Local Resources for Urban Climate Research and Education at ASU

Cool Pathways: Assessing the Impact of Shade on Pedestrian Activity and Thermal Comfort at ASU West Valley Campus

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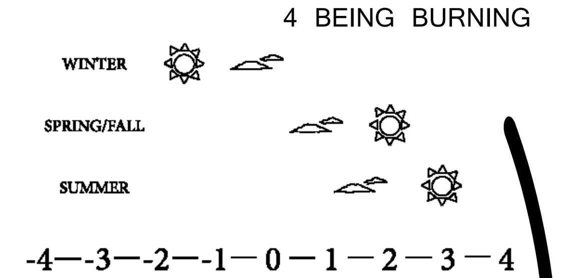
I. Executive Summary & Guiding Principles

The ASU West Valley Campus has a moldable micro climate in a region experiencing severe urban heat, with documented socio demographic inequalities in heat exposure and associated health risks (Molla et al., 2025; Kim et al., n.d.).

Preliminary proposed design: interconnected cooling pathways using a two-tiered shading strategy: built shade structures and a larger tree canopy.

Guiding Principles: Evidence-Based Design-- Directly apply findings from urban climate and public health research. Equity & Accessibility-- Prioritise shading for pedestrian routes connecting key campus destinations to ensure safe and comfortable access for all users, reducing exposure disparities (Molla et al., 2025). Health-Centered Approach-- Focus on reducing near-surface air temperature and mean radiant temperature (MRT), the primary drivers of heat-related illness, especially for vulnerable populations (Middel et al., 2016; Kim et al., n.d.). Synergistic Integration– Combine shade types to maximise cooling benefits, recognising that different strategies offer complementary advantages (Jareemit & Srivanit, 2022).



II. Site Analysis & Thermal Assessment

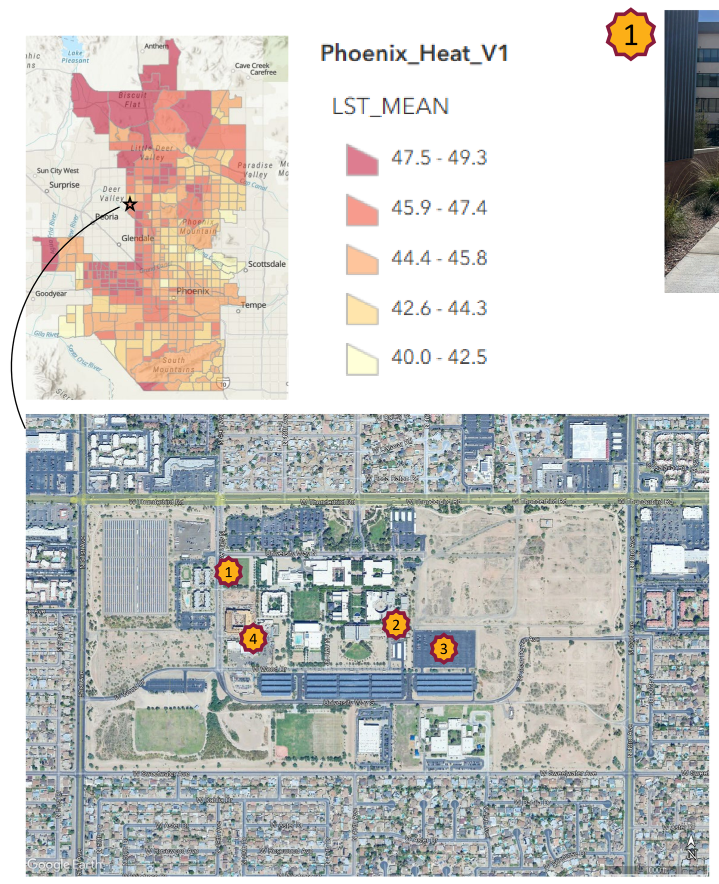


Fig 1
(ArcGIS & Google Earth Pro)

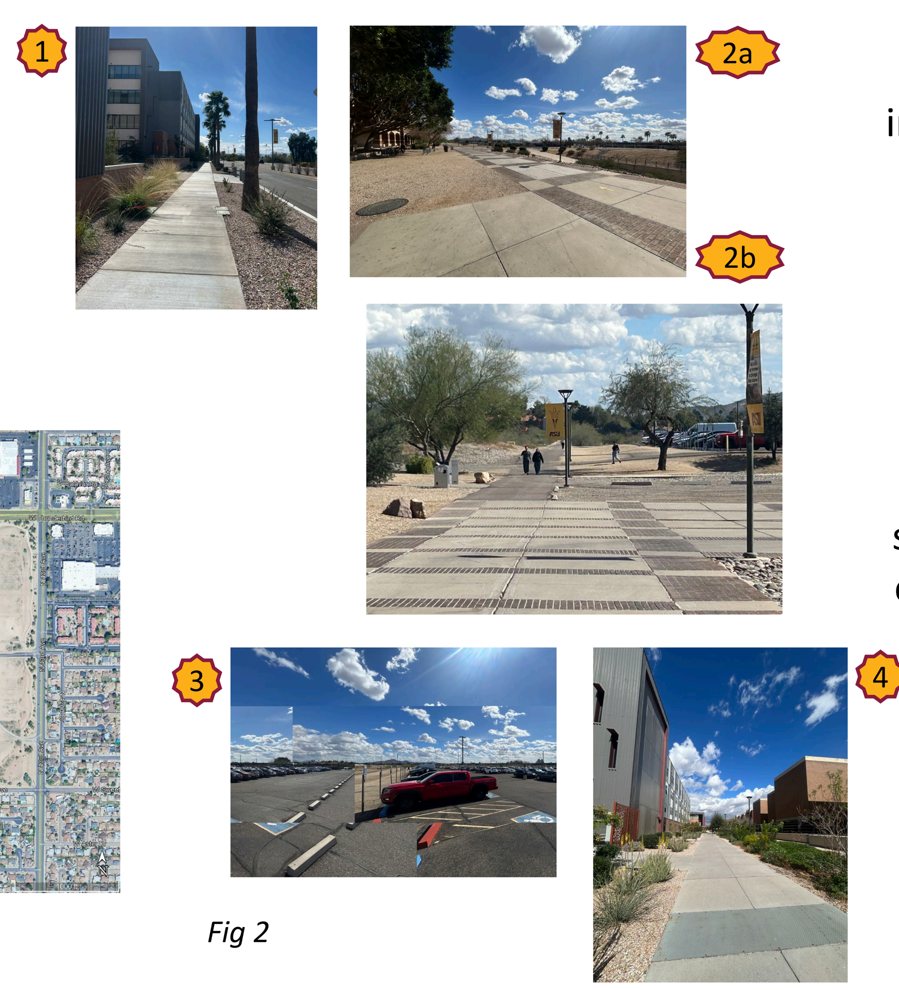


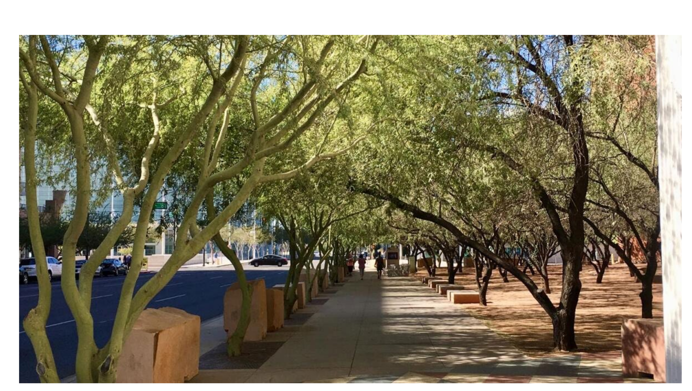
Fig 2

The city of Glendale is located at -112.159920°, 33.608485, approximately 1100 feet above sea level, in the West Valley region of the Phoenix Metropolitan Area in Maricopa County, USA. (Fig 1). In the study done by Middel et al., it was found that shade is very impactful to thermal comfort– most participants noted on a semantic differential 9-point scale that they noticed a 1-point difference in thermal sensation. They also found that shade type did not matter to the participants, and they perceived the same results no matter the shade type. The center of campus has plenty shade, but the edge pathways and parking areas are lacking. Areas that need the most implemented shade are the Southeast parking lots (near Washington Elementary School District No 6 and Sweetwater School, as well as the secondary paths and walkways further from the center of campus by the dormitories on the west side of campus (Las Casas). (Fig 2)

III. Proposed Shading: Two-Tiered Approach

Tier 1: Strategic High Tree Canopy Cover

Prioritise planting large-canopy, native, drought-tolerant tree species Focus on creating a continuous canopy cover to maximise the cooling corridor effect, drawing on research showing that tree canopies provide significant cooling performance and thermal comfort benefits (Jareemit & Srivanit, 2022; Locke et al., 2024). Target areas with high impervious surface cover (e.g., parking lots, plazas) for intensive tree planting to mitigate the local heat island effect (Molla et al., 2025).



Tier 2: Integrated Built Shade Structures

Provide immediate, high-quality shade in areas where trees cannot be planted or are maturing, and at critical nodes (e.g., bus stops, building entrances, rest areas). Design architecturally cohesive shade structures that block a high percentage of solar radiation, thereby significantly lowering MRT (Middel et al., 2016). Locate structures at key gathering points and transit stops to cover waiting individuals, directly addressing vulnerability during heatwaves (Kim et al., n.d.). Ensure structures are designed to integrate with future tree canopy growth, creating a multi-layered shade effect.

IV. Design Integration & Prioritisation Framework

Maintenance & Monitoring Plan:

Establish a dedicated maintenance program for all shade elements (tree pruning/watering, structure integrity checks, fabric replacement).

Commit to periodic re-assessment of campus microclimate to verify the cooling impact of the interventions and to guide future decisions.

Phased Implementation Plan:

Phase 1 (Immediate - 2 Years):
Install fabric sunshades and begin planting trees along the most important and heavily used corridors. Construct key built shade structures at major transit stops and central plazas.

Phase 2 (Mid-Term - 2-5 Years):
Expand tree planting program to secondary routes. Construct additional built shade structures. Begin retrofitting existing unshaded areas with integrated shade solutions.

Phase 3 (Long-Term - 5+ Years):
As tree canopies mature, they become the dominant shading element. Re-evaluate the campus thermal environment through follow-up measurements. Adapt and refine the shade network based on new data and campus developments.

Prioritisations:

Thermal Exposure: Highest priority to routes with highest air temperatures and MRT.
Pedestrian Volume: Routes with the highest foot traffic. (pathways to parking, to dormitories)
Vulnerable Populations: Routes with higher proportions of students, faculty, or staff who may be more vulnerable to heat (Kim et al., n.d.).
Connectivity: Routes that connect key campus nodes to create a continuous network of cool pathways., expanding the current shaded areas.

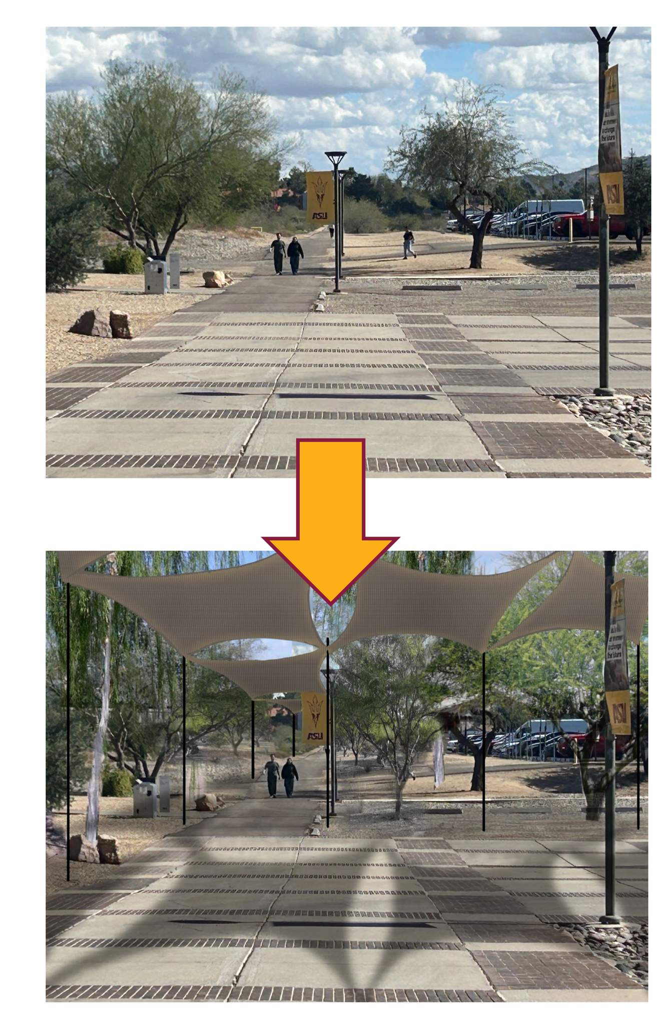
V. Expected Outcomes & Benefits

A significant decrease in MRT and air temperature along pathways lowers the risk of heat stress and illness for the campus community, aligning with findings on the importance of shade for thermal comfort (Middel et al., 2016; Kim et al., n.d.).

Creation of a safe, comfortable pedestrian environment that encourages walking and reduces reliance on vehicles for short trips, mitigating avoidance and reliance on vehicles (Molla et al., 2025).

A measurable improvement in outdoor thermal comfort, extending the usability of outdoor spaces throughout the year, as supported by comparative studies on shade performance (Jareemit & Srivanit, 2022).

Lowered Ambient Temperatures: A reduction in local air temperatures through increased tree canopy and reduced LST, contributing to a campus-wide cooling effect (Locke et al., 2024). This project could serve as a replicable model for other heat-vulnerable urban campuses and communities in dry/arid climates.



The top image was taken on a clear day in February, 2026, and is of the southeast walkway to the uncovered parking lot by WESD no.6 & Sweetwater School. The image below is a photoshopped version with more implemented shade of both built and grown types.

VI. References

Jareemit, D., & Srivanit, M. (2022). A comparative study of cooling performance and thermal comfort under street market shades and tree canopies in tropical savanna climate. Sustainability, 14(8), 4653.

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Locke, D. H., Baker, M., Alonzo, M., Yang, Y., Ziter, C. D., Murphy-Dunning, C., & O'Neil-Dunne, J. P. M. (2024). Variation in the relationship between urban tree canopy and air temperature reduction under a range of daily weather conditions. Heliyon.

Middel, A., Chhetri, N., Hagen, B., & Selover, N. (2016). Impact of shade on outdoor thermal comfort-a seasonal field study in Tempe, Arizona. International Journal of Biometeorology.

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