GLOBAL HEAT HEALTH INFORMATION NETWORK

Urban Heat Interventions & Evaluation:

A Los Angeles Case Study on Improving Heat-Health Outcomes Using Land Cover Prescriptions

Masterclass 5.3

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Los Angeles Urban Cooling Collaborative / University of California, Los Angeles

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Photo credit: TreePeople

LOS ANGELES URBAN °COOLING COLLABORATIVE

LOS ANGELES, CA, USA

- 10 million residents
- Mediterranean climate
  - 121°F/50°C on Sept. 6, 2020
- Varied topography and ecosystems
  - Sea level to 10,000 ft/3,000m
  - Coastal sage scrub, chaparral, oak woodland, montane woodland, grasslands, desert, riparian, and wetlands

Photo credit: Patrick Coyne

LOS ANGELES, CA, USA

Video credit: Coalition to Preserve LA

MENTIMETER QUESTION #1

THINK ABOUT YOUR CITY OR TOWN.

Why do some neighborhoods have more tree cover than others?

PROJECT TEAM

LOS ANGELES URBAN °COOLING COLLABORATIVE

MULTI-DISCIPLINARY AND INTER-SECTORAL PARTNERSHIP TO BRIDGE SCIENCE TO PRACTICE

Academia | Non-Governmental Organizations | Government | Private Industry

Public health, bioclimatology, forestry, policy, climate science, environmental psychology, anthropology

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TreePeople

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UCLA / TreePeople

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UCLA

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Climate Resolve

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Applied Climatologists

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Dr. Scott Sheridan
Kent State University

Kurt Shickman
Global Cool Cities Alliance

CAN LAND COVER CHANGES COOL LOS ANGELES ENOUGH TO SAVE LIVES?

We tested "prescriptions" combining

Tree cover + Solar reflectance (albedo) of roofs and pavements

We evaluated the prescriptions' impacts on

- Temperature, humidity
- Mortality reductions
- Air mass frequencies
- Climate projections

HEALTH OUTCOMES

Mortality	Deaths ● may not be diagnosed as heat-caused or heat-related ● "excess deaths" are over and above those expected normal for the time period, based on historical averages
Morbidity	Any episode of illness, impairment or degradation of health ● hospitalizations ● emergency room visits ● ambulance calls

PRESCRIPTION SCENARIOS

	Tree Cover	Solar Reflectance (Albedo)
Rx 1	Low	High
Rx 2	High	Low
Rx 3	Medium	Medium
Rx 4	High	High

Tree Cover Prescription Metrics

Baseline = 16% for LA County; variable by district.
Low = 25% relative increase (baseline x 1.25)
Medium = 100% relative increase (baseline x 2)
High = 40% tree cover (regardless of baseline)
For example, for LA County baseline of 16%, a low scenario would be an increase to 20%; medium to 32%; and high to 40%.

Solar Reflectance Prescription Metrics

Baseline = Steep roofs reflect 10% of solar energy. Flat roofs reflect 30%. Roads reflect 10-15%.
Low = Steep roofs reflect 25%. Flat roofs reflect 63%. Roads reflect 20-25%.
Medium = Steep roofs reflect 30%. Flat roofs reflect 70%. Roads reflect 30%.
High = Steep roofs reflect 35%. Flat roofs reflect 75%. Roads reflect 35%.

AN AIR MASS APPROACH TO EVALUATE HEAT-HEALTH RELATIONSHIPS

- Led by **Dr. Larry Kalkstein,** our researchers evaluate **"weather situations"** rather than individual weather elements
- Unique procedure developed in their lab, the **spatial synoptic classification (SSC)**
- Puts each day into a particular air mass type
- Two types particularly oppressive: **Dry Tropical** and **Moist Tropical+**

Dry Tropical (DT)	Represents the hottest, driest conditions found at any location. There are two primary sources of DT: either it is transported from desert regions, or it is produced by rapidly descending air.
Moist Tropical+ (MT+)	Hotter and more humid subset of common MT, and thus captures the most "oppressive" subset of MT days. Air mass originates over warm water bodies. Warmest nights of any air mass.

MEAN MORTALITY INCREASES WITHIN OPPRESSIVE AIR MASS TYPES

Location (Air mass frequency)	Dry Tropical (DT) Excess mortality (% of usual)	Moist Tropical+ (MT+) Excess mortality (% of usual)
New York (11%)	+16.6 (7%)	+16.9 (7%)
Los Angeles (4%)	+8.4 (5%)	+8.4 (5%)
New Orleans (2%)	None	+3.7 (9%)
Phoenix (1%)	+2.7* (7%)	None
Rome (11%)	+6.2 (14%)	+5.0 (12%)
Shanghai (11%)	None	+42.4 (16%)
Toronto (7%)	+4.2 (11%)	+4.0 (10%)

MENTIMETER QUESTION #2

THINK ABOUT YOUR CITY OR TOWN.

What groups of people are most vulnerable to heat?

WE EVALUATED 4 EXCESSIVE HEAT EVENTS FOR ALL OF L.A. COUNTY AND FOR INDIVIDUAL "DISTRICTS"

1.

Hot and humid
All days MT+

July 22-26, 2006

2.

Drier
Mix of MT and DT

June 19-22, 2008

3.

Less extreme
More common event

Aug. 26-30, 2009

4.

Very hot and dry
DT days, Santa Ana event

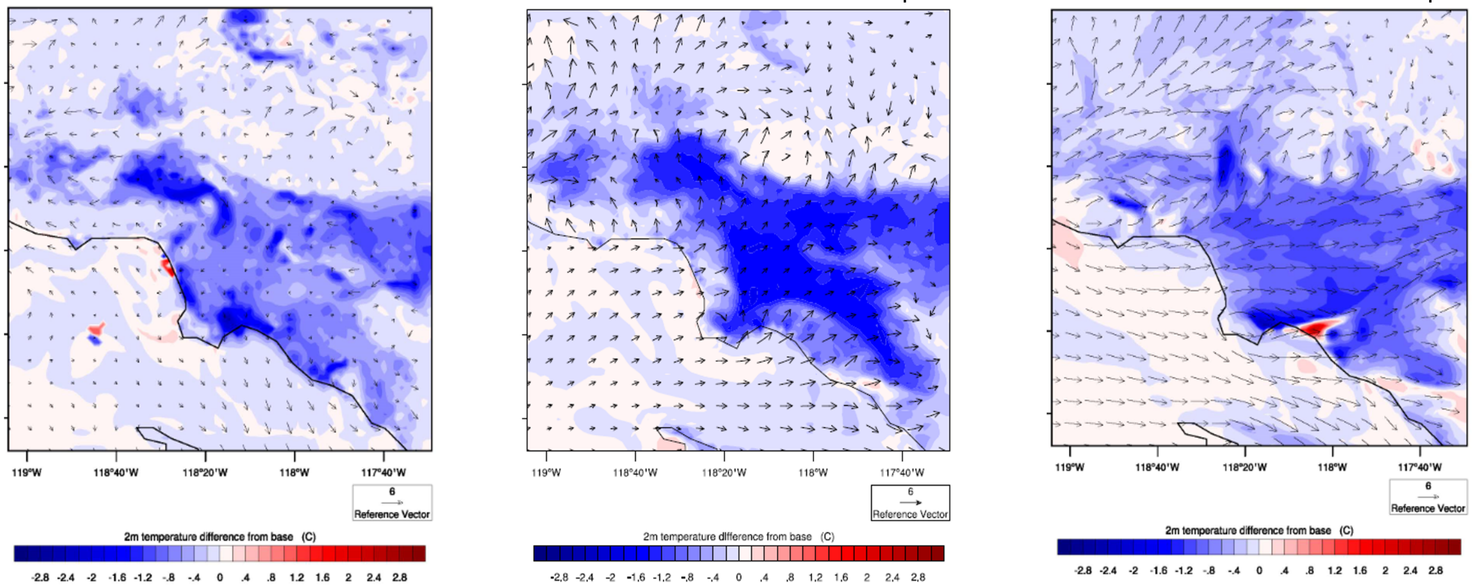
Sept. 24-29, 2010

MODEL RESULTS: COUNTY-LEVEL AIR TEMPERATURE DIFFERENCES

County-level mitigation Rx 1; Low tree cover, high reflectance
2m Air T differences: Control - Rx1
Heat Wave: August 26, 2009

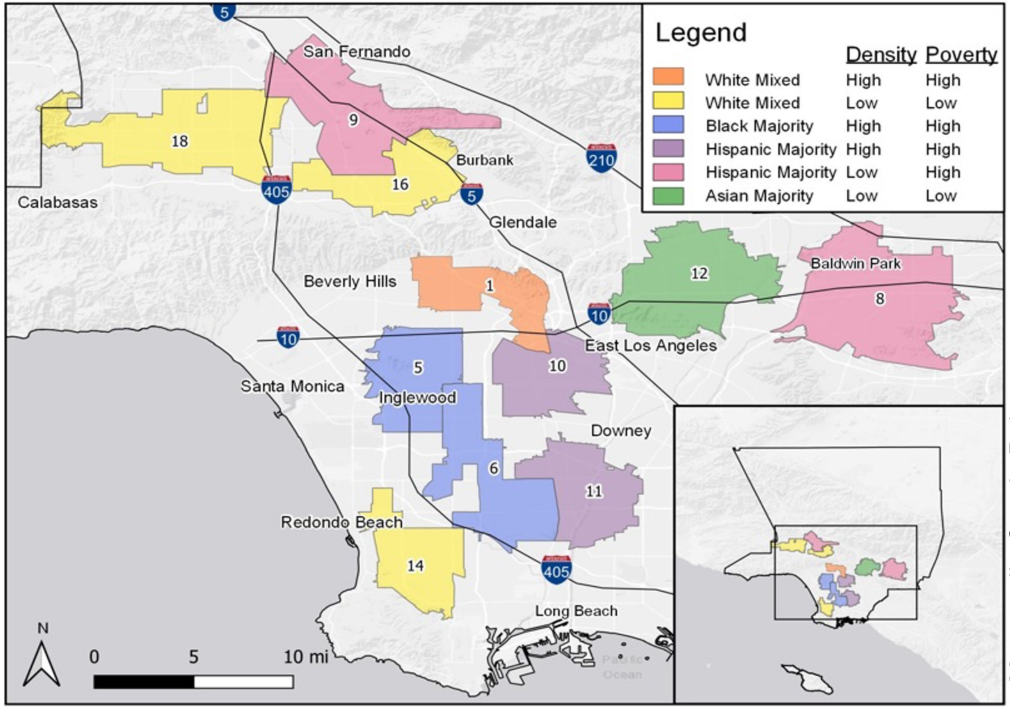
ASU Urban Climate Research Center
Arizona State University

11am 1pm 5pm



DISTRICT-LEVEL ANALYSIS

- County divided into **18 unique and rather homogeneous, heat-vulnerable districts**
- Most were around **300,000 people**
- Some districts proved to be problematic (e.g., missing data, low population densities)
- We **reduced the number of districts to be evaluated to 11**



Map credit: Cassie Roberts

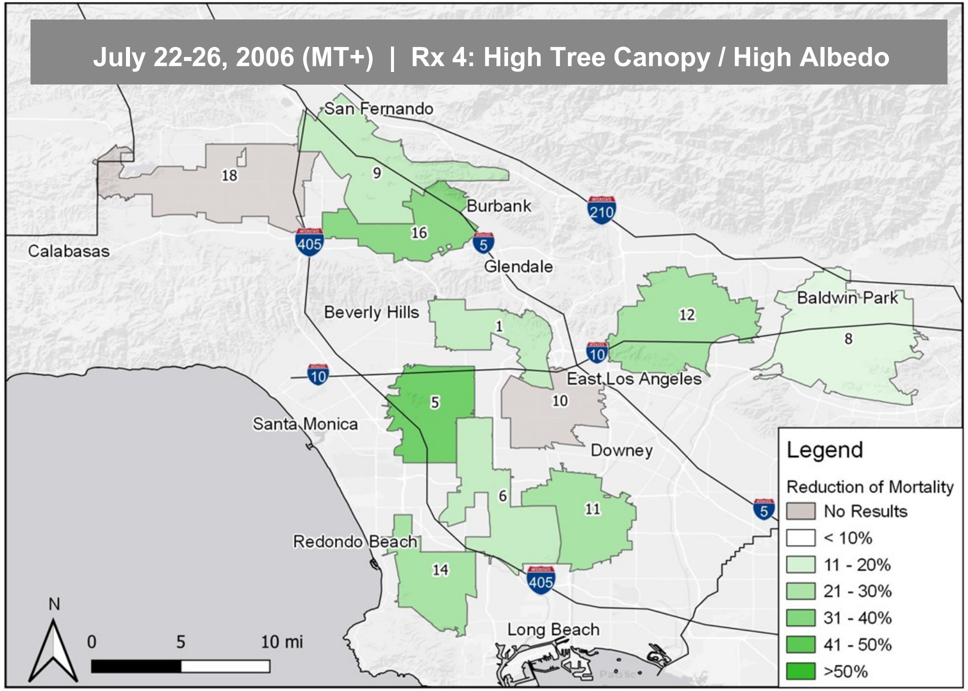
MORTALITY REDUCTIONS BY DISTRICT

Low-income, more densely populated districts:

- had the **greatest increases in heat-related mortality during heat waves**
- showed the **greatest mortality reductions from cooling prescriptions**

There were some unexplained exceptions:

- low-income, densely-populated District 10 showed little impact
- higher-income, low-density District 16 showed improved outcomes



Map credit: Cassie Roberts

HOW MANY YEARS COULD CLIMATE-CHANGE INDUCED WARMING BE DELAYED?

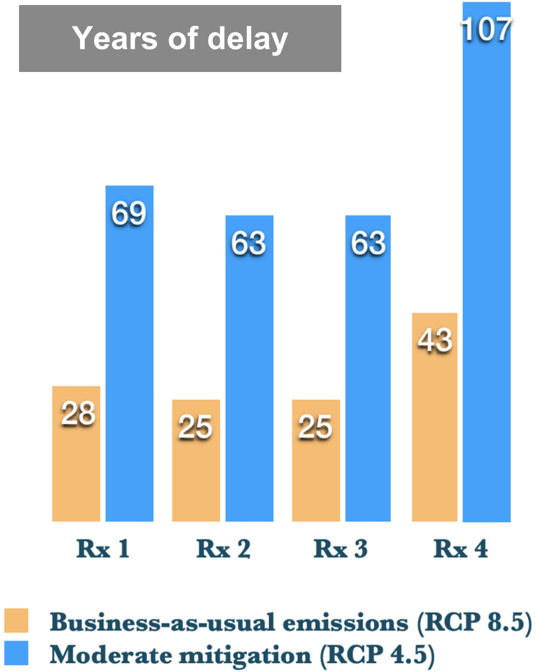
Average temperature reduction of land cover prescriptions

Rx 1: -1.1°C

Rx 2: -1.0°C

Rx 3: -1.0°C

Rx 4: -1.7°C



SUMMARY OF STUDY FINDINGS

Temperature reductions often exceeded 1.0°C (1.8°F), and up to 2.0°C (3.6°F), a life or death difference

25%+ reductions in heat-related deaths are possible, saving dozens of lives during the worst heat waves

Oppressive air masses could be shifted to more benign ones

Heat impacts of climate change could be delayed ~25-60+ years

COOL CITY IMPLEMENTATION: TREES

- Tree planting and care efforts led by NGOs and local government
- Focused on low-canopy neighborhoods
- Funding support from local and state agencies

CITY PLANTS · TREEPEOPLE · KOREATOWN YOUTH+ COMMUNITY CENTER · North East Trees · LA CONSERVATION CORPS · Los Angeles Beautification Team · LA DWP · STREETS LA

Image credit: TreePeople

COOL CITY IMPLEMENTATION: COOL ROOFS, COOL STREETS

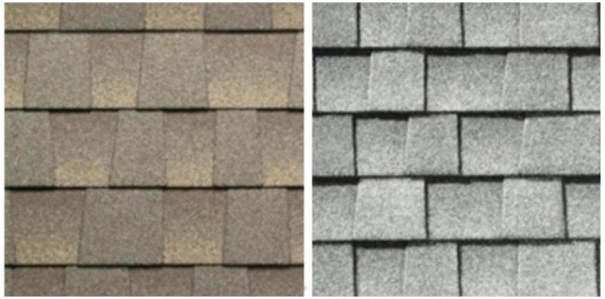
2013 - cool roof ordinance applies to all new and refurbished homes

2015 - residential cool streets pilot

Climate Resolve

STREETS LA

Eric Garcetti @MayorOfLA



Greg Spotts @Spottnik

It's very hot on Coronado St in CD13- but the Cool Seal treated pavement is more than 10 degrees F cooler than black asphalt @MitchOFarrell

3:06 PM - 29 Aug 2017

Slide credit: Climate Resolve

COOL CITY IMPLEMENTATION: BOLD TARGETS AND MANDATES

Target

Reduce urban/rural temperature differential by at least 1.7 degrees by 2025; and 3 degrees by 2035

Baseline: 5.58°F * in 2012
Source: Yale-NUIST Center on Atmospheric Environment, using NASA MODIS data
*Annual-mean daytime

1° by 2025
3° by 2035

Target

Increase tree canopy in areas of greatest need by at least 50% by 2028 to grow a more equitable urban forest that provides cooling, public health, habitat, energy savings, and other benefits

Baseline: Average across City is 20%; to be updated upon completion of citywide tree inventory
Source: MacPherson, 2008

50% by 2028

Countywide:

Baseline:

LA County had 20% urban tree canopy cover as of 2016.

2025 Target:

Increase urban tree canopy cover by 10% of baseline

2035 Target:

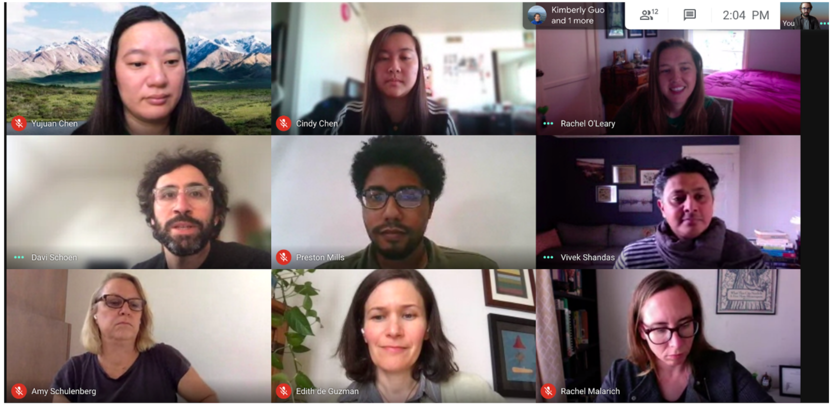
Increase urban tree canopy cover by 15% of baseline

2045 Target:

Increase urban tree canopy cover by 20% of baseline

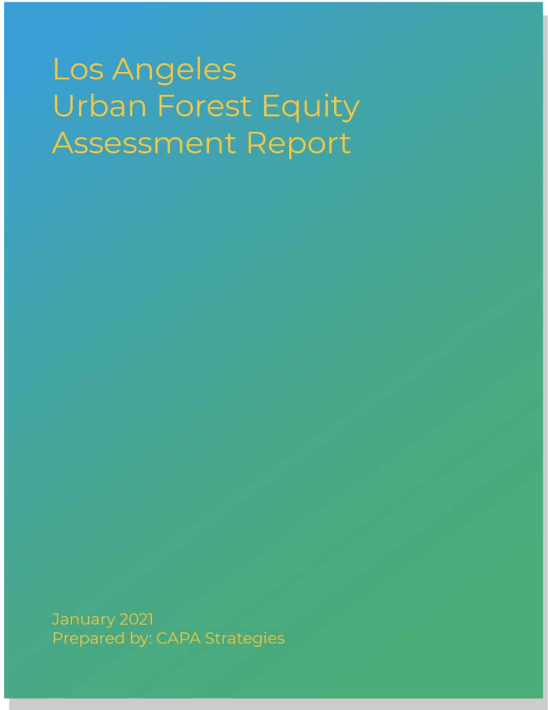
Data Source: Los Angeles Regional Imagery Acquisition Consortium; TreePeople; UCLA CCSC

HOW DO WE ADDRESS URBAN FOREST (IN)EQUITY?



New partnerships and roles working with NGOs, communities, government, and academia:

- **Urban Forest Equity Visiting Scholar**
- **City Forest Officer**



Slide credit: CAPA Strategies

URBAN FOREST EQUITY PARTNERSHIP | TREE PLANTING ‘TIERS’

TIER 1

No site modification is needed. Tree canopy goals can be achieved by planting vacant existing vacant locations.

TIER 2

Minimal site modifications needed. Tree canopy goals can be achieved with additional financial resources and possible site modifications within current City and County standards.

TIER 3

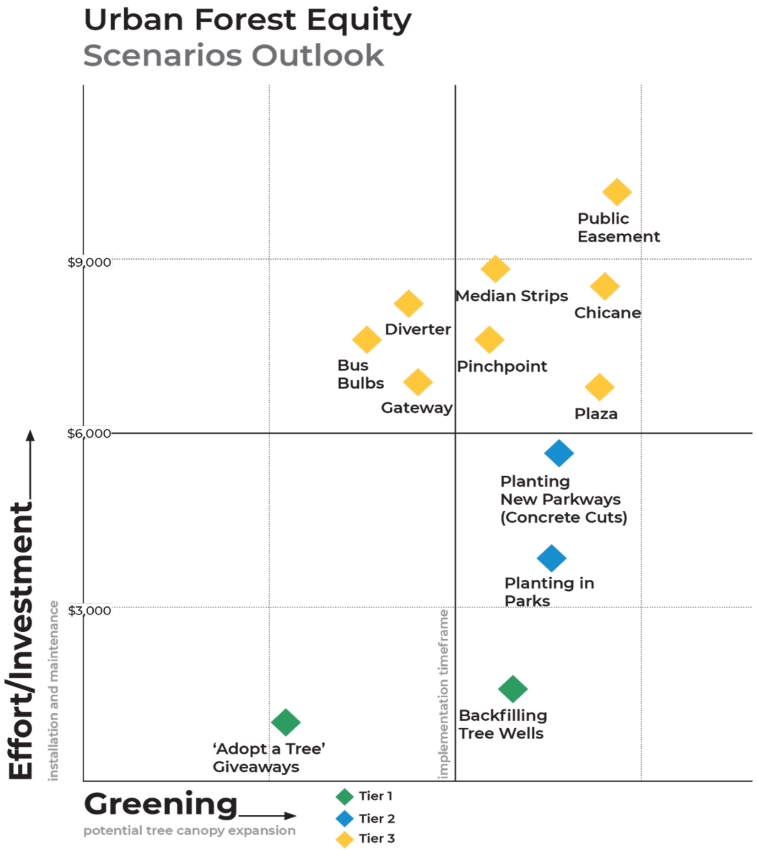
Drastic site modifications needed. Significant tree canopy increase cannot be achieved with existing infrastructure; drastic infrastructure and policy modifications are needed to reach canopy equity and public health targets.

Slide credit: CAPA Strategies

COSTS AND BENEFITS OF 'TIERS'

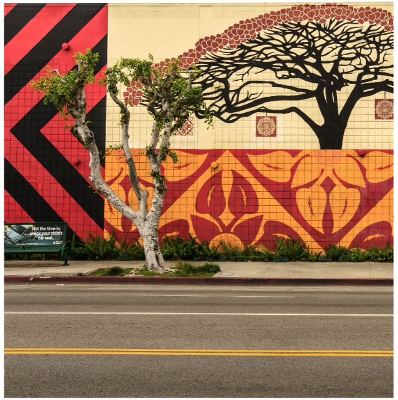
Tier 2 Assessment

Woodman Avenue, San Fernando Valley



Slide credit: CAPA Strategies

THANK YOU!



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