A Decision Support System for Urban Canopy Selection

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Research Question

Problem

- Record heatwaves are being seen across the globe [1]
- Engineered shade structures effectively reduce thermal exposure [2]
- No readily available tools exist for urban planners to compare tradeoffs between different shade types

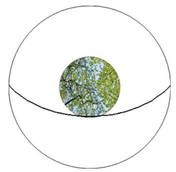
Solution

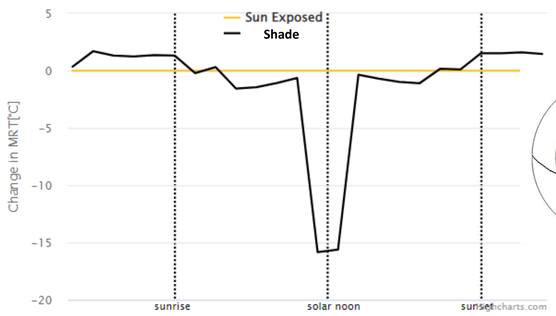
- Develop a **web-based decision support system** for urban planners to compare trade-offs of differing shade structures in urban form

Methodology

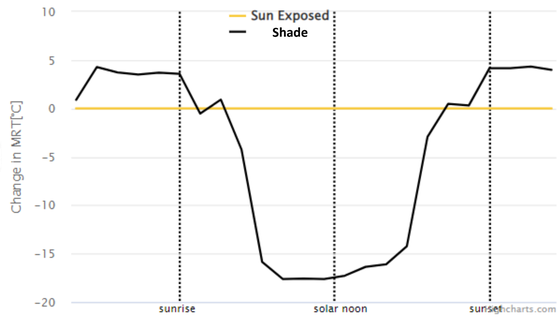
- Create interactive website
  - HTML/JavaScript
- Web APIs
- Calculate sun path position
- Calculate shortwave and longwave radiations
- Calculate mean radiant temperature (MRT)

Results



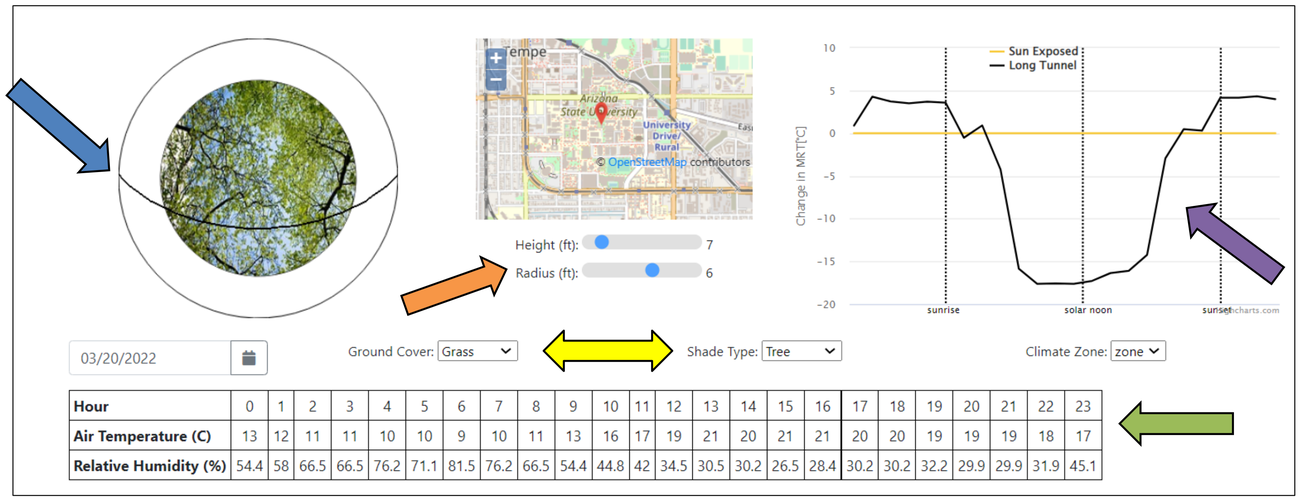


This graph (left) shows a tall tree that provides a drop in MRT of about 15℃ at one hour of the day



This graph (right) shows a much shorter tree that provides a more consistent shade (drop in MRT) throughout the day

Overview of Web Tool



Hour	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Air Temperature (C)	13	12	11	11	10	10	9	10	11	13	16	17	19	21	20	21	21	20	20	19	19	19	18	17
Relative Humidity (%)	54.4	58	66.5	66.5	76.2	71.1	81.5	76.2	66.5	54.4	44.8	42	34.5	30.5	30.2	26.5	28.4	30.2	30.2	32.2	29.9	29.9	31.9	45.1

Key Features

- Sun path curve based on location and date
- Hourly temperature and humidity readings
- Adjustable shade dimensions
- Various shade and ground types
- Calculated hourly MRT

Future Work

- Allow more locations with a Weather API
- Additional shade-type parameters
- Compare accuracy of web-tool with real-time data

References

[1] Meehl, G. A., & Tebaldi, C. (2004). More Intense, More Frequent, and Longer Lasting Heat Waves in the 21st Century. Science, 305(5686), 994–997. https://doi.org/10.1126/science.1098704

[2] Ariane Middel, Saud AlKhaled, Florian Arwed Schneider, Björn Hagen, Paul Coseo. (2021). 50 Grades of Shade. Bulletin of the American Meteorological Society (BAMS). https://doi.org/10.1175/BAMS-D-20-0193.1

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