Microclimate Regulation in Cities: Connecting Science, Policy, and Design

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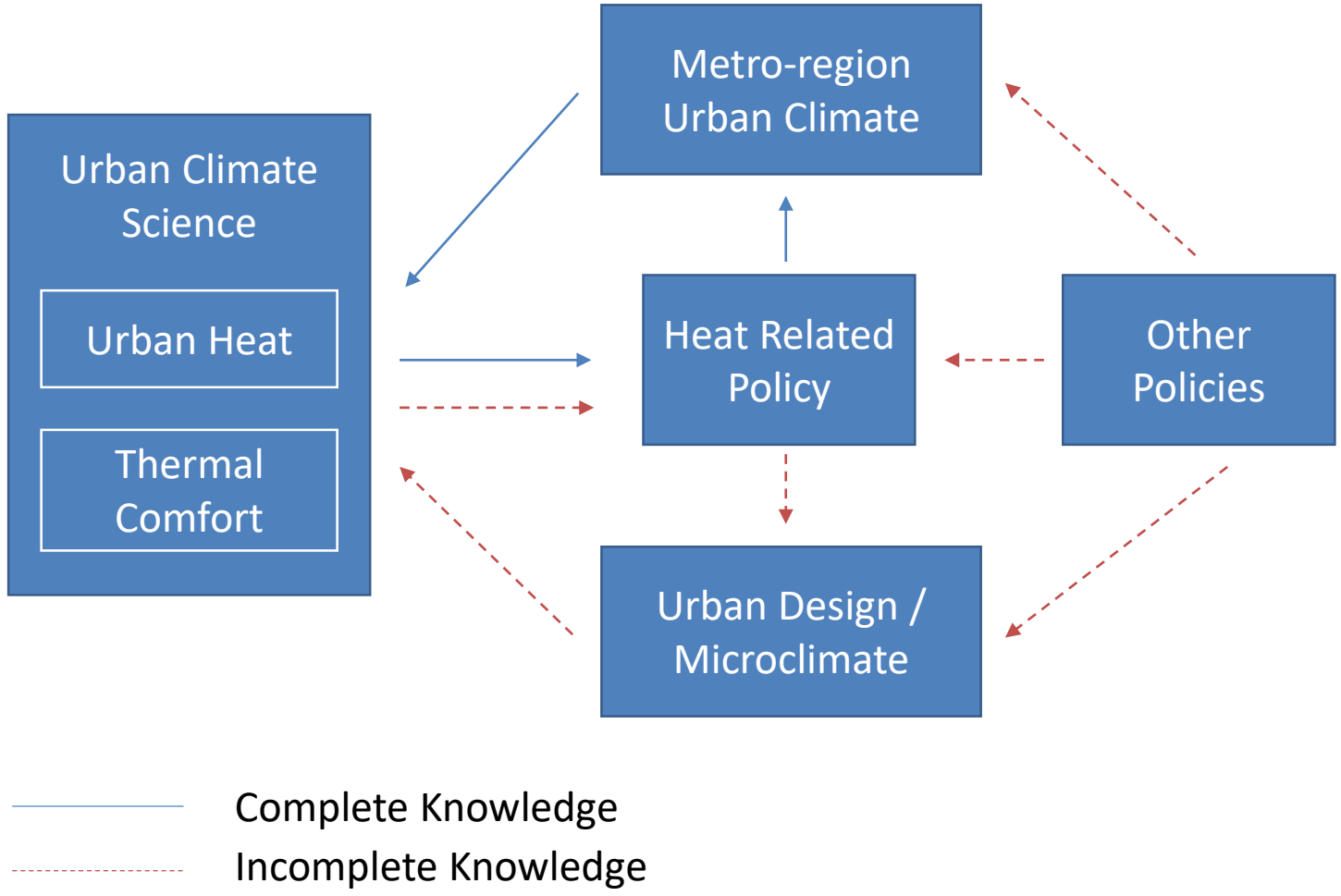
Creating Shade in Public Art Installation, Santa Monica

Barriers to Actionable Urban Climate Science

	Knowledge Complete	Knowledge Incomplete
Adoption	Actionable Science	**Panacea/ Adaptive Management**
Non-Adoption	Knowledge-to-Action Gap/ Co-production	No Action



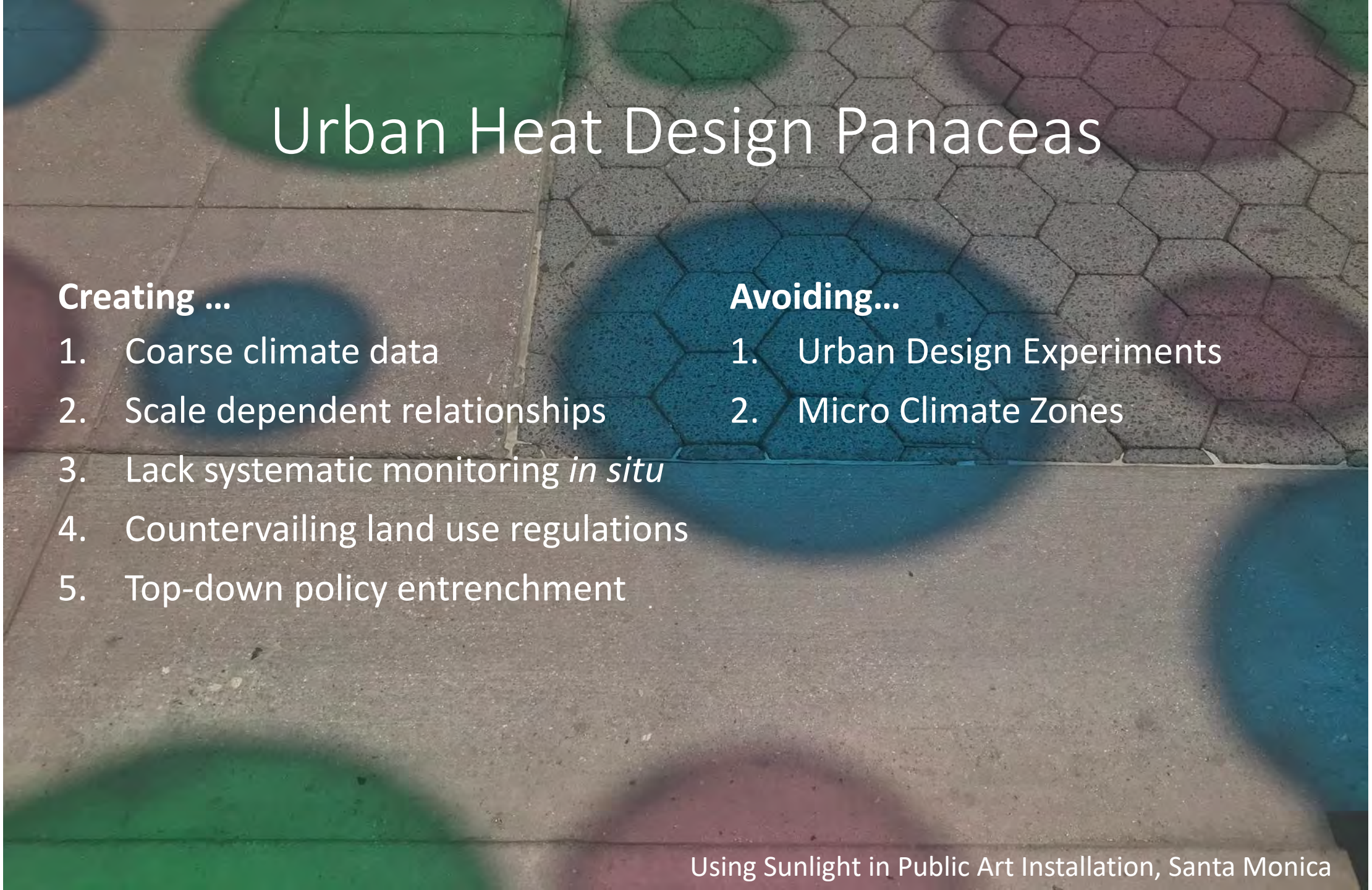
Urban Heat Design Panaceas

Creating …

1. Coarse climate data
2. Scale dependent relationships
3. Lack systematic monitoring *in situ*
4. Countervailing land use regulations
5. Top-down policy entrenchment

Avoiding…

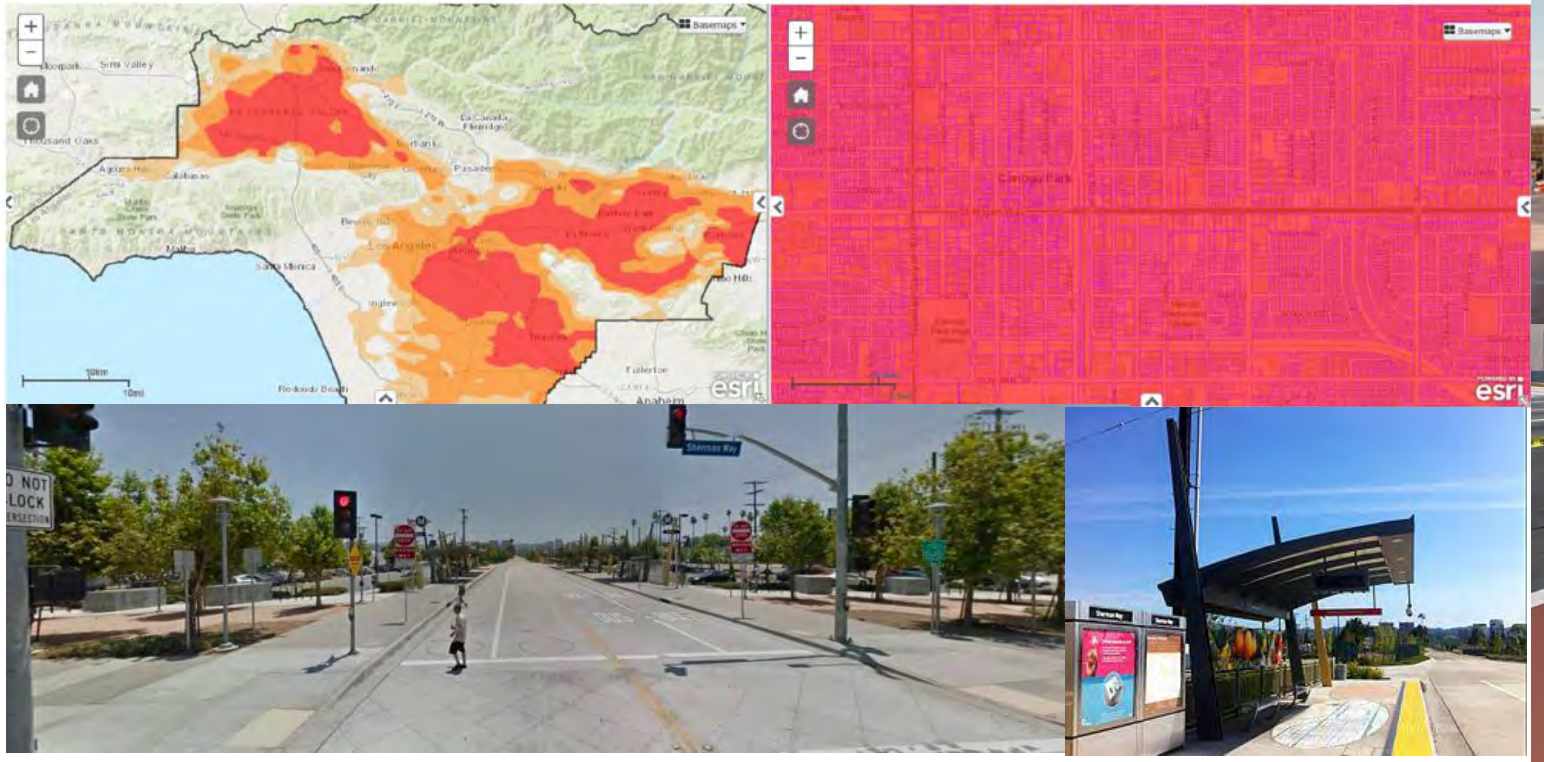
1. Urban Design Experiments
2. Micro Climate Zones

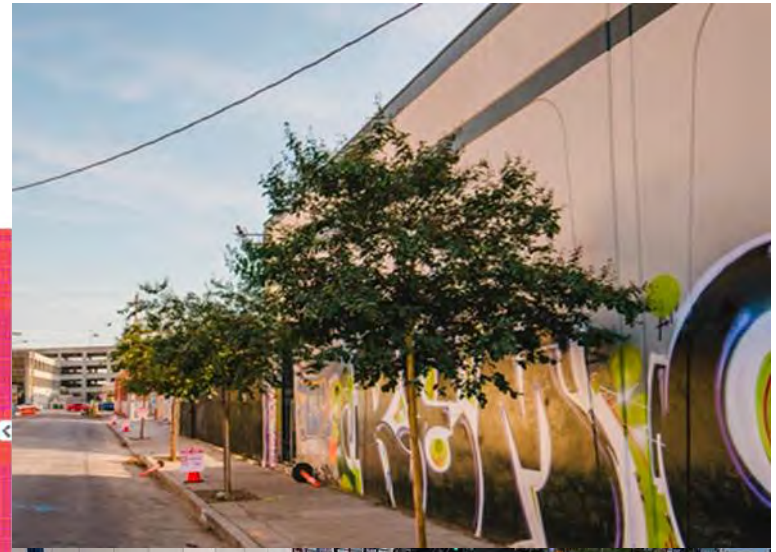


Using Sunlight in Public Art Installation, Santa Monica

Coarse Climate Data

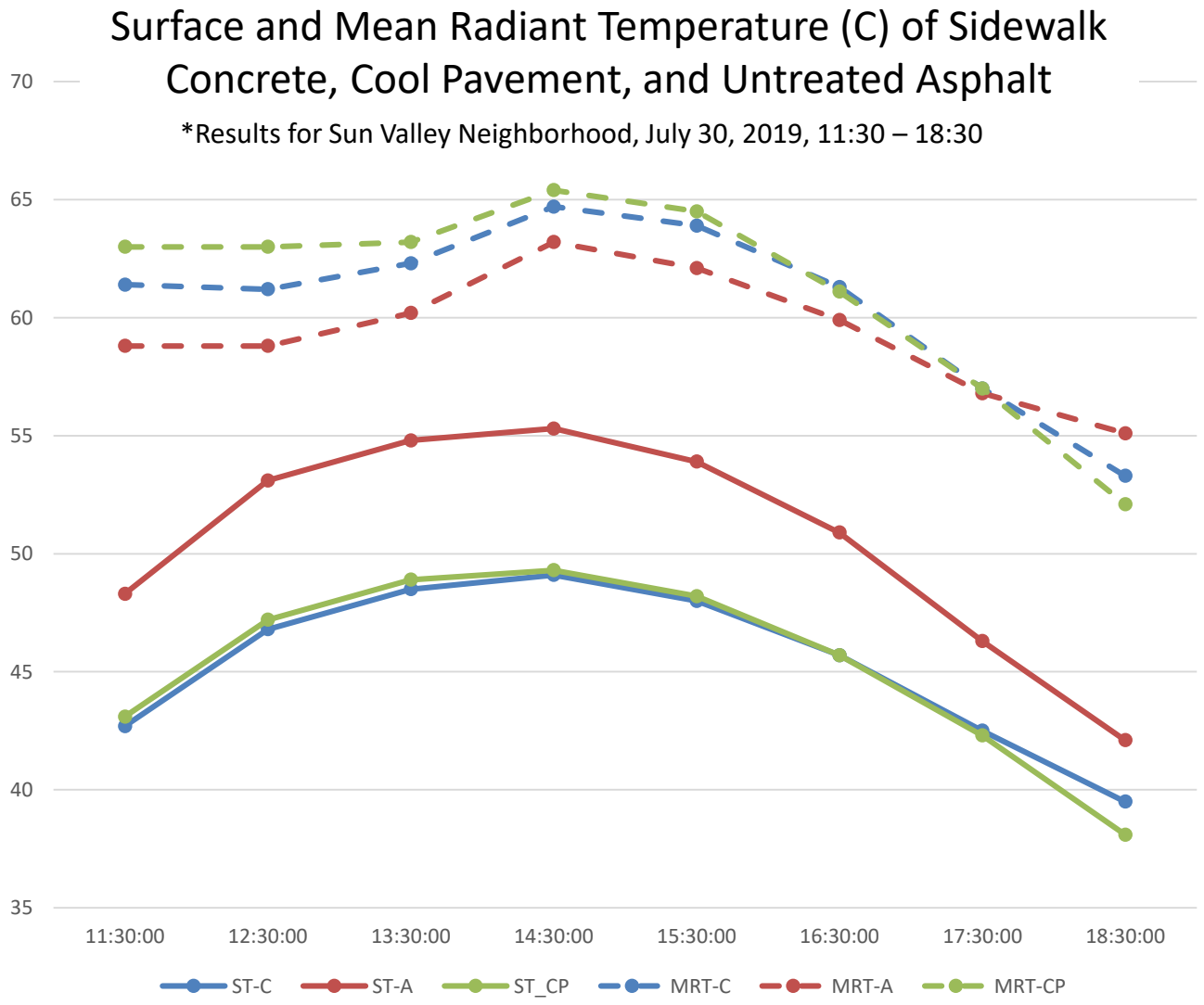
"The Urban Heat Island Effect in Los Angeles County and **Zooming in on the Project Area**. Source: Trust for Public Land Climate-Smart Cities Decision Support Tool."





Urban Cooling Strategies for Los Angeles Neighborhoods Serviced by the Orange Line, SB1 Adaptation Planning Grant, Dept. of Public Works, City of LA (Top Left) compared to intervention site and intervention (Bottom Left); Three year old trees planted in the downtown LA design district by TreePeople (Top Right), Cool pavement seal on protected bike lane in LA (Source: Great Streets).

Scale Dependent Relationships

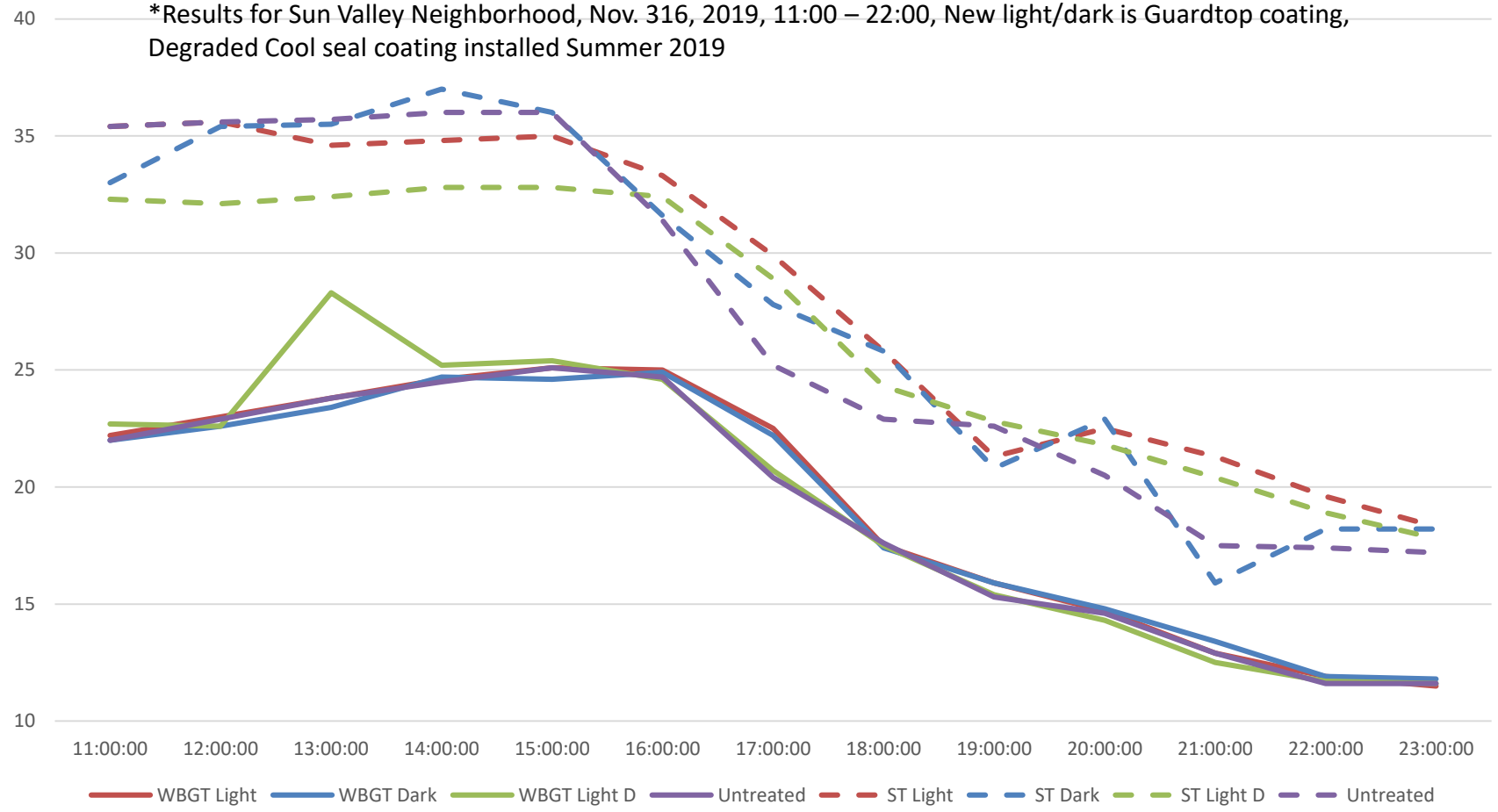


Middel, Turner, Schneider, Zhang, Stiller. Under Review.

Systematic Monitoring of Performance *In Situ*

Surface Temperature (ST) and Wet Bulb Globe Temperature (WBGT) for New Light, New Dark, and Degraded Light Cool Pavement and Untreated Asphalt

*Results for Sun Valley Neighborhood, Nov. 316, 2019, 11:00 – 22:00, New light/dark is Guardtop coating, Degraded Cool seal coating installed Summer 2019



Cool pavement study site in Sun Valley, Los Angeles (top left); World Resources Institute Street Albedo Map of study area (bottom left)

Countervailing land use regulations

New housing triggers road widening standards and street tree removal in parts of Los Angeles.

Decade	CCRs in Sample	Average CCR Page Length	Average # Landscaping Clauses	# CCRs Require Landscaping	CCRs with ALGs	% CCRs with ALGs	New HOAs United States
1940	1	3	0	0	0	**0**	NA
1950	18	3.94	3.33	0	0	**0**	NA
1960	9	5.11	4.77	1	0	**0**	NA
1970	48	8.06	4.95	7	2	**4**	10,000
1980	76	22.14	6.8	30	11	**14**	26,000
1990	67	31.35	10.01	51	33	**49**	94,000
2000	81	38.07	9.84	51	43	**53**	92,500
2010	3	42.33	9	2	2	**67**	89,100

Restrictive covenants are land use regulations “hidden” in property contracts and proprietary documents.

Turner & Stiller. Forthcoming. Journal of the American Planning Association.

Top Down Entrenchment?

"Trees make a streetscape feel welcoming, help manage stormwater, and **reduce the urban heat island effect by providing shade.**" (Greening DC Streets 2014, p. 17)

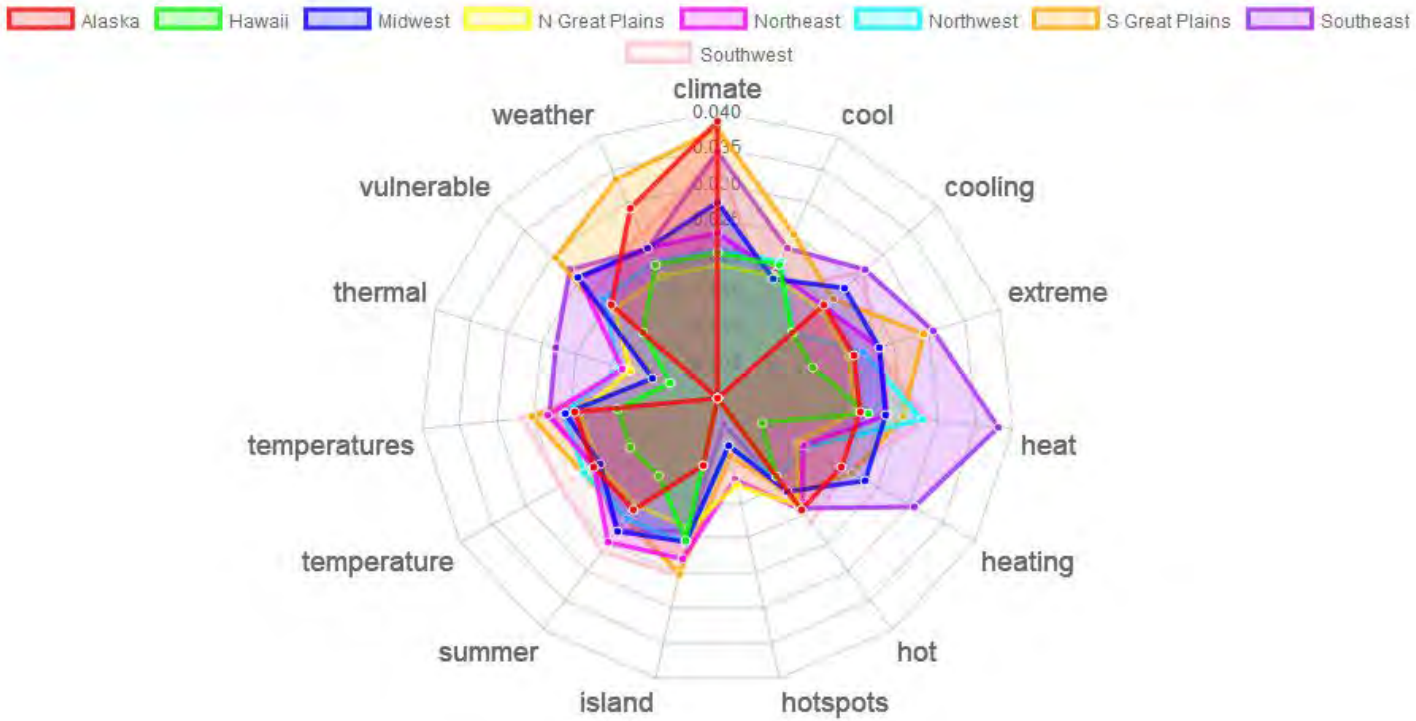
Heat Related Goals
Urban Heat Island
Extreme Heat Events
Building Energy Use
Human Health

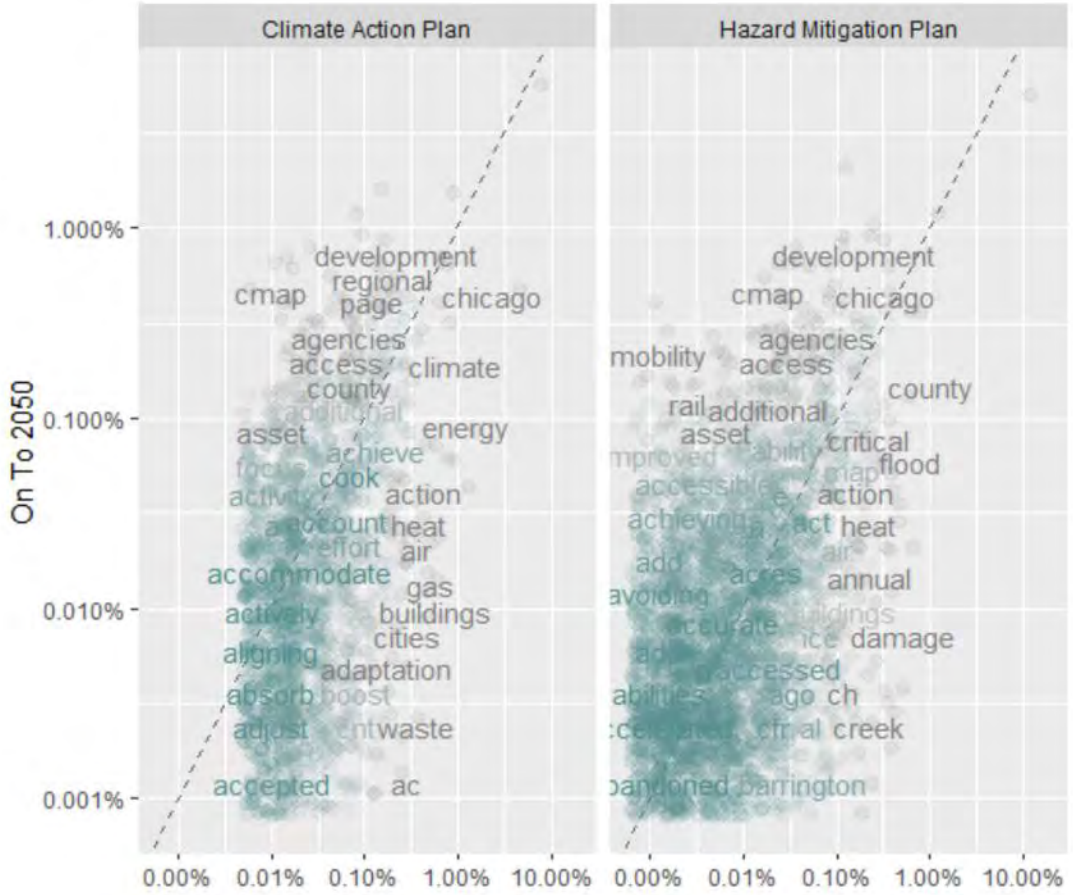
Temperature Type
e.g., Air, Surface, Radiant

Mechanisms
e.g., Albedo, Evapotranspiration, Emittance

Urban Design Interventions
Cool Surfaces
Urban Greening/Trees
Shade Structures
Water Features

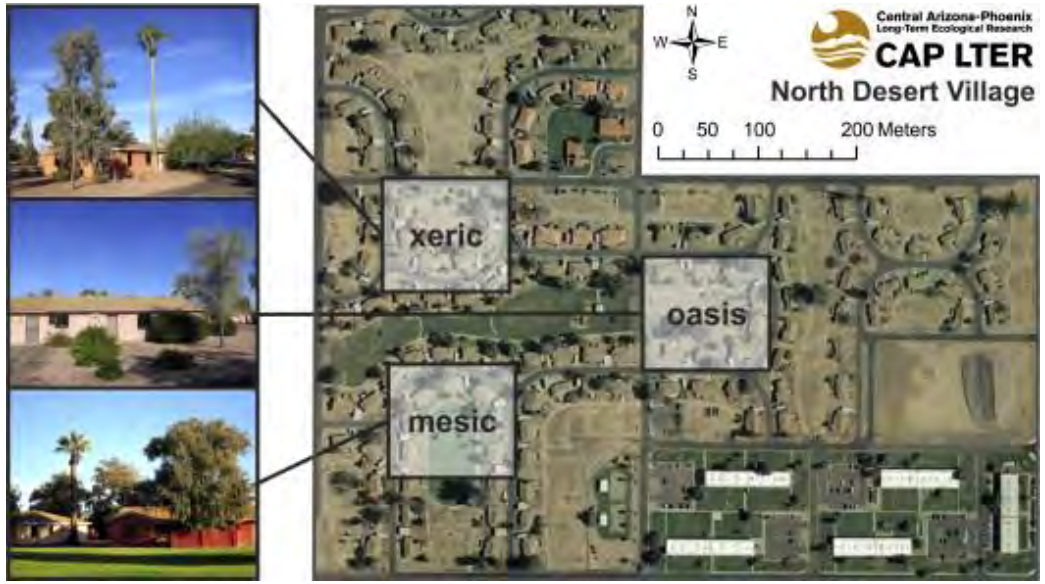
Framework for content analysis of planning docs for 75 US cities (Top Right); Text analysis comparing climate regions (Bottom Left) and plan types (Bottom Right)

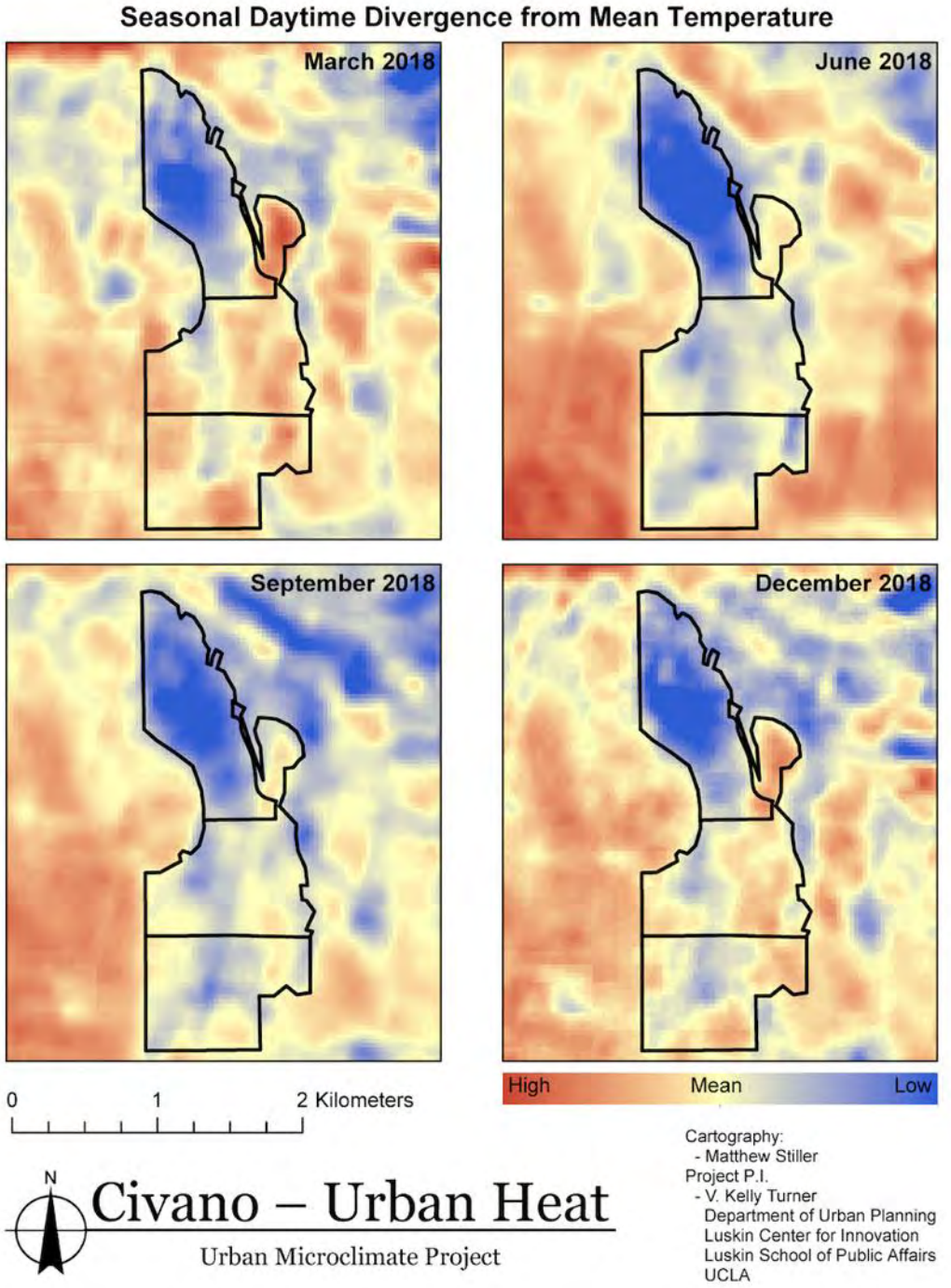




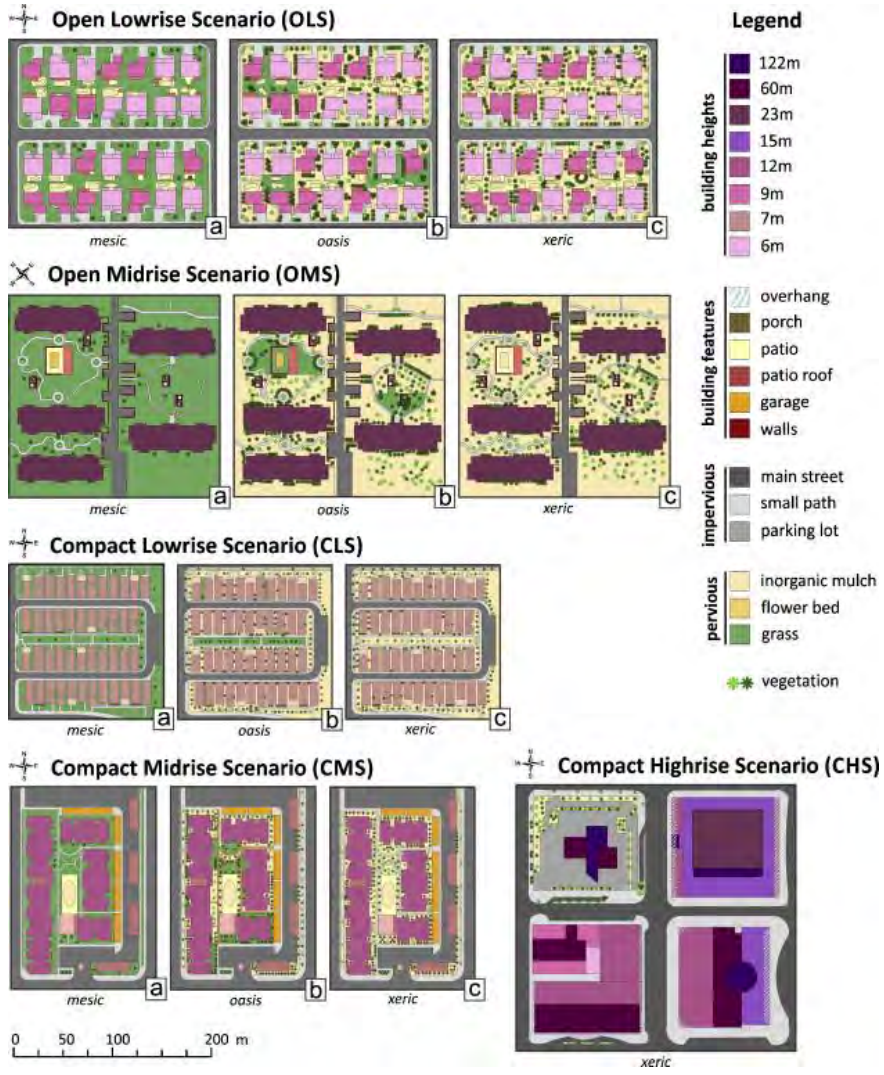
Urban Design Experiments

Hubbard Brook experimental forest (Top Left); North Desert Village Experiment, Source: Middel et al. 2014 (Bottom Right); New Urbanist development Civano, Tucson, AZ

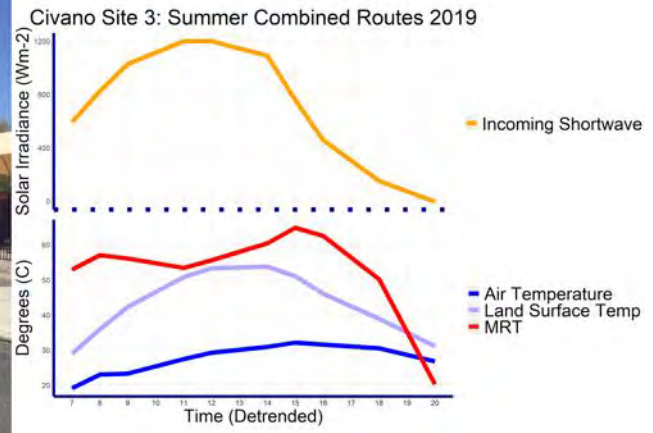


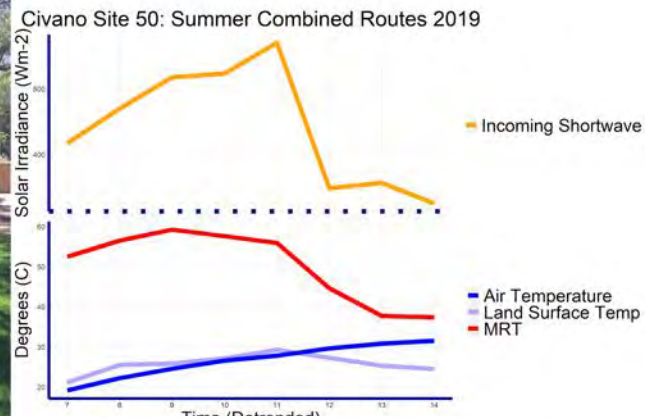


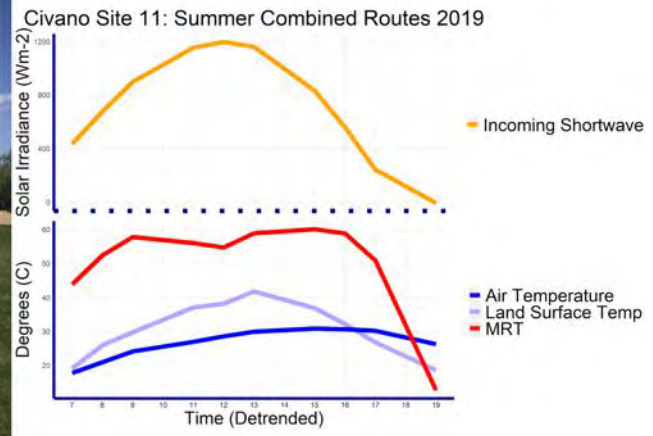
Microclimate Zones?



Local Climate Zones, Stewart and Oke (2012) image from Middel et al. 2014 (Left); @asuMaRTy transect sites in Civano, Tucson, AZ May 2019







Thank You!

Ariane Middel, Yujia Zhang, Florian Scheider (Arizona State), Matthew Stiller (U. Colorado), Jonathan Ocon, Falak Zaidi (UCLA), Lizy Dastin (Santa Monica CC)

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Solar Reflective Coating/Street Art installation in South L.A. (Eric Skotnes)