The Heat Island Effect and Air Quality

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EPA Advance Program Webinar Series
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U.S. EPA Heat Island Reduction Program

EPA's Heat Island Program

Program Overview

- **Mission**

  The EPA Heat Island Reduction Program works to create sustainable and comfortable communities by promoting state and local programs and policies that include heat island reduction measures.

- **Heat Island Community**
  - Local and state policymakers and program implementers
  - Academia/researchers
  - Other federal agencies
  - Non-profit organizations
  - Industry

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Program Resources

- Website
  - Calendar of events, newsroom, info on mitigation strategies and risks and benefits
- Community Actions Database
  - 75+ local and statewide initiatives
- Newsletter

Available at epa.gov/heatisland

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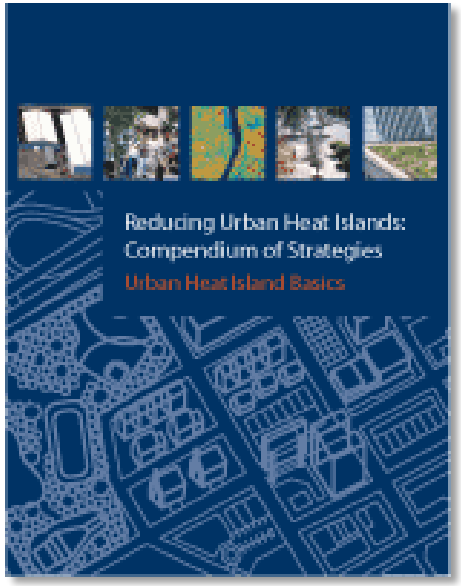
Program Resources, continued

- *Reducing Heat Islands: Compendium of Strategies*
  - Heat island basics
  - Mitigation strategies in depth
  - Implementation guidance and examples
- Webcasts
  - Topics such as heat health, measuring heat islands, mitigation strategies, air quality, etc.



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Heat Island Basics

- Heat islands are built-up areas that are hotter than their rural surroundings.
- As buildings and roads replace open land and vegetation, formerly permeable and moist surfaces become impermeable and dry. That leads to higher temperatures.

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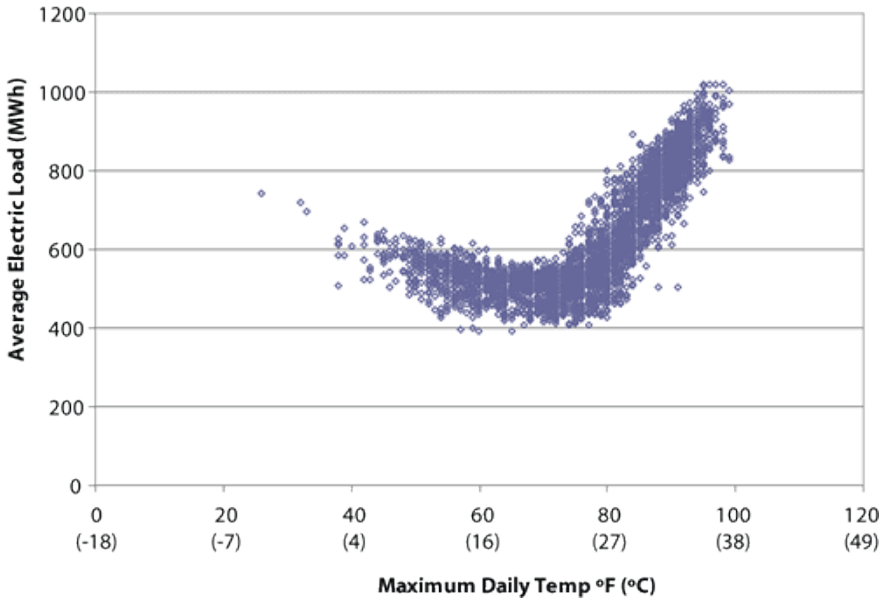
Heat Island Impacts

- Higher energy consumption (and emissions of greenhouse gas emissions and criteria pollutants)
- Reduced air quality
- Higher risks to public health
- Reduced water quality



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The Air Quality Connection

Two main effects:

- Higher energy demand for cooling buildings leads to higher emissions from power plants
  - Among cities with heat islands, 5-10% of electricity demand is used to compensate for the heat island effect.
- Warmer temperatures in heat islands can lead to higher concentrations of ozone.

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Cooling the Heat Island

Four main strategies

1. Planting trees and vegetation
2. Green roofs
3. Cool roofs
4. Cool Pavements

Smart growth and other green infrastructure strategies can also provide heat island mitigation benefits.

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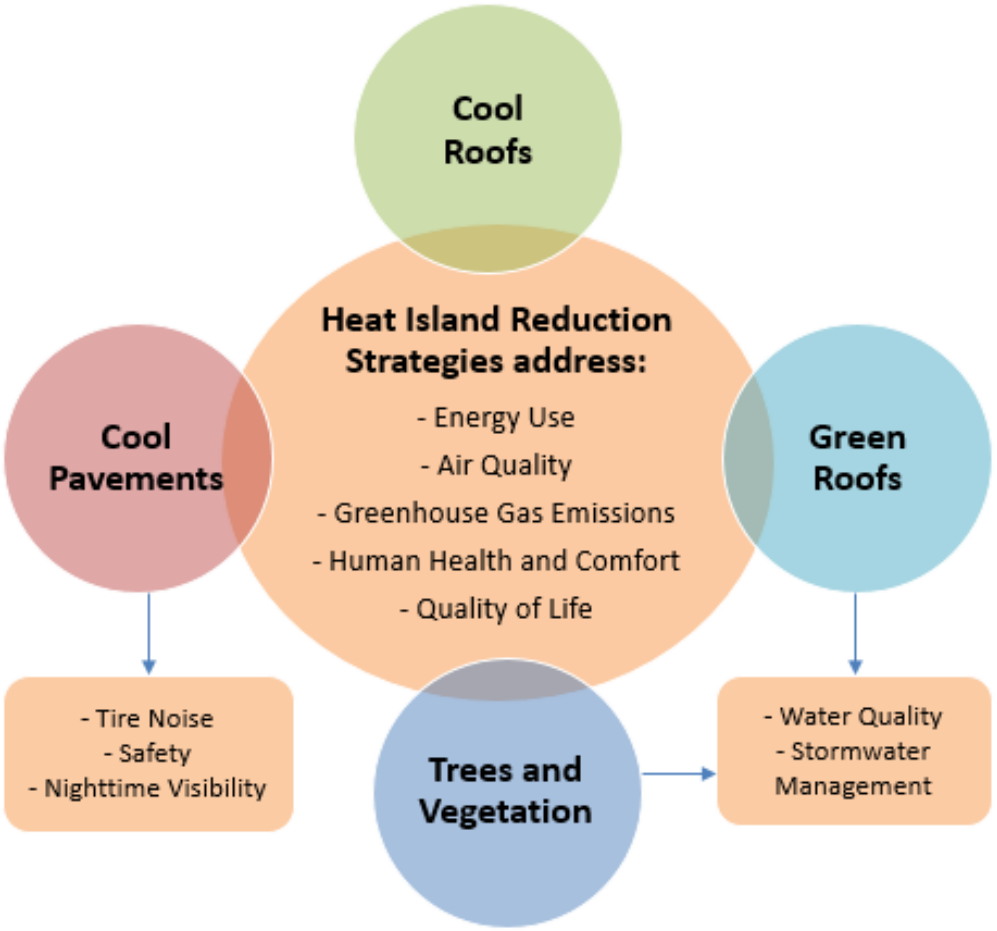
Multiple Benefits of Mitigation Strategies



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Implementing the Strategies

- **Voluntary efforts**
  - Demonstration projects
  - Training and tours
  - Incentive programs (rebates, tax credits)
  - Outreach and education
  - Awards
  - Tree planting programs

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Implementing the Strategies, continued

- **Regulatory policies**
  - Building codes and zoning laws
  - Tree protection and landscaping mandates
  - Stormwater management requirements

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Heat Island Mitigation in SIPs: Trees and Vegetation

- Sacramento, California
  - Urban Forests for Clean Air demonstration project
    - Supported by a Congestion Mitigation and Air Quality Improvement Program grant
- Maryland – Statewide
  - Regional Forest Canopy Program
    - SIP Bundle of programs includes increasing the tree canopy
    - First proposed in 2007 Baltimore Nonattainment Area 8-Hour Ozone SIP and Base Year Inventory
- Washington, D.C.
  - Regional Canopy Management Plan

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Heat Island Mitigation in SIPs: Cool Roofs

- California
  - Reduced Ozone Formation and Emission Reductions from Cool Roof Technology [All Pollutants]
    - Preliminary draft SIP measure, April 2016
    - Control Methods: Expansion of state standards and subsidy program
    - Regulatory History: Title 24 of California's Energy Efficiency Standards for Residential and Nonresidential Buildings (2013) requires new or replacement roofs to be cool roofs

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How Much Does Heat Island Mitigation Improve Air Quality?

- Answer: “It’s complicated.”
- At least four modeling studies show that increasing albedo (reflectivity) and vegetation can reduce ozone concentrations. Main findings:
  - Increasing albedo and vegetation can affect air temperature during the day, not so much at night.
  - Temperature decreases can reduce ozone in localized areas, not necessarily city-wide.
  - Biggest impacts may be downwind of areas where mitigation measures are installed.
  - Heat island mitigation measures may be most effective for ozone reduction if implemented on a large scale in a city or region.

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How Much Does Heat Island Mitigation Improve Air Quality?...continued

- Unintended consequences to consider:
  - Some trees emit VOCs and can contribute to ozone formation.
  - Reducing temperature may increase carbon monoxide and NOx concentrations at ground level (due to less turbulence in the air)
  - Very highly reflective surfaces can increase peak ozone (reflected sunlight can increase photochemical reactions that create ozone)
  - Effects vary by weather, city size, topography, population density, other factors

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The Bottom Line

- Heat island mitigation measures benefit air quality and more!
- With the right tree species and right level of reflectivity in cool roofs and pavements, heat island mitigation should reduce ozone with no unintended consequences.

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Tools and Resources

- iTree https://www.itreetools.org/
- Cool Roofs and Cool Pavements Toolkit http://www.coolrooftoolkit.org/
- Adapting to Urban Heat: A Toolkit for Local Governments http://www.adaptationclearinghouse.org/resources/adapting-to-urban-heat-a-tool-kit-for-local-governments.html
- EPA's Green Infrastructure Program https://www.epa.gov/green-infrastructure
- Energy Star label for Cool Roofs https://www.energystar.gov/productfinder/product/certified-roof-products/
- Lawrence Berkeley National Laboratory - Heat Island Group https://heatisland.lbl.gov/
- GSA Green Roof Site: http://www.gsa.gov/portal/category/104999

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Funding Opportunities

- EPA's Heat Island Newsletter https://www.epa.gov/heat-islands/forms/heat-island-newsletter-signup
- EPA's State and Local Climate and Energy Newsletter https://www.epa.gov/statelocalclimate/newsletters-climate-and-energy-programs
- Green infrastructure funding https://www.epa.gov/green-infrastructure/green-infrastructure-funding-opportunities

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