Spruce Up! Using Green Roofs and Green Spaces to Beat the Heat

Thank you for joining. We will start in a few minutes.

NEW! Two audio options:

1. Listen via computer
2. Call in to 1-855-210-5748

EPA

HEAT ISLAND REDUCTION PROGRAM

State and Local Energy and Environment Program

Spruce Up! Using Green Roofs and Green Spaces to Beat the Heat

July 11, 2019

Hosted by:

U.S. EPA Heat Island Reduction Program

Webcast Agenda

- **Overview of Heat Islands and EPA's Heat Island Reduction Program**
  - Victoria Ludwig, U.S. EPA Heat Island Reduction Program
- **Green Roofs and Walls: Strategies for Fighting the Urban Heat Island**
  - Steven Peck, Green Roofs for Healthy Cities
- **Environmental Effects of Green Roofs, a Case Study in Kansas City**
  - Robyn DeYoung, U.S. EPA
- **Denver's Green Building Ordinance Development Process**
  - Katrina Managan, Denver Department of Public Health and Environment
- **Question and Answer Session**

HEAT ISLAND REDUCTION PROGRAM

Webcasts now use Adobe Connect

Troubleshooting Tips

- Try a different web browser (e.g., Firefox, Chrome)
- Download the latest version of Adobe Flash Player or the Adobe Connect Plug-in
- Check with your Information Technology (IT) department about your internet security settings
- Find help online

HEAT ISLAND REDUCTION PROGRAM

How to Participate

Audio

- **Computer**
  - Audio will begin when the Host signs on
  - Tip! Unmute your speakers or headphones
- **Phone**
  - Call in to 1-855-210-5748
  - Tip! Mute your computer speakers to avoid audio feedback
- **Participants are muted**

HEAT ISLAND REDUCTION PROGRAM

How to Participate

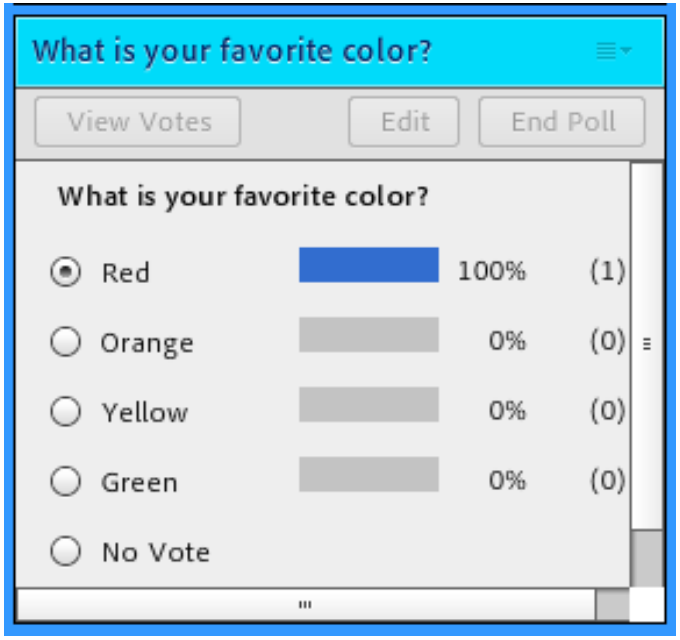
Question and Answer

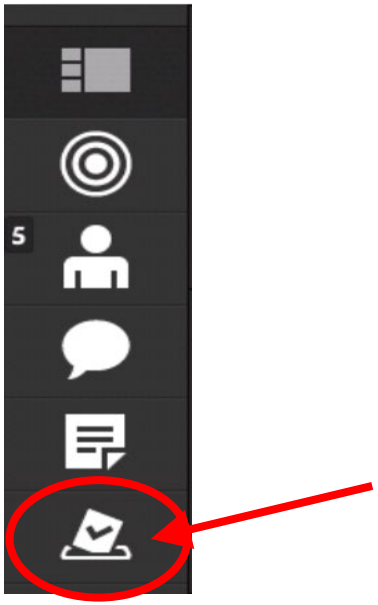
- Enter your question in the Q&A box
- Questions will be moderated at the end
- EPA will post responses to unanswered questions on the Heat Islands webpage

How to Participate

Polling

- We'll ask several poll questions during the webcast
- On mobile devices or tablets
  - Exit full screen mode
  - Tap on the Poll icon



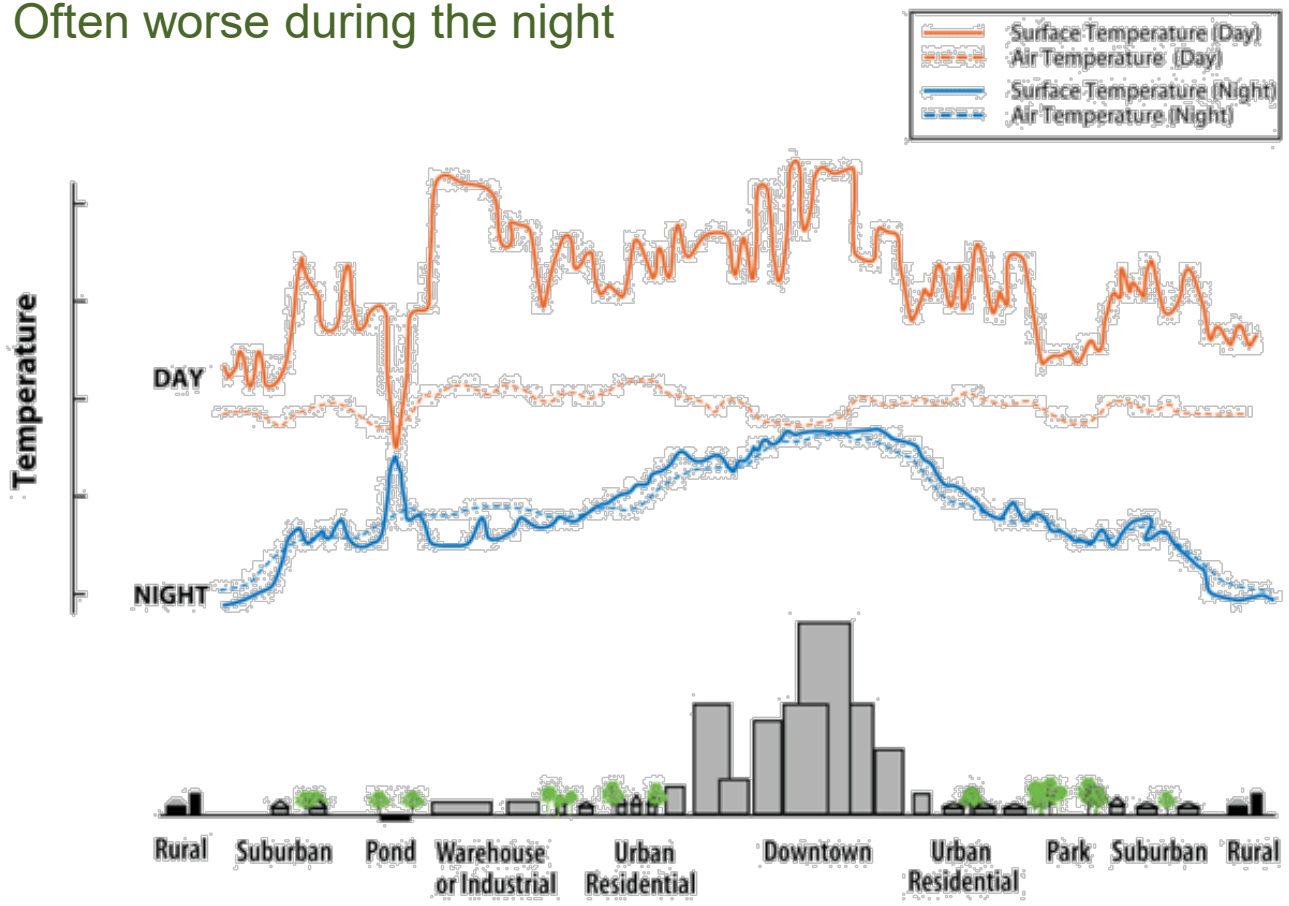


Overview of Heat Islands and EPA's Heat Island Reduction Program

Victoria Ludwig
U.S. EPA Heat Island Reduction Program

Overview of the Heat Island Effect

- Micro-scale temperature differences between urban and rural areas
- Urban temperatures can be significantly higher than rural
- Often worse during the night






Causes

- Reduced vegetation
- Materials used to build urban infrastructure (impermeable, heat absorbing, dry)
- Urban geometry (dense development)
- Waste heat (e.g., air conditioners, car engines)

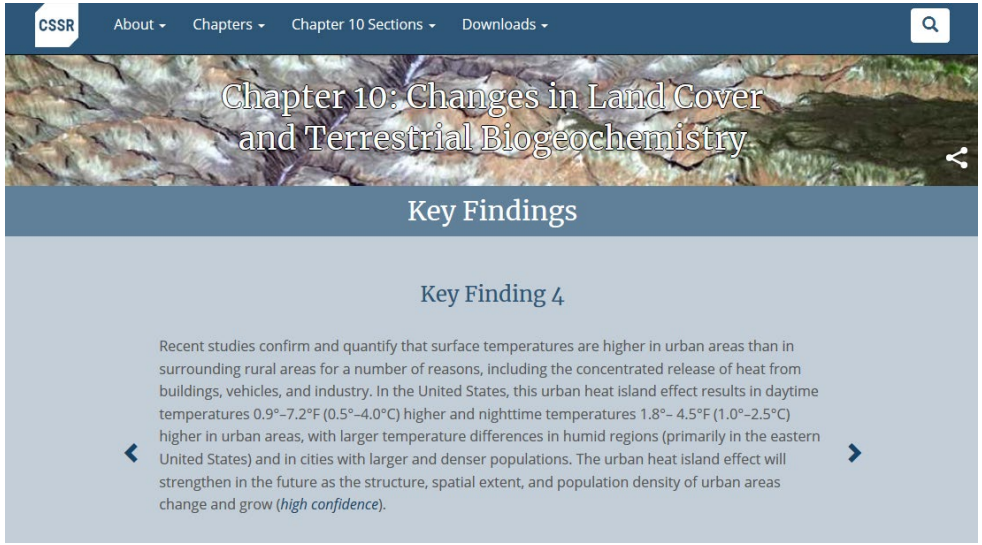
Impacts

- Energy and greenhouse gases
- Air quality
- Public health
- Stormwater

HEAT ISLAND REDUCTION PROGRAM

Heat Island Effect Strengthening

"In the United States, this urban heat island effect results in daytime temperatures 0.9°–7.2°F (0.5°–4.0°C) higher and nighttime temperatures 1.8°– 4.5°F (1.0°–2.5°C) higher in urban areas, with larger temperature differences in humid regions (primarily in the eastern United States) and in cities with larger and denser populations."

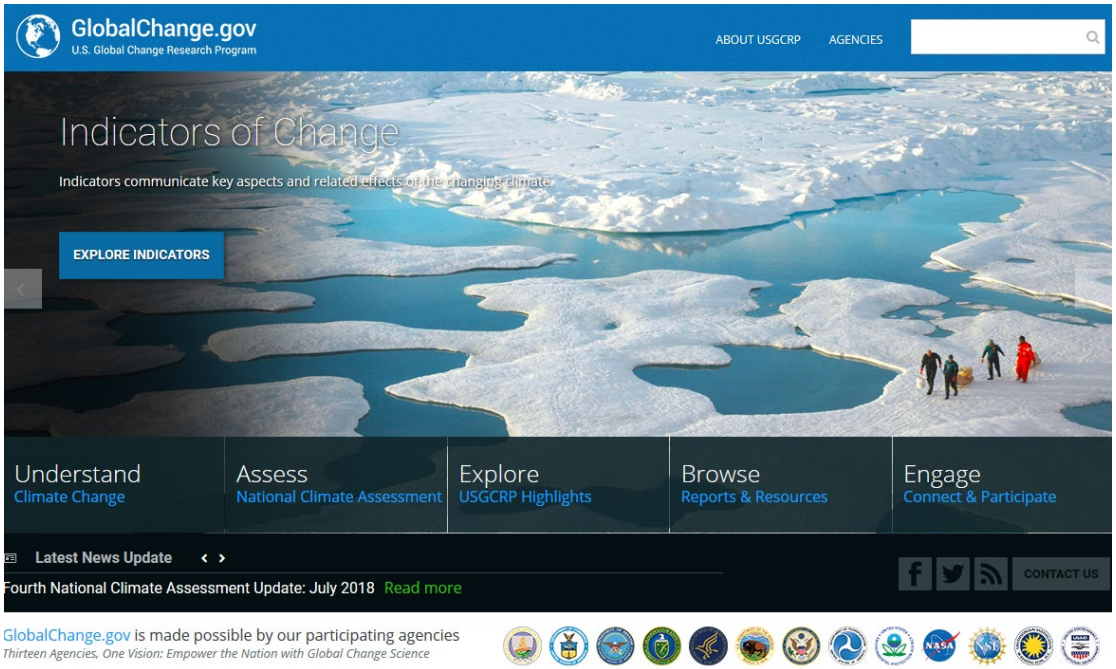


Hibbard, et al., 2017. Changes in land cover and terrestrial biogeochemistry. Climate Science Special Report: Fourth National Climate Assessment, Volume I.

HEAT ISLAND REDUCTION PROGRAM

Heat Island Effect Strengthening

The U.S. Global Change Research Program issued a key finding in its 2017 special report that it projects with high confidence that the heat island effect in the U.S. will strengthen in the future



Heat Island Reduction Program Resources

Program Overview

- **Mission**

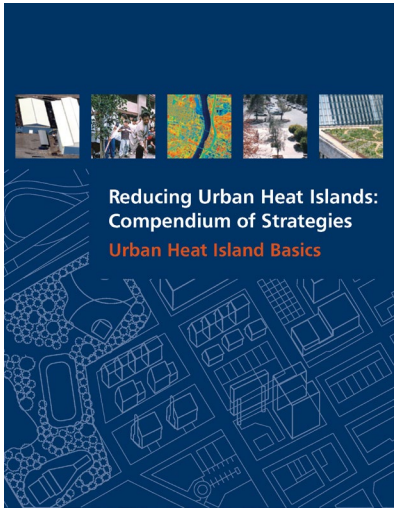
  Outreach and technical assistance program that works with a variety of stakeholders to help create sustainable and comfortable communities by promoting effective programs and policies that reduce heat islands.

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

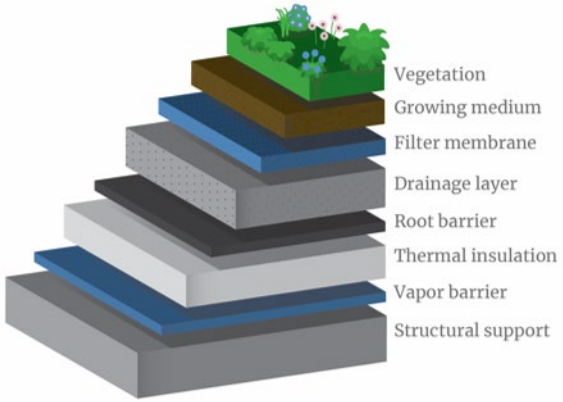
HEAT ISLAND REDUCTION PROGRAM

Heat Island Program Resources

- ***Compendium of Strategies:*** ***Reducing Urban Heat Islands***: Heat island science, detailed info on mitigation strategies, local examples, policy options



- **Website**: Basic information on heat island topics, calendar of events, newsroom, links to other resources
  - Recently updated: Using Green Roofs to Reduce Heat Islands
  - Coming soon!
    - Heat Islands and Equity page
    - Updated Learn about Heat Islands page



HEAT ISLAND REDUCTION PROGRAM

Heat Island Program Resources

- **Examples**: Database of more than 75 local and statewide initiatives to reduce heat islands
- **Webcasts**: Topics include case studies, public health connections, advances in mitigation policy
  - Most recent webcast covered cool roofs and pavements and case studies of Los Angeles and San Antonio
- **Newsletter**: Recent news on projects, policies, and research

HEAT ISLAND REDUCTION PROGRAM

EPA's Heat Island Newsletter

EPA Updates

Upcoming Webcast

Spruce Up! Using Green Roofs and Green Spaces to Beat the Heat

When: Thursday, July 11, 2019, 2:00–3:30 PM, EST

Join this 90-minute webinar to learn how green roofs and other green spaces are being used to address urban heat across the country. The webinar will highlight the many benefits that such practices can bring, such as how green roofs are improving air quality and public health in Kansas City, Missouri. The event will also feature a national green roof expert and delve into Denver, Colorado's recent green building ordinance.

Agenda:

- **Overview of Heat Islands and EPA's Heat Island Reduction Program**. Victoria Ludwig, U.S. EPA Heat Island Reduction Program.
- **Green Roofs and Walls: Strategies for Fighting the Urban Heat Island**. Steve Peck, Green Roofs for Healthy Cities.
- **Environmental Effects of Green Roofs, a Case Study in Kansas City**. Robyn DeYoung, U.S. EPA.
- **Denver's Green Building Ordinance Development Process**. Katrina Managan, Denver Department of Public Health and Environment.

HEAT ISLAND REDUCTION PROGRAM

Contact Information

Victoria Ludwig

U.S. Environmental Protection Agency

202-343-9291

Website

EPA Heat Island Newsletter Sign-Up

Follow these sites for Heat Island Reduction Program updates!

@EPA | @EPAair | Facebook | LinkedIn

Poll 1

EPA

HEAT ISLAND REDUCTION PROGRAM

State and Local Energy and Environment Program

Green Roofs and Walls: Strategies for Fighting the Urban Heat Island

Steven Peck

Green Roofs for Healthy Cities

EPA

HEAT ISLAND REDUCTION PROGRAM

State and Local Energy and Environment Program

Green Roofs & Walls: Tools to Address Stormwater & the Urban Heat Island

By Steven W. Peck, GRP, Honorary ASLA
Founder and President, Green Roofs for Healthy Cities
Co-Founder, Green Infrastructure Foundation
Co-Founder, World Green Infrastructure Network

“It is not the strongest species that survives, nor the most intelligent that survives. It is the one that is most adaptable to change.”

- Charles Darwin

“We are the first generation to feel the impacts of climate change and the last generation that can do something about it.”

- Barack Obama

Overview

1. Organizational Introduction
2. Nomenclature for Green Roofs and Walls
3. The Big Idea – Policy Opportunity
4. How Green Roofs and Walls Address the urban heat island
5. Case Study Examples
6. Getting There: Living Architecture Performance Tool
7. Conclusion

1. About Green Roofs for Healthy Cities (GRHC)

Big Sur
Award of Excellence 2009
Winner: Fred Ballerini

Phoenix Convention Center
Phoenix, AZ
Award of Excellence 2011
Winner: Ten Eyck Landscape Architects, Inc.

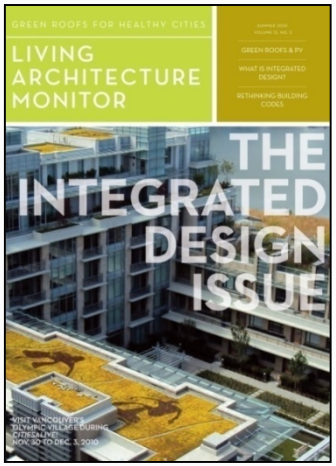
Non-profit industry association.

Mission

To increase the awareness of the economic, social and environmental benefits of green roofs and green walls, and other forms of living architecture in North America through education, advocacy, professional development and celebrations of excellence.

Green Roofs for Healthy Cities

1. GRHC Activities



- Grey to Green Conferences
  Minneapolis, MN Sept. 30-Oct 1/2019
  Washington, DC Oct. 29-30/2019

- One day Local Market Development Symposia
  Denver, CO Aug. 9;
  Portland, OR Sept. 13

- Green Roof Professional Accreditation – Online training and testing.

- Living Architecture Magazine

- Living Architecture Academy

1. About the Green Infrastructure Foundation

Charitable arm of GRHC.

Mission

To partner with communities to shape healthy, resilient and sustainable places through living green infrastructure.

- Green Infrastructure Charrette Program
- Living Architecture Performance Tool

1. Green Infrastructure Charrettes

- Teams of interdisciplinary experts and local stakeholders redesign real sites using green infrastructure.
- Visuals and economic analysis of redesigns are combined to create a compelling vision for green infrastructure and economic case.
- Charrettes completed in Seattle, WA; Harlem, NY; Toronto, ON…
- Charrettes can engage and educate private and public sector individuals to improve policy and incorporate green infrastructure into new developments.
- For more info: contact Rohan: rlilauwala@greenroofs.org

2. Nomenclature – Green Roof Basics

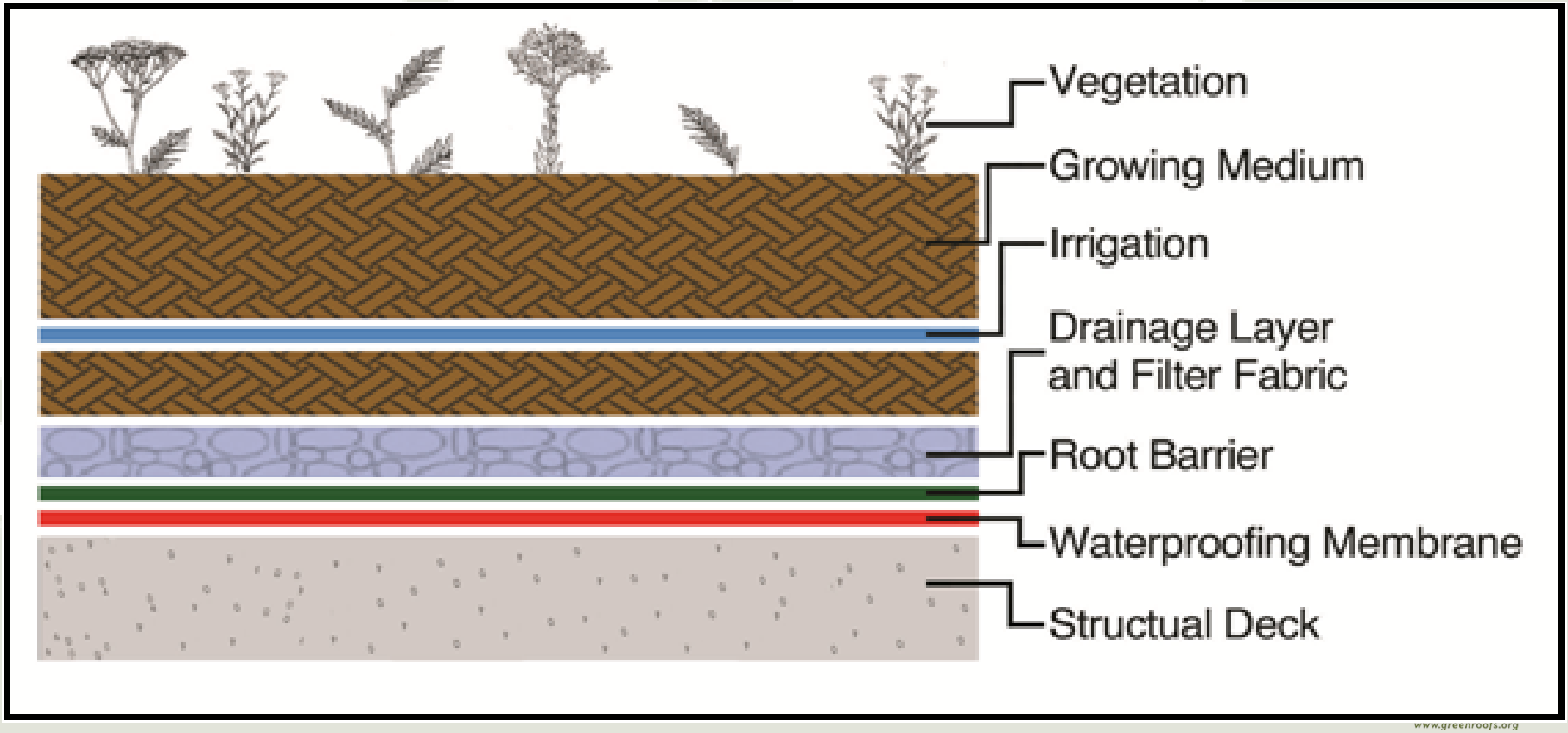
- **Intensive green roofs** – feature woody plants and shrubs
- Always accessible
- Greater maintenance, cost and loading capacity

- **Extensive green roofs** – sedums and grasses
- 6 inches of growing medium or less
- Less weight, loading capacity
- Not well suited to hot dry climates

- Loose laid/built up systems
- Modular systems-trays

2. Green Roof Components

- Green roofs come in many types, but all share some basic components
- Designed to protect waterproofing, structure & sustain plants



2. Nomenclature – Green Wall Basics

A ‘Green Wall’ is an all-encompassing term that is used to refer to various forms of vegetative wall surfaces:

- Green Facades – climbing plants in ground or planters
- Living Walls – affixed to building envelop – soil or hydroponic based
- Retaining Living Walls

Source: Jakob Rope System

Source: Tournesol Siteworks

Source: Deltalock GTX

3. Big Idea 1: Keep Water Onsite and Grow Plants

- Institute policies that incent or require building owners to capture rainwater/stormwater.
- Store the water onsite – in drainage layers or cisterns.
- Use the water to supply green roofs, green walls and trees to improve their ability to reduce the urban heat island.
- Also use air conditioning condensate, grey water, and potable water to offset stormwater.

3. Big Idea 2: Cooling the City is Like Building a Power Plant

- Cities can save money on infrastructure costs and adapt to climate change
- Building owners can save – even make money!

3. Big Idea 3: A Role for Public Policy!

Green roof policies and programs are being implemented by governments worldwide because:

- Leverage wasted roof space - as much as 30% of land area
- Leverage private investment in new buildings
- Leverage that green roofs provide public and private benefits
- Proven technologies – millions of square feet installed annually
- Local/regional jobs creation.
- Multiple public and private benefits – which can be tailored to different districts.

3. Green Roof Benefits Are Public and Private

Public (community)

- Biodiversity
- Stormwater Management
- Urban Heat Island Reduction
- Employment Opportunities
- Climate Change

Private (building owner)

- Stormwater Management
- Energy Use Reduction
- Increase in Roof Lifespan
- Programming
- Property Value and Worker Productivity
- Membrane Durability
- Agriculture
- Noise Reduction

U.S. Coast Guard Headquarters
Washington, DC
Image courtesy of Sempergreen

3. Green Wall Benefits Are Public and Private

Public (community)

- Biodiversity
- Stormwater Management
- Urban Heat Island Reduction
- Employment Opportunities
- Climate Change
- Aesthetics

Private (building owner)

- Energy Use Reduction
- Property Value
- Biophilc related health benefits
- Agriculture
- Noise Reduction
- Integrated Water Management

Jakob Cable Green Wall System

3.Selected Cities With Supportive Policies

Selected cities that require green roofs on new development projects:

- New York
- Copenhagen
- Basel
- Toronto
- Tokyo
- Linz
- Singapore
- Portland, OR
- Cordoba
- San Francisco
- Berlin
- St. Laurent …

Selected cities the provide incentives/stormwater and/or green space regulations that support green roofs on new and existing buildings:

- Washington, DC
- Chicago
- London
- Milwaukee
- Toronto
- Seattle
- Denver
- New York
- Paris

3. Lots of Policy Tools

- **Density/Floor Area Ratio Bonus** –Developers are permitted to increase the density of their building by increasing the floor area.

- **Funding (Grant)** – Up front funding to cover the costs of the design, installation.

- **Mandate** (Laws and Regulations) **-** Green roofs are required on new developments.

- **Stormwater Fee Credit** - Property owners will receive a credit on their stormwater fees. Stormwater fee credits are calculated based on the amount of impervious area targeted or based on how effective the green infrastructure is in reducing stormwater runoff.

- **Tax Credit/Abatement** - An amount deducted from taxes (credit) or a reduction of taxes(abatement) for the construction of a green roof.

- **Green Area Factor.** New developments and major retrofits are required to use a various green infrastructure to meet a specific area of greenspace.

- **Other**: the expedition of project permits; and using green roofs for sustainable development plans and 'green' building requirements.

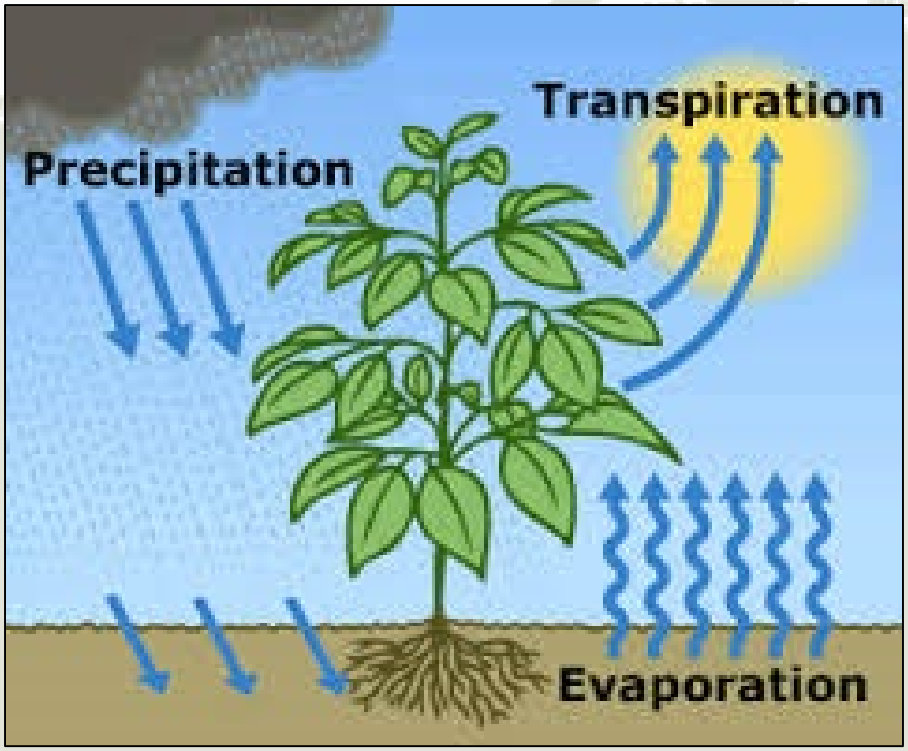
4. How it Works – Plants Are Fueled By Water

- Green roofs have been used for hundreds of years to insulate buildings
- Insulation reduces heat gain in buildings

- Evapotranspiration prevents solar radiation becoming sensible heat
- Convection (sensible heat loss)
- Solar Shading
- Reflectivity (Albedo)
- Thermal Mass Transfer

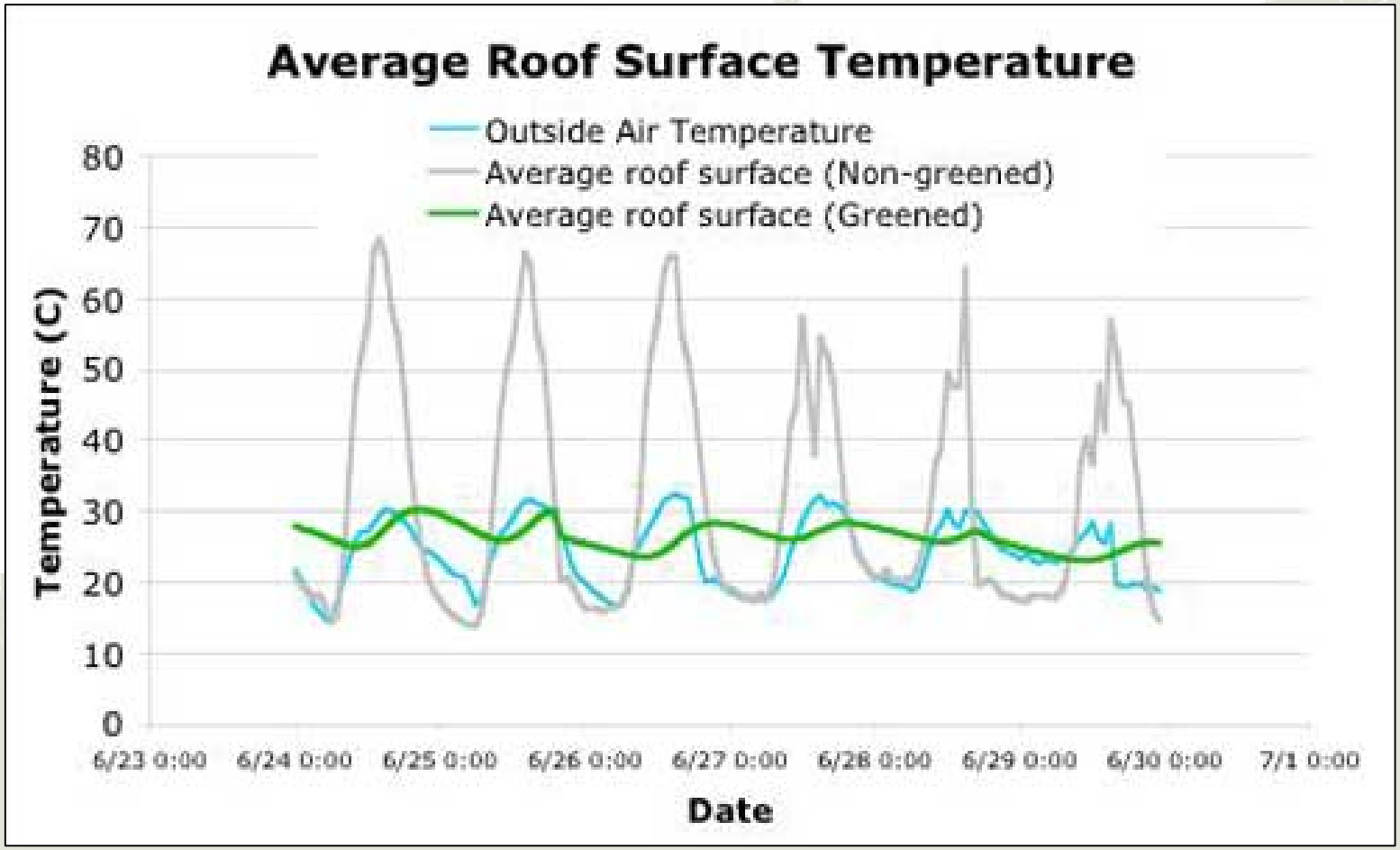
4. How Plants Reduce Urban Heat Island

- Primarily through evapotranspiration
- Instead of directing stormwater away from buildings – it should be captured and used to cool the buildings by supporting plants
- Higher evapotranspiration means greater potential urban heat island reduction



4. Water + Plants = Urban Heat Island Reduction

- Standard black roof: 169 degrees vs. Green Roof: 90-119 degrees
- Difference: 60 degrees or more



GREEN ROOFS FOR HEALTHY CITIES
www.greenroofs.org

5. Case Study: Chicago City Hall Green Roof

Source: Conservation Design Forum

5. Case Study: Chicago City Hall Green Roof

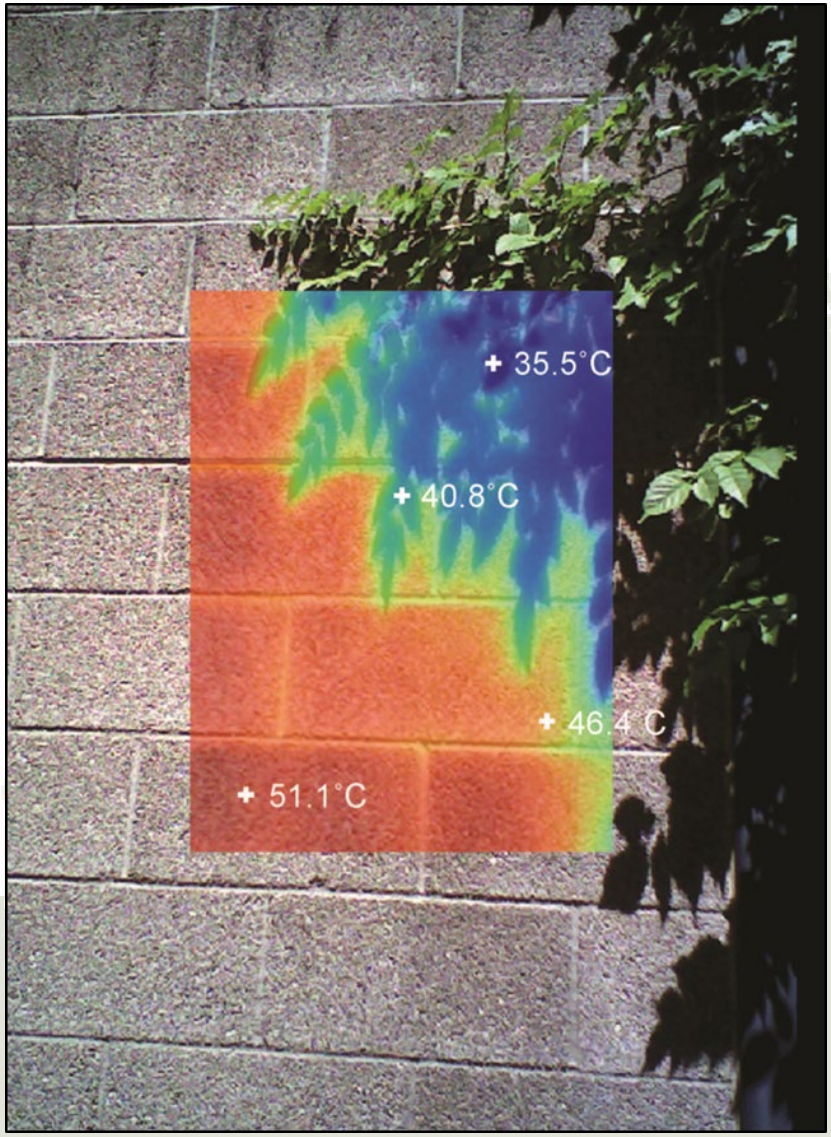
Source: Conservation Design Forum

Chicago City Hall has estimated savings of $60k a year

5. Case Study: Studios 5c Green Façade (Tempe, AZ)

Source: greenscreen

5. Case Study: Studios 5c Green Façade (Tempe, AZ)



- A 3 storey commercial office/retail building with a green façade that is an integral performing element in the management of the Arizona climate.

- The green façade was designed to shade and cool external circulation, stair wells and corridors; by allocating this function to the green facade, the designers were able to reduce the AC load and the size of the equipment by a large percentage by 10 to 20%.

Source: greenscreen

6. Getting There: Living Architecture Performance Tool

- After 5+ years of development work - Green Infrastructure Foundation launched Version 1.0 in 2018
- 110 points available across 8 different areas – water, energy and climate, health and well-being, etc.
- Projects that are green roofs and or green walls – completed or in progress can apply for certification.

1. Process	5
1.1 Integrated Design Process	Prerequisite
1.2 Stakeholder and Community Engagement	3
1.3 Living Systems Expertise	2
2. Water Management	25
2.1 Stormwater Management	Prerequisite + 16
2.3 Irrigation	5
2.4 Water Balance	4
3. Energy Conservation	14
3.1 Envelope Thermal Moderation	5
3.2 Urban Heat Island Reduction	4
3.3 Renewable Energy	2
3.4 HVAC Integration	3
4. Habitat and Biodiversity	11
4.1 Plants	4
4.2 Growing Media Depth and Composition	2
4.3 Habitat Elements	2
4.4 Biomass	3

5. Health and Well-Being	21
5.1 Biophilic Design – Visibility	2
5.2 Biophilic Design – Accessibility	4
5.3 Food Production	10
5.4 Air Quality Improvements	3
5.5 Acoustics	2
6. Materials and Construction	14
6.1 Structural Soundness	Prerequisite
6.2 Environmentally Sensitive Materials	3
6.3 Sustainable Materials	3
6.4 Construction Waste Management	2
6.5 Equity-Focused Sourcing and Hiring	3
6.6 Bird-Friendly Glass	3
7. Post-Construction	10
7.1 Operations and Maintenance	Prerequisite + 2
7.2 Fertilizer and Pesticide Use	2
7.3 Monitoring	3
7.4 Education	3
8. Innovation	10
8.1 New Approaches or Strategies	
8.2 Exemplary Performance	10

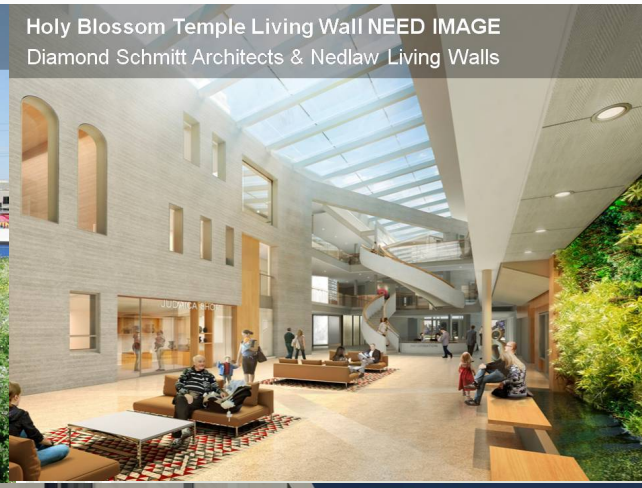
6. Getting There: Living Architecture Performance Tool

- **For Building Owners/Designers:**
  - Framework or guideline to ensure maximum benefits are obtained
  - Branding, marketing, or increased visibility
  - Ensure long-term performance and health of living architecture
  - Clearly meet regulatory requirements
  - Take advantage of Leadership in Energy and Environmental Design (LEED) or Sustainable Sites Initiative (SITES) credits for living architecture

- **For Policy Makers:**
  - Regulatory framework or guideline to inform policy or incentives
  - Outsource compliance if you do not have the expertise or capacity in house
  - Ensure incentive or grant funding is spent more effectively
  - New opportunities to incentivize green walls with greater certainty of performance benefits

Free download from the Green Infrastructure Foundation

6. Projects in Pilot Phase (2019)



GREEN ROOFS
FOR HEALTHY CITIES
www.greenroofs.org

7. Conclusion

- We must ‘seize the day’ and adapt to our rapidly changing environment.
- The urban heat island is a growing problem, but with performance driven policy we can adapt.
- Big Idea: Capture rainwater, keep it onsite and use it to support green roofs, walls and other forms of green infrastructure.
- Big Idea: Cooling a city is like building a power plant.
- Win-win for building owners and the citizenry.

Toronto: 7 million sq feet and counting!

GREEN ROOFS
FOR HEALTHY CITIES
www.greenroofs.org

Thank You!

My contact Info: speck@greenroofs.org

Resources:

- Green Roofs for Healthy Cities
- CitiesAlive
- Green Infrastructure Foundation

- Grey to Green Conferences:
  - Minneapolis, MN Sept 30-Oct. 1
  - Washington DC., Oct. 29-30

- Living Architecture Monitor (digital magazine): Download for free
- Living Architecture Performance Tool: Download for Free

GREEN ROOFS
FOR HEALTHY CITIES
www.greenroofs.org

Poll 2

Environmental Effects of Green Roofs, a Case Study in Kansas City

Robyn DeYoung
U.S. EPA

Estimating the Environmental Effects of Green Roofs: A Case Study in Kansas City, Missouri

Date: July 11, 2019

Robyn DeYoung
U.S. EPA Office of Water
Stormwater Program

State and Local
Energy and Environment Program

EPA

Today's Presentation

- Background on green roofs in Kansas City, Missouri (KCMO)
- Elements of analytical framework to estimate benefits
- KCMO case study results
- Conclusions

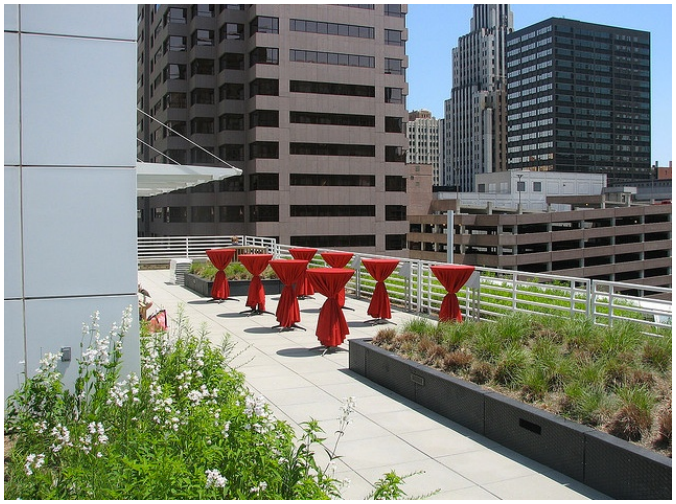
Motivating Factors for KCMO to Adopt Green Roofs

- Stormwater and sewer system discharges
  - Consent Decree with EPA
- Ozone and particle pollution
- Urban heat island effect

Goodfreephotos.com

Green Roofs in Kansas City

- KCMO added 450,000+ ft^2 of green rooftop from 1999 to 2015
- Including 16 existing green roofs
- At least 3 under construction



Example: Kauffman Center for the Performing Arts

- Built in 2011
- One of the largest green roofs in the country at 4.4 acres
- Estimated to save $56,000 a year in water costs[1]

Jeffrey L. Bruce & Company LLC

- Green Roofs for Healthy Cities gave it the Award of Excellence in 2013

1. Green Roofs for Healthy Cities

Elements of the Analytical Framework

Objectives:

- Establish a replicable analytical framework for assessing the impacts of green roofs
- Estimate impacts related to:
  - Stormwater retention
  - Heat exchange and evapotranspiration
  - Building energy savings
  - Change in power plant emissions
  - Monetized health benefits

Green Roof Methodology

- Obtain local data
- Project green roof growth
- Calculate water, heat, and energy impacts
- Calculate emissions reductions
- Monetize benefits to society

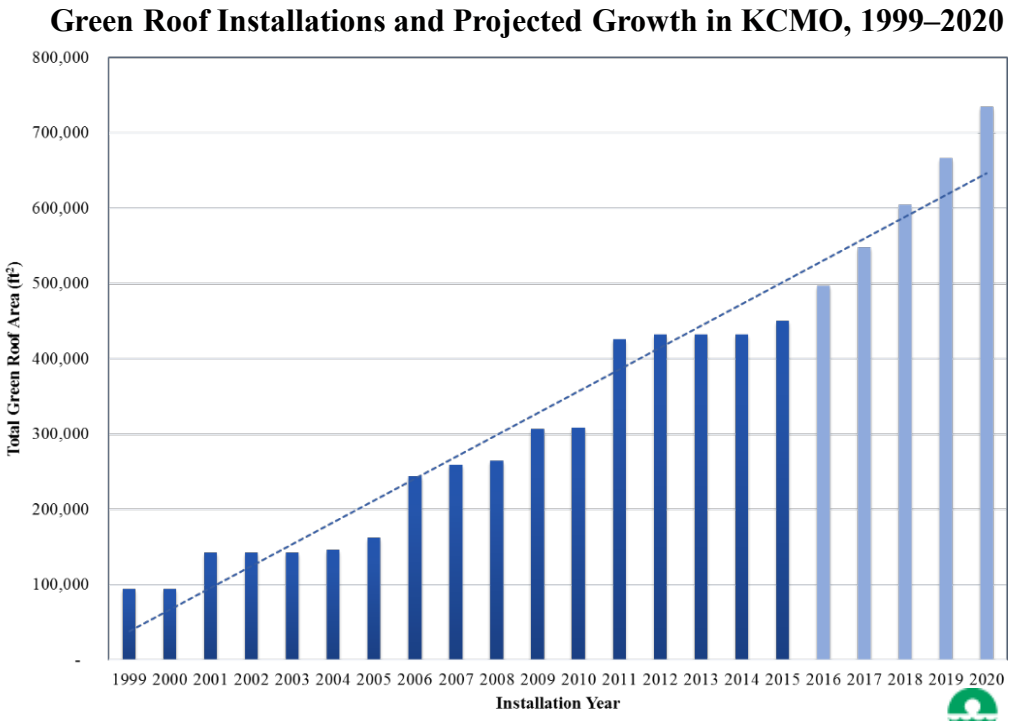
Obtain Local Data

Asked local green roof architects and municipal, state, and regional planners for information on:

- The types and number of buildings with green roofs
- Any buildings with green roofs under construction
- Existing policies providing incentives for green roofs

Project Green Roof Growth 2020 Projection Scenario

- Started with existing green roof installations
- 10.3% compound annual growth rate
- Projected 700,000+ ft^2 of green rooftop by 2020



Calculate Energy and Water Savings

- Green Roof Energy Calculator is a free online tool
- Compares energy performance of building with and without a green roof

Greenroofs.com

- Annual building energy performance datasets for 100+ North American cities
- Jointly developed by Portland State University, University of Toronto and Green Roofs for Healthy Cities

Quantify Avoided Power Plant Emissions

- AVoided Emissions and geneRation Tool (AVERT) is a free EPA tool
- AVERT using outputs from the Green Roof Energy Calculator
- Estimates avoided nitrogen oxides (NO_x), sulfur dioxide (SO_2), and carbon dioxide (CO_2) emissions at power plants due to lower demand on the electricity grid
- Regional, state and county level emissions available

AVERT
AVoided Emissions and geneRation Tool
www.epa.gov/avert

Estimate Economic Effects of Improved Air Quality

- Used Co-Benefits Risk Assessment (COBRA) derived estimates to estimate monetized health benefits
- Reductions in:
  - Premature mortality
  - Hospital admissions
  - Emergency department visits
  - Asthma exacerbation
  - Respiratory symptoms
  - Missed days of school or work

COBRA
Co-Benefits Risk Assessment
Health Impacts Screening and Mapping Tool

Results of KCMO Case Study: Projected Environmental Benefits

By 2020, green roofs in KCMO will:

- Retain 29 inches of annual stormwater runoff
- Save 602,000 kWh of electricity ($42,000)
- Reduce emissions from power plants:
  - 90 lbs/yr of particulate matter$_{2.5}$
  - 2,690 lbs/yr of SO_2
  - 1,800 lbs/yr of NO_x
  - 1,150 tons/yr of CO_2
- Improve public health, with economic benefits of: $35,500 - $80,000

Conclusions

- Quantitative methods provide tangible data for decision-making
- Methods replicable nationwide
- Green roof policies and incentives will bolster environmental outcomes

Access the report

EPA Web resources

- Using Green Roofs to Reduce Heat Islands

- Soak up the Rain: Green Roofs

Questions?

Robyn DeYoung, U.S. EPA

Office of Water

202-343-9080

deyoung.robyn@epa.gov

Poll 3

Denver's Green Building Ordinance Development Process

Katrina Managan

Denver Department of Public Health and Environment

EPA

HEAT ISLAND REDUCTION PROGRAM

State and Local Energy and Environment Program

Urban Heat Island and the Green Building Ordinance

EPA Heat Island Webinar

July 11th, 2019

1.3.2 Importance of Climate Projections for Denver

The Climate Adaptation Plan has identified the following three key potential impacts for Denver based on climate change projections for the Front Range:

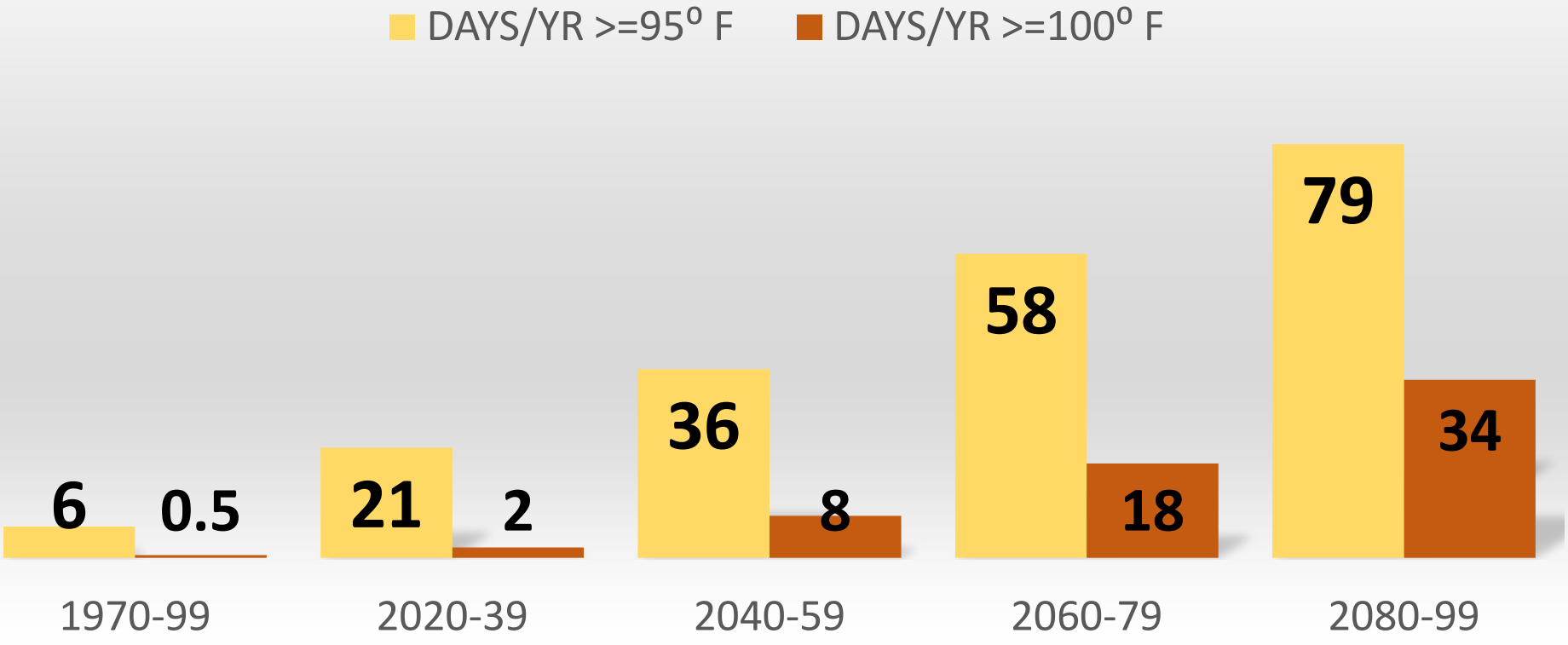
1. Increase in temperature and urban heat island effect
2. Increase in extreme weather events
3. Reduced snowpack and earlier snowmelt

Increase in Temperature and Urban Heat Island Effect

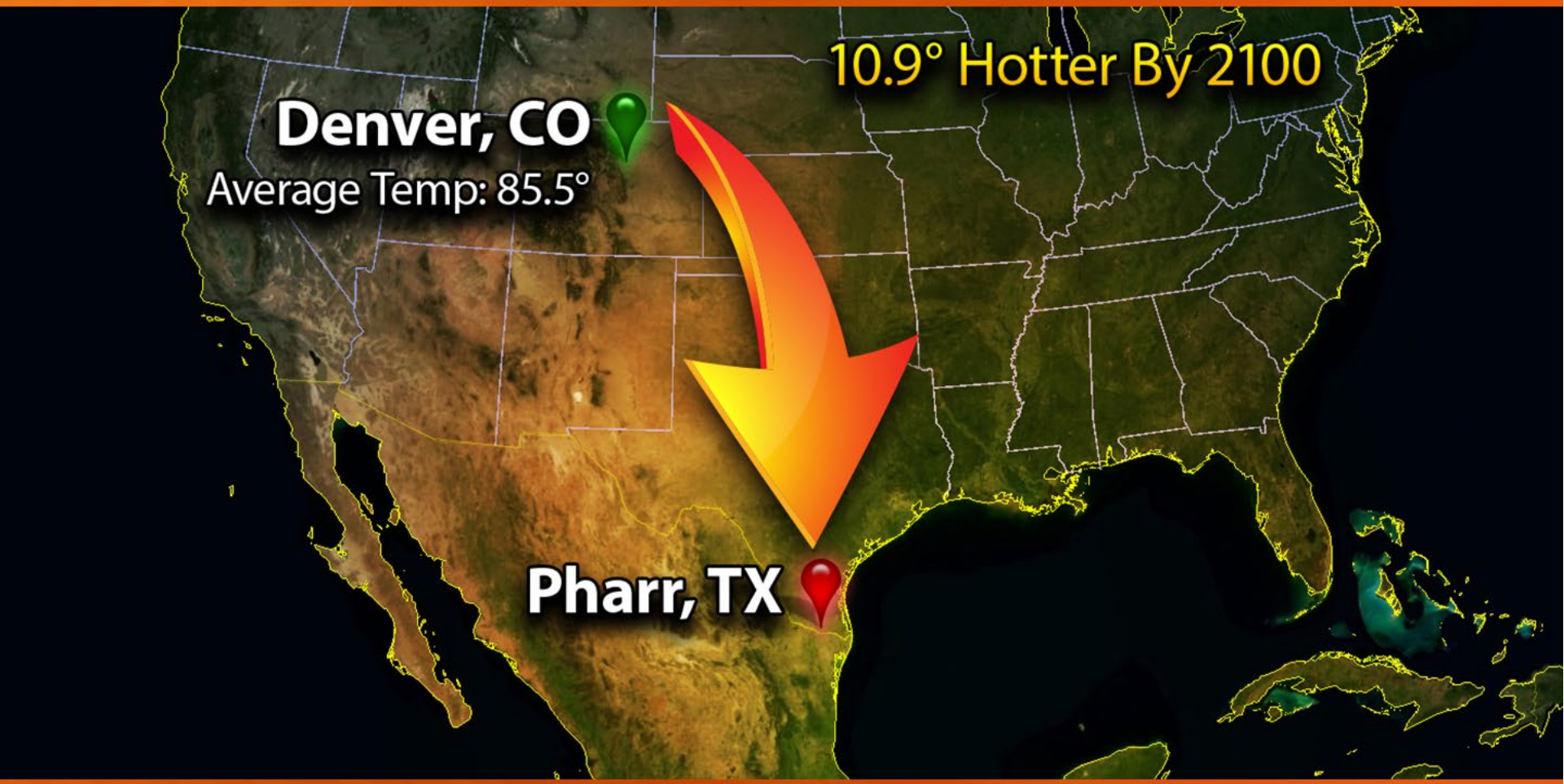
Urban heat islands refer to the elevated temperatures in developed areas compared to more rural surroundings. Urban heat islands are a result of surface properties of building materials, such as pavement and asphalt, combined with reduced vegetation. On a hot, sunny, summer day, surfaces exposed to the sun can reach 50 to 90°F hotter than the air temperature, while shaded or moist surfaces, often in more rural surroundings, remain close to air temperatures. On average the difference in daytime surface temperatures between developed and rural areas is 18 to 27°F and the difference in nighttime temperatures is 9 to 18°F.

City and County of Denver Climate Action Plan (2014)

Projected Change in Denver's Climate

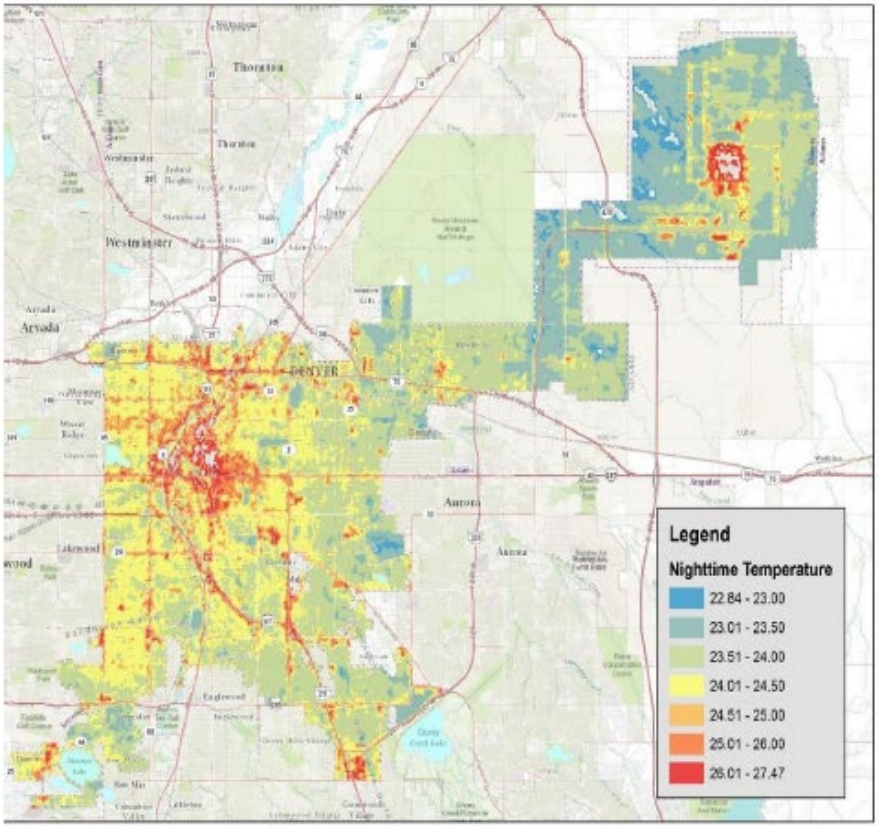


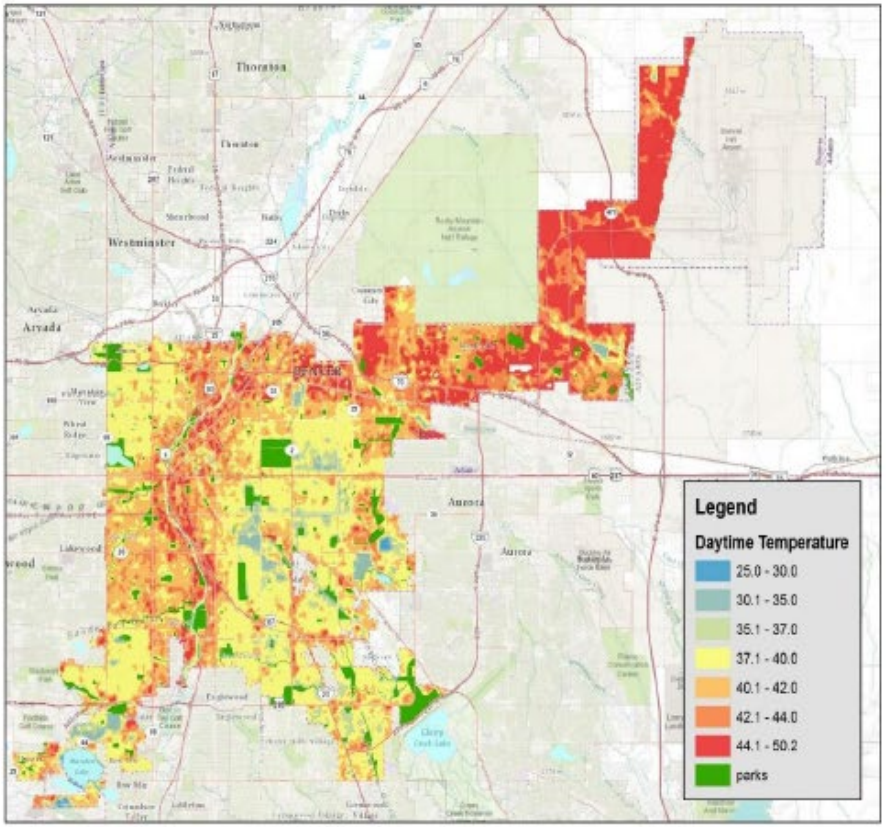
WHERE YOUR SUMMER IS HEADED



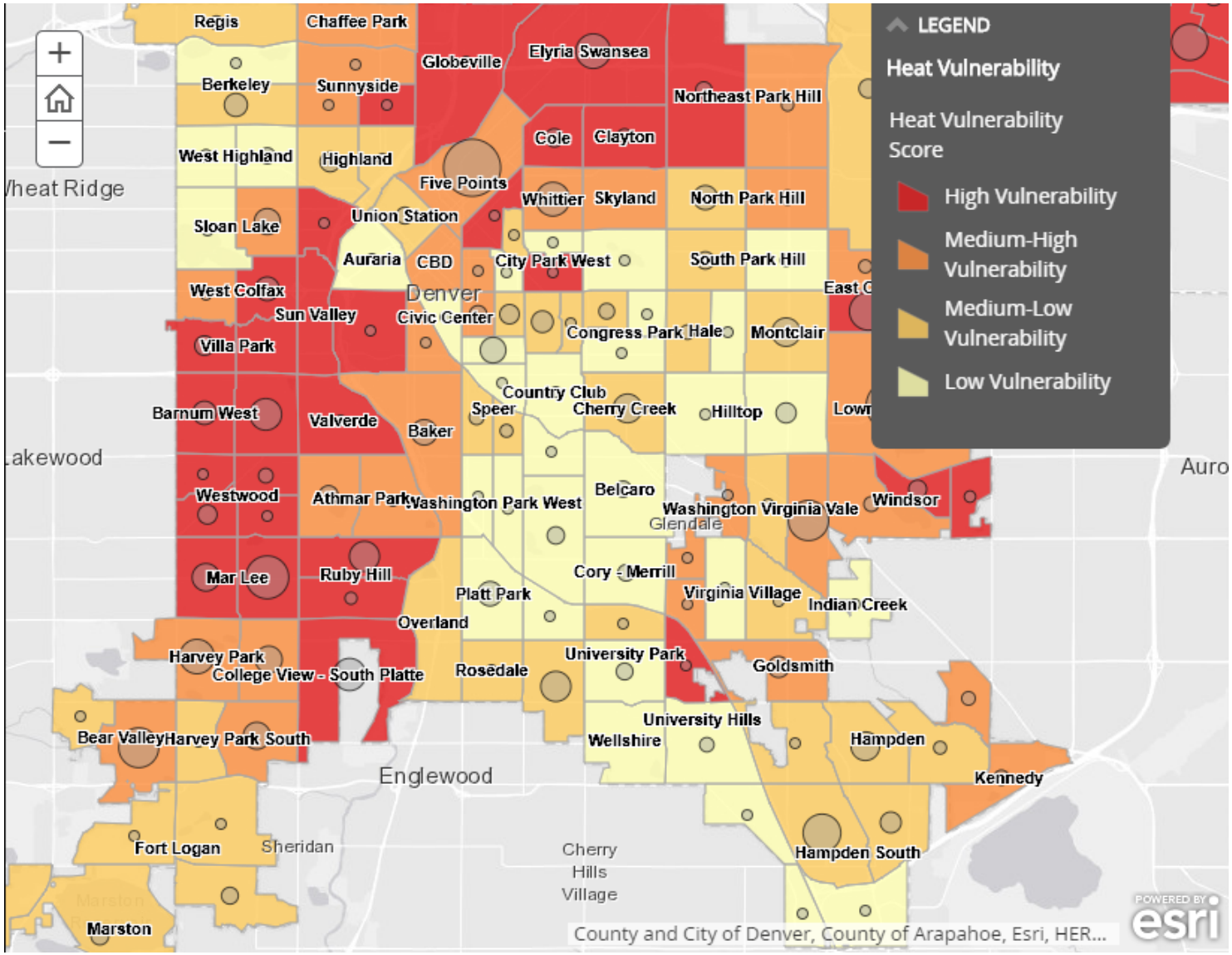
Current temperatures: PRISM Climate Group, Oregon State University, http://prism.oregonstate.edu, accessed July 1, 2014.
CMIP5 multi-model ensemble dataset based on current emission trends.

CLIMATE CENTRAL



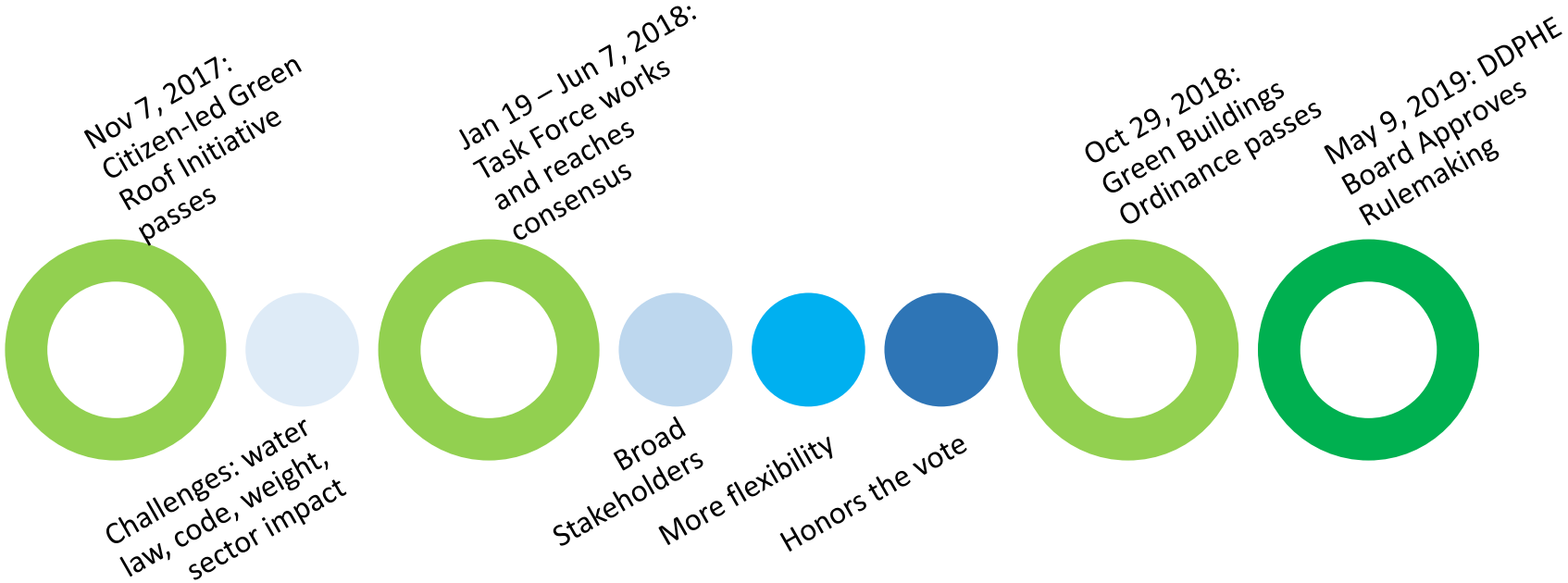


Source: Mehdi Heris and Austin Troy, CU Denver Dept of Urban and Regional Planning


LEGEND
Heat Vulnerability
Heat Vulnerability Score
High Vulnerability
Medium-High Vulnerability
Medium-Low Vulnerability
Low Vulnerability
Regis
Chaffee Park
Globeville
Elyria Swansea
Berkeley
Sunnyside
Northeast Park Hill
Cole
Clayton
West Highland
Highland
Five Points
Whittier
Skyland
North Park Hill
Wheat Ridge
Sloan Lake
Union Station
Auraria
CBD
City Park West
South Park Hill
West Colfax
Denver
Sun Valley
Civic Center
Congress Park
Hale
Montclair
Villa Park
Country Club
Cherry Creek
Hilltop
Barnum West
Valverde
Speer
Baker
Lakewood
Westwood
Athmar Park
Washington Park West
Belcaro
Washington Virginia Vale
Windsor
Glendale
Mar Lee
Ruby Hill
Cory - Merrill
Platt Park
Virginia Village
Indian Creek
Overland
Harvey Park
College View - South Platte
Rosedale
University Park
Goldsmith
University Hills
Bear Valley
Harvey Park South
Wellshire
Hampden
Englewood
Kennedy
Fort Logan
Sheridan
Cherry Hills Village
Hampden South
Marston
County and City of Denver, County of Arapahoe, Esri, HER...
POWERED BY esri

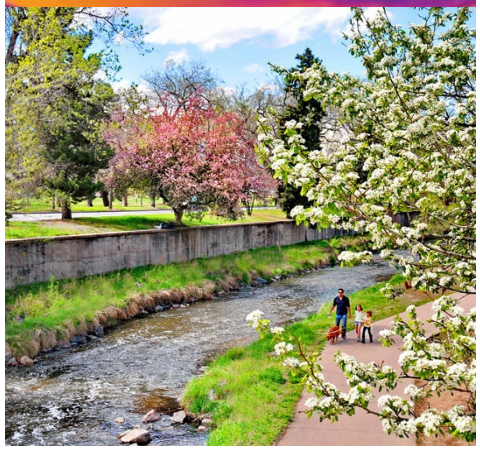

50% of Denver homes do not have air conditioning

Green Roofs to Green Buildings



Green Building Ordinance Increases Benefits

- Urban Heat Island
- Green Spaces
- Water and Storm Water Management
- Greenhouse Gas Emission Reductions



Green Buildings Ordinance

Buildings over 25,000 sq. ft.

Cool Roof Required
+
ONE of the Following Compliance Options

Compliance Options for *New Buildings*

- Green Roof / Space
- Pay for Offsite Green
- Green + Solar or Energy Efficiency
- Solar or Energy Efficiency
- Certification

Compliance Options for *Existing Buildings*

- Green Roof / Space
- Pay for Offsite Green
- Solar or Energy Efficiency
- Certification
- Energy Program

Green Buildings Ordinance: Who is Covered

Buildings of 25,000 square feet or more:

1. **New buildings**
2. **Existing buildings** – only if recovering/replacing roof
   - Early enrollment into Energy Program
   - At roof replacement
3. **Additions**
   - 25,000–49,999 sq. ft.
   - ≥ 50,000 sq. ft. or more

Exemptions
Ordinance does not apply

- Buildings or additions under 25,000 square feet
- Parking structures
- Temporary buildings, air-supported structures, greenhouses
- Single-family homes or duplexes
- Groups of 3 or more attached dwelling units in which each unit extends from the foundation to roof and is not more than 3 stories above grade plane
- Roof replacements of less than 5% of the roof or roof section area (annually)

Partially Exempt
Must still do a Cool Roof

- Residential buildings 4-5 stories, or under 62.5 feet in height
- Roof recover only
- Existing green roof or the building/campus has already met the ordinance
- Emergency roof replacement (wind or fire damage, not hail)
- Hail damage with insufficient insurance coverage (ONLY until Nov. 2, 2019)

Questions?

Katrina Managan
Climate Smart Buildings Team Lead
katrina.managan@denvergov.org
720-865-2890

Question and Answer Session

Connect with the Heat Island Program

Victoria Ludwig

U.S. Environmental Protection Agency

202-343-9291

Webcast Feedback Form

Heat Island Program Website

EPA Heat Island Newsletter Sign-Up