Heat Island Group

BERKELEY LAB

UHI mitigation in cities: Integrated approach is key to success

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Taller Efecto Isla de Calor Urbana en la Ciudad de México

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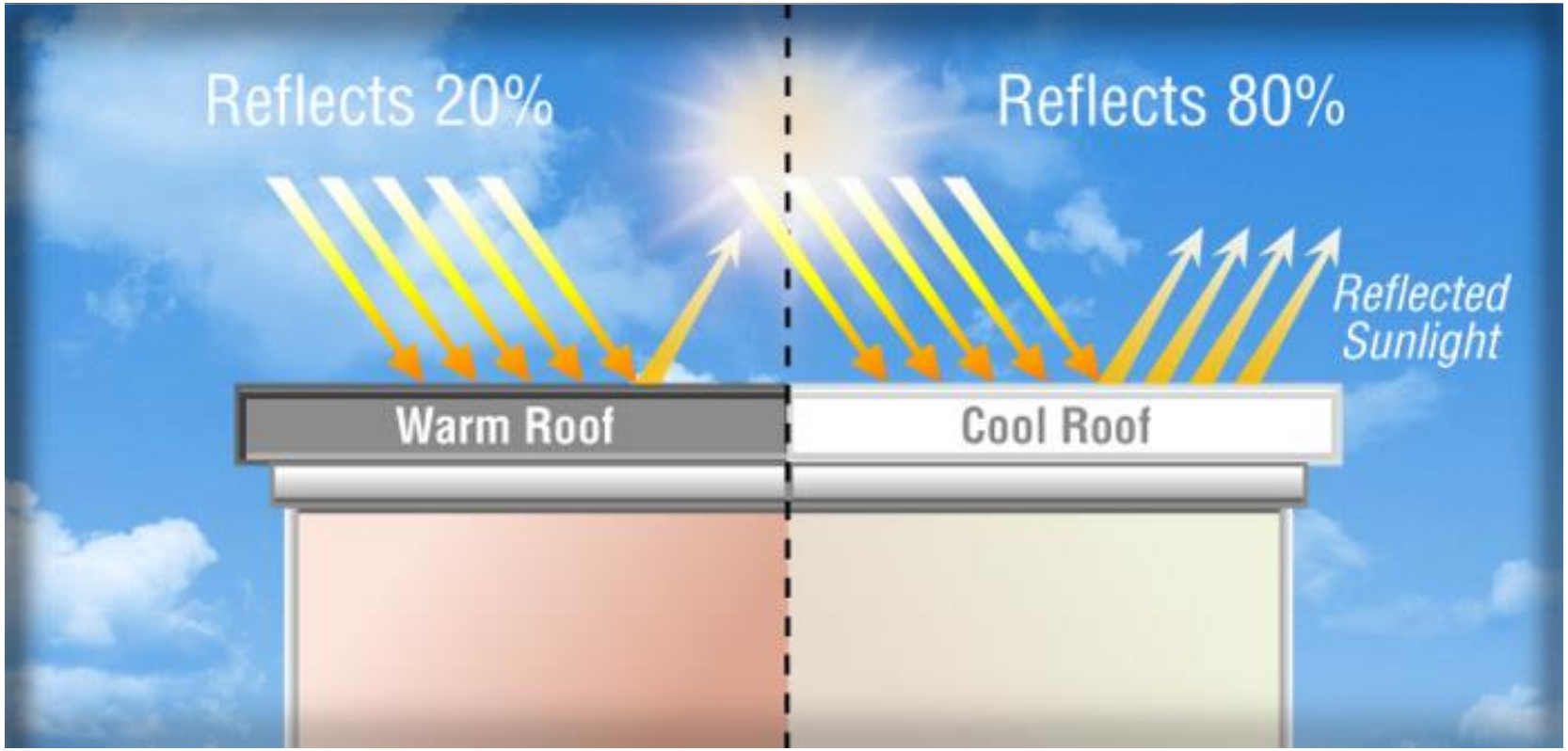
The Heat Island Group at LBNL have been working since 1986 to characterize and develop countermeasures for urban heat islands (UHIs)

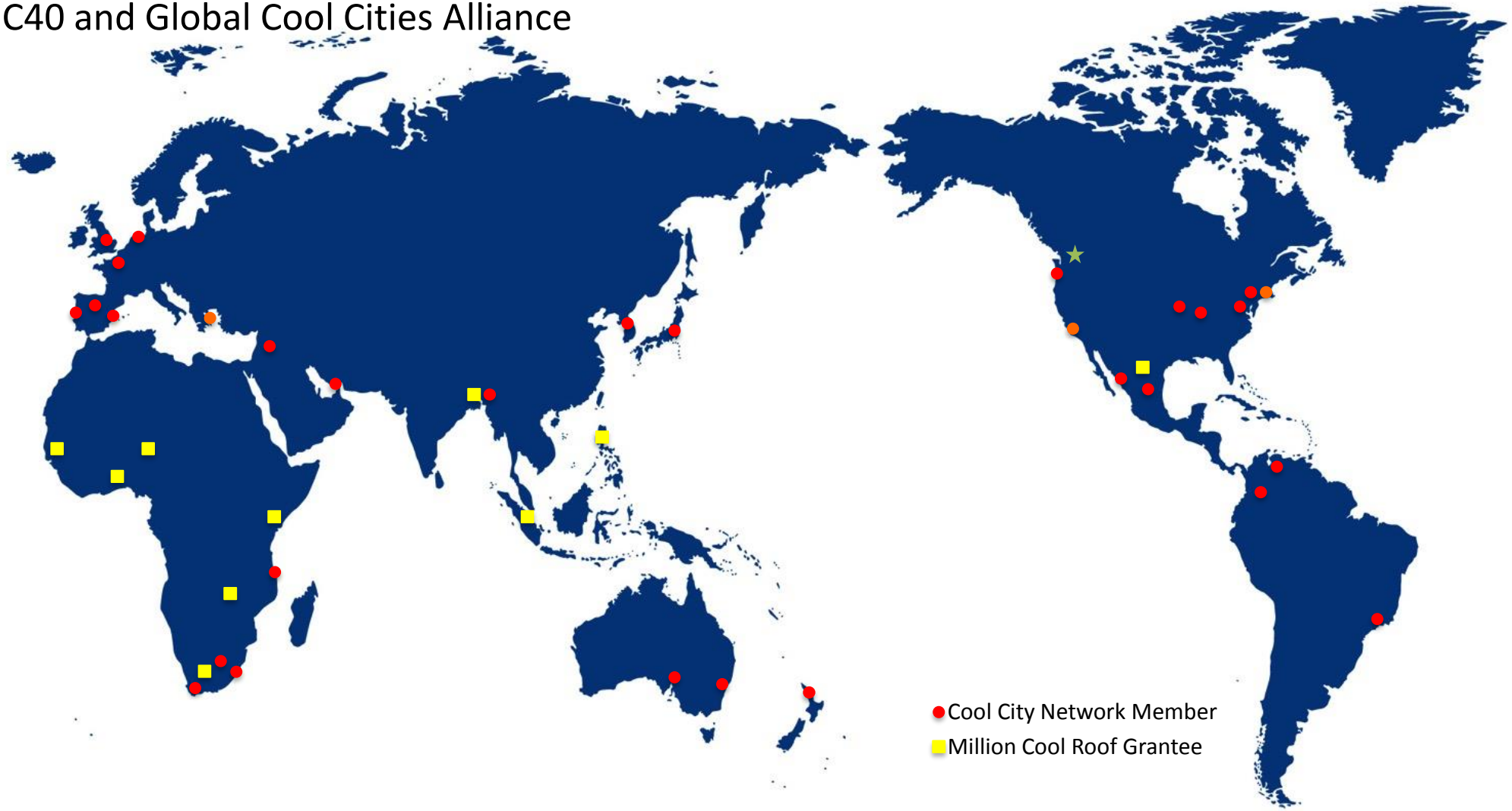
We work to cool buildings, cities, and the planet by making roofs, pavements, and cars cooler in the sun.



We are here today because we know mitigating urban heat islands is important to multiple city goals and policies

CDMX is not alone—many cities are working to develop research, policy, and plans to cool their cities

Cool Cities Network
35 global members
Managed by C40 and Global Cool Cities Alliance



We learned that an integrated, systems approach leads to successful outcomes

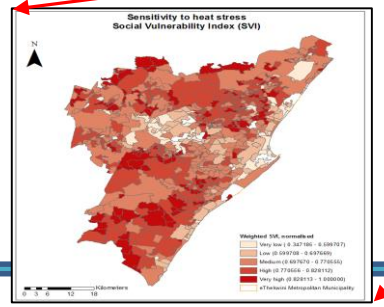
Taking Stock	How can urban cooling contribute to existing priorities, strategies, and plans? What existing policies, programs, partnerships, developments, projects or research would advance cooling efforts?
Stakeholder Engagement	Which organizations/constituencies should be a part of the policy design process? Which groups would serve as effective champions for cooling? What capacity and support do they need to be successful?
Gather and Analyze Data	What data already exists that characterizes climate, land use and land cover, vulnerable populations, future capital improvements, and other unique aspects of my city? What data exists that supports action on urban cooling, like energy saving benefits?
Policy Development	What mix of cooling strategies delivers the most immediate, high-impact results while minimizing negative consequences?

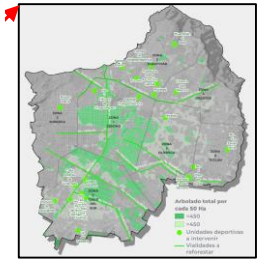
Source: Adopted from Global Cool Cities Alliance

Over a dozen case studies of good urban cooling practices

eThekwini
Targeting Policy for Social Uplift

- Data-driven mapping of region based on health, demographic, and socio-economic factors
- Tree planting in most vulnerable areas via mini-nurseries.





Guadalajara
Ciudada Fresca

- Map and monitoring urban hot spots
- Public awareness campaign for cool roofs
- Planting 15k trees in hot spots, main roads, and sports facilities ($21M in annual benefits)
- Revitalize nurseries for 74 native species

Hyderabad
Cool Roof Pilot

- 40 houses, 1,000 m^2
- 2°C reduction in indoor air temp. 76% residents very happy with cool roof.
- Product retails at $21/$m^2$ (provided free in pilot by Dow)

Specific examples

Los Angeles has been collaborating with researchers, city departments, local non-profits, and many other stakeholders to implement their urban cooling efforts

PLANS & GOALS + **STAKEHOLDER COLLABORATIONS** + **RESEARCH** = **ACTION & IMPLEMENTATION**

GREEN NEW DEAL PLAN

Resilient LA

LA Cooling

LA City Council's ittee on ooling and Urban Heat Impacts

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UCLA

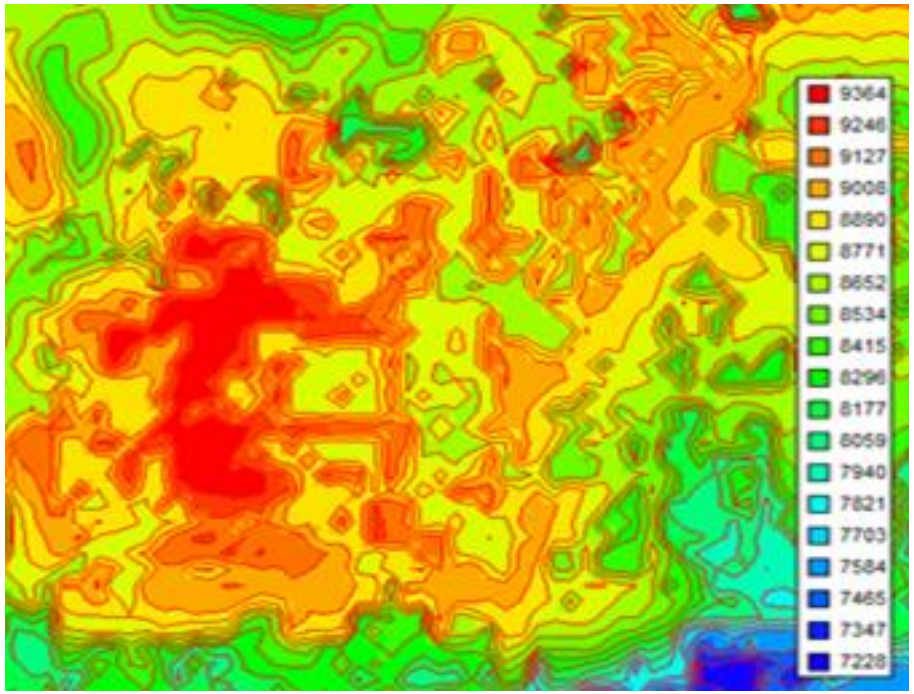
ASU Arizona State University

Altostratus Inc.

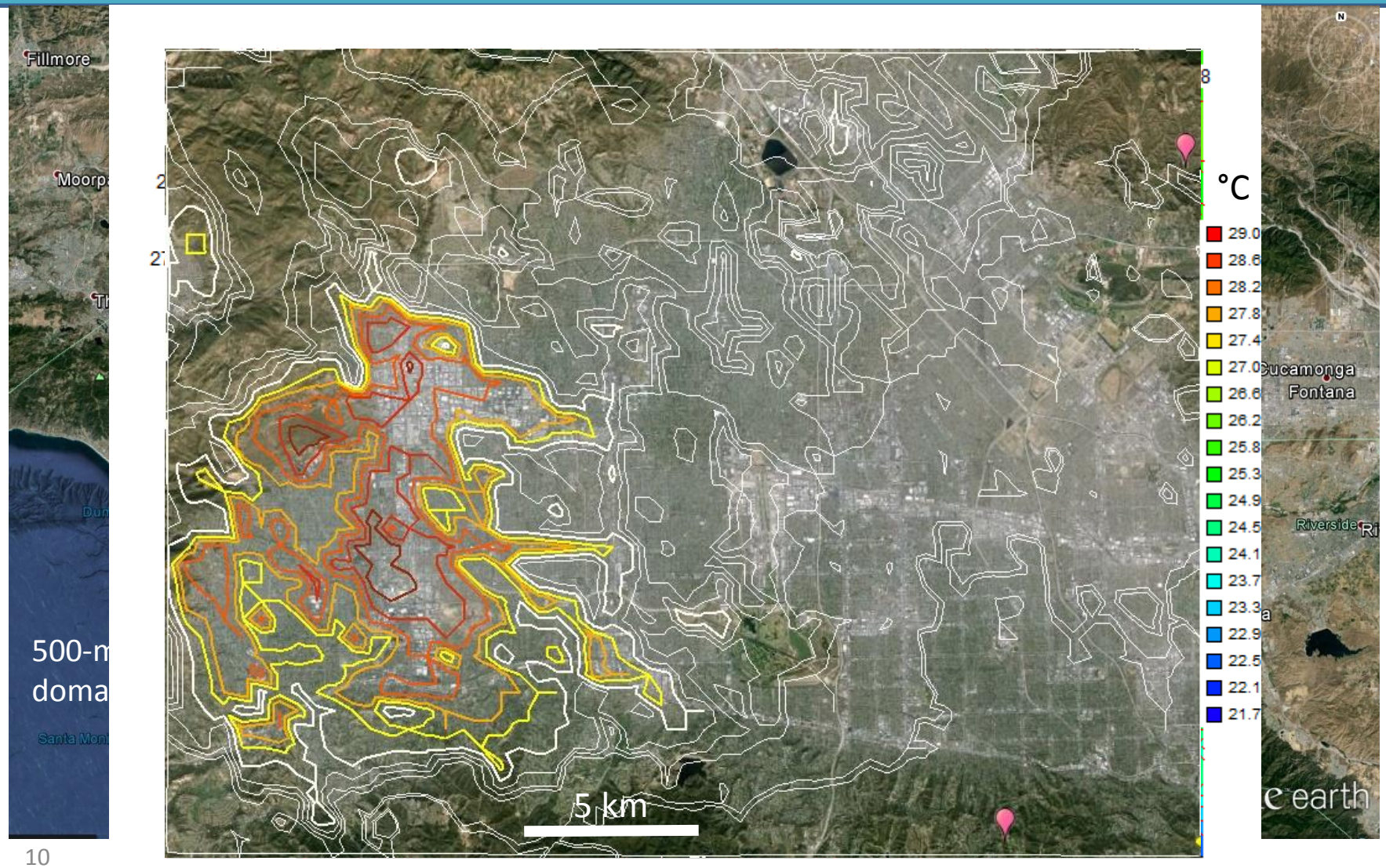
Cool roof mandate

Increase in tree canopy

We completed a project recently to measure and model how surface cover affects air temperature in Los Angeles…

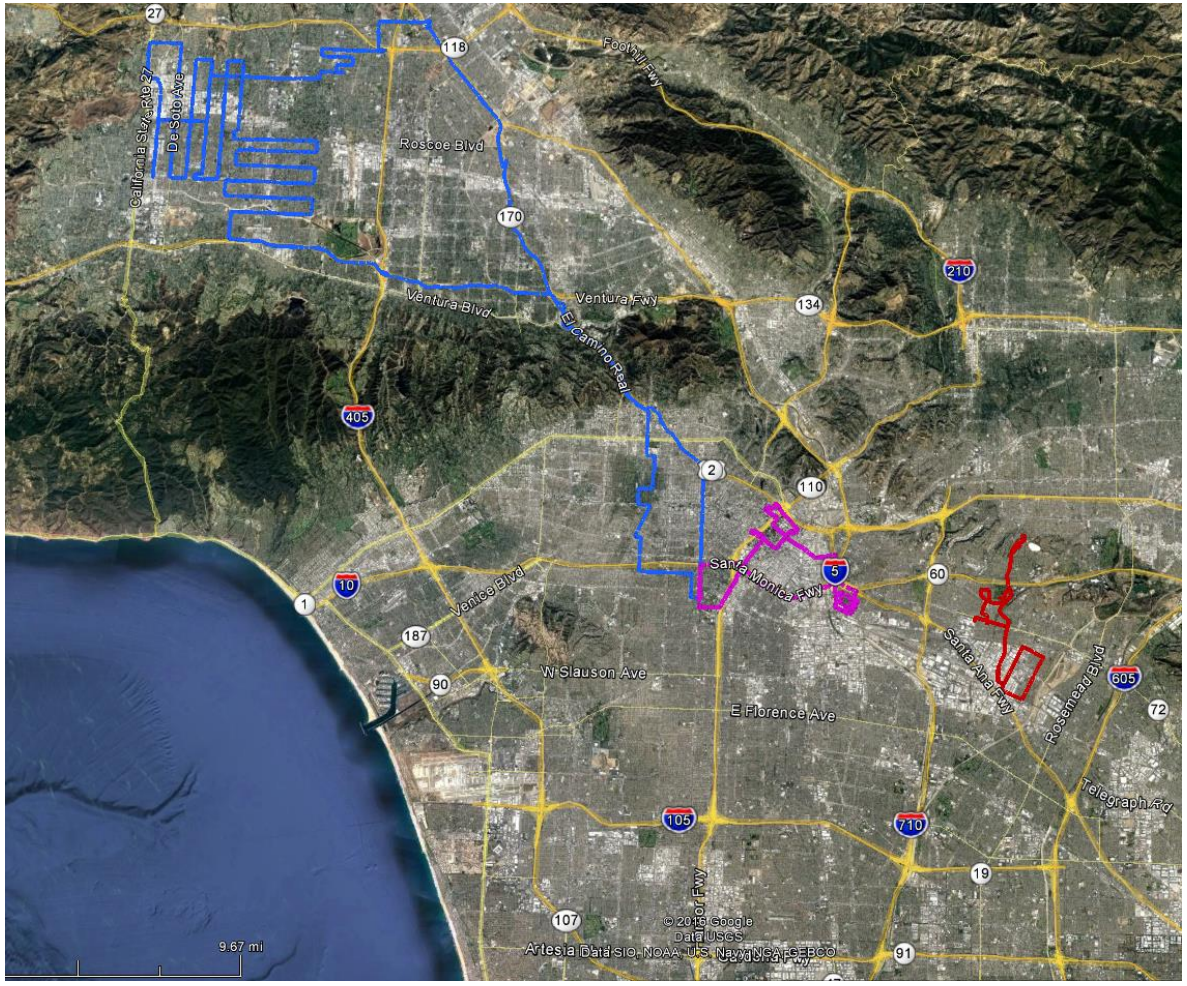


Urban climate simulations guide placement of rooftop weather stations & routes for mobile transects



Mobile transects (car + thermometer + GPS) used to check modeled air temperature simulations

Mobile transect sensor (front & side views)



Three different mobile transects routes

Increases in albedo and tree cover were found to reduce air temperatures: these findings affect local implementation in California communities

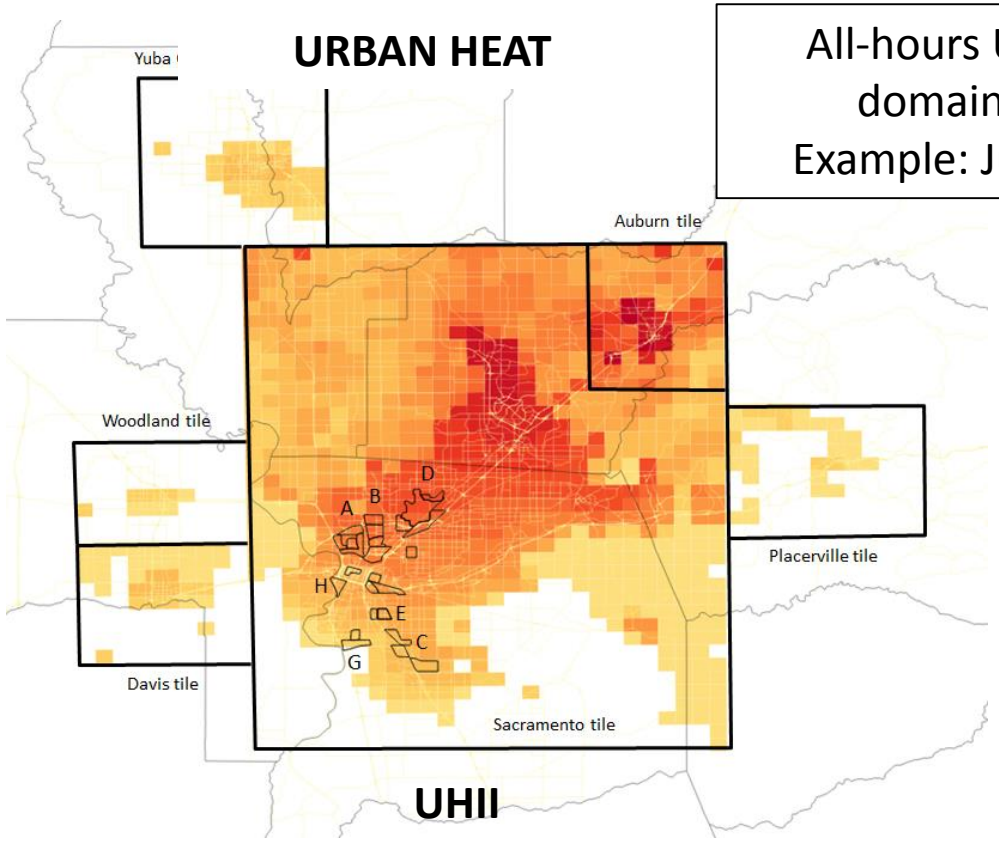
Source: Central Roofing

Source: Chandler's Roofing

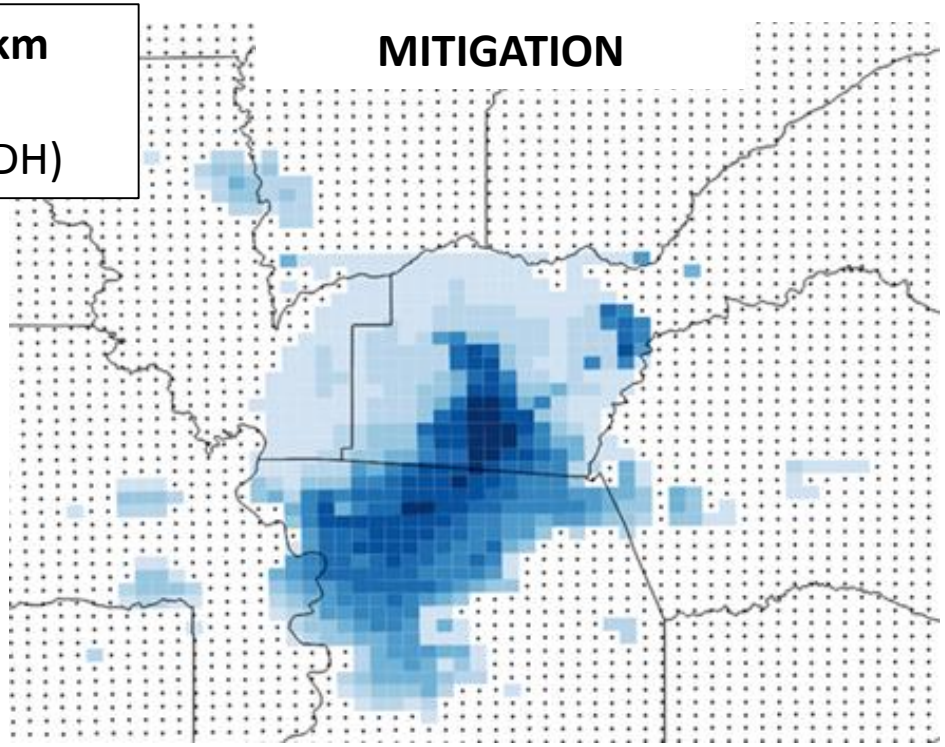
- Evidence in study from existing roof albedo & urban greening values which have room for improvement
- Cool roof & greening programs and policies can mitigate urban heat
- These programs can be tailored to be more effective

Modeling tools and methods have evolved to evaluate regional and local effects of UHI mitigation strategies

All-hours UHII (composite **2 km** domain) and UHII change.
Example: July 16 – 31, 2015 (DH)



All-hours UHII (composite **2 km** domain)



(from albedo and vegetation increases)

Composite of UHII tiles (each relative to its own time-varying upwind reference points). Example: July 16-31, 2015 all-hours averaged UHI Index for six tiles in the Sacramento region.

In places such as Auburn and Roseville / Lincoln, the UHI Index can be elevated at times because of day/night variations in temperature of natural surroundings, higher elevations, or heat transport -- effects range from (white to dark blue) 0 to -549 C° · hr / 15 days.

Mitigation potential of local projects, cooling strategies and scale of effects

Location

Cooling Strategy

Project area	All-hours Tair UHII (°F)**		Localized/no advection UHII attainment local mitigation only	Localized+advection UHII attainment local mitigation+advection
D05	4.34			
Yuba City / Marysville		Cool roofs / pavements	-58%	-82%
Downtown YC and M		Cool pavements	-46%	-70%
		Electric vehicles	-7%	-31%
		Vegetation cover	-71%	-95%
D06	3.85			
Woodland		Cool roofs / pavements	-60%	-93%
DAC census tracts		Cool pavements	-69%	-101%
		Electric vehicles	-7%	-39%
		Vegetation cover	-51%	-84%
D07	8.06			
Sac / SE Sac		Cool roofs / pavements	-29%	-63%
AB617 A, B, D		Cool pavements	-31%	-65%
		Electric vehicles	-6%	-39%
		Vegetation cover	-33%	-67%
D07	4.19			
Sac / SE Sac		Cool roofs / pavements	-56%	-93%
AB617 C, E, G		Cool pavements	-60%	-97%
		Electric vehicles		
		Vegetation cover		

Local effect

Neighbor effect

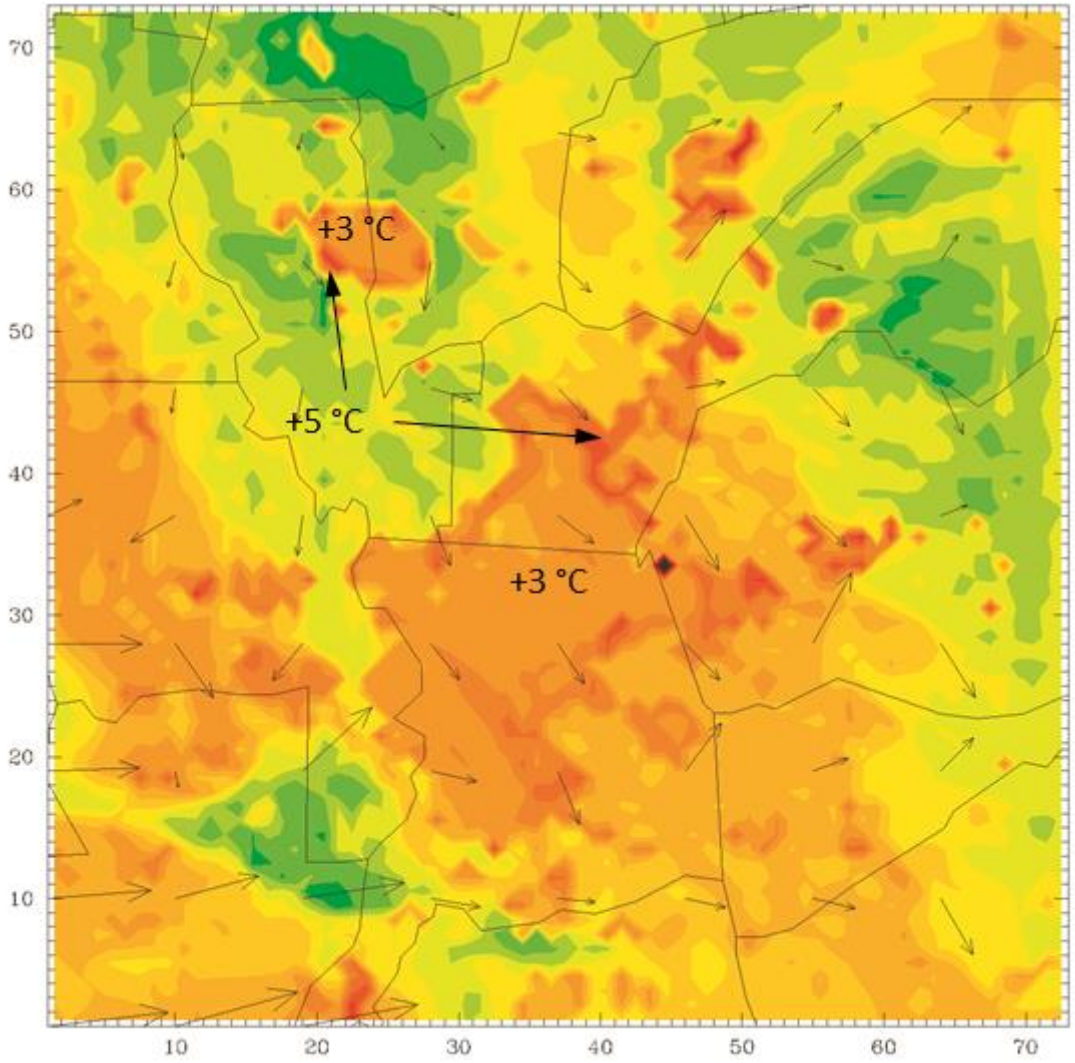
Gracias! / Thank you!

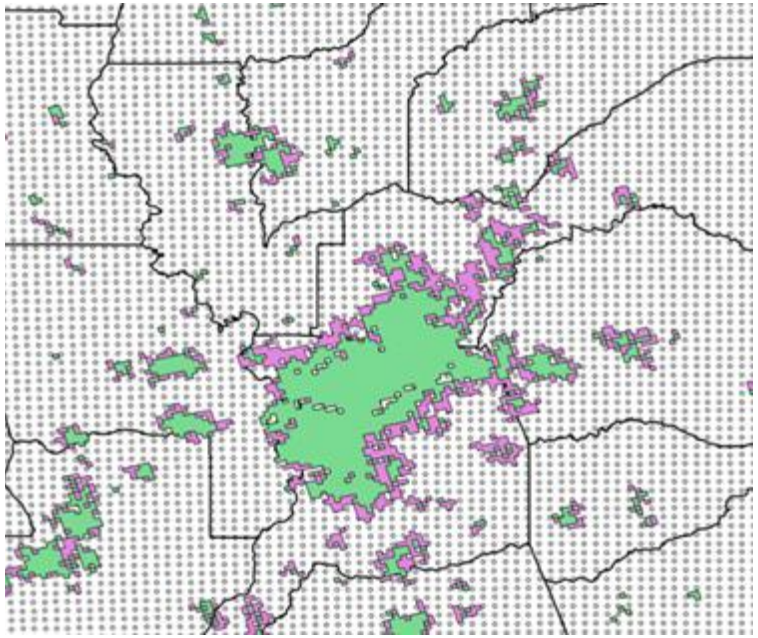
Supplemental

Effects of climate and land-use changes.

Example: Temperature difference between 2050 RCP 8.5 and 2015 at 1600 PDT, July 27.

(Specific random hour, showing intra-urban differences between current and new urban areas)





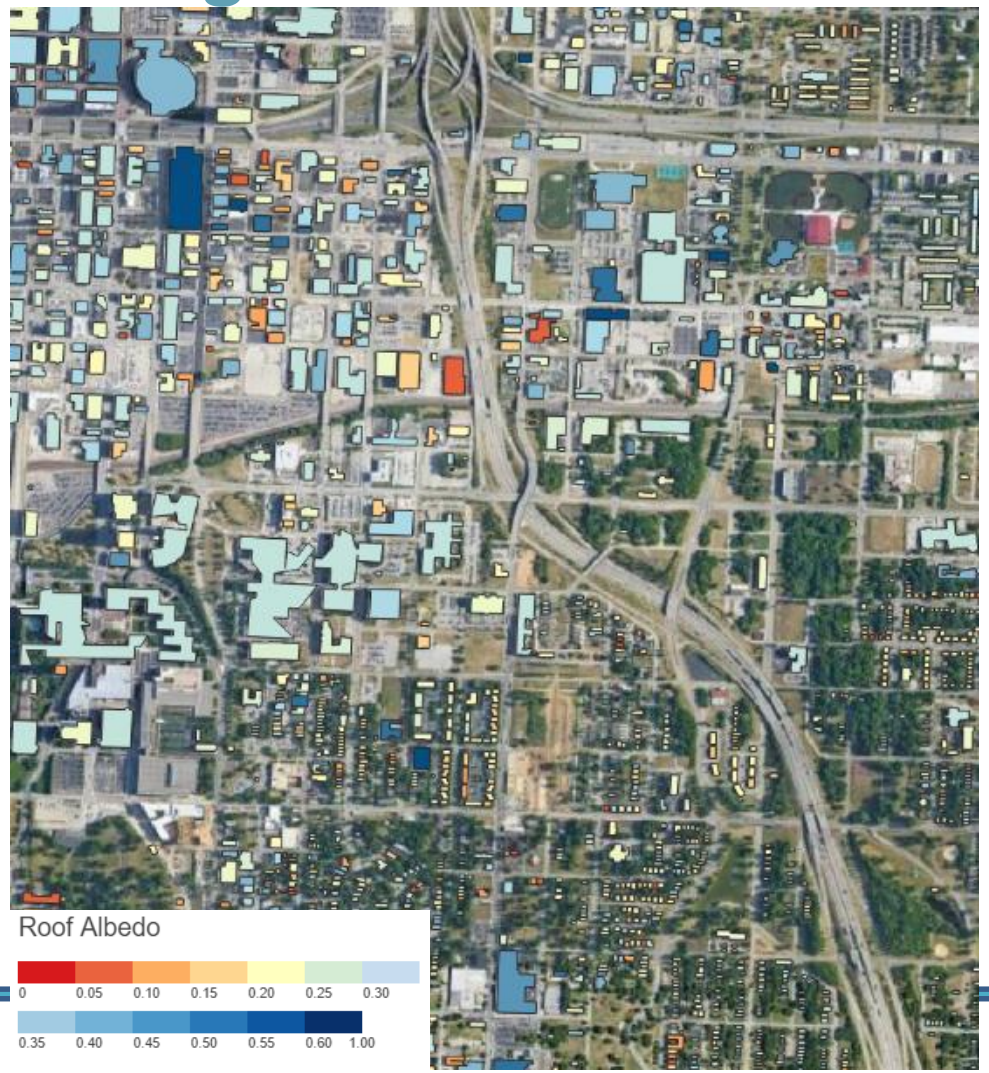
New urban areas by 2050

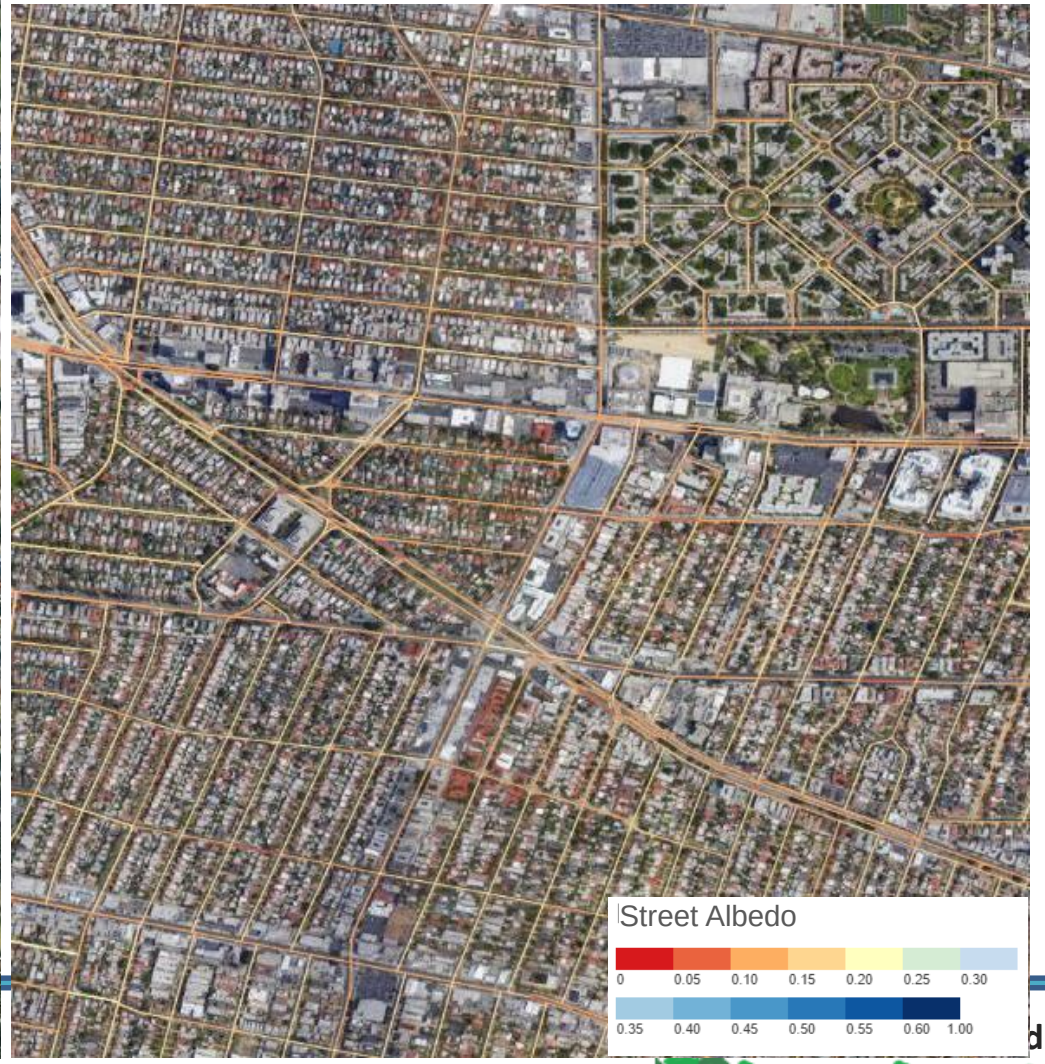
Temperature change:

- Dark green to dark red: +1 to +5 °C
- New urban areas up to 5 °C (9 °F): clim + LU
- Current urban are up to 3 °C (5.4 °F): clim

Altostratus Inc.

Coming Soon: Urban Surfaces Model for Roof and Road Albedo





0.5 – 2M resolution

Imagery from 2009 to 2018

Free to use

Plays well with others

Paris: Cool Oasis Initiative

Permeable pavement

High-albedo pavement

School gardens

Rainwater catchment

Shading structures

Tree canopy

Outcomes →

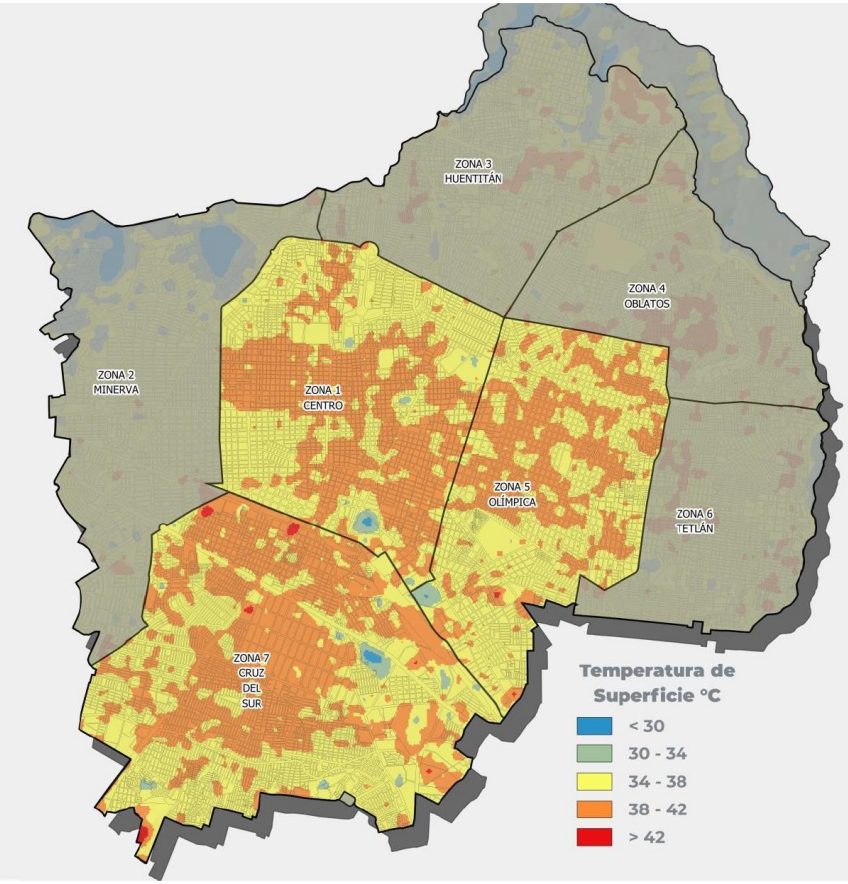
Source: Bloomberg Associates

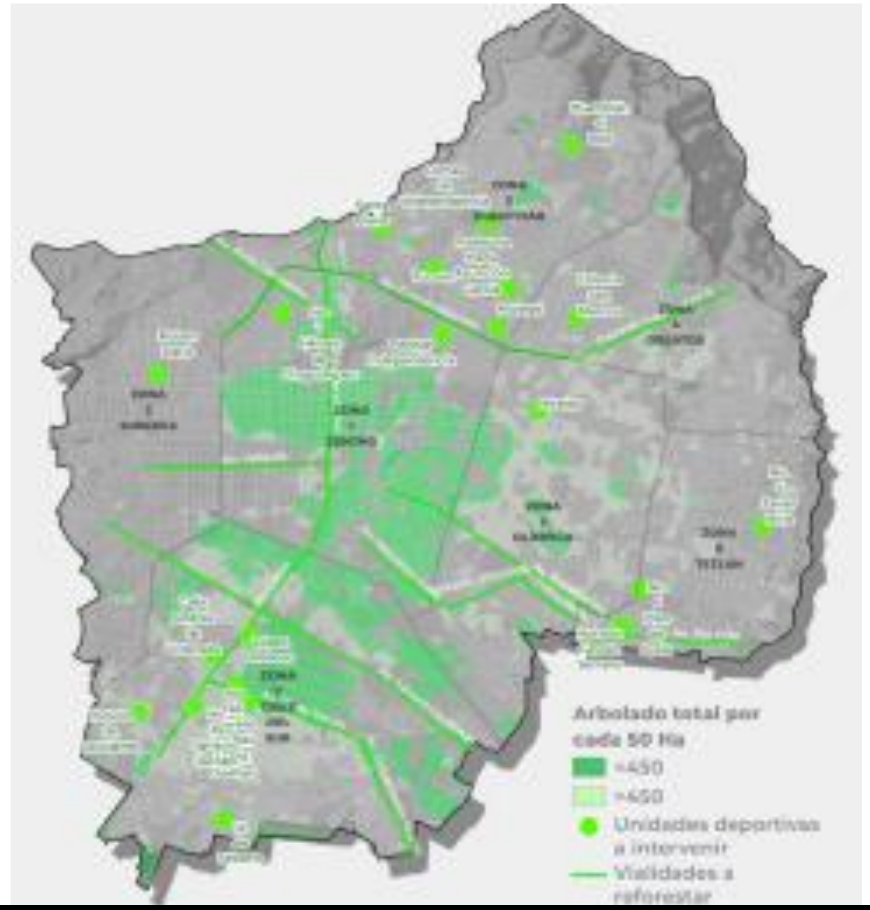
US $5M for 30 playground retrofits in highly vulnerable neighborhoods – 770 by 2040

Guadalajara: Ciudad Fresca

Identify heat islands ◊ Promote cool roofs (primarily coating) ◊
Reforestation in strategic sites ◊ Reinvigorate native tree nurseries

Guadalajara: Cuidad Fresca





15,000 trees planted:

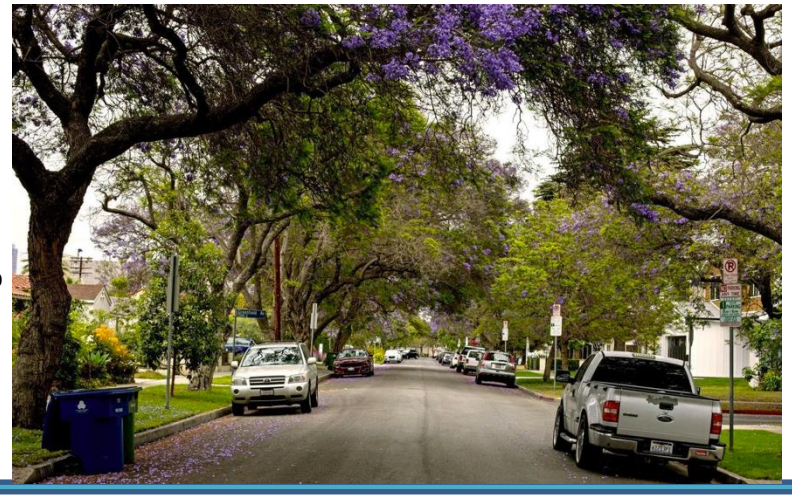
- Along 15 main roads
- In 39 parks
- Near 19 sports facilities

Support nurseries for 74 native tree species

Identify heat islands ◊ Promote cool roofs (primarily coating) ◊ Reforestation in strategic sites ◊ Reinvigorate native tree nurseries

Increases in albedo and tree cover were found to reduce air temperatures

Source: Central Roofing



Source: Los Angeles Times

- Weather station analysis revealed increases in roof albedo at neighborhood scale are associated with reductions in air temperature
- Analysis from mobile transects also found a cooling effect from area-wide increase in albedo and/or canopy cover