



URBAN HEAT – GUIDANCE DOCUMENT

Honolulu Climate Change
Commission Meeting
December 1, 2023



The Honolulu Climate Change Commission

- Gather the latest science and information on climate change impacts to Hawai'i, with a focus on O'ahu
- Advise the CCSR, Mayor, City Council, and executive departments of the City as they look to draft policy and engage in planning for future climate scenarios

Urban Heat Guidance

Purpose

- Provide a set of scientific findings and recommendations on managing heat stress and heat shocks (heat waves)
- Identify impacted communities in light of global and regional climate projections
- Describe the physical nature of atmospheric and urban heat in Hawai'i
- Provides accounts of how other cities have managed urban heat

Urban Heat Guidance

Acknowledgments

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The content of this paper rests solely with the Honolulu Climate Change Commission.

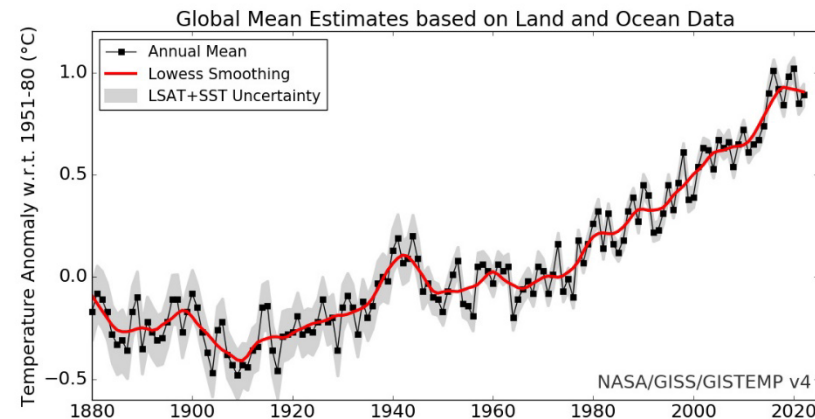
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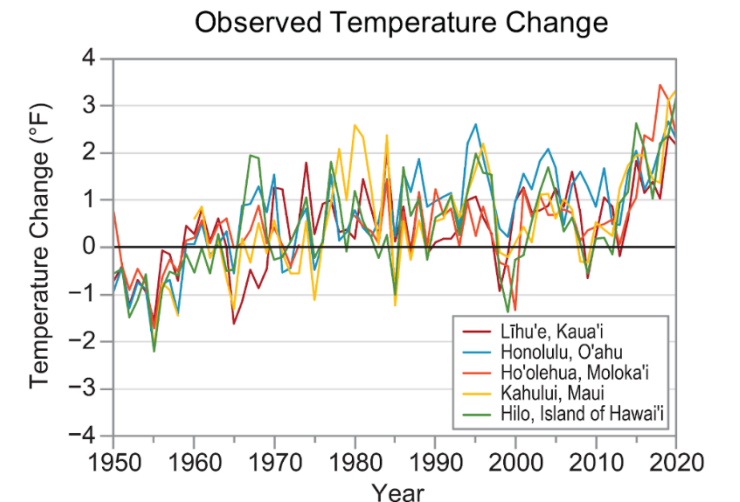
Urban Heat Guidance

Summary of Findings

- Human activities, principally through emissions of greenhouse gases, have unequivocally caused global warming, with global surface air temperature reaching 1.1°C (2°F) above 1850–1900 in 2011–2020.
- Without a strengthening of policies, global warming of 3.2°C (5.8°F) is projected by 2100.
- Average air temperature has risen 1.1°C (2°F) in Hawai‘i since 1950.



Global surface temperatures relative to 1880-1920 (Source: NASA GISS).

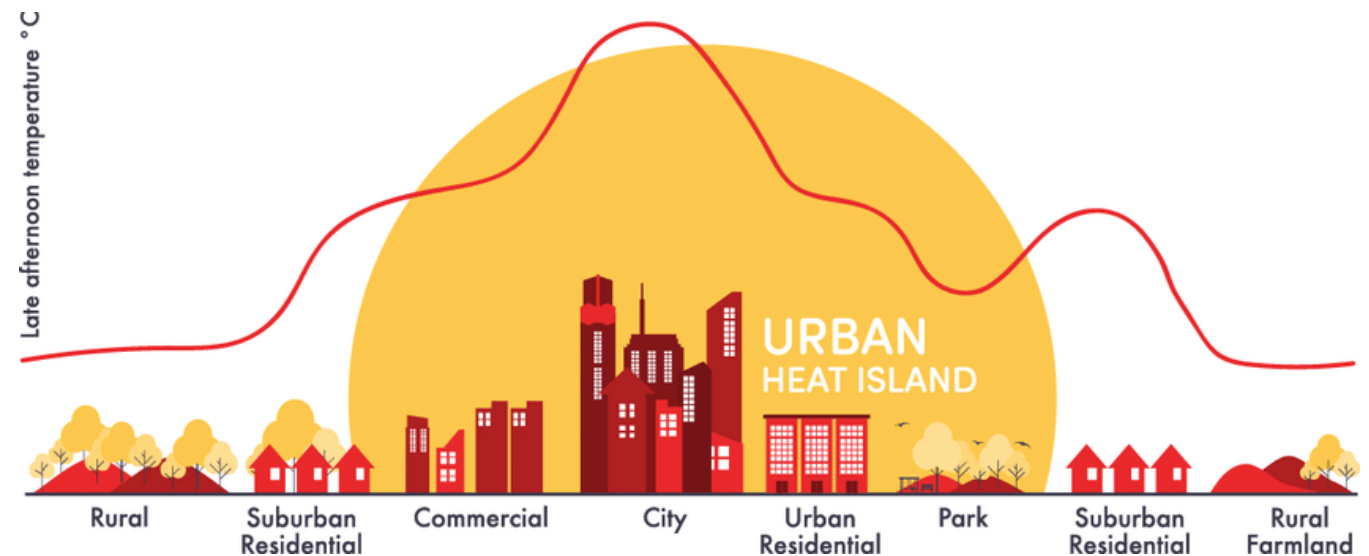


Hawai'i observed temperature changes since 1950 (Source: NOAA-NCEI)

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Summary of Findings

- Climate change is causing a rise in the global frequency and magnitude of extreme heat.
- Under current global emission reduction pledges, children born in 2020 will experience 7.5 times more heatwaves (30 vs 4 heat waves).
- Heat waves are worsened by the urban heat island effect.

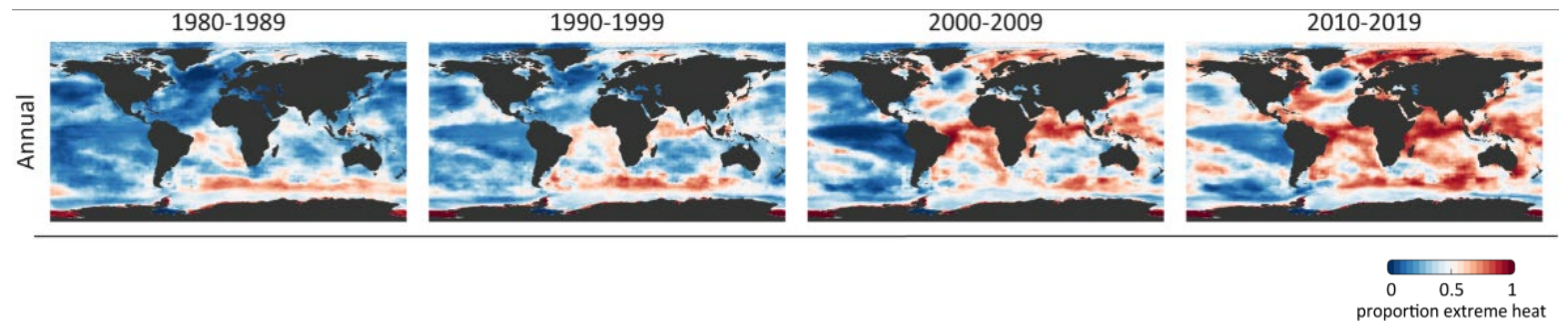


Urban heat island effect (Source: World Meteorological Organization, Kamyar Fuladlu).

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Summary of Findings

- Heat stress and heat shocks are climate change- and extreme weather-related hazards for Honolulu.
 - Changes in local winds exacerbate rising heat.
 - Increasing sea surface temperatures and air temperature result in rising heat stress.
 - A 2019 O‘ahu, community heat assessment found many neighborhoods with afternoon heat indices between 100°F and 107°F.

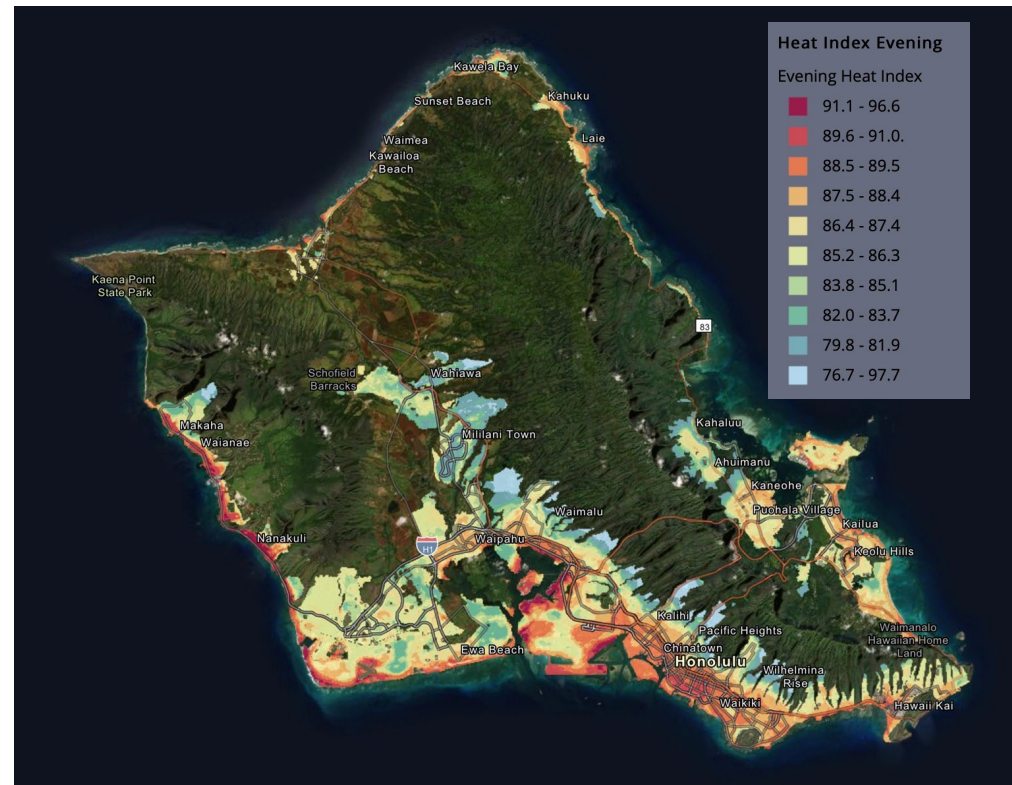


Decadal evolution of frequency of extreme marine heat from 1980–2019 (Source: Tanaka, K., & Van Houtan, K. (2022)).

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Summary of Findings

- Urban heat waves are strongly associated with socio-economic impacts.
 - Complex exposure patterns highlight an urgent need for locally-tailored adaptations and early warning systems.



*Evening heat index, O'ahu, Saturday, Aug. 31, 2019.
(Oahu Heat Vulnerability map series)*

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Summary of Findings

- Extreme heat can trigger fatal heat exhaustion or heat stroke.
- Older adults, young children, people working in hot conditions, and people with chronic conditions face the highest risk.
- Heat waves are already a leading cause of weather-related deaths in the United States, killing more than 600 people each year.

The infographic is divided into two main sections: Heat Exhaustion (orange background) and Heat Stroke (red background). A central figure of a person is split vertically, with the left side orange and the right side red. The left side lists symptoms of heat exhaustion: Dizziness, Thirst, Heavy Sweating, Nausea, and Weakness. The right side lists symptoms of heat stroke: Confusion, Dizziness, and Becomes Unconscious. Below the symptoms, there are two boxes labeled 'ACT FAST'. The Heat Exhaustion box lists: Move to a cooler area, Loosen clothing, Sip cool water, and Seek medical help if symptoms don't improve. The Heat Stroke box lists: Move person to a cooler area, Loosen clothing and remove extra layers, and Cool with water or ice. At the bottom, there are logos for NOAA, CDC, and NIOSH, along with the slogan 'Stay Cool, Stay Hydrated, Stay Informed!' and a small NOAA logo.

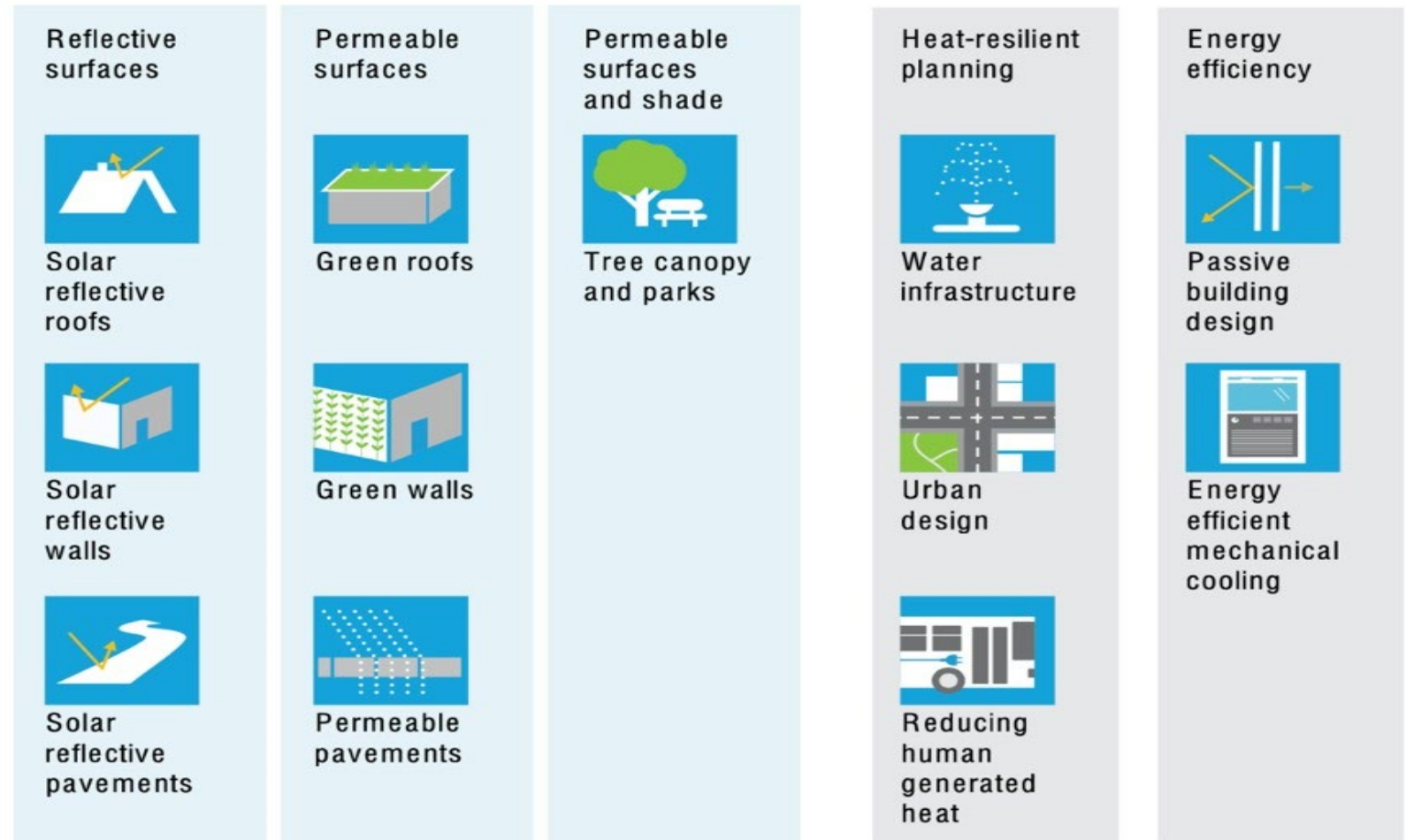
Heat Exhaustion	Heat Stroke
ACT FAST <ul style="list-style-type: none">• Move to a cooler area• Loosen clothing• Sip cool water• Seek medical help if symptoms don't improve	ACT FAST CALL 911 <ul style="list-style-type: none">• Move person to a cooler area• Loosen clothing and remove extra layers• Cool with water or ice
<i>Dizziness</i> <i>Thirst</i> <i>Heavy Sweating</i> <i>Nausea</i> <i>Weakness</i>	<i>Confusion</i> <i>Dizziness</i> <i>Becomes Unconscious</i>
<i>Heat exhaustion can lead to heat stroke.</i>	<i>Heat stroke can cause death or permanent disability if emergency treatment is not given.</i>

Stay Cool, Stay Hydrated, Stay Informed!

Urban Heat Guidance

Summary of Findings

- Experiences of other urban areas provide guidance on practices that are effective in mitigating heat stress and heat shocks.



Commonly used urban cooling solutions (Source: Filho, W. L., et al. (2017))

Urban Heat Guidance

Summary of Findings

- The use of more reflective surfaces in hot cities around the world could cancel the warming effect of 44–57 billion metric tons of emitted carbon dioxide.
 - Increasing the reflectance of land surfaces (e.g., by converting to highly reflective roofs only) could offset as much as 30% of greenhouse warming.



(Images: Lawrence Berkeley National Lab)

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Summary of Findings

The City has taken important steps with regard to managing urban heat:

- The O‘ahu Resilience Strategy (2019) identifies:
 - Action #32 “Deploy sustainable roof systems to manage urban heat and rainfall” and
 - Action #33 “Keep O‘ahu cool by maintaining and enhancing the community forest” (100,00 trees by 2025).
- Climate Ready O‘ahu: draft Climate Adaptation Strategy includes strategies and actions for heat hazards
- (More examples and detail in Table 1 of Urban Heat Guidance)



O'ahu Resilience Strategy 2019
(<https://www.resilientoahu.org/resilience-strategy>)



Draft Climate Ready O'ahu – Climate Adaptation Strategy
(<https://www.climatereadyoahu.org/>)

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Recommendations

- Urban O‘ahu may experience intolerable levels of heat by mid-century – **action is needed now**.
- Create a public education and outreach program to increase heat awareness.
- Develop a comprehensive plan for emergency heat response.
- Collect more heat information.
- Develop heat resilience building guidelines and codes.
- Develop a cool-streets and cool-roofs/walls program.
- Use census data to identify underserved and low-income communities that are at risk of heat stress and shock.

Urban Heat Guidance

Survey and Community Input

- Reached out to 50+ diverse stakeholders
- Two weeks to provide feedback via survey
 - Global Security Concerns
 - Human Health
 - Environmental Health
 - Equity
 - Community Resources
 - Priority Strategies
 - Existing Strategies to Mitigate Heat Used
 - Increased Energy Use with Increased AC Use
 - Heat Mitigation Strategies
- Received 8 responses

Urban Heat
Guidance

Survey and
Community Input

Human Health

- Recommendation #5 should leverage roof and exterior wall solar reflectance provisions in Subsection R401.3.1 in Honolulu's Ordinance 23-25
- Develop thermal safety standards

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Survey and
Community Input

Environmental
Health

- Include of land moisture through "One Water" practices and permaculture practices.
- Need for water demand impacts analysis as a result of increased heat and heat mitigation

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Survey and
Community Input

Equity Concerns

- Programs that install cool roof and cool exterior wall materials for free on public housing and in low-income neighborhoods
- Analyze whether Title I schools disproportionately experience urban heat impacts and prioritize heat mitigation strategies at/near those schools, especially those without AC

Urban Heat Guidance

Survey and
Community Input

Near-Term Policy Priorities

- Require heat resilient planning for all new construction, especially in the areas most impacted according to the heat survey.
- Shade at bus stops

Urban Heat Guidance

Survey and
Community Input

Increased
Energy and Air
Conditioning
Use

- Describe research on projected energy use with increased air conditioning, and the impacts on demand on the electrical grid, onsite renewable energy system sizing, and the ability to meet greenhouse gas emissions targets
- Elaboration of how passive cooling strategies, like cool roofs and walls, help reduce A/C use

Urban Heat Guidance

Survey and
Community Input

Missing Mitigation Strategies

- More discussion and policy on landscape-led design instead of civil infrastructure-led design.
- Discussion on tree counts so that the city becomes a technical forest
- Depaving should be a strategy.
- Add recommendations for hydration stations, shade at bus stops, shade structures along important pedestrian and bicycle routes