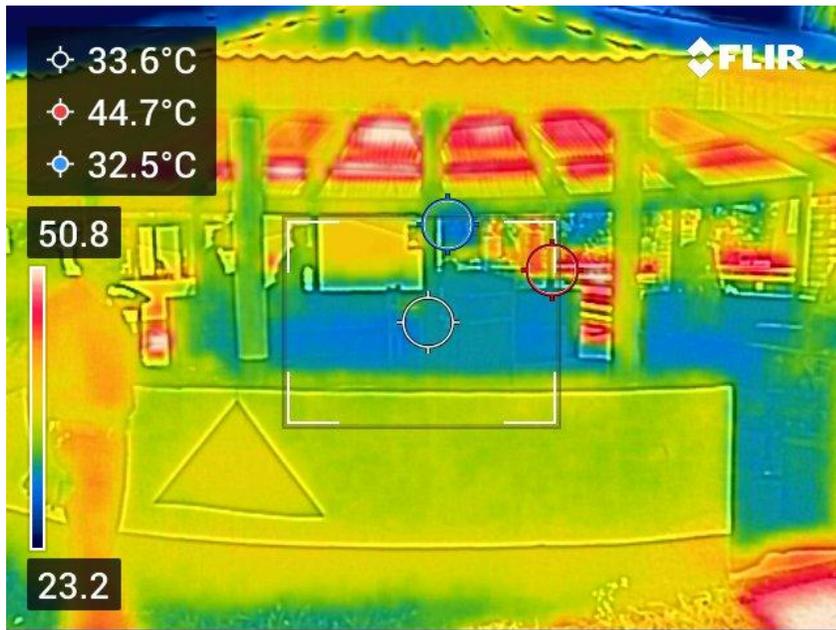
Person in white blue

Tree canopy with people



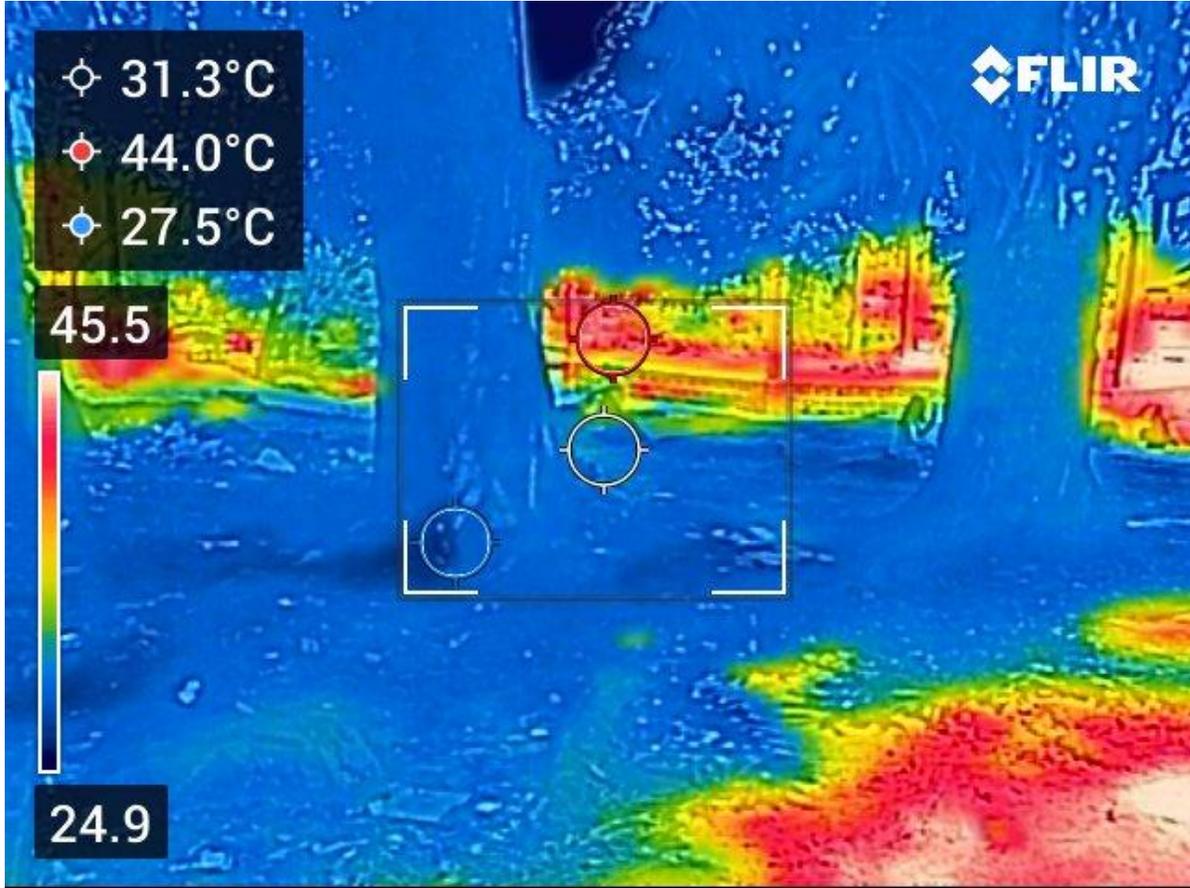
The canopy provided shed for the people experiencing a cooling area

Summer hut (Outside)

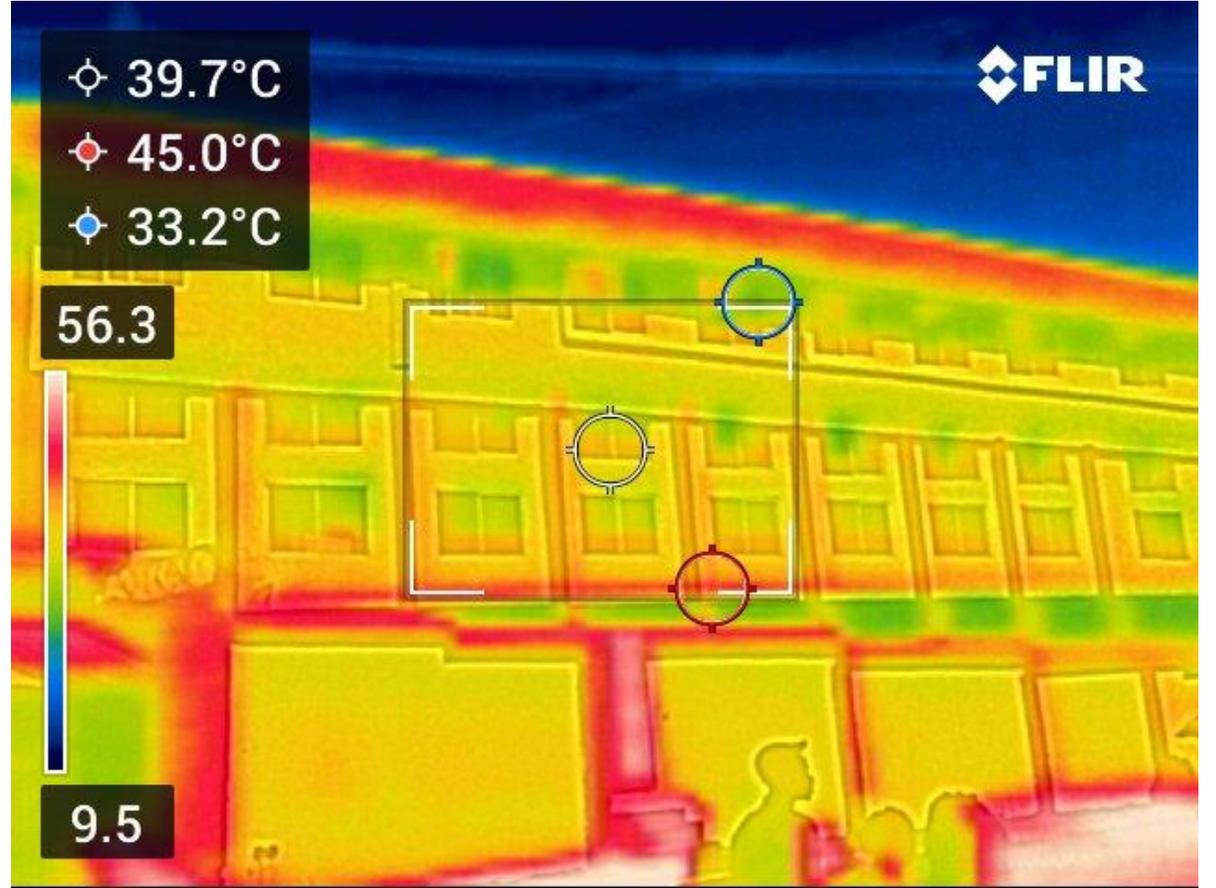


Only the roof top were experiencing hottness

Mango canopy



Glass vertical surface





Importance of nighttime temperatures

- **Heat risk is cumulative:** Lack of nighttime cooling prevents physiological recovery (Basu & Samet, 2002).
- **High minimum temperatures** are more strongly associated with mortality than daytime peaks (Kuras et al., 2017).
- **Social equity issues:** People without A/C or in poorly ventilated housing are more exposed to high *indoor temperatures* at night.
- **Urban heat island** impacts on air temperature are greatest overnight.



Physical Causes of Urban Heat Summary

1. **Concrete & Asphalt (impervious surfaces)** – Urban infrastructure, such as buildings and roads, alters surface radiation and energy balance.





1. **Lack of Vegetation** – Reduced tree cover limits shading and evapotranspiration, which are natural cooling processes





Waste Heat from Human Activities – Heat emissions from vehicles, air conditioning, and industrial processes add to urban temperatures





1. **Dark Surfaces** – Conventional materials like asphalt and dark roofs have low albedo, meaning they absorb more solar radiation than natural landscapes





1. **Air Pollution** – Some pollutants,
2. such as greenhouse gases
3. and aerosols, trap heat and
4. exacerbate warming in cities





- **Building Density** – High-rise buildings
- and narrow streets can trap heat,
- reducing air circulation and increasing
- localised warming.

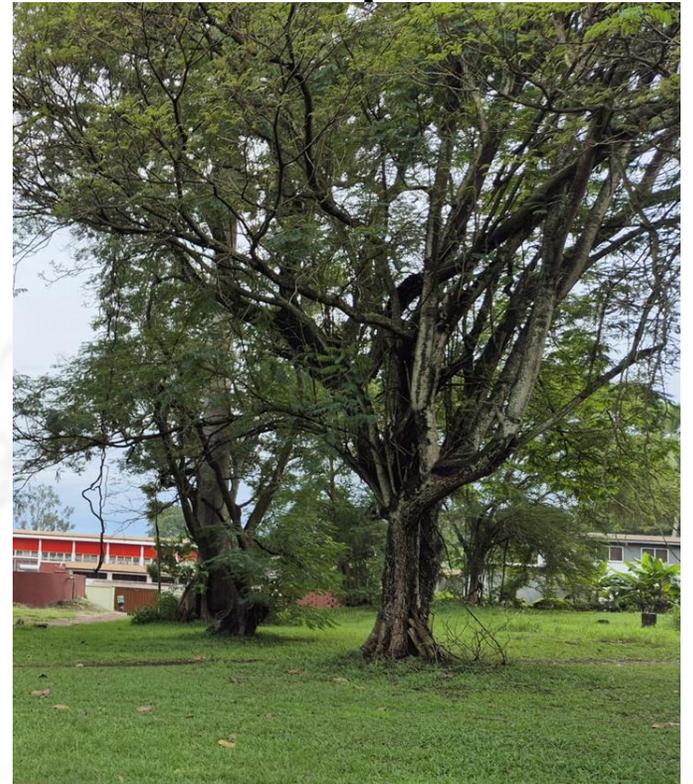






Solutions to Reduce Urban Heat

- **Increasing Green Spaces** – Planting trees and implementing green roofs can lower urban temperatures through shade and evapotranspiration.





- **Cool & Reflective Roofs** – High-albedo materials reflect solar radiation, reducing heat absorption.





- **Permeable Pavements** – These allow water infiltration and mitigate heat retention.





GREEN BUILDING

- A certified building that uses 20% less energy, water and embodied energy in materials.





- Urban cooling through albedo modification



*Santorini,
Greece*

*Los Angeles,
USA*



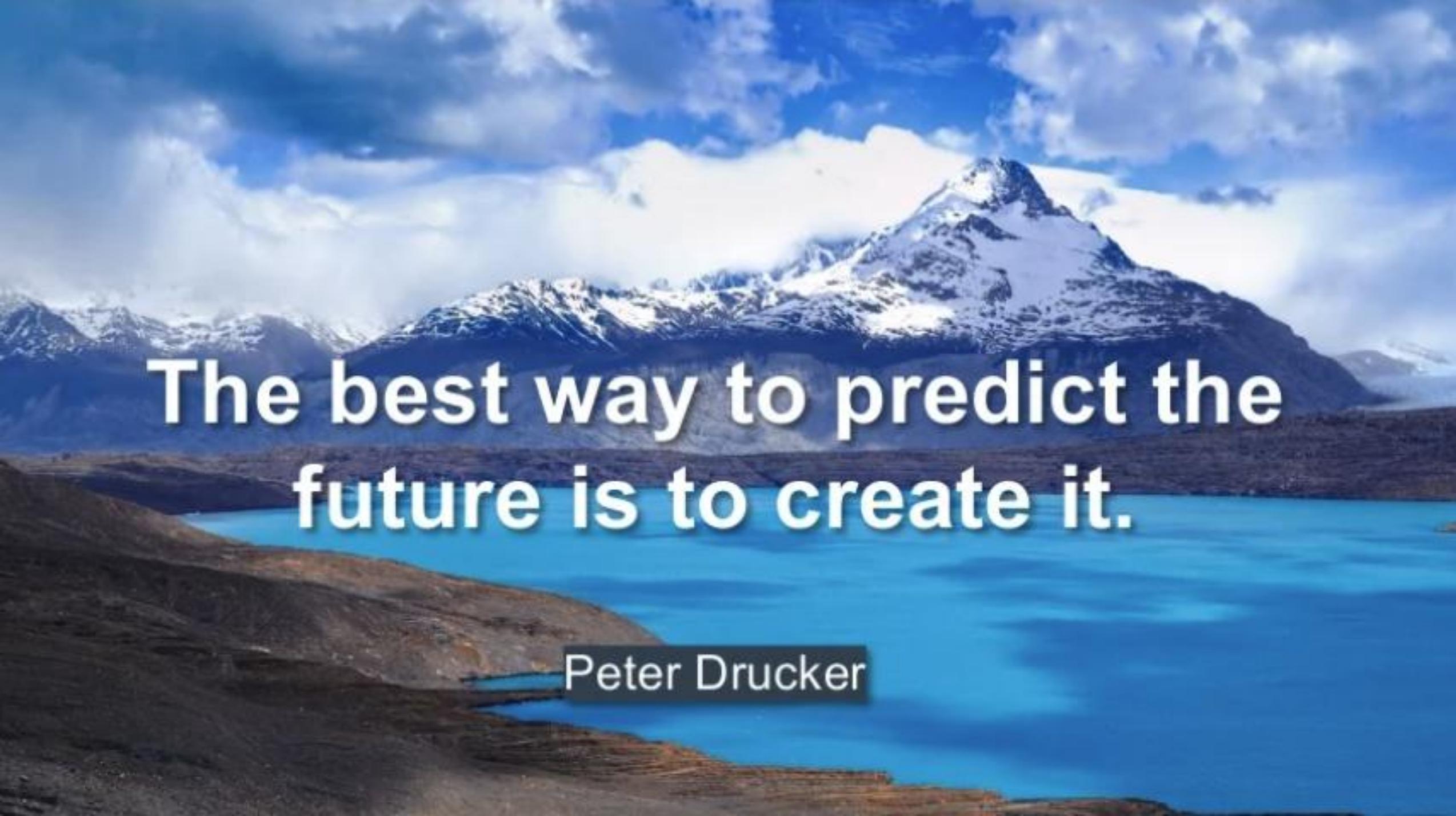
- **Smart Urban Planning** – Designing cities with wider streets, improved airflow, and green corridors can enhance cooling effects.
- **Reducing Waste Heat** – Promoting energy-efficient buildings, public transportation, and alternative cooling technologies can help mitigate urban heat.



**In the new world, it is not
the big fish which eats
the small fish,
it's the **fast fish** which
eats the **slow fish**.**

**Klaus Schwab
Founder and Executive Chairman
World Economic Forum**





**The best way to predict the
future is to create it.**

Peter Drucker

•QUESTION TIME



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THANK YOU!